VALUE MANAGEMENT
of Construction Projects

Second Edition

John Kelly · Steven Male · Drummond Graham

WILEY Blackwell

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Preface

The decade since the first edition of this book has seen significant changes within the construction industry in general and value management in particular. The first quarter of 2004 saw the highest construction output during the previous decade; although construction in the United Kingdom was consistently running at a high level until the first quarter of 2008 when another peak occurred from which construction did not recover as the United Kingdom entered recession in the second quarter of 2008.

Value management, following a period of rapid development during the late 1990s and early 2000s and coinciding with the period covered by the first edition of this book, began a period of twin track development in construction. This comprised a period of consolidation for the value management of construction projects and an exciting period of new development in the strategic value management of assets, Portfolios and Programmes of projects.

On the first track, the value management of construction projects entered a period of stabilisation. It was increasingly commissioned by the new and developing Integrated Service Provider companies offering a cradle to grave integrated supply chain configuration primarily within Private Finance Initiative, Prime Contracting and other Design, Build Finance and Operate procurement systems. The definition of value management provided in the first edition is

> *Value management is the name given to a process in which the functional benefits of a project are made explicit and appraised consistent with a value system determined by the client.*

It has proved consistently accurate through a large number of project value studies. Edition 1, Chapter 5, described study styles and value processes founded on the international benchmarking study of value management and the observations from over 200 value studies conducted by the authors. The fundamental principles described in the first edition have proved sound and are carried forward and developed in terms of theory and practice in Part 2 of this text – The Anatomy of a Value Study.

On the second track the authors were commissioned to undertake a growing number of strategic value management studies founded on construction but increasingly involving a complete reappraisal of a client's property assets, within an environment of change, to maximise value for money from a portfolio of property and consequent potential Programmes of projects. Several studies reflected a shift from a facilities management as an operations and maintenance service to a more comprehensive asset management service maximising the benefit of a portfolio of assets to achieve client core business objectives. These value studies were undertaken in health, education, transport (road and rail) and maritime environments. It was interesting to note that colleagues in Australia were also engaged on similar value studies typified by the Pacific Highway planning studies. These strategic value management studies required a new application of the methodology. The research, development and practice involved in this journey is described in this second edition. A new definition of value management was evolved to encapsulate those second track developments in making clear that value management is a more wide ranging value study as an intervention involving the three stages of Organisation and Diagnostics, Value Workshop and Implementation. The new definition is

> *Value management is a value study (or series of value studies) with the aim of optimising organisational decision making and performance by increasing effectiveness and efficiency through a formal, structured, value-based management methodology involving key stakeholders. At project level VM is the name given to a value study in which the functional benefits of a project are made explicit and appraised in alignment with a value system determined by the client.*

On a personal note, in 2007, John Kelly resigned the Chair of Construction Innovation at Glasgow Caledonian University, although retaining some academic duties and visiting professor appointments, to establish a small consultancy company specialising in training, research and consultancy in value management and whole life costing.

In 2008, due to changing research interests, Steven Male gave up his Chair of Construction Management to become Professor of Property and Infrastructure Asset Management at the University of Leeds. He resigned this post in late 2011 to pursue other interests and to run his own business in Edinburgh specialising in value management training, research and consultancy.

Drummond Graham is Director of Thomson Bethune, Chartered Surveyors, Edinburgh.

John, Steve and Drummond undertake commissions individually and jointly, meeting regularly, as they have done for over 20 years, to discuss studies undertaken and to plan future development.

During the past 20 years we have interacted with hundreds of construction clients, consultants, contractors, value management practitioners and academic colleagues from many countries. We have taught undergraduate and postgraduate modules, run institutionally accredited value management courses and supervised research students at Ph.D. level. We have widened the scope of value management activity and directed value studies at the highest levels in commerce, public sector institutions and government.

In the development of this text we are particularly grateful to Dr Derek Thomson of Loughborough University whose (sometimes highly) critical but helpful insights over three years into our research, theory and development of a Whole-Life Value method have given us the confidence to include the proposals in Chapter 12. In particular, we would also like to express our thanks to Bob Charette CVS, Montreal, and Howard Elegant CVS, Evanston, Illinois, whose enthusiasm for value management and early insights into its practice instigated this journey in 1986. Furthermore, to all the people and organisations too numerous to mention who have given us freely of their time, views and insights and who indeed may see something in this text that has resulted from a comment or other interaction we give you our grateful thanks.

John Kelly
Steven Male
Drummond Graham
September 2014

Glossary

In this book the terms and abbreviations listed here have the meaning ascribed notwithstanding contrary definitions in other publications.

Terms and Abbreviations	Meaning in this Book
AM – Asset management	A defined management process that links an organisation's strategic plan to the whole life management of physical assets. AM includes investment decisions associated with managing assets through time to create value for an organisation.
Benchmarking	Identification and measurement of own performance and comparison with best in class.
Benefits realisation	An audit process conducted at each stage in the development of the project to ensure that the benefits identified in the business case are embodied both in the developing project and at completion, into the organisation's core business.
Business as usual	The things done to keep the business operating on a day-to-day basis.
Business case	The strategic, commercial and/or organisational case for an investment to effect a change to the core business of an organisation.
Client	The person(s) or organisation that engages professional assistance in the undertaking of the inception, planning, financing, execution and commissioning of a project.
Client's Project Value System	The client's value system modified to apply to a specific project and expressed in terms of time, cost and quality.
Client's Value System	The corporate and business values that arise from deep within the client business as the perspectives and paradigms existing within the organisation's governing board, departments and individuals. It is these values that are transmitted through the client core supply chain as a value thread.
Client stakeholder team	Those stakeholders from the client organisation and those (primarily customers and users) inextricably linked to the benefits or disadvantages of the Programme or project.
Component	A single manufactured product installed in a single operation which can be described by its manufactured part number or by its physical characteristics and function.

CREM – Corporate real estate management	The management of property owned, leased or held incidentally by an organisation to support its corporate mission and thereby contribute to its business operations. CREM is less concerned with the investment value of property.
Element	That part of construction which performs the same function irrespective of the components and materials from which it is made.
Facilitator	The person who manages the value study workshop process, commonly but not necessarily the VSL.
Function analysis	The processing of Programme and/or project information to succinctly define functional requirements in an inert form, that is, in an expression, devoid of cost or performance measures, commonly comprising an active verb and a descriptive noun.
Gatekeeper	An individual or occasionally an organisation, that coordinates information passing between the constituents of an organisationally complex endeavour for example, the client project manager for a construction projecr passing information to a Value Study Leader in a value study.
GSL	Government Soft Landings.
HMG	Her Majesty's Government (UK).
HMGCO	HMG Cabinet Office (UK).
HMT	Her Majesty's Treasury (UK).
Innovation	The search for a new idea and the presentation of the idea in a form conducive to use; comprises two steps, the generation of ideas to satisfy identified required functions and a judgement of which of the many ideas generated are of potential use.
ISP – Integrated Service Provider	A consultancy or construction company offering to a client an integrated service in, *inter alia*, Programme and project management, design and cost management services, construction delivery and facilities management.
Job Plan (USA)	In the United States the agenda for the workshop phase only of a value study.
MoV	Management of Value (UK).
NAO	National Audit Office (UK).
Option appraisal	The functional description of a potentially worthwhile change to the operation of an organisation and the identification of options which maximise the value of the change. Option appraisal includes the evaluation of potential options and the recommendation of a single option.
P3	Portfolios, Programmes and Projects.

Paradigms	The explicit or implicit rules governing the way in which individuals and departments operate, responding to and contributing to, the corporate culture of the organisation. These rules influence the client's value system.
Performance indicator	A factor that can be accurately measured to enable the comparison of performance.
Perspectives	The deeply held consensual views of individuals and groups within a client organisation that influence its corporate culture and thereby the client's value system. The more senior the individual or group the more influence.
Portfolio	Groupings of Programmes and/or projects which may or may not be interdependent managed by the organisation at strategic level.
Programme	An organisational structure or framework to group, co-ordinate and manage substantive change through related projects.
Project	A process, operating in parallel to the core business, to deliver an investment within a programmed time to effect change to the core business of the client organisation.
Project Board	A temporary formal group of client representatives and other key stakeholders set up to oversee the governance of the project.
Project Manager	The person responsible for the day-to-day management of the project. The gatekeeper between the client and the project team.
Project Sponsor	The client representative responsible for the project. The project sponsor is commonly chairman of the Project Board and responsible for the delivery of the business case.
Project Value System	The client's project value system as incorporated into design and construction. The client's project value system may be influenced by the design and construction team.
Quality	The totality of features and characteristics of a product or service that bear on its ability to satisfy stated needs or implied needs. The assessment of quality is a construct of comparability in which the degree of excellence is determined as the provision of all basic needs at the required level and all performance needs at the highest level. In this book quality is focused on the facets of Community, Environment/ Sustainability, Exchange, Flexibility, Esteem and Comfort.
Quality Assurance	The management of defined, consistent, standards of products and/or services to assure freedom from defects.
Risk	A disadvantageous future event in which the probability and consequence of the outcome can be estimated.

SFC	Strategic Forum for Construction (UK).
Stakeholders	Those individuals and groups that are in a position to directly influence the development of a Programme or project or are directly affected by the actions of an organisation pursuing a Programme or project.
Supply chain	The people and organisations involved in the production and distribution of a product or service from raw material to customer/consumer.
Systems	A number of identified discrete components combined to form a mechanism to perform a single function or a number of functions of a similar nature, e.g. a central heating system.
Systems approach to analysis	A number of individual processes working synergistically to deliver a defined objective.
TQM – Total Quality Management	A system of technical and organisational management expressed in the cultural attitude of staff to the provision of the highest level of excellence in products and/or services.
Uncertainty	A future event in which the probability and consequence of the outcome cannot be estimated.
VA – Value analysis	A value study of a current service or the production of an existing product with the aim of identifying and eliminating unnecessary cost through the analysis of the necessary functions required of the product or service.
Value	A relationship between function, time, cost and quality.
Value gap	Value gap analysis defines the difference between the status quo and what could potentially be achieved by undertaking a value study to enhance a project and the value of an asset.
Value study	A discrete intervention in the core business of the client to undertake a structured appraisal at Portfolio, Programme or project level with the aim of enhancing value by effecting change. A value study comprises the three generic phases of Orientation and Diagnostic phase, Value Workshop phase and Implementation phase.
Value thread	The mechanism that conducts the client value system through the supply chain.
Value workshop	A team based activity comprising key stakeholders to review and synthesise information to make explicit function and value in order to derive innovative solutions for a Programme or project.
VE – Value engineering	A value study of a designed space, element, system and/or component with the aim of improving the design by providing the necessary functions at the lowest cost without compromising quality.

VfM – Value for money	The optimum combination of whole of life costs and quality (or fitness for purpose) of the product or service to meet the users requirement. VfM is achieved when the highest level of benefit is received in exchange for the least consumption of resources.
VM – Value management	A philosophy and management style to enhance stakeholder decision making. It is operationalised through a value study (or series of value studies) with the aim of optimising organisational decision making and performance by increasing effectiveness and efficiency through a formal, structured, value-based management methodology involving key stakeholders. At project level VM is the name given to a value study in which the functional benefits of a project are made explicit and appraised in alignment with a value system determined by the client.
VSC – Value Study Commissioner	The person, usually an employee of a client organisation, responsible for commissioning value studies.
VSL – value study leader	The person responsible for the planning and execution of a value study.
WLC – Whole-life cost	An economic evaluation method that takes account of all relevant costs over the defined time horizon (period of study), including adjusting for the time value of money. A WLC exercise is used in option appraisal or to predict a cash flow.
WLV – Whole-life value	A systems approach to the discovery, representation, measurement and audit of the lifetime value of an asset (product or service) to an organisation. WLV is used in option appraisal and benefits realisation.
Work plan	As BS EN 12973:2000 and AS 4183:2007 note the strategy and plan for a value study detailing each of the three phases of Orientation and Diagnostics, Value Workshop and Implementation.

Part I
Introduction and Evolution of Value Management

The value methodology as a structured management service has been recognised for almost 70 years. It began in the manufacturing industry of the United States in 1947 as an in-house service to reduce the cost in the production of existing products without compromising product quality. This activity, called value analysis, was carried out by a structured examination of the function of the product using an in-house team of designers, production engineers and purchasing agents. By the 1960s the term value engineering was being used to describe a service where the focus shifted to the function analysis of the design and estimated cost of proposed products rather than products already in production. It was during the early to mid-1960s that value engineering transferred from the analysis of manufacturing design to the analysis of construction design initially through the activity of US Navy Bureau of Yards and Docks.

The 1980s saw an increasing international interest in the use of value engineering in design and construction and included an embryonic discussion of value management. In the United Kingdom, value management in construction evolved in the late 1980s. The first UK textbook (Kelly and Male, 1993), *Value Management in Design and Construction*, by the authors was published in 1993. Since that time value management in construction has evolved to become an established service with commonly understood tools, techniques and value study styles. The authors' research activity which began in 1986, funded by the Education Trust of the Royal institution of Chartered Surveyors (RICS), was boosted in the 1990s by further funding from the RICS and the Engineering and Physical Sciences Research Council. The latter funded a major examination of the international benchmarking of value management practice which investigated best practice from the perspective of tools, techniques and study styles using the authors' 1993 text as the research benchmark. One significant outcome of this work was the completion of a new benchmark entitled 'The Value Management Benchmark' published by Thomas Telford (Male *et al.*, 1998).

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The benchmarking research was the foundation for further research into value management which confirmed that it is a service with three primary core elements:

1. A system of function analysis promoting an understanding in and a clear definition of requirements of construction projects.
2. An appreciation of the client's value system and the transference of this value system to the project effectively defining the criteria for project success.
3. The value study process involving a structured stakeholder team.

Furthermore, that research also identified that value management is operationalised as a value study process with key intervention points during the project inception and development process with three equally important generic phases:

- The Orientation and Diagnostics phase
- The Value Workshop phase
- Implementation phase

Part One comprises two chapters. Chapter 1 outlines the changes that have occurred in value engineering and value management research and practice since the first edition; with a brief overview of influential reports, the changes in construction procurement and the developments in value management, notably their application to a wider organisational context reflecting contemporary thinking in asset management.

Chapter 2 describes the three stage development of the value methodology from its inception in the 1940s to 2014. The chapter describes the evolution of value engineering and value management and concludes with the salient features of a value study in order to provide a foundation for the subsequent chapters in this book.

References

Kelly, J. and Male, S. (1993) *Value Management in Design and Construction: The Economic Management of Projects*. London: E and F N Spon.

Male, S., Kelly, J., Fernie, S., Grönqvist, M. and Bowles, G. (1998a) *The Value Management Benchmark: A Good Practice Framework for Clients and Practitioners*. London: Thomas Telford.

1 Introduction

1.1 The aims and objectives of the book

The 1980s saw an increasing international interest in the use of value engineering in design and construction and an embryonic discussion of value management (VM). The climate in UK construction of the 1990s was right for the further development of innovative systems including VM.

The authors' research activity into the topic, which began in 1986 and was funded by the Education Trust of the Royal Institution of Chartered Surveyors (RICS), was boosted in the 1990s by further funding from the RICS and the Engineering and Physical Sciences Research Council (EPSRC). The latter funded a major study into the international benchmarking of value management practice that resulted in the completion in 1998 of 'The Value Management Benchmark' published by Thomas Telford (Male *et al*., 1998). The benchmark was the springboard for detailed work into three areas. First, to make clear different study styles and their application at particular stages of projects, and, relate each study style with their most commonly associated method, tools and techniques. Second, to investigate the concept of quality and value to understand their interrelationship and their application within supply chain thinking. Third, to extend the use of VM into other organisational settings and investigate other more generic study styles.

This research work was carried out by the authors, or under their supervision, using a variety of research methods. Significant findings were made through grounded theory and action research approaches. This work continued unabated, reshaping, refocusing and extending the authors' ideas about the theory and practice of value engineering and more, especially value management.

What has changed from edition 1

In reviewing the context and content of the first edition, published in 2004, the authors concluded a second edition needed to take account of the following:

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- A range of recent UK industry and government publications, most notably BS EN 16271:2012 – Value management: Functional expression of the need and functional performance specification, the imminent update of BS EN 12973:2000 Value Management; BS EN 1325:2014 Value Management – Vocabulary; the changes to 'Value for Europe' governing the training and certification of Value Management in European Union countries; the UK Government's Management of Value (MoV) initiative, together with other leading reports, international guidance and standards on Value Management.
- Research in value management undertaken since 2002.
- Changes in value management practice, particularly in relation to the management of Portfolios, Programmes and Projects (P3).
- Developments in the theory of value, principally value for money measures, whole life value, option appraisal, and benefits realisation.
- New asset management initiatives covering the management of physical infrastructure, for example, BSi PAS55 2008 'Asset management: Specification for the Optimized Management of Physical Assets', which has transitioned into a suite of three documents comprising the new standard BS ISO 55000: 2014 Asset Management (BS ISO 55000: 2014 Asset Management – Overview, Principles and Terminology; BS ISO 55001: 2014 Asset Management – Management Systems – Requirements; BS ISO 55002: 2014 Asset Management – Management Systems – Guidelines on the application of ISO 55001).
- A wealth of material contained within over 200 case studies undertaken by the authors as consultancy and research, and distilled into lessons learned and good practice.

The chapters in the second edition demonstrate the further contextualisation of value management within construction. This text is influenced principally by a UK-style construction culture. This book, draws together developments in value management thinking and practice, and argues that value management needs to develop further and potentially within different practice settings.

The objectives of the second edition

The second edition deals distinctively with the practical opportunities and difficulties of VM set in the context of theory and good practice in a range of organisational contexts.

In writing the second edition, the authors have brought together and synthesised the background, international developments, benchmarking and action research in value management to provide a comprehensive package of theory and practice. The book is overtly concerned with value management in terms of the philosophy, process, use of function analysis and the nature of team dynamics. It proposes methods for determining the client's value system, quality criteria and whole life value. An exploration of different value management study styles is conducted, and the text proposes solutions for various activities at different stages of projects and organisational contexts. The book describes, but does not probe into, the areas of creativity, such as those described by De Bono or TRIZ, or the fields of operational research and more specifically operational hierarchies, nor does it address the whole subject area of group decision support. These are covered excellently in texts by other authors and academic colleagues.

The second edition follows on from a chronology and reflections on research, teaching and practice since the first edition. It describes further developments in value thinking and presents a validated approach to the method and practice of value management. It also attempts to position and reposition value management in the construction industry for the next decade.

The objectives of the book are as follows:

- Describe in sufficient detail for practical use a series of VM study styles, tools and techniques, including presenting the core technique of function analysis.
- Interpret and reinterpret the results of recent research and specifically the authors' own research into the international benchmarking of value management.
- Record developments in value thinking during the past decades, addressing the nature of value, transforming it into definitions, and also discussing its alignment with total quality management and performance indicators.
- Examine the complexity of value systems that must be addressed in any Value study, specifically the project value chain and value thread, and also organisational value.
- Present a reasoned argument for the development of the client's value system, integrating the components of value, cost, time, risk, functionality and quality.
- Examine teams, team behaviours and facilitation, and to point out practical issues when facilitating value teams in workshop settings.
- Describe an enhanced VM process, argued to be the potential foundation for future 'professional' development.

The authors intend that this book is used to enhance value management knowledge in the following ways:

- By dipping in and looking for a particular topic using the Contents list at the front of the book or the Index.
- Understanding the process of value management and the tools and techniques, in particular information contained in Parts 2, 3, 4 and the Appendix, which provide information for the background and development of value management to be appreciated together with the study styles, tools and techniques, which combine to form a value management service.
- For checking on a particular value management study style, tool or technique. The Toolbox (Appendix) is provided in alphabetical order.
- For an accomplished value management practitioner to benchmark their service. Parts 2, 3 and 4 together with the Appendix provide the study styles, tools and techniques, to permit the practitioner to adopt or amend them for their own personal use. Additionally, Part 3 explores the value concepts and describes a method for the construction of the client's value system.
- For a theoretical overview of value the reader is referred to Part 4, Chapter 11, in which the authors expose value and break it down into a number of discrete points and themes. A definition of Whole Life Value and a proposed method for its management is given in Chapter 12.

- A consolidated methodology for value management and the authors' thoughts on the subjects of managing stakeholders, professionalism and ethics in this context are set out in Part 4, Chapter 13 .

Audiences for the second edition

The second edition is written for a number of audiences. For the competent practitioner who may be looking to benchmark their existing service; for construction clients, consultants and contractors who may be looking to probe value management further; and for undergraduate and postgraduate students. This book, whilst it is focused on construction, is also applicable to projects in other sectors and much of the thinking, philosophy, systems, tools and techniques can be adopted or adapted.

For practitioners, construction clients, consultants and contractors there is one chapter devoted to an extensive collection of case study material representing the authors' diversity of practice. The case studies deal with the design and implementation of value studies in their different contexts, and the lessons learned. Further detailed case studies are also presented in other chapters to reflect the operationalisation of value management research and practice within different organisational contexts that have been undertaken by the authors.

For the undergraduate or postgraduate student taking a course or module that includes value management, the second edition is designed to be an extended exposition of the process and to present some fertile ground for individual thought.

For the researcher, this is the authors' personal view of the value management story thus far. We have utilised numerous research methods since the mid-1980s including hypothetico-deductive, action research and grounded theory based analysis. Techniques have included literature analysis, case study analysis, case vignettes, benchmarking, questionnaire survey, structured and unstructured interviews, and the real-time analysis of live projects. The second edition extends that work further by looking forward in the final chapter on the possible future direction and challenges facing value management.

1.2 Developments in UK construction

A fertile ground was prepared for further developments in value management in the UK construction industry during the 1990s, and that has continued up to the point of writing the second edition. A diverse and copious range of reports and initiatives have sought to increase the efficiency and effectiveness of the industry from the 1990s onwards, and this has influenced value management in a number of ways.

- The Latham Report (Latham, 1994) spawned the Construction Industry Board, which published influential works on the modernisation of the industry. Value management was seen to be conducive to good practice and received significant coverage.
- The Egan Report (Egan, 1998), which spawned the Movement for Innovation (M4I), took advantage of Web technology to showcase examples of good practice and provided an

opportunity for benchmarking through its key performance indicator database. It was influential in shifting a substantial proportion of the construction industry towards more collaborative working, an environment in which value management thrives.

- The National Audit Office (NAO) report *Modernising Construction* (NAO, 2001) argued forcefully for the application of whole life thinking to meet the needs of end-users, the use of integrated working, risk management, and value management and value engineering to improve buildability and drive out waste from the process.
- The Strategic Forum for Construction report *Accelerating Change* (SFC, 2002) built on the work of M4I and established Rethinking Construction as the primary vehicle for public and private sector construction product and process advancement. There is significant stress on value and value-for-money, integrated working across the supply chain, and also whole life value.
- The Office of Government Commerce launched the Gateway process (OGC, 2003) which, with the accompanying construction procurement guidance, describes the benefits of good practice in construction procurement in the public sector. Documents describe the place for value management within this process.
- The NAO report *Improving Public Services through Better Construction* (NAO, 2005) defines value management and value engineering, and notes their use throughout that text and in a range of case studies.
- A report produced in 2005 called *Be Valuable: A Guide to Creating Value in the Built Environment* (Saxon, 2005) grappled with the concept of value, and set out with the goal of shaping knowledge on and about value in the built environment. It focuses on exploring, articulating, defining and trying to resolve competing views on a vital concept in construction and the wider built environment. It outlines preliminary thoughts on the 'soft landings' approach to design and management. It noted that in the buildings-sector of construction the traditional focus has been on cost minimisation and not on value optimisation. The report, in setting out a series of definitions and arguments around value-related information, explains the relationships between value and stakeholder viewpoints in the built environment. It adds, 'Most value is created in the opening stages of defining need and designing the response. Once the delivery phase begins the task shifts to defending the value proposition against erosion'. The report further adds 'Value engineering to minimise cost, can erode the proposition if unskilfully done. Changes or substitutions to meet practical needs or increase supplier profit may also risk the customer quality sought' (p 44). The report argues against value engineering as a cost reduction and substitution approach.
- The Strategic Forum for Construction report *Profiting from Integration* (SFC, 2007) continues to articulate better value for money through integrating the supply chain, a focus on whole life value, risk management and value engineering. In the same year, the NAO report *Building for the Future: Sustainable Construction and Refurbishment on the Government Estate* (NAO, 2007) examined the extent to which Government Departments and Executive Agencies are meeting sustainability targets for their new buildings and major refurbishments. Much like earlier reports, there is a continued emphasis on integrated working across the supply chain and a focus on whole life value. The report adds further that sustainability is consistent with the HM Treasury's definition of value for money, noted as 'the optimum combination of whole life cost and quality (or fitness for purpose) to meet the user's requirement' (NAO report p.7).

The report adds further that it is the responsibility of integrated teams to 'ensure that all of the aspects of sustainability included in the original design are delivered, i.e. that "value engineering" does not result in less sustainable product substitutions or the removal of sustainable design criteria on grounds of cost' (NAO report p.27). The implication is clear from this last statement that value engineering is, but should not be seen as, a cost-cutting exercise to the detriment of sustainability, and within that concern is the potential for it to focus on product and material substitution, which again may act against sustainability.

- The joint HM Government and Strategic Forum for Construction report *Strategy for Sustainable Construction* (BERR, 2008) again emphasises the importance of a focus on whole life value. Furthermore, in 2008 the Business and Enterprise Select Committee reported on a major inquiry into the UK construction industry in its publication *Construction Matters* (BEC, 2008). This was a substantive and in-depth review across the numerous facets of construction. The report addresses in a significant way the concept of whole life value.
- The Government's *Construction Strategy* (HMGCO, 2011) set out the arguments for a significant change in the long-term relationship between Government at different levels and the construction industry. The strategy sets out how the public sector will become a better, more informed and co-ordinated client such that it will achieve a set of requirements that are specified, designed, procured and delivered more effectively and efficiently to the benefit of the country. By challenging industry business models and practices the continuing intent is to replace adversarial cultures with collaborative ones. The strategy also articulates the necessity for cost reduction and innovation within the supply chain to maintain market position, and not innovation focussed around the tendering process in order to establish bargaining positions for potential future claims. It further argues that procurement should be seen not just as a stand-alone process but as part of a broader aspect within the built asset life cycle. There are a number of issues and consequences of the Construction Strategy such as proposed new procurement models, Building Information Management (BIM) and the concept of 'Soft Landings'.
- In the same year as the Construction Strategy was published, the British Standards Institute published BS8534:2011, entitled *Construction Procurement Policies, Strategies and Procedures – Code of Practice* (BSi, 2011). The standard provides recommendations and guidance on the development of policies, strategies and procedures for the procurement of construction in the built environment. It covers public and private sector organisations. The standard notes BS EN 12973, Value Management, as a normative reference, amongst others. It goes on to define VM as 'a structured approach to the assessment and development of a project to increase the likelihood of achieving the objectives at optimum whole life value for money' (p.4). It also defines a series of other terms, including value-for-money, noting this includes optimising whole life cost and quality to meet the user's requirements. The Standard views VM as an integral part of the project delivery process, noting that in the establishment of the Business Need a VM study should be undertaken. The focus of the study should be on establishing business and stakeholder needs in the short and long term, and to set objectives. The Standard is clearly recommending the use of VM in a proactive manner and at an early stage on a project. It also recommends that

VM should be undertaken at various stages throughout a project – multiple interventions – and that risk and value management should be undertaken together as part of this activity. Equally, the Standard argues that good project planning should include identifying when VM is undertaken, and also notes criteria weighting mechanisms for the selection of consultants in their use of VM.

- Finally, Construction Commitments 2012 represents the principles intended to underpin all construction projects to achieve a better industry and exceed current best practice. The six principles cover client leadership, procurement and integration, design quality, a commitment to people, sustainability, and health and safety. A focus on whole life value is noted within the design quality principle.

In the context of the foregoing, stakeholders is a term often used in construction. At an organisational level, a stakeholder is defined as a person or group of people who have a vested interest in the success of an organisation, or the environment within which it operates, and at project level a project stakeholder is a person or group of people who have a vested interest in the success of a project and the environment within which the project operates (McElroy and Mills 2000: p.759). The issue of stakeholders in the context of value management will be addressed further in Chapter 13.

To conclude, the 1980s, 1990s and 2000s saw a further significant impetus to reform the way construction operates. Procurement systems were developed based on framework agreements, negotiations, integrated team-working, guaranteed maximum price and cost plus projects that initiated forward-thinking contracts such as PPC 2000, the Defence Estates Prime Contract and the NHS ProCure 21/21+ procedures. PFI/PPP also gained significant ground as a procurement strategy that embraced whole life thinking and value-for-money through the Public Sector Comparator mechanism. VM was advocated as good practice within many of these approaches and some encapsulated it as a formal way of working. The review of reports cited earlier also articulates the increasing momentum towards thinking about value, value for money, stakeholders, whole life value, and not just cost. Some reports reviewed also caution about the inappropriate use of value management/value engineering as purely a cost-reduction methodology.

Section 1.3 reviews briefly developments in value management.

1.3 Developments in value management

The essence of value-based thinking is a focus on delivering value and value-for-money to a client, customer or end-user. Value and value-for-money are multifaceted, are often context-driven, and involve elements of subjectivity, judgement and the need for appropriate measures. In project-based organisations or industries, such as construction, they typically involve consideration of clients, customers, end-users and other important stakeholders that impact or influence projects. In this context, value-based thinking keeps the client, customer, end-user and other key stakeholder requirements to the fore. Its focus is on their requirements, which the Value Management methodology typically expresses as functions. As a management approach, value-based thinking seeks innovative alternatives to meet those functions and requirements. Within the framework provided by these principles, the VM methodology uses tools and techniques to select the most effective option that best meets those functionally expressed requirements at optimal or least cost and then delivers them efficiently. Typically it will also involve issues around trade-offs, clarity over value-criteria, engagement with the market place and supply chains, and considerations of risks to creating and delivering value throughout the whole process of delivery.

Maximum value as defined by Burt (1975) is obtained from a required level of quality at least cost, the highest level of quality for a given cost or from an optimum compromise between the two. This is a useful definition because it highlights the relationship between value, quality and cost. In this book, the definition of value is extended to include a relationship between time, cost, risk, functionality, and the variables that determine the quality a client seeks from the finished project.

Value management

Value Management is a philosophy, a set of principles, and a formal, structured, value-based management methodology for improving organisational decision-making. Its aim is to optimise organisation performance by increasing effectiveness and efficiency through a Value Study. The basis of a formal value study is as follows:

- It is a function-oriented management methodology that can fit into a wider organisational context at
  - Corporate level
  - Portfolio, Programme and/or Project level
  - Service and/or product level.
- It is a structured, challenging and mediating process involving key stakeholders drawn from across important value interfaces. For example, key user representatives, client senior managers and the different members of the design team. Hence, it involves using the right team at the right time.
- It focuses on exposing, making explicit and exploring a construction client's 'value criteria' and using this subsequently for resolving trade-offs surrounding solutions, options and alternatives.
- It permits different 'value systems' to coalesce to the benefit of the client across a project, Programme, Portfolio and organisation.
- It is a change-oriented methodology.

At project level, Value Management is the name given to a process in which the functional benefits of a project are made explicit and appraised in alignment with a value system determined by the client. It is concerned therefore with optimising the strategic, concept, feasibility, technical and operational aspects of a project and its outcomes against that explicit value system.

This definition applies to all types of projects irrespective of which sector they come from. For example, the project could be the design and manufacture of a product, the design and construction of a building or infrastructure as physical assets or products, the re-evaluation of an organisational process or the provision of a new or improved service in banking, insurance or public services such as education or health.

The factor that makes value management possible in construction is the identification of a project. The client for the project would implicitly or explicitly establish a value system for that project. 'The client' in the context of this definition and for the remainder of this book is the person, persons or organisation responsible for the inception and, perhaps, funding of the project and for its eventual adoption back into the client's mainstream business.

During its first three decades of life, however, value management (practised as value engineering) developed within the manufacturing sector with only a slight take up into other areas. From the mid-1970s onwards value management was adopted for use as a value-for-money measure within the construction industries of initially the United States and subsequently a number of other countries. In the United Kingdom, the 1990's and 2000's have seen growth in its development and practice at differing intervention points across a wide range of construction project types. Over the same period risk management has developed and is often associated with value management as a complementary service. That future developments in value management belong to the service sector is beyond dispute. The authors take the view that value engineering is a subset of value management, and that risk management is an inherent and integral part of value management and a value study; they are contiguous. Risk and Risk Management are about assessing the risks to delivering value and value for money in an organisational and project context.

Developments in value management practice

New practices, particularly in management, bring with them the 'trending' effect. A good idea is launched into the marketplace as a new service by an entrepreneurial consultant. Recognising the good idea, other consultants offer the same service. Over time, the service assumes the trappings of standardisation, regulation and institutionalisation; clients buy from the best, which can now be distinguished, and some consultants discontinue the service.

In construction, projects and their management are intertwined with notions of value, value-for-money and the best ways to manage these throughout the project life cycle. This is also inextricably linked to developments in VM. The history of construction project management in the United Kingdom can be tracked through landmark projects, for example, the construction of the National Exhibition Centre (NEC) in Birmingham, the London Liverpool Street station complex, Wembley Stadium, the Scottish Parliament, and the 2012 Olympics complex in London. At the time of the NEC project, employment of a consultant project manager was relatively rare but soon became recognised as a better way of doing business. Within a short period of time many consultancy organisations were selling the services of project management. However, over time those unique assets that make project management special have become recognised and the activity of project management has become a specific and accepted skill. In the United Kingdom, the Association for Project Management (APM) aims to be the first point of contact for and the national authority on project management, and through the International Project Management Association (IPMA), an international authority. This has to be viewed alongside, for example, the Project Management Institute in the

United States. The APM and PMI both develop Bodies of Knowledge, and standards for project management, Programme and Portfolio Management which include references to value management and value engineering. These institutes aim *inter alia* to develop professionalism in project management and to achieve recognised standards and certification for project managers.

Value management activity in UK construction started to come to the fore in the early 1980s. Value management was given a further boost in Europe by the European SPRINT programme (Strategic Programme for Innovation and Technology Transfer) in the early 1990s. It was the precursor to the establishment of European value management standards and a training and qualification system entitled Value for Europe, configured with its own European Governing Board (EGB). As part of this development, within the United Kingdom, the Institute of Value Management, operating under the auspices of the EGB, has developed systems and procedures for certification and training, training course approvals, ethics and standards, and a branch network. SAVE International in the United States, and its affiliates, have similar structures. There is a debate on institutional structures and practitioner frameworks for VM and professionalism in Chapter 13.

1.4 The structure of the second edition

The book is structured into four parts, each with a particular focus.

Part 1, entitled *The Introduction*, which includes the current chapter and Chapter 2 on the further evolution of VM, provides the background for the remainder of the book. *Part 2*, building and extending on this, is entitled *The Anatomy of a Value Study*, and comprises five chapters. Its scope is to establish how to design and conduct a value study under different circumstances. Chapter 3 deals with value study styles on projects. Chapter 4 deals with the core VM technique of Function Analysis. Chapter 5 deals with teams, team dynamics, and managing value teams, a particular issue for the management of workshops. Chapter 6 deals with innovation and benefits realisation. Chapter 7 provides an extensive suite of nine detailed case studies conducted by the authors, and the lessons they have learned from those studies.

Part 3, entitled *Whole Life Business Value*, comprises four chapters. Its scope is to extend the discussion on where and how VM can be applied in different organisational contexts. Chapter 8 deals with physical asset management, an important emerging theme for those organisations that have to manage a significant portfolio of physical assets through time. It brings to the fore issues of asset ownership, management and performance, and whole life value. VM case studies conducted by the authors are also presented. Chapter 9 deals with Portfolio, Programme and project management, and how VM can be applied in that context. The chapter presents a case study that has also been conducted by the authors in this area. Chapter 10 competes Part 3 and is concerned with option appraisal, risk management and whole life costing. A VM case study is presented that brings together a whole range of different facets for consideration in option appraisal. *Part 4*, entitled *Developments in Whole Life Value Thinking*, comprises three chapters. Its scope is to look forward at possible future developments in VM. Chapter 11 breaks apart the concept of value. Chapter 12 proposes a methodology for exploring and managing whole life value. Chapter 13 draws together a number of strands from across the whole book, and presents an enhanced VM methodology and extends the notion of study styles. It also addresses institutional and practice structures for the continued development of VM, and the related concepts of profession, professionalism and ethical standards. The Appendix contains a value management tool box; an alphabetical listing of those tools and techniques commonly associated with value management.

The chapters in this book depict a construction context principally influenced by a UK-style construction culture. The aim of the first edition was to record, discuss and establish the development of value management until 2003. This second edition reflects on the significant developments in asset management, Portfolio, Programme and project management, whole life value, and construction practice over the past 10 years through the lens of the authors' considerable research and consultancy experience. It presents a new paradigm for value management practice for the next decade.

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2 Evolution of Value Engineering and Value Management

2.1 Introduction

An examination of the formation of value analysis in the late 1940s and the development of value engineering (VE) and subsequently value management give an insight into the foundation of the diverse types of value studies described in this book and practiced today. The term value study is used here to denote the implementation of a value improvement philosophy and methodology through a structured process. This chapter is structured into three parts:

- A brief historical background.
- A discussion of the three phases of development in value studies is presented, comprising
  - Phase 1 – The analysis of existing manufactured components with the aim of providing those functions satisfied by the component at the least cost.
  - Phase 2 – A development of the process of analysis to include a study of components during their design to ensure that when manufactured they precisely satisfy their required functions at the required quality and at the least cost. During this phase there was transference of the concept to construction where the design and construction of components and elements of construction were similarly analyzed.
  - Phase 3 – This brought about a significant change where the focus was not just on the component but on entire projects for the satisfaction of an organisational or business strategy through manufactured products, services and the optimal development of built assets in the built environment, the focus of much of this book.
- A brief outline of the development of standards and guidance documentation, and international research relating to the development of value engineering and value management (VE/VM).

The chapter concludes with the salient features of a value study, which are discussed further in detail in other chapters of this book.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

2.2 Historical background

The evolution of value analysis is consistently recorded by a number of the early writers (Crum, 1971; Fallon, 1971; O'Brien, 1976; Parker, 1985). During World War II a shortage of strategic materials led the allied governments to require that such materials be reserved for the armaments industries. In the United States, manufacturers producing non-military goods were obliged to use alternative materials, and at GEC Philadelphia, Harry Erlicher, the Vice President of Purchasing, became responsible for sourcing supplies. To guarantee specified performance from the alternative materials, some redesign work was necessary. In some cases the substitute materials achieved equal or better performance at lower cost. Erlicher decided that a process should be evolved to ensure that lower cost alternatives were discovered by intent rather than by chance.

Lawrence D. Miles, purchasing agent for a division of GEC located in Baltimore, was assigned the task of developing such a system and in 1947 completed the development of a systematic functional approach to cost reduction, which he called value analysis. The undertaking of value analysis necessarily required interaction with other departments within GEC and therefore a team approach to analysis was evolved to aid efficiency. The team approach invariably required the gathering together of the team members in a workshop forum facilitated by a leader who would lead the team through a structured process.

Therefore, a characteristic of value analysis from the very beginning was the team approach to creatively providing the required function, resulting in the generation of many alternatives to an existing solution. Where cost-efficient alternatives were found, they were tested and approved by the product designer.

A synoptic definition (Kelly and Male, 1993: p.8) of value analysis, which also holds true for current value engineering, is as follows:

> An organised approach to providing the necessary functions at the lowest cost.

From its inception, value analysis was seen to be a cost validation exercise that did not affect the quality of the product. The straight omission of an enhancement or finish, which was detrimental to the quality of the product, was not considered value analysis.

This leads to a second definition (Kelly and Male, 1993: p.8):

> Value analysis is an organised approach to the identification and elimination of unnecessary cost.

where unnecessary cost is defined as cost that provides neither use nor life nor quality nor appearance nor customer features. In this context:

- *Use* refers to the utility of the component. This utility is measured by reference to the extent to which it meets function and performance requirements.
- *The life* of the component or material must be in balance with the life of the assembly into which it is incorporated. For example, unnecessary cost may be incorporated if a component is specified, which has a life of 12 years, within a product that will be redundant in 4 years.

- *Quality* can be subjective, but, however it is perceived, it must be preserved. It can also be specified and therefore defined. The philosophy of value engineering looks towards reducing cost without sacrificing quality. Quality is discussed further in Chapter 11.
- *The appearance* of a product visually attracts the customer. The aesthetic features of any building or product are often those that delight the customer.
- *Customer features* are those enhancements that sell the product but which of themselves do not add to the customer's required functions. Features such as the ability of a car to go 'off road', or the acceptance of high-performance apps on a mobile phone attract the customer even if they are not a stated requirement of the majority of customers and may be infrequently or never used.

The three phases of development from value analysis to value management are described in the following sections.

2.3 Definitions, terminology and practice – Phase 1: 1947 to 1963

The first phase of development was the period during which value analysis and subsequently value engineering developed within manufacturing. Initially, this development was within the manufacturing industries of the United States and Japan (an early adopter in 1955 (SJVE, 1971, 1981)), but during the 1960s it became adopted within manufacturing internationally. During this first phase, the initial development of value analysis was restricted to its practical application as a cost reduction procedure that focused on modifying the design of products and equipment to achieve lower manufacturing cost. This focus shifted towards the end of this period to the redesign of products to attain the same function at a reduced cost. The process was developed by practitioners with little academic scrutiny. For example, texts up to 1972 – Miles (1961), Gage (1967) and Crum (1971) – describe the process without a formal structured definition of value analysis.

In 1954, the United States Department of Defense's Bureau of Ships became the first US government organisation to implement a formal programme of value analysis. It was at this time that the term 'value engineering' came into being for the administrative reason that engineers were considered to be the personnel most appropriate for this programme (Parker, 1985). The formation of the Society of American Value Engineers (SAVE) in 1959 established the term value engineering, which came into common use as the preferred term, and is the term most used in the United States today. Also in 1959, value engineering was endorsed by the Secretary of State for Defense, Robert McNamara. The first recorded use of a value incentive clause in a construction contract was in 1963 by the United States Navy Bureau of Yards and Docks.

A characteristic of North American value engineering from its inception is the team approach to function definition and creativity through application of what Miles (1961, 1989) called the Job Plan, a logical, sequential approach to the study of value. The early Job Plan was manufacturing orientated, as in the example shown later, but the principles of the Job Plan and its name has been applied in other sectors and in other countries.

All North American value engineering texts refer to a pattern derived from Miles's original Job Plan, which is summarised as follows (Miles, 1961):

- *Phase 1: Orientation.* The orientation phase can take a number of forms from a single meeting to a schedule of investigative activity. The aim is to determine what is to be accomplished, what does the client need and/or want, what are the desirable characteristics? As practised by New York City, for example, it is an introductory facilitated short workshop with the aim of allowing everyone involved in the project an opportunity to understand all the issues and constraints. It provides everyone who is to make a decision with an opportunity to give and receive information.
- *Phase 2: Information.* This phase is usually the introductory phase of a facilitated workshop in which all of the available information relating to the project under review is gathered together. This includes securing all costs, quantities, drawings, specifications, proposed or existing production methods, samples and prototypes. The objective of the information gathering phase is to identify the functions of the whole or parts of the project, as seen by the client organisation, in clear, accurate and unambiguous terms. The information should not be based upon assumption but be obtained from the best possible source and corroborated if possible, with tangible evidence. The reasoning behind this is that the quality of decision making cannot rise above the quality of the information upon which the decision is to be made.

  Information is categorised as follows:
  - *Client needs*, which are the fundamental requirements that the project must possess to serve the client's basic intentions. Needs should not be seen solely in terms of utility as the client may have a need for a flamboyant statement or a need for a facility that heightens the client's esteem.
  - *Client wants*, which are the embellishments that would be nice to have but do not satisfy need.
  - *Project constraints* are those factors that will impose a discipline upon the design, for example, the shape of the site, planning requirements and regulations.
  - *Budgetary limits* expressed as the total amount that may be committed to the project in initial capital and life-cycle costing terms.
  - *Time* for design and construction as well as the anticipated period for which the client will have an interest in the building.

  Although, as stated, the quality of decision-making cannot rise above the quality of the information on which the decision is to be made, care should be taken not to spend unjustifiable time and effort in information seeking. Fallon (1971) refers to the dilemma between the dangerous consequences of acting upon inadequate information and the possible missed opportunity while waiting for reliable information to arrive. However, in the context of informing those attending a value study workshop, much of the information in the categories mentioned should be contained in the Business Case.

  Information is used to understand function. Function analysis is a fundamental step in a value study in which functions of all or parts of the project under review are recorded. Function analysis is described briefly later and in more detail in Chapter 4.

- *Phase 3: Speculation*. Following the information stage and the understanding of function, ideas are generated to solve the identified problem using brainstorming sessions. All suggestions are recorded.
- *Phase 4: Analysis*. The whole life cost of each idea is estimated and ranked in order of highest gain and highest likely acceptability. The best ideas are investigated thoroughly.
- *Phase 5: Development and planning*. The manufacturing/construction schedule is established by identifying operations, design and production personnel, suppliers, and others involved in project planning. An ethos of creativity is promoted in all involved parties.
- *Phase 6: Schedule execution*. The manufacturing/construction schedule is pursued, evaluating and appraising further suggestions from suppliers, and subcontractors.
- *Phase 7: Status summary and implementation*. If in a position to take executive decisions, new ideas are acted on; if not, make recommendations to those who are to take the ideas forward for further development, selection and implementation.

It is to be noted that Miles was solely concerned with manufacturing and this is reflected in his Job Plan. However, the basic principles of the Job Plan have carried forward into value study agendas in manufacturing and construction. The British Standard BS EN 12973 (2000; BS EN 12973:2000) refers to the term Work Plan, which is the term used in this book.

Value engineering reached Europe during the 1960s. The first recorded major programme in the United Kingdom (Crum, 1971), was at the Dunlop Company in 1961. By 1966, value engineering was prevalent in many European manufacturing organisations. The Value Engineering Association was formed in the United Kingdom in 1966 and held its first conference in 1967.

2.4 Definitions, terminology and practice – Phase 2: 1963 to 1989

During its second phase of development in manufacturing, the focus shifted away from the analysis of existing products to the evolving design of new products. Crum (1971), an early UK author of value engineering, saw the work of Miles (1961) as value analysis because it focused on an existing product, whereas he considered value engineering as the correct term in the context of the developing design of a manufactured product. In the 1970s, the manufacturing industries of Japan developed the principles of value engineering and applied them enthusiastically, with a very strong function-oriented cost-cutting focus due to intense industrial competitive forces, and an acknowledgement that its early application in research and development and design for production would pay significant commercial dividends (SJVE, 1971, 1981). In the late 1970s and during the 1980s the development of value engineering appeared to be retained within manufacturing companies for competitive advantage and discussion amongst practitioners decreased.

The early manufacturing focus on the improvement of existing products on a production line meant that value engineering was less applicable to construction, which tends to deal with 'one-off' products. However, the switch of emphasis in manufacturing to value engineering the design of new products awakened interest in the construction industry where techniques to value engineer design became much more relevant. Value engineering spread quickly within the United States construction industry's public sector and also began to penetrate the construction industries of other countries. In 1973, at the 13th SAVE conference, it was estimated that over half of the audience were from the construction industry (O'Brien, 1976). Also by 1973 the technique was well embedded in US Government agencies concerned with construction (Parker, 1985). The worldwide dissemination is illustrated by the publication by the Australian Department of Defence manual, DRB 37 Value Analysis (Australian Department of Defence, 1983), which retains the tenor of the original definitions of value analysis as 'the systematic effort directed at identifying the functions of systems, equipment, facilities, procedures and supplies for the purpose of achieving the essential functions at the lowest cost consistent with the needed purpose, performance, reliability and maintainability'.

Szöke and Dandri (1980) undertook a three-and-a-half-year study on behalf of CIB W55, the international construction research forum, of value engineering in the construction industry. They reported that the United States, Canada and Japan were countries of widespread application with 24 other countries reporting intermittent application, typified by the French experience of sporadic development, which waxed and waned over the period. In 1972, the UK Value Engineering Association became the Institute of Value Management, but by the late 1980s it had become moribund with a membership of less than 10. Kelly and Male (1988) reported in an Royal Institution of Chartered Surveyors (RICS) Education Trust sponsored study on the relationship between value engineering and the quantity surveying practice of cost management. A recommendation of the report was that the term value management should be used in preference to value engineering, although at that time the terms were seen by the authors to be synonymous.

2.5 Definitions, terminology and practice – Phase 3: 1989 to 2014

During the third phase of development, interest in value management grew within the manufacturing and construction industries and along with the interest came a debate over definitions, terminology and practice. Over the period, a level of consistency has developed internationally on the meaning of the various terms and also of the nature of the endeavour. This consistency was aided by a number of guidance documents on the application of value management published by professional institutions and central government organisations.

During the 1990s there was a shift from the application of value management techniques solely to the design and production of components to its application to organisational and business strategy as a whole. Manufacturing evolved a value management definition to incorporate an emphasis on a systematic product and manufacturing development with a concept to customer focused design procedure.

The lever of quality developed by Winston Davis of Jaguar cars in the late 1990s demonstrates graphically that quality enhancements can be achieved by applying either minimal effort at the early concept stage (value planning) or considerable effort at the value analysis or process stage, The lever of quality is shown in Figure 2.1.

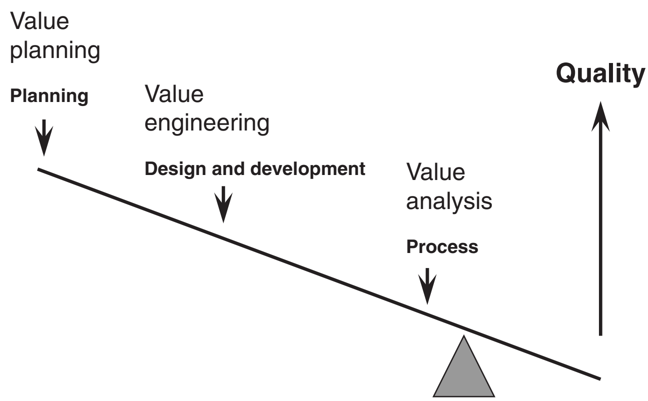

Figure 2.1 The lever of quality (after Winston Davies).

Value management as a method for competitive advantage is illustrated by the total value management methodology outlined by the Ford Motor Company (Financial Times, 11 March 2002) and included in the Ford (2013) supplier portal, which describes Team Value Management as an initiative to ' . . . identify and deliver maximum value at lowest total cost. This fact-based, collaborative method eliminates waste throughout Ford and its supply base'.

The characteristics of value management in a manufacturing context are as follows:

- Manufacturing has a long planned project gestation, although competitive pressures are continually reducing the time a new product takes to get to market.
- Manufacturing has a high level of customer focus.
- Manufacturing has to bear very high production testing costs. This is particularly true in the car industry.
- Manufacturing has a high tier 1 supplier cost base, commonly 85% of the final product cost.
- Manufacturing has demonstrated from the 1990s through the first decade of the new millennium a huge willingness to improve efficiency in the face of global competition.
- Manufacturing generally retains design within its own organisation.

The shift in manufacturing from a focus on the value engineering of components to a focus on the application of value management to organisational and business strategy aided the adoption of value management in construction. In construction, one of a number of project-based industries, the focus is on the provision of the highest value facility or utility to meet the strategic requirements of the organisation or business through a programme of value management interventions. This widening of the scope of value management during its third phase of development led to a debate and general agreement on terminology.

In the United States the term value engineering was seen to be restrictive and in 1997 the Society of American Value Engineers renamed themselves SAVE International. At the same time a value methodology standard was introduced, and subsequently updated (the latest standard SAVE International, 2007 – reviewed later in this chapter). The current SAVE International definitions are:

- Value engineering – The application of a value methodology to a planned or conceptual project or service to achieve value improvement.
- Value management – The application of a value methodology by an organisation to achieve strategic value improvement.

Although at first sight it appears that value management has as many definitions as authors of value management texts, guidance and standards, there is a reasonable level of agreement on meaning. A selection of definitions is given here:

- A service which maximises the functional value of a project by managing its development from concept to completion and commissioning through the audit (examination) of all decisions against a value system determined by the client (Kelly and Male, 1993: p.4).
- A systematic, multidisciplinary effort directed toward analysing the functions of projects for the purpose of achieving the best value at the lowest overall life cycle project cost (Norton and McElligott, 1995: p.11).
- The value process during the concept, definition, implementation and operation phases of a project [which] encompasses a set of systematic and logical procedures and techniques to enhance project value throughout the life of the facility (ICE, 1996: p.2).
- A structured approach to defining what value means to a client in meeting a perceived need by establishing a clear consensus about the project objectives and how they can be achieved (Connaughton and Green, 1996: p.2).
- The integration of proven and structured problem-solving techniques . . . implemented by a multidisciplinary team under the guidance of a knowledgeable value practitioner to seek out the best functional balance between the cost, reliability and performance of a product or project (Thiry, 1997: p.10).
- Value management is a structured and analytical process in which a prescribed Work Plan is followed to achieve best value, and, where appropriate, best value for money in products, processes, services, systems and organisations (AS/NZS 4183, 2007 – reviewed later in this chapter).
- Value Management (VM) as a philosophy, together with its associated tools and techniques, emphasizes the need to consider function and cost in a structured and systematic way, as part of any strategic decision process – Hong Kong Institute of Value Management (HKIVM, 2013).

These definitions are sufficiently consistent to be able to isolate the salient features of value management as being

- A philosophy of value improvement to projects, products, processes, services, systems and organisations.
- Strategic in nature and proactively evolutionary in operation throughout a project's life cycle.

- Function orientated.
- Based upon a structured interrogation of what is of value to the client.
- Stakeholder and team based.
- Led by a knowledgeable, possibly qualified, Value Study Leader (VSL).
- A structured process involving the use of procedures and techniques to address value.
- Concentrates on strategic mission and the definition and specification of proposed Programmes and projects within a broader organisational context.
- Likely to result in change to an organisational status quo.
- With application at a number of points in the evolution of a single project or a Programme of projects.

In contrast, the salient features of value engineering are as follows:

- It is technical in nature, reactively focused on the improvement of a product or design and specification of designed space, elements, systems and components.
- Function orientated.
- With an actual or presumed understanding of the client's value system.
- Technical team based.
- Led by a value engineering facilitator or knowledgeable VSL.
- A structured process involving the use of procedures and techniques.
- Application to a technical problem with distinct and defined boundaries.

The salient features of value management and value engineering as listed above are derived from literature contemporary to the third phase of the development of VM/VE. These features are reflected in the discussions in this book. Having reached a consensus on the meaning and salient features of VM and VE the following sections outline those factors which have to be considered in the organisation of a value study. Whilst these brief descriptions are covered in detail in later chapters sufficient has been explained to understand the value study styles described in Chapter 3.

2.6 The Project, Portfolio or Programme of projects

Value management has application to the development of a Project, Portfolio or a Programme of projects. In this context a Portfolio of projects is a grouping of unrelated projects, and a Programme of projects is a grouping of related projects. For example, a new rail line may be considered a Programme since it is comprised of a number of related track, signalling and station projects each sufficiently large and self-contained to be considered a project in their own right. Portfolios, Programmes and projects management are considered in detail in Chapter 9. The focus of this chapter predominantly relates to projects.

In brief, a Project, as a process, is an activity undertaken that implements change. The essence of a project is the recognition that the investment through a project is undertaken to add value to the core business of a client by adjusting or changing the core activity of the business for the better. The traditional view of a project is that it has, by definition, a start date, a completion date, resources and personnel for its

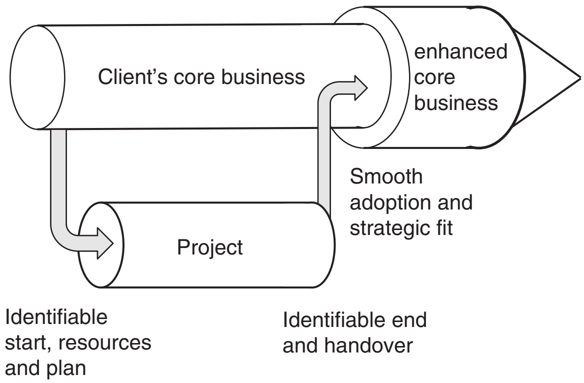

Figure 2.2 The relationship of a project to the core business.

undertaking (not necessarily from the core business), a method for its smooth integration back into the core business, and ideally performance indicators that allow its impact on the core business to be measured (Standing, 2001). The relationship of the project to the core business is illustrated in Figure 2.2.

2.7 The 1998 international benchmarking study of VM and VE

Description of the study

In 1998 a value management benchmarking study was conducted in the United Kingdom, and funded and sponsored by the Engineering and Physical Sciences Research Council (EPSRC). It was a collaborative study by the Universities of Leeds and Heriot-Watt with the aim of synthesising the best of VM/VE practice internationally and presenting it in the form of a value management benchmark. There were three outputs:

- Male S., Kelly J., Fernie S., Grönqvist M., and Bowles G. (1998a), The value management benchmark: a good practice framework for clients and practitioners, Thomas Telford, London.
- Male S., Kelly J., Fernie S., Grönqvist M., and Bowles G. (1998b), The value management benchmark: research results of an international benchmarking study, Thomas Telford, London.
- An interactive CD Rom.

Sixty-five individuals representing 58 international collaborating organisations contributed to the study through face-to-face benchmarking sessions. Although this study is dated, it summarised the development of VM/VE internationally at the midpoint of the third phase in the development of VE/VM and gives high confidence in the benchmark of the discipline as it was practiced in 1996/1997.

The study determined the characteristic workshop opportunities in a construction project; the activities undertaken in each characteristic workshop; the tools and techniques used at each stage; the issues surrounding qualifications, certification, legislation and the professional development of value management; and some observations concerning practice within the public and private sectors.

The 1998 research study occurred at a time that can be considered a transition between the US domination of VM/VE theory and those theories of primarily value management developed in Europe, Australasia and Asia. As stated earlier, the European Community Strategic Programme for Innovation and Technology Transfer (SPRINT) working group on value analysis began its work in 1989. Prior to 1989 the development of the value engineering process and the study methodology described earlier reflects the practice of mainstream value engineering in the United States. At the time, development through academic research was relatively limited. Research undertaken by practitioners predominantly tended to concentrate on near market developments of the service, often involving enhancements to economic modelling or quality techniques. Developments can be tracked through the SAVE International annual conference proceedings and the quarterly Journal. In 1996, as demonstrated in Table 2.1, a number of UK construction bodies reported on their studies into VE/VM. The 1998 benchmarking study collated the various perspectives and developed a methodology described in the first edition of this book in 2004. The benchmarking study is briefly described.

Points in the project process for the application of value management

In an earlier work, Kelly and Male (1993) identified four levels in the project delivery process as illustrated in Figure 2.3. It was presumed that these levels would have a direct impact on the form and type of a value study. The levels formed the basis of a programme of value study interventions.

Table 2.1 Value Management/Value Engineering Intervention Points.

ICE ***Creating value in engineering design and practice***	CIRIA ***A client's guide to value management in construction* (Connaughton and Green, 1996)**	HM Treasury CUP No 54 ***Value management***	BSRIA ***Value engineering of building services* (Hayden and Parsloe, 1996)**	Draft European Standard – (became BS EN 12973:2000) ***Value management***
VP1 – Early concept	VM – Concept	Option appraisal and business case	VM1 – Inception/ definition	Inception
VP2 – End of concept – develop a brief	VM – Feasibility	Outline design	VM2 – Outline proposals	Concept
VE1+ – Post brief	VE – Scheme design	Final sketch plan	VE1 – Scheme design	Feasibility
	VE – Detailed design	Detail design	VE2 – Detailed design	Implementation
		Construction handover		Use

a Project awareness	b Client development	A Inception	B Feasibility	C Outline proposals	D Scheme design	E Detail design	F Production information	G Bills of quantities	H Tender action	J Project planning	K Site operations	L Completion	M Feedback
Pre-brief		Briefing		Sketch plans		Working drawings				Site operations			

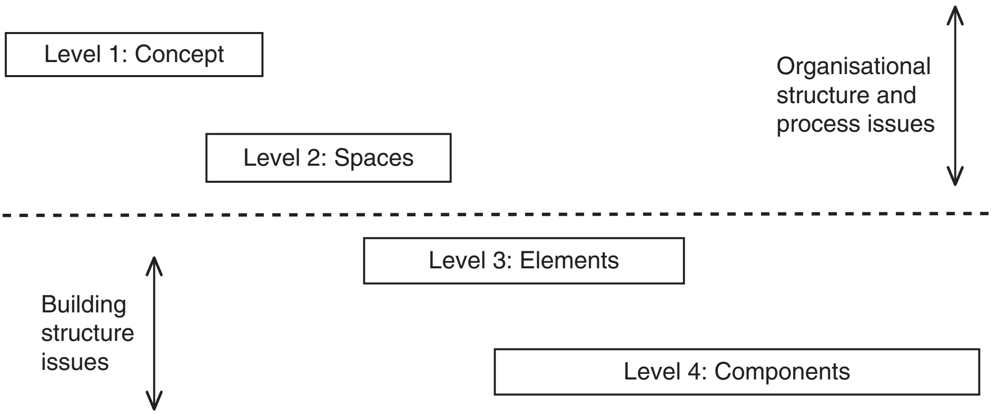

Figure 2.3 Activity levels in the construction process. *Source*: Kelly and Male (1993: p.160), based on the RIBA Plan of Work.

The interventions are therefore:

- *Concept*, the point at which a decision to proceed with a project is taken and the formulation of the strategic brief, budget cost and outline business case undertaken;
- *Spaces*, when the size, adjacency, servicing and finishings of spaces are defined in the project brief and the scheme design cost plan;
- *Elements*, when the building takes a geometric form, elements are identified, a cost plan configured and an outline business case completed.
- *Components*, when the detailed design of elements is undertaken and included in the detail design cost plan.

Contemporary literature all dated 1996 largely confirmed these intervention points. These are summarised in Figure 2.4 and Table 2.1

At the same time, in the United States SAVE stated 'VM must be applied as early in the design cycle as feasible to achieve maximum benefits' (SAVE International, 1998: p.1), indicating that value studies could be conducted at two stages:

1. Schematic stage
2. Design development (up to 45%).

The then Australian and New Zealand Standard (AS/NZS 4183, 1994; updated in 2007, and reviewed later in this chapter) took a broader view, encompassing what seemed to be the whole of the construction supply chain and identifying eight stages:

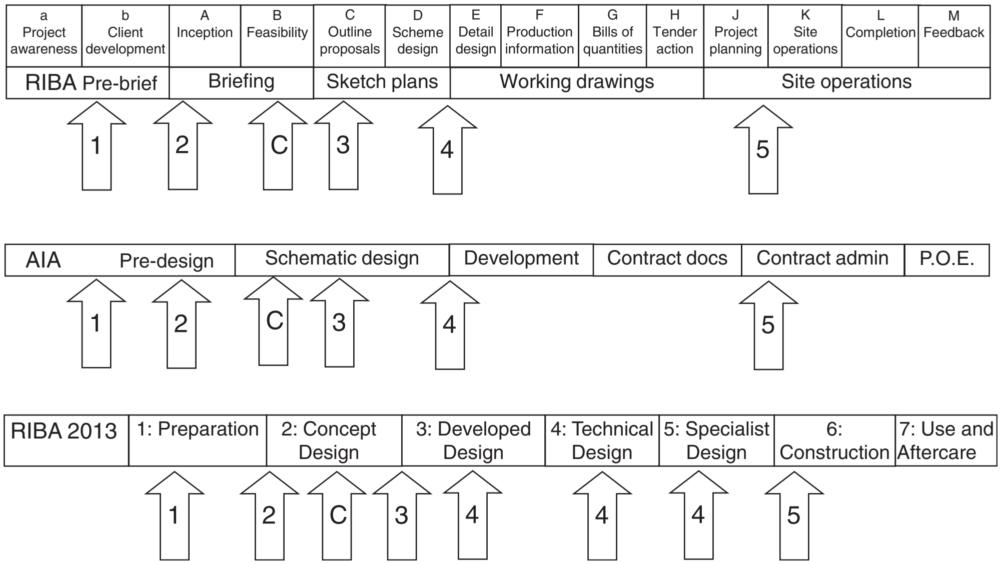

Figure 2.4 Value opportunities with reference To AIA and RIBA processes.

1. Project concept
2. Client brief
3. Site selection
4. Design proposals
5. Material selection
6. Construction programs
7. Construction methods
8. Facility management.

The post-benchmarking conclusion of the 1998 study (Male *et al.*, 1998a) was that there were characteristically six points for the application of VM/VE in a project:

1. The Pre-brief Value Study where the focus is on the definition of the project in functional terms without a presumption of what to build. At this value study, the concept is established and sufficient understanding of the project for the preparation of the outline business case. The Construction Industry Board (1997) referred to this stage as the compilation of the strategic brief.
2. The Brief Value Study where the strategic brief is confirmed (or evolved if a pre-brief value study had not been held) and a project brief developed. The project brief for a building is space orientated. The output of the value study is a description of the space requirement in functional terms together with adjacency relationships, definitions of size to meet function, service and IT support and required level of finishes. This information becomes the foundation of the room data sheets.
3. The Concept Design Value Study is a review of the outline scheme to date. It has two functions: first, to audit the developing design against the strategic and project brief, and second, to be innovative in improving the design through the examination of options.

4. The ‘Charette’ is a particular form of value study that amalgamates the Pre-brief, Brief and Concept Design value studies. In the absence of these value studies it is the first value management intervention and is an audit of the progress on the project to date. Involved in the value study are those from the client organisation who have contributed to the brief and the full design team.
5. The Detailed Design Value Study is a technical value study that considers the function and cost of space and elements. This is the form of value study that is the mainstay of US value engineering.
6. Operational studies are value studies held either during the latter stages of detailed design, or post contract or post package tender. They involve the design team and the main or package contractor in a short value study to find efficiencies in manufacture and/or construction.

Whilst there was evidence to suggest that value management was conducted beyond the construction stage, there was infrequent mention in the 1998 study fieldwork discussions, as was the case with facilities management. Each of the value opportunity points has been identified in Figure 2.4. The figure relates the opportunity points to the RIBA Plan of Work, the AIA Design Process and the new 2013 RIBA Plan of Work (RIBA, 2013).

Benchmarked requirements for a successful value management process

The 1998 benchmarking study determined a series of prerequisites to ensure the smooth running of a value study. These relate to the involvement of people and the venue for the workshop, and include:

- Agreement to participate by all parties involved in the value study.
- Senior management support for value management.
- An experienced and independent Value Study Leader(s).
- An appropriate team skill mix.
- The presence of client decision taker(s).
- An isolated workshop environment.

A number of benchmarking partners highlighted the necessity for pre workshop orientation, either as a data gathering exercise by the VSL, or, through a preworkshop meeting to:

- Gather information,
- Elicit views and opinions of key stakeholders and project specific participants,
- Help to define value study scope,
- Identify project constraints,
- Contextualise the value problem within both the ‘business’ and project delivery process, and
- Brief the workshop team on the purpose and agenda for the workshop.

These requirements are as valid in 2013 as they were in 1998.

Conclusion of the 1998 benchmarking study

The conclusion of the benchmarking study was that value management and value engineering are team based, facilitated, problem-solving services that used a number of recognised tools and techniques at specific points in the evolution of the project. The original Miles Job Plan was generally followed but its updated form retitled as a Work Plan and with function analysis playing an enhanced role. The Kelly and Male 'project levels' illustrated in Figure 2.3 were robust and useful in comparing the chronology of value management activity through a project's life cycle. The definition of value studies was refined and the activity within each value study clarified as an output of the research study.

At the time of the benchmarking study, the majority of activity, particularly in the United States, Canada, Japan and Korea was at value opportunity point 4, 35% design (Figure 2.4). In the United Kingdom, the 'Charette' was considered the most common style of value study. Activity in Australia was mixed, but in New South Wales there was emphasis by one organisation on the strategic briefing stage. The French and German focus was on manufacturing with emphasis on value engineering at detailed design but with some earlier application through functional specification (Janin, 1989).

The research study indicated that the process of value management – the value study – could be broken down into three main areas:

- The *inputs* required for a study (now termed by the authors the Orientation and Diagnostics Phase);
- The *process* of value management before, during and post-workshop; and
- The *outputs* of the value management workshop (now termed by the authors the Implementation Phase).

At each stage of the study it was identified that a number of steps are undertaken. For each step there are a number of techniques available, the most appropriate depending upon the circumstances. Figure 2.5 shows these steps in the shaded boxes under the various Work Plan stages, with a selection of techniques that had been employed in practice. It was not the intention to describe the Work Plan stages but the schematic was used as the basis of the detailed dialogues with benchmarking collaborators on the research project.

The elicitation of the methodology into an explicit framework indicated a number of issues for further consideration:

- The Information stage is often cited as the most important stage in the value management process. It lays the foundations on which the remainder of the exercise is built. The process diagram shows that the information stage has the greatest number of possible activities associated with it, particularly when preworkshop information is taken into account.
- It is notable that there is little or no variation of techniques applied at the creativity stage, although the literature reveals that there are a fair number of creativity techniques available, with brainstorming proving to be by far the most popular in practice.

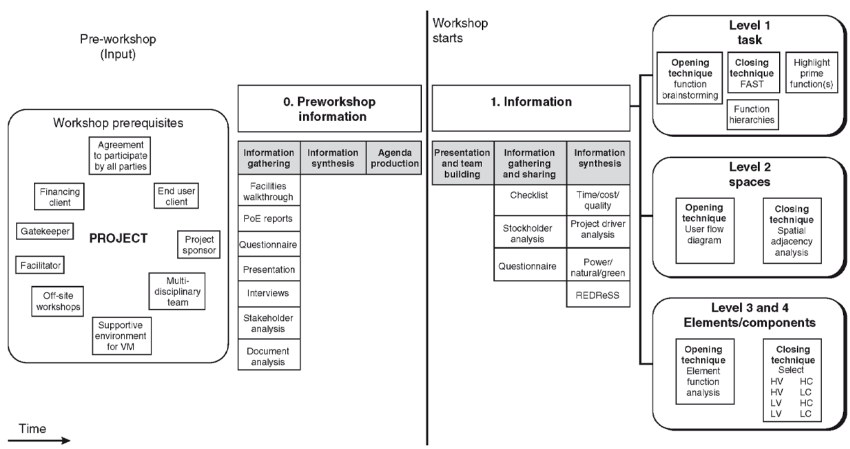

Figure 2.5 Value management methodology. (a) Pre-workshop and (b) post-workshop. *Source*: Adapted from Male *et al.* (1998a,b; Figure 5) The Value Management Benchmark.

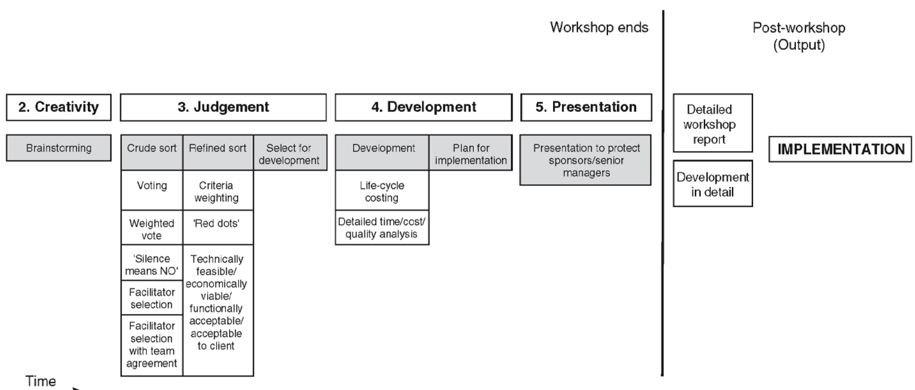

Figure 2.5 (*Continued*)

- Although Figure 2.5 shows the process as a sequential series of well-defined steps, the practice of value management was not so clear cut. There can be an overlapping and iterating of the team's activities.
- The exploration of the methodology also highlighted that the concept of levels is robust regardless of the type of project – civil engineering, building, process plant, and so on. However, civil engineering and process plant studies were similar in that studies were normally addressing levels 1, 2 and/or 4, although level 3 spaces in a civil engineering project could include an exploration of geographic locations, whereas value studies on building projects encompassed levels 1 to 4.

The benchmarking study carried forward the theories expounded in the first book (Kelly and Male, 1993) and formed the foundation of the first edition of this book (Kelly, Male and Graham, 2004). This second edition carries forward the theories developed in the benchmarking study and those expounded in the first edition of this book and develops and adjusts them following a further 8 years of research and practice.

The next section reviews recent standards and guidance note documents relevant to value management.

2.8 Standards and procurement guidance

British and European (BS EN) Value Management Standards

The UK and European Value Management Standards are as follows:

- British Standard BS EN 12973:2000 Value Management
- British Standard PD 6663: Guidelines to BS EN 12973
- British Standard BS EN 1325:2014 Value Management – Vocabulary – Terms and Definitions. Note: this document supersedes BS EN 1325-1:1996 and BS EN 1325-2:2004 Value Management, Value Analysis, Functional Analysis Vocabulary
- British Standard BS EN 16271:2012 Value management – Functional expression of the need and functional performance specification.

European Standard EN 12973 was approved by CEN on 7 October 1999 and was issued as a British Standard in April 2000. The standard defines value management as a style of management particularly designed to motivate people, develop skills, and promote synergies and innovation, with the aim of maximising the overall performance of an organisation. Value management provides a new way to use many existing management methods and is consistent with quality management. The standard states that value management has been proven effective in a wide range of activities. The standard also argues that VM is distinct from other management approaches by bringing together simultaneously attributes not normally found together into a single management system.

The standard recognises that stakeholders, internal customers and external customers hold differing views of what represents value. The aim of value management is to reconcile these differences while enabling an organisation to achieve the greatest progress towards its stated goals with the use of minimum resources. Value management simultaneously addresses management goals, encourages positive human dynamics, respects internal and external environmental conditions and positively provides the methods and skills for achieving results.

The value management approach outlined in the standard embraces three underlying principles:

- A continuous awareness of value for the organisation, establishing measures or estimates of value, and monitoring and controlling them. In this context value is described as a relationship between satisfaction and the resources used in achieving that satisfaction.
- Attention to the identification of objectives and targets before seeking solutions.
- Maximising innovative and practical outcomes by focusing on function.

The consideration of the context of value management is followed by a discussion of style, functional focus and base techniques. In respect of style, the standard highlights the importance of a four-part approach involving teamwork and communication:

- A focus on what things do rather than what they are (function approach);
- An atmosphere that encourages creativity and innovation;
- A focus on customers' requirements; and
- The application of a framework that is applicable to all levels within an organisation, promoting a receptive attitude of mind to the use of functional concepts, methods and tools. Examples of pro forma frameworks for value analysis and the work plan are included in the standard.

The functional focus relates to customer or product needs described as 'use needs' and 'esteem needs'. Use needs, which correlate with user-related functions (URFs), are identified as tangible measurable activities. Where these activities involve a product, the product will also relate to the function known as product-related functions (PRFs). Esteem needs are the parts of the total need that are subjective, attractive or moral.

The standard defines successful value management as working within a context of human dynamics, methods and skills, management style and environment. The environment described is the environment within which value management operates and takes into account the broader environments of customers, suppliers, statutory and legal constraints, and ecological considerations. The methods and skills fall into two categories: the method of undertaking a formal value management study including the value management study plan, a broad set of principles for implementing a VM study, and the methods or techniques used within a value management study. The latter include value analysis, function analysis, function cost, function performance specification, design to cost and design to objectives. Other methods and tools used concurrently are described as including creativity, failure mode effects, criticality analysis, life-cycle costs and quality function deployment.

The standard distinguishes two distinct value roles, that of the Value Manager, who is responsible for designing, developing and implementing a VM programme, and the VM Study Leader who will: set the timetable for a VM study; identify the resources to be used; apply value methods, tools and techniques; have the skills to select team members, build teams and manage groups of people; and conduct an audit on completion of a study to ensure benefits have been implemented and provide feedback for future studies.

The standard incorporates some useful information, guidance and frameworks for value management. However, although it may be set out as being sector neutral, it does lean heavily towards manufacturing with an emphasis on the product.

The standard is supported by PD 6663: Guidelines to BS EN 12973: Value Management – Practical guidance to its use and intent which is an 18 page explanation of VM principles with brief case study examples. BS EN 1325:2014 give definitions of value analysis, functional analysis and value management.

UK OGC achieving excellence in construction procurement guidance

The 1994 report entitled 'Constructing the Team', prepared by a committee chaired by Sir Michael Latham (Latham, 1994), was the foundation for a number of subsequent reports and initiatives that focused on the improvement of construction procurement in the UK public sector. These culminated in 2003 in a series of procurement guidance documents under the generic heading of 'Achieving Excellence in Construction' produced by the then Office of Government Commerce (OGC, 2003), whose work is now subsumed within the work of the Cabinet Office.

Procurement Guide 03 'Project Procurement Life Cycle – the integrated process' outlines a generic approach to the procurement of a construction project commencing at project inception and finishing at disposal. This describes the recommendation for a VM study to:

- Identify business needs, generate options to meet business needs and confirm that a project is required.
- Undertake a post-brief feasibility study to evaluate options to meet business needs and generate a high level business case.
- Evaluate concept design options that satisfy the brief, identify risks and develop whole life cost models.

There is also a recommendation to undertake VE and risk management studies from sketch design through component development stages.

Procurement Guide 04 'Risk and Value Management' commences with the phrase 'risk and value management are interrelated tasks that should be carried out in parallel'. This concept is discussed in further detail in Chapter 10. The guide describes value management as a structured, auditable and accountable process that focuses on the enhancement of value above cutting costs, although acknowledging that cost reduction may be a by-product. The guide differentiates between value management and cost reduction by stating that value management is

- Positive, using principles and techniques that achieve business need by providing the required quality, in the required time, at the optimum whole life cost. This while acknowledging that achieving optimum whole life cost may require additional initial capital expenditure.
- Involves stakeholders (or their representatives) and members of the integrated project team in value studies led by a value study leader.

The guide describes value engineering as that part of value management that considers specific aspects of the design, construction, operation and management.

The procurement guidance documents have been archived by the Cabinet Office but at the date of publication are available online.

The UK Cabinet Office Management of Value

Management of Value (MoV) guidance (Dallas and Clackworthy, 2010) is a publication supporting a training programme in best value practice overseen by the UK Cabinet Office. MoV supports the principles of value management in a comprehensive programme of improving benefit and (usually) reducing expenditure and speed of delivery without impacting essential project scope or service quality. It is an asset management orientated training programme which seeks to facilitate the optimal balance between investment and long term operating expenditure by:

- Enabling more efficient delivery by employing fewer resources and using these resources to better effect.
- Using techniques and procedures to define objectives and scope clearly in terms of the organisation and end users' short and long-term needs.
- Supporting decision-making based upon maximising value for money.
- Encouraging innovation that is well aligned to the organisation's goals.
- Measuring and auditing value, taking account of monetary and nonmonetary benefit and achieving optimal balance between them, thus demonstrating the optimal value has been achieved.

Management of Value involves taking a team representing the key stakeholders in a project through a series of processes and techniques (or a MoV study) at predetermined points, usually coinciding with key decision points, throughout the life cycle of the project.

The guidance summarises the seven fundamental principles of MoV as:

- Aligning with organisational objectives – MoV activities must be aligned with the organisation's objectives or Porftfolio strategy to ensure a consistent and contributory approach across all Programmes and projects.
- Focusing on functions and requirements – MoV focuses on what things do to contribute to the required outcomes and seeks to improve them. This approach clarifies expectations and stimulates innovation by identifying those value drivers that are critical and must be delivered in full to yield a successful outcome. This reflection of criticality is indicated by weighting the relative importance of each value driver. This process is aided by a Functional Analysis System Technique (FAST) diagram and a value tree diagram.
- Balancing the variables to maximise value – Reconciling the needs and views of different stakeholders to maximise overall benefit by brokering consensus on their differing expectations to deliver what they need whilst balancing against available resources.
- Applied throughout the investment decision – Taking note of the changes in those involved and their focus on different elements of the project as it evolves.

- Tailoring the approach to the problem to be solved – Small and simple to large and mission-critical.
- Learning from experience – Taking time to learn lessons from previous experience avoiding the repetition of past mistakes and building on success.
- Assigning clear roles and responsibilities – Building a supportive culture ensuring governance is in place to support and deliver.

The similarities of MoV with the developed practice of value management are plain to see; however, in common with most of the guidance reviewed in this section, there is little by way of substantive in-depth practice examples.

The SAVE International value methodology standard

The purpose of the Value Methodology Standard (SAVE, 2007) is to establish the specific six-phase sequential Job Plan process and outline the objectives of each of those phases. The standard highlights that it is not the intention to standardise the specific activities that are used to accomplish each of the phases of the Job Plan. The standard intends to set out the minimum that clients and providers should expect when the value methodology is applied to a project, which for the purposes of the standard, is defined as: a product, process, procedure, design or service (SAVE, 2007: p.4). The standard defines 'value' as a fair return or equivalent in goods, services or money for something exchanged. Value is commonly represented by the relationship of Value = Function/Resources, where resources are measured in terms of materials, labour, price, time, and so on required to accomplish that function. Function is measured by the performance requirements of the customer, and is usually expressed as a measurable noun and active verb combination.

The standard notes that the value methodology encompasses the names of Value Analysis (VA), Value Engineering, Value Management and Value Planning (VP). These are terms that can be found in use internationally, often interchangeably. The standard is therefore eclectic at the level of encompassing discipline nomenclatures. The standard adds that other value improvement processes can qualify under it as value studies provided they adhere to the standard's Job Plan, the structured process behind the methodology, and perform Function Analysis as part of their total process.

The standard defines a Value Study (SAVE, 2007: p.4) as the formal application of a value methodology to a project in order to improve its value. More specifically, a value methodology, as a systematic process implemented within a Value Study, involves:

- A Value Study Team, comprising a multidisciplinary team of experienced professionals and stakeholders. It may also include individuals that are not associated with the project under review but can provide a different perspective. The standard makes no explicit assumption that the team is externally appointed by the commissioning client, is a project team already formed, or, is some mix of the two.
- Following the systematic, sequential process of the Job Plan, comprising at least the following six phases of: information, function analysis, creative, evaluation, development and presentation.

A value study is led by a Value Team Leader who is trained in the value methodology techniques and is qualified to lead a team using the Job Plan. The standard defines the value team leader being a 'team facilitator' who should be a SAVE Certified Value Specialist (CVS) or Value Management Practitioner (VMP) who operates under the guidance of a CVS. The value study will generally encompass three phases:

- Pre-workshop (preparation). The purpose of this phase is to plan and organise the Value Study, and addresses what has to be done to prepare for it. The outcome of this phase should be a clear understanding of what senior management needs to have addressed, the strategic priorities, and how improvements will increase organisational value. During this phase a decision can be taken on whether there is value in proceeding with the rest of the study, and if the study parameters need to be changed. The standard notes common activities, tools and techniques that can be adopted for this phase.
- Workshop (execution of the six-phase Job Plan). The standard sets out in some detail the purpose, activities, tools and techniques and outcomes expected at each of the Job Plan stages conducted within the Workshop phase.
- Post-workshop. The purpose of this phase is to ensure the value alternatives developed from the Workshop phase are implemented and the benefits projected by value activities have been realised. The standard adds that project stakeholders will determine those changes to be implemented as a result of the value study, and will represent changes from the original concept or base case. The standard also argues that a follow-up and lessons learned review is undertaken to improve future value studies. A series of activities and expected outcomes are presented for the Post-workshop phase.

In terms of a value study duration, the standard notes that the Workshop phase is typically of five days duration, with no times proposed for the Pre-workshop and Post-workshop phases, except that they are in addition to the Workshop phase. However, the standard highlights that where there is clarity around the scope of a project, and/or it is of low complexity, this duration might be reduced. It adds further that for projects of large scope or complexity the duration could be 10–15 days. The language adopted always assumes a workshop; and, the Job Plan is only relevant during the Workshop phase. It is also clear the 'value study' takes place within the Workshop phase using at least the six sequential Job Plan stages, and, that pre- and post-workshop activity are complementary to its success.

The standard also sets out a series of roles and responsibilities:

- Two clear management roles, that of senior management, operating through an Executive Board, to provide leadership and ensure strategic expectations and goals for a value study are made explicit, and in a prioritised manner. They should understand the potential benefit of a Value Study, approve resources for it and guide the approval of required funding to realise a study's recommendations. The second managerial role is that of a 'Value Manager', the organisation's designated manager of value who will confirm that value methodology activities are coordinated and performed effectively to meet goals and objectives of the organisation. The responsibilities of this role will vary throughout a project's life cycle.

- The Value Team or Value Study Team members, who are selected to participate because of their expertise.
- The Value Team Leader, who will plan, lead and facilitate the value study.

The standard also talks in terms of the Value Professional, a person who applies the value methodology to study and search for value improvement. The term is noted as being synonymous with terms such as value analyst, value engineer, value practitioner and value specialist.

In conclusion, the SAVE standard is eclectic in terms of the nomenclature subsumed within it for the different manifestations of value management. It is explicit in terms of a value study being enabled, led and facilitated within a workshop environment by a Value Team Leader who takes a value team through the sequential Job Plan process to produce and recommend a series of value improvements for subsequent implementation on completion of the workshop. The implementation of these value improvements are at the discretion of project stakeholders.

ASTM standards

ASTM E1699-13 Practice for Performing Value Analysis (VA) of Buildings and Building Systems and Other Constructed Projects. The eight-page standard describes the use of VA (or VE) at specific stages identified as predesign, schematic design (15%), design development (45%), construction drawings (100% design) and VECP post-design contractor's proposals. The standard also refers to the practice in relation to products and processes.

ASTM E2013-12 Standard Practice for Constructing FAST Diagrams and Performing Function Analysis During Value Analysis Study. The 16-page standard describes the practice of constructing FAST diagrams as a communication vehicle enabling all stakeholders to understand, analyse, revise and agree on the purpose of the whole project and its subcomponents. This understanding enables the creation of alternative solutions to the function.

The Australian value management standard AS 4183

The objective of the Australian Standard (AS/NZS 4183, 2007) is to provide guidelines for the application of Value Management to an 'entity' defined as: products, processes, services, systems and organisations. In this capacity, the standard defines terms, establishes the elements of value management and clarifies roles and responsibilities. The standard notes that a VM Study can be undertaken by a multidisciplinary group with an independent Value Management Study Facilitator, or by individuals in their normal course of their work.

The standard notes the technical and cost-reducing focus of traditional value analysis and value engineering, but also recognises the collaborative and inclusive focus on establishing core values and commitment to agreed outcomes.

Value is an attribute of an entity determined by its perceived usefulness, benefits and importance. The standard notes that value will differ from person to person, place to place, organisation to organisation, and time to time. Usefulness is the purposes fulfilled and functions performed. Benefits are the advantages gained, or enhanced well-being. Value-for-money (VfM) is highlighted as a measure used for comparing alternatives based on the relationship between value and cost, and is a comparative assessment of the total functional requirements met compared to the cost of providing each alternative to meet these functions. VfM is expressed as a measure of the value of the entity/a measure of the total cost of the entity. The standard notes that in determining value-for-money it is useful to address the following:

- What does the entity do?
- What is the entity's total cost?
- What is the assessed worth?
- What are the essential functions for the entity?
- What alternatives will deliver these essential functions?
- What is the total cost of these alternatives?
- Which alternative achieves best value-for-money?

These are very similar to the questions posed originally by Lawrence Miles when he developed value analysis in the 1940s.

The scope of the VM study, the structured and analytical process that follows a prescribed Work Plan, is set out in a VM Brief. This should be endorsed by the commissioning client or its representative. The standard notes that a VM study uses a multidisciplinary group that comprises technical specialists – a diverse group of stakeholders, end-users, and decision makers, or any combination of these. The VM study duration is determined by its objectives, and may take place over an extended period of time. The standard also adds, however, that where workshop duration is operating under a time constraint, the study objectives should be set to be effectively addressed in that time limit.

The term Work Plan, the sequential, prescribed approach to implementing VM, is used in preference to the more narrowly interpreted term 'Job Plan'. The Work Plan covers the following phases of a Value Management Study:

- Preworkshop Planning: review or prepare the VM brief, select study group members, organise the venue, gather and distribute relevant information, prepare facilitation strategy and agenda, brief study group members.
- Workshop: confirm study objectives; build knowledge and understanding of the entity, its context, value parameters, functions, and success factors; generate multiple ideas; evaluate ideas, develop options and proposals, make recommendations, and where appropriate decisions, prepare an action plan.
- Post-workshop: prepare study report.
- Post-study: implement decisions and recommendations.

The standard sets out a series of more detailed activities to be covered in each of the phases mentioned. The standard again argues for a workshop being the primary focus of much of the analytical, integration and developmental work. The pre- and post-workshop activities are seen as complementary to this.

In behavioural terms, the VM Study Group comprises those individuals that have the necessary breadth and depth of appropriate experience to achieve the study objectives, and also have appropriate responsibility, authority and credibility to achieve this. They should be receptive to new ideas, committed to working collaboratively and to interact openly with others to pursue best value or best value for money. In sum, they should have a commitment to actively participate throughout all stages of the study, should accept that the VM study's overall interests are more important that sectional interests or personal concerns and accept the group's commitment to the study outcomes.

In terms of defining roles, the standard notes that a VM Study Facilitator is a suitably experienced and competent person in the principles and practice of VM and group facilitation, who has no vested interest in the outcome of a study, and who helps the VM Study group work effectively and efficiently. The standard also highlights the role of a Value Analyst, a person who is suitably experienced and competent in the principles and practice of value management. They are able to apply VM in decision-making as an individual in their normal course of day-to-day work and have sufficient skills and experience to analyse the entity.

In conclusion, the standard focuses on a workshop as the arena within which a value study unfolds. Pre- and post-workshop activity are seen as complementary to this. The VSL has the nomenclature attached of that of a 'facilitator' and the Work Plan takes account of pre and post workshop activity. It is interesting that the standard uses the term 'group' throughout rather than team to describe the multidisciplinary constellation of individuals and their expertise, which is brought to bear within the value study. Group behaviour is, however, emphasised and portrayed clearly as collaborative. There is still an emphasis on function analysis, but its emphasis is subsumed in the more generic term of 'building knowledge and understanding of the entity' rather than the identified discrete workshop phase noted in the SAVE Job Plan.

2.9 International research into value management

In conjunction with developments in international practice, guidance notes and standards, international research into VM has covered numerous topics (adapted from Male *et al.*, 2007; Bowen, Edwards and Cattell, 2009 and Luo *et al.*, 2011):

- Using VM in construction (Dell'Isola, 1982; Kelly and Male, 1993; Connaughton and Green, 1996; Kelly, Male and Graham, 2004).
- Success factors, enablers and barriers to the adoption of VM (Palmer, Kelly and Male, 1996; Fong and Shen, 2000; Shen and Liu, 2003; Liu and Shen, 2005; Cha and O'Connor, 2006; Bowen, Edwards and Cattell, 2009).
- Benchmarking and Best Practice in VM (HM Treasury Central Unit on Procurement, 1996; Male *et al.*, 1998a, 1998b).
- VM, Project Briefing and Design Processes (Fang and Rogerson, 1999; Kelly *et al.*, 2005; Yu *et al.*, 2007; Luo *et al.*, 2011).
- Using VM in project briefing as a means of eliciting, clarifying, and specifying client's requirements (Green, 1992; Kelly and Male, 1993; Barton, 2000; Kelly, Male and Graham, 2004; Shen *et al.*, 2004; Yu *et al.*, 2007).

- VM methodologies and techniques (Pasquire and Maruo, 2001; Spaulding, Bridge and Skitmore, 2005).
- Analysing building components (Asif, Muneer and Kubi, 2005).
- VM performance measures (Lin and Shen, 2007).
- Integrating VM and Risk Management (Green, 2001; Chappell, Walker and Greenwod, 2002; Dallas, 2006).
- The relationship between VM, Cost Consultancy and Quantity Surveying Practice (Kelly and Male, 1988; Ellis, Wood and Keel, 2005).
- VM as a profession (Male and Kelly, 1999).
- Group Decision Support Systems (Green, 1994, 1996, 1999; Shen and Chung, 2002; Luo *et al.*, 2011; Fan and Shen, 2011).
- Group Dynamics and Teams in VM (Leung, Chu and Xinhong, 2003).
- Defining what 'value' means to a client, project stakeholders and project's objectives (Green, 1992).
- Using VM to enhance value on public sector projects (Fong, 1999; Male and Kelly, 1989).
- Client Value Systems (Kelly, 2007).
- VM as a Management Style (Male *et al.*, 2007).
- 'Hard' versus 'Soft' Value Management (Liu and Leung, 2002; Green and Liu, 2007; Leung, Chu and Xinhong, 2003; Alalshikh, 2010).
- National contextualisation of VM (Fong, 2004; Cheah and Ting, 2005; Liu and Shen, 2005; Bowen, Edwards and Cattell, 2009; Luo *et al.*, 2011).

This list is diverse but can be characterised as research that investigates: industry context; country context, good practice and benchmarking of VM, VM interventions; methods, process tools and techniques; institutional and professional frameworks for VM; and team dynamics and management. These areas will be addressed further in subsequent chapters.

There has been an ongoing and considerable research dialogue around distinguishing between 'Hard' and 'Soft' VM, together with what has been termed the rhetoric of VM (Green, 1992; Green, 1994; Green, 1999; Ellis Wood and Keel, 2005; Liu and Leung, 2002; Leung, Chu and Xinhong, 2003; Green and Liu, 2007). The Hard VM approach is seen to derive from a positivist and rationalist perspective, with an implicit assumption that a problem can be identified and is well structured, there is a search for efficient ways of achieving an objective, which is defined at the outset, remains constant through time, and where a solution is an optimised outcome to meet those objectives. Equally, the term positivist rhetoric is often used for those supposedly advocating a Hard VM approach. The Soft view of VM is that of social constructivism and the creation of a shared social reality that is open to continuous renegotiation. Within this somewhat unproductive debate, much of which is philosophical and classificatory in nature between those seen as protagonists of Hard VM and those of Soft VM, there have been various attempts at characterising our own contributions to Value Management under these headings. This will be addressed further in the final chapter.

Section 2.10 draws together a brief review of standards internationally and procurement guidance.

2.10 Implications for value management and value studies

Introduction

This chapter has considered the development and maturation of value engineering and value management and discussed the evolving issues. The salient features of value management and value engineering from this chapter are as follows:

- A philosophy, methodology and set of tools and techniques that are focused and implemented within a value study.
- Not concerned with cost cutting or specification reduction, although it is acknowledged that this may be a by-product of a carefully considered and logical value analysis.
- Function orientated.
- Team based, collaborative and consensus building, and led by a knowledgeable VSL.
- A structured and challenging process by continuing to ask why, what, how and when questions.
- Applied at a number of points in a project's life cycle, or to products, processes, services, systems and organisations
- Based upon an understanding of what is of value to the client.

The factors that differentiate value management from value engineering are as follows:

- Value management is commonly undertaken at the commencement of a project.
- Value management is strategic in nature, proactively evolutionary in operation and involves members of the client organisation and relevant stakeholders in a structured interrogation of:
  - What exactly is required to meet a defined need, and
  - What factors govern the successful fulfilment of that need and how are these factors measured.
- Value engineering is a subset of value management and is commonly undertaken following the initial or later design of a product or system.
- Value engineering is technical in nature, reactively focused on the improvement of a product or system.

The following section discusses factors to be considered in a value study. The terms and concepts underpin the remainder of the book.

Factors to be considered in a value study

This section briefly describes the accepted meaning of the key terms cost, worth, function, value and teams. While all these aspects are discussed in detail in later chapters of this book the explanation is sufficient to understand the structure and dynamics of a value study, addressed further in Chapter 3.

Cost

Cost is the price paid or to be paid. Cost is a relatively simple concept since it is always comprised of the following:

- Cost of production labour.
- Cost of plant or production machinery.
- Cost of raw materials or components.
- Cost of overheads, for example, management/supervision costs, facility management costs, costs of water and energy.
- Profit or surplus.

The addition of the five elements of cost equals the price charged. It is often said that one person's price is another person's cost.

Worth

Worth is defined by North American value engineers as the least cost to perform the required function or the solution that will deliver the required function at the least cost. This is a useful concept as it draws a distinction between pure utility cost and actual cost. For example, a varnished hardwood veneered, hardwood lipped, fire-resisting door (excluding, frame, fitting and ironmongery) may cost £300. However, a simple, flush-faced, fire-resisting door blank (excluding frame, fitting and ironmongery) may cost £80. The functions of the door are as follows:

- Access space.
- Secure space.
- Control access.
- Resist fire.
- Enhance aesthetic.

The logic of worth is that all functions excluding enhance aesthetic can be provided for £80. If it is decided that the function 'enhance aesthetic' is costing £220 (£300 − £80) then the client should be asked if there is a willingness to pay that £220 for the aesthetic function in a specific location. In a prestigious reception area perhaps yes, perhaps the client would be willing to pay more. However, in a back office location the client may not be so willing. Hence, value and worth are context related.

Function

An area of consistent agreement within early and subsequent VM/VE literature is the requirement for the processing of information to determine the utility of a component, system, element, product, building or infrastructure facility in simple, clear functional terms. Although not a feature of Miles' first edition, North American practice evolved a tradition that functions should be recognised in a simple verb plus noun form. This tradition has spread and is still captured in current standards and guidance notes, although the strict two-word definition of function is less strictly adhered to by most VM/VE practitioners.

The primary function of a hospital can be encapsulated in:

- Organise diagnosis.
- Treat patient.
- Heal patient.

The primary function of a wall can be described as:

- Support load.
- Divide space.
- Secure space.
- Insulate space.

The definition of function in such a clear and concise way aids the accuracy of the definition. If the function cannot be defined concisely then it can be argued that the function is not understood.

The simple listing of functions in the wall example just mentioned is most suitable for the function definition of components, systems and elements. This is because asking the question 'how?' will immediately give rise to a technical solution. Thinking of ways of 'supporting load' leads to technical solutions, such as 'concrete blocks' and 'masonry'. The power of the technique comes from considering the question 'why does the wall have to support load?' This forces a deeper analysis of function, for example, if the building has a steel, concrete or timber frame then the wall does not have to support load and another technical solution is possible. Similarly, 'secure space' may be a function of an external wall on the ground and possibly first floor but less likely on the sixth floor. A systematic analysis of function ensures the most appropriate technical solution in terms of cost, performance and quality.

For more complex products and structures, such a function listing is inadequate because asking the question 'how?' gives rise to another function, a subfunction of the primary function. For example, 'heal patient', may give rise to subfunctions of 'rest patient', 'administer drugs', 'monitor patient', and so on. Recognising this existence of primary and subfunctions Charles Bytheway (Bytheway, 1965) evolved a function analysis relationship diagramming technique, which he called FAST. The form of diagramming is developed in Snodgrass and Kasi (1986), Kaufman (1990), Kaufman and Woodhead (2006) and replicated in most other VM/VE texts.

Function is a description of purpose or task and as such does not have a unit of measurement associated with it. In this, it differs from cost and worth, which are both measured in units of currency. Function is discussed in detail in Chapter 4.

Value

Whereas cost and worth are objective and measureable, and functions are objective and normative, value is a subjective concept describing the interest or importance that something holds for a person, stakeholders, or an organisation. However, for value to be managed the concept of value must be assessable and that assessment must be capable of repeatable objective or subjective evaluation. A number of authors have put forward methods of assessment and these are discussed in detail in Chapter 11.

The most popular statements in terms of value are:

- That value can be determined by analysing the relationship between time, cost and quality.
- Value can be represented by the expression

$$\text{value} = \frac{\text{function}}{\text{cost}}$$

It should be noted that the expression is not a true mathematical expression but an accurate representation of the units of function that can be obtained for a unit of cost. Adam (1993: p.176) defines value as the lowest cost to reliably perform a function where the definition of function is that which the product process or system delivers to make it work and sell. There is a clear interferential link between cost, function and performance.

Teams

Value management/value engineering literature is consistent in its description of the requirements for using a multidisciplinary team and its leadership in a value study. Male *et al.* (1998a) record that the proper facilitation of a team is a fundamental critical success factor in the application of VM/VE a value study workshop.

As stated earlier, value engineering studies are technical in nature and reactively focused on the improvement of a product or design. A feature of North American value engineering, particularly in the context of public sector projects, is the use of a separate review team that is essentially 'shadowing' the work of the project design team for a short period of time during a value study. The term adopted here for brevity and simplicity is a 'shadow team' for this type of appointment. In many countries throughout the world the team commissioned for a value engineering study is the team responsible for the design or production of the product. However, in the North American public sector the team is commonly a separately commissioned one that is often appointed by the value engineering study leader. It is argued that the independent value engineering 'shadow team' brings objectivity to the exercise, and in the case of public sector projects a measure of audit and public accountability. Value management teams, being more proactive in their endeavours, tend to comprise relevant stakeholders and those responsible for the execution of the project. This and other factors affecting team performance and team dynamics are discussed further in Chapter 5.

Value management and value engineering involves the gathering together of a value team under the VSL, typically in a workshop environment, to analyse information relating to the project and synthesise innovative solutions to defined challenges or opportunities for improvement.

In the North American public sector, the value engineering workshop is often referred to as the '40 hour study' in recognition of a 1 week enterprise following the workshop stages of the Job Plan, simplistically represented as follows:

Monday and Tuesday	*analyse information and generate functions*
Wednesday	*organise functions and brainstorm innovative solutions*
Thursday	*select best ideas and begin outline development*
Friday	*refine developed ideas into a recommended short list for further work. Present findings to client team.*

The '40 hour study' is still reflected in the most recent SAVE International standard reviewed earlier. During the evolution of value engineering and value management, this workshop structure has been significantly adapted to suit particular project types and stages in a project's evolution. The composition of a value study is discussed in more detail in Chapter 3.

2.11 Conclusions

Alakshish (2010) argues that there are broadly two schools of thought on value management: the North American School, founded around the thinking and standards of SAVE International and its international affiliates, and the European and Australian School of thought, represented in the European and Australian value management standards that see value management in broader organisational terms, and much more loosely coupled in terms of process, tools and techniques. It is seen as a management style. It is yet to be determined whether there is a third, emergent school of thought in the Far East that has a constellation of researchers and practitioners centred around Hong Kong. The emergent third school could be built around the concepts of Group Decision Support Systems, originally investigated by Green (1994) in the United Kingdom. This third School of thought has a very strong information technology emphasis to a value study, particularly in the management of workshops.

Value Management is seen here as comprising two major components. First, a philosophical component that encompasses underlying thinking and principles encapsulated within terms such as value planning, value management, value engineering, value analysis and the management of value. It has strategic and tactical facets depending on the when, what, how and why of the value study. The perspective adopted here is that VM is a management style. The second major component is a value improvement methodology focused and implemented through a value study that encompasses intensive team working, process, tools and techniques.

The value study is led by a VSL, who designs this with three underlying phases that make up the Value Study Work Plan. These are termed here as follows:

- Orientation and Diagnostics phase – comprising fact finding, diagnosis of value challenges, and workshop planning, including planning for implementation.
- Value Workshop phase – at which all information is considered, function defined and innovative solutions found and selected for further development. The workshop phase is typically structured around the discrete steps in the SAVE (2007) Job Plan for a workshop.
- Implementation phase – at which selected solutions are worked on and their implementation planned.

A multidisciplinary value team can be:

- Appointed under separate contract to the VSL, as with the North American public sector practice – the 'shadow team', or
- Drawn from stakeholders and technical experts in some combination selected from within the commissioning client's organisation, who work on the project under study, or are external to these. In this instance the VSL is appointed by the commissioning client and will work with this extended group.

Much of the exposition of value management historically has evolved around the nucleus of a facilitated workshop. The SAVE International, European and Australian standards attest to this, and the research of the authors confirmed this in the 1998 benchmarking study. The Pre- and Post-workshop phases were seen as complementary to this, but in some ways they appear secondary in emphasis, particularly in the SAVE International and Australian standards. This is contrasted here to the view of the authors. Each of the three phases just noted that comprise the Value Study Work Plan are of equal importance to the success of a value study, as much as the selection of the VSL and the value team. The success of a value study and value management in an organisation is also dependent on those prerequisites highlighted in the 1998 benchmarking study.

Subsequent chapters will discuss and expand on much of the content of this chapter.

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Part II
The Anatomy of a Value Study

A value study is a discrete intervention during the inception, evolution, development and delivery of a project or a Programme of projects and comprises all activities necessary to ensure that the project will use the least amount of resources in delivering the client's required benefits. In edition one of this book (Kelly *et al.*, 2004), Chapter 5 described study styles and value processes based largely on the findings from the international benchmarking study of value management (Male *et al.*, 1998) and the observations from over 200 studies conducted by the authors under a range of procurement systems. The fundamental principles described in the first edition have proven to be sound and are carried forward and developed in terms of theory and practice in this text.

Part 2, the anatomy of a value study, comprising Chapters 3–7 provides in-depth analysis and case study material from research projects and value studies undertaken by the authors both nationally and internationally. In Part 2, the authors have focused on value studies of projects. Significant further research and lessons learned from value studies undertaken within the remit of asset management, and value studies involving Portfolios and Programmes of projects are described in Part 3. Splitting the book in this way allows the authors to clearly describe the processes of value management and value engineering applied to projects without all the caveats necessary to incorporate changes to the process required when considering an asset management study or a study involving Portfolios, Programmes and projects. Part 2 is therefore solely about projects. It is the intention of the authors that students of value management and practitioners will be able to follow the processes of value management and value engineering in a logical ordered fashion. The authors have been meticulous in archiving the many case study reports and meeting regularly to discuss value studies undertaken as VSLs and reflect on and record the reasons why some activities went well and also where improvement was possible. This wealth of data has been used for the chapters in Part 2 as source data for the description of the methodology, tools and techniques illustrated by case study material.

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Chapter 3 provides an overview of value study styles commencing with examples of situations in which the client may wish to undertake a value study. The argument is made that value studies within the project management process facilitate the understanding of the primary purpose of the project and its constituent parts, and the value system, by which the project benefits are judged to be successfully delivered. The three phases, Orientation and Diagnostics, the Value Workshop and Implementation are discussed in detail. Aware of the advances in multimedia technology and research into group decision support the authors have raised the spectre that workshop activities may be in future undertaken by the value team in dispersed locations either synchronously or asynchronously. The current issues are briefly addressed. Five types of value study are described in detail with typical tools and techniques and illustrative agenda. Other study styles that are a variation on one of the five types of value study described in detail are briefly described. The chapter concludes with an illustrative case study, complete with details of tools and techniques used and the agenda for the study. The case study concludes with lessons learned.

Chapter 4 provides a discussion of function as a concept followed by a description of the process of function analysis and its application within value engineering and value management studies. On the basis that the quality of function analysis cannot rise above the quality of the information on which the function analysis is based, the chapter describes effective methods for the discovery and synthesis of relevant information using a number of techniques. Following the synthesis of available information function analysis is a closing technique that succinctly defines function in terms which are totally devoid of technical specification or cost. A description of methods for undertaking strategic function analysis through function diagramming is followed by the more technical function analysis activities of function space diagramming and element, system and component function analysis. The techniques described in Chapter 4 are illustrated by reference to a case study and concludes with six important questions to ask at the end of the function analysis exercise.

Chapter 5 addresses the role of the Value Study Leader (VSL) in designing and managing a value study. An analysis of the theory of teams and team dynamics complements a discussion of the situations in which the VSL assembles and manages a team in a number of different project environments. The comprehensive literature review and discussion of the management of teams highlights the issues to be addressed by the VSL in designing the value study and in particular the workshop process and agenda. The discussion addresses team size, workshop management styles and the extent to which the VSL needs to be sensitive in the use of various approaches and the use of tools and techniques in terms of team behaviour, information elicitation, structuring and processing.

Chapter 6 describes the linked processes of innovation, implementation and benefits realisation. Innovation is defined as the search for a new idea and the presentation of the idea in a form conducive to use. In a value study innovation is undertaken by the value team generally by brainstorming as many solutions as possible to the functional requirements. This is followed by a judgement exercise based on which of the brainstormed solutions are of use. It is those potential ideas that survive the judgement phase and are taken forward for further development, endorsement by the design team and subsequently implementation. Benefits realisation is a parallel activity undertaken at stages during the design and construction process and after the project has been absorbed into the client's core business. The benefits realisation activity ensures that the governance procedures for the project described in the business case are being adhered to and that the developing project, and ultimately the completed project, is compliant with the functional requirements and the value system defined by the client stakeholders.

Chapter 7 contains nine case studies selected as representatives of value study styles and the different stages in the project that a value study might be carried out. Case studies illustrate the three stage value study process and the steps undertaken at the Orientation and Diagnostics, the Value Workshop and Implementation phases. Lessons learned from each value study are described. The case studies reflect a value study conducted of a single project, with the exception of case study 3, a rail infrastructure Major Project comprising a Programme of projects, and case study 9 that demonstrates the use of the value management methodology adapted to suit the requirements of an organisational restructuring exercise.

Chapters 3 to 7 inclusive, together with the Appendix – Toolbox, describe the types of value study likely to be encountered by the VSL conducting value management and value engineering on projects. The chapters are structured with sufficient detail in terms of methodology, tools and techniques and indicative agendas to enable a full understanding of the process. Subsequently, Parts 3 and 4 reflect the extended role of the VSL as experienced by the authors in research and practice deep within the client organisation, requiring an understanding of their corporate approach to asset management, Portfolios and Programmes of projects, and considering these from the perspective of whole life value. As in Part 2 extensive reference is made to case study material.

3 Value Study Styles

3.1 Introduction

A value study is a discrete intervention during the inception, evolution, development and delivery of a project. It comprises all activities necessary to ensure that the project will use the least amount of resources in delivering the required functional benefits whilst requiring the minimum sacrifices to be made.

The activities comprising the value study fall within three generic phases:

- Orientation and Diagnostics
- Value Workshop
- Implementation

Value studies in the form of value management (VM) or value engineering (VE) can happen at any point during the project but typically occur at:

- Strategic briefing – project planning and business definition.
- Project briefing – performance specification and the establishment of systems.
- Concept design – the technical expression of the project brief.
- Charette (C) – undertaken in the place of the studies at points 1, 2 and 3, see Chapter 2, Figure 2.4.
- Detailed design.
- Specialist design of the component parts of the project.
- Operations, manufacture and/or construction.
- The integration of the project back into the core business. The core business of the client reflects the mission of the organisation. For example, the mission and core business of a pharmaceutical company may be 'the responsible and sustainable procurement, marketing and selling of health and beauty products'. A project to enhance the core business may require a value study to determine the optimal method of integrating the project with the existing business.

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Chapter 2 describes the evolution of VE/VM from its inception in the 1940s to the present day (2014). This chapter introduces the anatomy of value studies. It describes the structure of the common forms of contemporary value studies to provide a framework for the detailed discussion in the following chapters of the book. The concepts of the Client Value System, Client Project Value System and Project Value System are introduced. They will be extended and explored in more depth in Chapters 9, 11 and 12. A case study is included in the final part of the chapter referenced back to earlier sections in the chapter. The reader may wish to read the case study first then refer back to the discursive text or alternatively read the text and use the case study as a means of confirming understanding. The aim is to give an overview of the value study process without the detailed description and discussion of later chapters. The study styles are presented as stand-alone activities but assume an earlier study style has already been undertaken.

3.2 The inception of a project

In this chapter, the focus is on projects but the same approach can be applied to Programmes and projects nested within Programmes. The approach taken will depend on whether the value study is performed within the strategic domain of the client or whether the study is focused on the tactical satisfaction of a business requirement.

The inception of a project is likely to be the stage at which the client executive or investment decision maker takes the key decision to devote resources to investigate the worth of a project in the context of the organisation's strategic objectives. Strategies, Programmes and projects are discussed in detail in Chapter 9. However, for the purposes of this chapter, a Programme is defined as a cluster of related projects undertaken either in parallel or serially to achieve a common purpose. Complex projects are often Programmes of simpler projects and should be defined as such. Recognising and defining a Programme of projects allows an increased number of options to be considered and consequently the application of maximum innovation.

A project always implies change and usually becomes the vehicle to achieve change. The drivers for change for the private sector include the following:

- To comply with the strategy of a client organisation in a competitive environment;
- To enhance a current product/service;
- To provide a current product/service in a more efficient manner;
- To bring to market a new product/service;
- To discontinue a current product/service;
- To reduce operating cost;
- To satisfy a regulatory, safety and/or security need; and
- To enable the continued production of a product or provision of service in the situation where a system has failed.

Additional drivers for change specific to the public sector include the following:

- To comply with the policy of government or other executive authority;
- To meet a demand resultant from a change in population demographic profile;

- To meet a demand resultant from a change in the expectation of the constituent community often expressed through the vote;
- To restructure, adapt, or redefine a service provision; and
- To take advantage of an opportunity, often provided by funding being made available by the government to satisfy a particular objective that is consistent with the objectives of the organisation.

In dealing with projects, the client organisation should be confident of the answers to the following questions:

- What are the goals of this project?
- What is the definition and scope of this project?
- Why is the investment needed and what is the purpose of this project?
- Does this project fit the strategic plan of the organisation?
- Is this project part of a Portfolio or Programme of projects?
- Is this project dependent on other projects? If yes are they affordable/likely to go ahead? This aspect deals with the sequencing and precedence of projects, and the consequences if one fails to proceed.
- Is this project competing with other projects? If yes then which project will bring about the greatest benefit in the context of the resources required for its undertaking?
- What resources are required to investigate and if necessary prepare a strategic outline business case? Can those resources be made available?

The understanding of the drivers for change and the reasons for the development of a project are fundamental to ensuring maximum value from the project in enhancing the client's core business.

3.3 The specification and procurement of a value study

Value studies are undertaken for a wide variety of reasons illustrated by the case studies in Chapter 7. The following are representative examples:

- *Policy requirement of the client organisation and/or the funding agency.* This generally demonstrates a forward-thinking client organisation focused on the provision of value within and by the business. However, in some organisations, such studies become tick box exercises through either a lack of understanding or enthusiasm amongst those within the client organisation responsible for commissioning the study, or through workshop fatigue, particularly in client executives, brought about by undertaking too many studies on inappropriate projects.
- *Lack of project focus or overspend.* A reason for triggering a value study is a concern by the client that the project has lost focus causing project creep or an overspend on all or parts of the project. Although a value study is a very effective way of addressing these issues by being used as a trouble-shooting tool, it generally illustrates that the

value study was undertaken too late in the development stages of the project. VM is very successful at refocusing projects that are in trouble, an example of 'project-rescue'.

- *Reinvigorating a stalled project.* A value study is a very effective way of bringing back to life a project that is stalled generally through negativity or a lack of enthusiasm on the part of key stakeholders. This type of study, however, tends to be politically sensitive and requires careful handling, again an example of 'project-rescue'.
- *Reorganisation within the client organisation.* A value study is a useful way of bringing together and directing those within the organisation responsible for and affected by the reorganisation. However, the study is only likely to succeed where the organisation is looking to change direction and/or expand. Studies aimed at maximising value to the client organisation through downsizing and redundancy is difficult politically and has been done.

A client contemplating a value study will need to consider a number of issues including the following:

- *The reason for the value study.* The reason for the value study needs to be made explicit by the commissioning client together with, if possible, the anticipated outcomes. Advice for clients with limited understanding of the value study process is available from professional value associations.
- *Type of value study.* Value studies tend to be one of two types, either the proactive development of function-oriented options and alternatives, an action plan that includes the functional benefits sought and the value criteria by which the project will be judged, and undertaken by a value team comprising stakeholders and/or the project team. Alternatively, value studies can be a review of past decisions as recorded in, for example, meeting minutes, briefing papers and drawings, and undertaken by either stakeholders and/or the project team or undertaken by an independent review 'shadow team', and with function-oriented solutions developed. This later type of study reviews the past in order to redirect the forward momentum of the project.
- *Appropriateness of the project for a single value study or a programme of value studies.* The majority of projects are conducive to a value study at some point during their conception and evolution; however, not every project is suitable for a full programme of value studies. It is simply not worth the investment of resources in a programme of value studies for projects that involve the following: a choice between off-the-shelf options; are straightforward in terms of design, technology and commissioning; have been the subject of continuous improvement exercises over a period of time; or are low-cost. Projects that are worthy of targeting for a full programme of studies are those that are repetitive, high cost, high risk, complex and/or mission critical.
- *Availability of an operating budget to pay for the value study.* A value study is not a zero cost operation, which is always a problem at project inception. The best way to understand the mission of the project and the criteria to be used to judge the success of the project is through a value study. However, in many organisations, a budget is not awarded until the mission of the project is clear.
- *Willingness of the stakeholders and consultants to be involved.* Generally, stakeholders are only willing to be involved in a value study if they see the benefit to themselves or the department/organisation they represent. For most stakeholders

contributing to a value study means doing something over and above the 'day-job'. Consultants are normally only willing to be involved if they are paid, which therefore implies that the value study was defined in their the specification of services on which their fee was based or they are to be paid on an hourly rate.

- *Scheduling.* A value study necessarily involves busy people. A successful value study tends to be scheduled well in advance to allow participants to make space in their diary. Support of senior managers is extremely important in this regard.
- *Availability of information.* The availability of all relevant information is fundamental to the success of a value study. The client should consider the position where information is confidential or politically sensitive.
- *Appointment of the Value Study Leader (VSL).* Except for straightforward value engineering studies, value studies should be led by a qualified VSL who should be independent of the project and not have an executive or operational role within the project team. The role of the Value Study Leader is discussed at length in Chapter 5.

3.4 Value studies within the project management process

Project management is the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realised from an investment. Projects are unique, transient endeavours undertaken to achieve the desired outcome. Projects bring about change and project management is recognised as the most efficient way of managing such change.

Value studies within the project management process facilitate the understanding of the primary purpose of the project and its constituent parts, and the criteria, the value system, by which the project benefits are judged to be successfully delivered. Risk studies are a part of a management system for the recognition, assessment and management of those risks that arise from the undertaking of a project as a vehicle for change. Put another way, risk management can be viewed as a way of ensuring that the risks to delivering value are minimised. Value management, value engineering and risk management nest within the project management process such that it is incomplete without their inclusion.

The Project Execution Plan (see Toolbox in the Appendix) will include a programme of value and risk studies occurring at points judged most effective by the project sponsor and/or project manager.

3.5 The three generic phases of a value study

One of the responsibilities of the VSL is to advise on the timing and structure of value studies. This is generally done in discussion with the commissioning client, project sponsor and/or project manager. Whilst the purpose and agenda of discrete value studies differ during the project, the underlying structure of the value study tends to remain constant and is reflected in three generic phases:

- *Orientation and Diagnostics phase*, where the VSL orientates himself/herself to the value problem or challenge, and through a review of documentation and perhaps interviews or meetings with key stakeholders will determine the underlying value issues to be addressed and resolved.

- *Value Workshop Phase*, involving analysis, synthesis, solution building or option development phase.
- *Implementation phase*, where options and solutions are taken forward into implementation.

The Orientation and Diagnostics phase

At the commencement of the Orientation and Diagnostics phase the Value Study Leader meets with the commissioning client's project sponsor and project manager to discuss the purpose and logistics of the study. Dependent on the terms of the value study commission, the VSL will undertake interviews and briefings with potential members of the value team and other key stakeholders who may not be involved in the value team. The purpose is to ensure a complete team of influential and knowledgeable stakeholders (see ACID test in Toolbox). Additionally, the VSL may undertake document examination to further understand the background to the project and thereby structure the most appropriate value study. In the context of a building or infrastructure project, the VSL may also undertake postoccupancy or postcompletion evaluation of a similar facility or structure. The study style and agenda for the next stage, chosen and designed by the VSL, will be appropriate to address the issues discovered during the Orientation and Diagnostics activity. This phase will also set in train the process for, or as a minimum, consider how options and solutions developed from the Workshop phase will be implemented. As part of this phase it may be that, in consultation with the commissioning client, the Workshop phase may involve a series of interlinked workshops, as opposed to, for example, only a single workshop.

The value workshop phase

The value workshop phase is where alternative and complementary views on the value problem are brought together, discussed, explored and solutions considered in a logical and recorded process. Solutions that best meet the functional requirements of the project and deliver the greatest benefit to the client are taken forward to the next phase. One of the most effective ways of taking forward solutions that on a *prima facie* basis appears to offer best value is through a detailed workshop report that includes an action plan. It may be the case that in the future multimedia technology will permit those activities undertaken currently in a workshop, to be undertaken by the value team in dispersed locations either synchronously or asynchronously. Whether this is as effective as a team in a single study location able to confirm understanding, debate face to face and generally socially interact is a question for further research.

The implementation phase

The action plan contained within the workshop report commonly details those actions to be undertaken, usually, but not exclusively, by those members of the value team. The project manager will normally schedule an implementation meeting at an appropriate date following the workshop. The implementation phase formally closes the value study. Research undertaken by the authors and others has highlighted a lack of attention to the implementation phase as a formal step. Project managers tend to roll forward those good ideas from the workshop at regular project progress meetings. Solutions that are easy to incorporate into the project as a part of the general development of the project design tend to be preferred to those that require some extra effort and extra work and yet may yield significant benefit.

3.6 Study styles, processes and deliverables

A study style is defined as an intervention and outcome of the stage in the project life cycle at which a value study is carried out, and the manner in which the process is conducted. This section reviews and develops further the styles commonly identified with value study opportunities and illustrated in Figure 2.4. Value opportunities are taken here to mean specific points in the project life cycle for value management or value engineering intervention. The studies conducted at value opportunity points are as follows:

- Value study type 1: Strategic briefing (project planning and business definition).
- Value study type 2: Project briefing (performance specification and the establishment of systems).
- Value study type 3: Concept design (the technical expression of the project brief).
- Charette (C) (undertaken in the place of the studies at points 1, 2 and 3).
- Value study type 4: Value engineering (detailed design and / or specialist design of the component parts of the project).
- Value study type 5: Value engineering (operations, manufacture and/or construction)
- Integration of the project into core business. There is no set style for this value study opportunity, which will require design in accordance with the principles described later.

The value opportunity points are those most commonly found in practice. They are not seen as compulsory although some clients may insist that studies are conducted at these points through their inclusion in standard operating manuals. It is reiterated that all projects do not require value studies to be undertaken at all value opportunity points. Careful and apposite design of value studies appropriate to the project is far superior from the perspective of resources expended on the project than unquestioning adherence to standard operating manuals.

3.7 Project development tracks

Projects develop along optional tracks that are either carefully selected and pre-planned or the project proceeds along a track chosen almost randomly with insufficient knowledge or thought. Whether on a route that is carefully planned or selected without serious consideration, a construction project will pass through the generic stages of strategic decision, performance specification, outline design, detailed design and construction, commissioning and handover. The value study types listed earlier can be used proactively in a carefully pre-planned way always looking forwards along the track or alternatively, the value study may be used reactively to look backwards along the track to validate decisions or identify and enhance previous decision making and then forwards towards a successful outcome.

Selected tracks may include undertaking the project briefing stage as a discrete value study or may include undertaking project briefing as an investigation. Where undertaken as an investigation, this is usually carried out by the architect or project manager. In the United States, there is a separate branch of architecture entitled 'architectural programming' that is solely concerned with project specification and effectively splits the analysis of briefing from the synthesis of design (Peña and Parshall, 2001). Where project briefing is the result of an investigation, then the next appropriate value study is after concept design. This is illustrated in Table 3.1.

Table 3.1 Options for value studies based on varying project development tracks.

	Track 1 Pre-planned Strategic and Project Briefing as a value studies	**Track 2 Pre-planned Strategic Briefing as a Value Study, Project Briefing as investigation (architectural programming)**	**Track 3 Pre-planned Strategic and Project Briefing as investigation (architectural programming)**	**Track 4 No pre-planning and no structured briefing**
Strategic decision	Value study type 1 – strategic briefing.	Value study type 1 – strategic briefing.	Structured investigation – strategic briefing/ architectural programming.	Strategic brief develops randomly possibly not explicit.
Performance specification	Value study type 2 – project briefing.	Structured investigation – project briefing/ architectural programming.	Structured investigation – project briefing/ architectural programming.	Project brief develops randomly possibly not written but expressed as a concept design.
Outline Design	Value study type 3 – Concept design.	Value study type—Charette.	Value study type—Charette.	Value study type—Charette.
Detailed Design	Value study type 4 – value engineering.	Value study type 4 – value engineering.	Value study type 4 – value engineering.	Value study type 4 – value engineering.
Construction	Value study type 4 – value engineering.	Value study type 4 – value engineering.	Value study type 4 – value engineering.	Value study type 4 – value engineering.

3.8 Value study type 1: Strategic briefing (project planning and business definition)

The strategic briefing study identifies the broad scope and purpose of the project and its important parameters. The focus is on articulating strategic needs and wants, the role and purpose of the 'business project' for the client organisation, particularly the reason for this investment. A strategic briefing study describes clearly and objectively the 'mission of the business project' and its strategic fit within the corporate and/or social aims of the client organisation. These aims are explicit in terms of commercial and/or social objectives and usually implicit in terms of cultural values. The objectives and cultural values combine to form the value system of the client organisation, termed here the *client's value system*. It is this value system along with the client's methodology for total quality management that is expressed by the client stakeholder team at the project level within the *client project value system* and overtly expressed as a part of the strategic brief. The structure and operational methods for determining the client project value system is described in Chapter 11. This is the value criteria against which all business project decisions and finally the success of the project are judged.

The important deliverable from a strategic briefing study is the output specification describing succinctly and explicitly the purpose of the project in functional terms and the criteria against which the project will have been judged to have delivered the benefits required by the client. Cost may be addressed at this stage in terms of an outline capital and revenue budget. The importance of this budget against the other factors to be considered is addressed in the client project value system. The output specification may include therefore a statement of the outline budget and the project strategic timeline.

At the strategic briefing study, a range of options are generated for delivering the business project, which may include the creation, refurbishment or renewal of a physical asset or assets as a corporate resource. The selection of a potential option for further development and project briefing signifies the completion of the strategic briefing stage, which precedes the decision to construct and the preparation of the high-level business case (strategic outline case).

The strategic briefing study will address the options to meet the business needs and will confirm that a project is required. The options will always include the Do Nothing option and could involve developing and investigating nonphysical asset alternatives.

The strategic briefing mission statement will always define the project by function and never by built solution. For example, 'combine and rationalise company accounting functions' is a functional mission statement whereas 'construct an extension to the existing head office to accommodate accounting staff from dispersed offices' is a built solution to the project problem. The strategic briefing study will structure information in a clear and unambiguous way to permit the decision to build to be taken in the full knowledge of all relevant facts. On completion of the strategic briefing study the decision to build can proceed with confidence, given that all relevant issues and options have been addressed and explored.

During the authors' research into architectural programming in North America (briefing in the United Kingdom), an architectural programmer in Canada used the analogy of a ‘go button’. The question he would ask of senior managers in client organisations was

> Are you sure you are ready to push the button and unleash the full resources of the construction industry, the destinies of hundreds if not thousands of people and affect the fortunes of numerous firms and organisations, including your own.

Interestingly, asking simple questions such as this returned many of his clients to the analysis stage of the strategic briefing study in order to be 100% sure that a building or infrastructure project is the solution to the value problem.

Orientation and Diagnostics phase

The Orientation and Diagnostics phase of the strategic briefing study poses problems for many client organisations unless they are familiar with the process of procuring projects. Often the problem can be summarised in ‘what do I do first?’ The challenge for the VSL is simply one of how to be involved with the embryo project. Often a client presuming a construction solution to a problem will approach a member of the construction industry. The problem here is the member of the construction organisation approached will assume that the client has correctly identified a construction solution as being the appropriate way forward.

The three most important steps to be undertaken by the client at this stage are the following:

- The appointment of a project sponsor/project owner/senior responsible officer to be co-ordinator for the project and interface between the client organisation, the wider stakeholder group and the project team.
- The appointment of a project team.
- The appointment of a VSL.

The post-appointment duties of the VSL are:

- To discuss with the client the structure (including the Work Plan) and timing of the strategic briefing study and the VSL’s proposals for the collection of information.
- The collection of relevant information by the VSL using such techniques as interviews, stakeholder mapping, document analysis, questionnaires, site tour, postoccupancy evaluation of a similar facility or of the facility under discussion in the case of refurbishment and adaptation projects.
- Further discussions with the client on the way forward follow the completion of information gathering including the interviews with primary stakeholders.

The value workshop phase

The five primary agenda items for a strategic briefing workshop are the following:

1. *Issues analysis* – an opening technique that makes explicit all issues pertaining to the strategic stage of a project. This technique uses all of the information gathered at the

Orientation and Diagnostics stage and structures it in a logical and organised manner to facilitate easy analysis. The technique is useful in exposing hidden agendas and as such can be politically quite sensitive. At the conclusion of the session, participants will decide which issues are of significant importance to the project and which issues could potentially seriously disrupt or halt the project if the issue is not addressed.

2. *Function analysis* – following the issues analysis, which is an opening technique, is function analysis. At the strategic briefing stage, this is normally conducted as a diagramming technique to display the mission of the project and its subfunctions in a needs/wants hierarchy. The function analysis stage is a closing technique and addresses the client's need for the project. It focuses value team thinking on the primary functions required to deliver this need, and why it exists.
3. *Client Project value system* – this sets the criteria by which the success of the project will be judged. This activity is first undertaken at the strategic briefing stage and reviewed thereafter. It normally involves some form of weighting and scoring technique to bring consensus to the stakeholder group.
4. *Options and outline option appraisal* – innovating options to satisfy the project mission and preliminary judgement. Normally undertaken as a brainstorming exercise, the aim is to present ideas to formalise a way forward. The 'Do Nothing' and 'Do Minimum' options are always explored. These provide the baseline against which other options can be judged.
5. *Action planning* – involves planning the further development of options and setting up the next stage. The action plan lists the options thought most promising in satisfying the project mission and the value system. A necessary part of the action plan is the date of implementation meeting/workshop at which those tasked with actions report their findings. The identification of champions to take options forward for further development is also undertaken at this stage.
6. *Reporting* – The workshop report records the organisation, synthesis, interpretation and reporting of activities undertaken. It forms the foundation for the full strategic brief and strategic outline business case. The value study report contains the synthesis of the information gained through investigation and the interpretation of this information plus new information revealed at the facilitated workshop. Those tasked with actions arising from the workshop use the report as a key reference document.

Implementation meeting/workshop

This is normally a short meeting to review the reports from individuals undertaking action tasks described in the action plan and value study report. The agenda normally comprises the following:

1. Review of the value study report.
2. Report from individuals on their work on the respective parts of the action plan. This includes budgetary and timescale details.

3. Final recommendations on whether there is a need for a project. If there is a justifiable project need then the confirmation of the mission and criterion by which the project will be judged a success in delivering the required benefits.
4. Discussion and decision on which option to pursue.
5. Confirmation of strategic timeline to end of project briefing stage.
6. Recommendations for any necessary announcements including public relations and media liaison as necessary, and, any ongoing communications strategy.
7. Redrafting of the value study report to form the Strategic Outline Case, which includes the recommendation of the option to be pursued.

The Strategic Outline Case report is the primary deliverable from the strategic briefing study and answers the following questions:

- What is the project context and how does this project fit the organisation's strategic plan?
- What is the definition of this project, what is the project's mission, its scope and what is the reason for investing now?
- What is the definition of need for this project as defined through goal and systems model or gap analysis (see Toolbox)?
- What are the specific goals of this project?
- What is the client's project value system and what will define this project as a success?
- What are the organisational structures for project delivery and who comprises the project team?
- Who are the project stakeholders and what are their issues with the project?
- What are the high-level risks?
- What is the likely project timeline, including any phasing?
- What is the likely procurement strategy or options for further consideration?
- What is the recommended option to satisfy need?
- What budget has been allowed for this project?
- What are the constraints on operating expenditure?
- In the case of a building project, is there a need to build/refurbish a facility to satisfy the project's requirements?

3.9 Value study type 2: Project briefing (the technical specification)

Project briefing follows the adoption of the strategic outline case and the decision to construct the preferred option. At the point when the project is defined as a construction project, the project manager (PM) is appointed. The compilation of the project brief focuses on specifying the 'technical project' by translating the strategic brief into construction terms and identifying the performance requirements of each of the elements of the project. If it is a building project, rather than an infrastructure project, this will also include spatial relationships. The specification of space will allow the outline budget for a building project to be confirmed.

The project brief is compiled in one of two ways, either through a value study (Table 3.1 – Track 1) or through a process of investigation usually undertaken by the project manager or architect (Table 3.1 – Tracks 2 or 3). Where the project brief is compiled by the project manager or architect, a value study is worthwhile and held after the concept designs have been developed from the brief. The advantages and disadvantages of compiling the project brief through investigation or through a value study are given in the Toolbox under the heading Briefing.

The project briefing stage indicates a shift from answering the question 'what is it that we're trying to do and why?' to 'what spaces and/or structures do we require to satisfy the functional requirements of the strategic brief?' There is also a shift in the personnel involved from executive senior management and key stakeholders, to a smaller representation of the former group plus operational staff and construction consultants and specialists. Once construction consultants and other project team members have been procured and commissioned, the *project value system* becomes established. It will operate throughout the life of a project. The client's value system will feed into this. It is important that the project mission (the function) and criteria for its success (the client's project value system) are correctly transferred to, and accepted by, the briefing team. There is the danger here that the strategic role of the project can be completely misconstrued by the incoming project team in the absence of a proper Orientation and Diagnostics exercise.

The activities undertaken by the project manager or architect and VSL in briefing the project will depend on whether an investigative or value study approach is taken. In an investigative approach to briefing, the project manager or architect will organise a schedule of interviews and meetings with representatives of the executive, senior management and particularly the operational staff. An investigation, synthesis of the data and commonly feedback sessions will result in a document recording the technical requirements of the project in terms of space and performance. This document is the basis for the development of the concept design.

In a value study approach to briefing, the VSL will organise the value study as described next. The architect or project manager will be members of the value team.

Orientation and Diagnostics stage

For a value study approach, the VSL will undertake a limited schedule of interviews with key personnel, circulate questionnaires, gather benchmarking information from similar projects, undertake postoccupancy evaluation of similar facilities, and be familiar with the proposed site. In undertaking this activity, the VSL will learn which personnel should be present at the briefing value study workshop. On completion of this activity, the VSL will design the workshop agenda.

The value workshop stage

Following the Orientation and Diagnostics stage, all information on the functional performance of the proposed project is gathered, analysed and processed into a formal briefing document. For a building project, the output deliverable is a functional specification of space and a description of the arrangement of spaces one with another in order to configure the most operationally efficient facility to satisfy the client requirements. An infrastructure project focuses on the functional specification of societal requirements for example ‘transport water from A to B’.

An investigative briefing activity by an architect or project manager regularly takes several weeks or months and if undertaken by an architect, the formal briefing document is commonly represented by a room or space schedule and a concept design. A value study therefore considers the brief and concept design in a single workshop – see Table 3.1 and Charette presented later.

A value study workshop will occupy one, two or three days dependent upon the complexity of the project. A facilitated workshop will comprise the project team, at this stage drawn from a representative of senior management and primary stakeholders, the operational members of the client organisation, the main members of the design, and facilities management team and the primary users of the project. Construction representation at this stage is not common but can be introduced through construction consultant appointment or alternatively may be available through a procurement system, which includes early contractor involvement, for example, Prime Contracting. The VSL will liaise with the project manager in the planning of the workshop value team using the ACID test principles (see Toolbox). Numbers should be strictly controlled and ideally should not rise above 20. Multiple representations from a single organisation or departments should be avoided, if possible, and the person responsible for working with the project should be selected, for example, the project architect in preference to the architectural partner in charge. The VSL may suggest a pre-workshop consultation meeting to review the complement of the value team for missing members and to avoid representation by those who would otherwise have a limited contribution.

The six primary agenda items for a project briefing workshop are as follows:

1. *Issues analysis* – An opening technique to make explicit all issues relating to the technical project.
2. *Function analysis* – A diagramming technique to map the usage and circulation flows within the proposed facility and the relationship of individual spaces one with another.
3. *Function space specification in terms of size, general servicing, ICT support and quality* – This information considers space generically, for example, specification for classrooms in a school or offices within an administrative building. This information becomes the foundation for detailed room data sheets compiled on an individual room by room basis. This is discussed in more detail in Chapter 4.
4. *Analysis of procurement options, timeline and budget.*
5. *Options and option appraisal* – Innovating options to satisfy functional space requirements and preliminary judgement.
6. *Action planning* – This includes further work on timeline, budget and procurement options, space schedule and preparatory work for the concept design.

A project briefing workshop will typically last between one and three days dependent on the complexity of the project. If it is a 2 or 3 day workshop, it is preferable for it to be residential. Although this is seen by some as expensive in time and resource, the benefits of a properly considered and signed off brief should not be underestimated, and, can save time and difficulties later in a project. Additionally, value team members tend to continue discussing and thinking outside of workshop time.

Indicative agenda

Table 3.2 presents an indicative agenda for a value study type 2: a briefing workshop, planned as a 1 day activity workshop.

Implementation meeting/workshop

The value study report is produced including the further work to be undertaken. At a scheduled time following the value study, a meeting is held to review the further work undertaken as part of the action planning process. The report and further work can be used by the project manager/architect as a basis for the development of the project brief.

The project briefing document resulting from the value study would include the following:

- A summary of the relevant parts of the strategic briefing document.
- The function and activities of the client, including the structure of the client organisation and the project structure for the delivery of the project.

Table 3.2 Agenda for a briefing workshop.

09.00	Attendee introductions and agenda.
09.15	Review of Strategic Brief and Strategic Assessment.
09.30	Issues analysis – brainstorm all issues relevant to the project brief arising from initial information.
10.15	Identify first, important issues, and second, those important issues which are critical and/or potential roadblocks.
10.30	Short discussion to fully understand critical issues.
11.00	List all users, group users who will use the facility in a similar manner, draw flowchart showing essential features of use (by project team broken down into small groups).
12.00	Collate user flow diagrams and discuss.
13.00	Lunch break.
13.45	From user flow diagrams list all functional spaces required and describe size by function (e.g. study room for 20 people, IT suite for 10 people) Describe also general environmental requirements (heating ventilation, lighting, acoustic), quality of wall, floor, ceiling finishes and C and IT requirements. Describe external spaces. These descriptions are indicative only for groups of spaces but are a sufficient foundation for the project manager/architect to prepare the room data sheets after the workshop.
15.45	REDReSS (see Toolbox).
16.15	Construct/review project timeline, noting specifically the date of the planning application and the most desirable date of 'ready for use'. Analysis of procurement options.
17.00	Review Whole Life Cost and Client Project Value System matrix agreed at strategic briefing and include any general directions to the design team.
17.30	Create an action plan indicating tasks annotated with 'by whom' and 'by when'. Note: the majority of activity for the next stage will fall to the design team although some of the information required for the project brief will be obtained from the client.
18.00	Concluding remarks and end.

- The aim of the design including priorities for project objectives.
- The site, including details of accessibility and planning.
- The size and configuration of the facilities.
- Outline specification of general and specific areas, elements and components in output terms.
- Costs centred budget for all aspects of the project including all elements of the project.
- Facilities management implications.
- The skeletal project execution plan including:
  - Targets for time, cost and quality including milestones for decisions.
  - A risk management program and a method for validating design proposals.
  - The procurement process.
  - Environmental policy and environmental delivery and control.
  - Key performance indicators for each stage of the project.

3.10 Value study type 3: Concept design (the technical solution)

The concept design marks the watershed between the gathering and processing of the performance specification requirements that are incorporated in the brief and the expression of those concepts ideally in several optional technical designs. In their seminal text, Peña and Parshall (2001: p.16) state that:

> Programmers (those engaged in taking a brief) must be objective (to a degree) and analytical, at ease with abstract ideas and able to evaluate information and to identify important factors while postponing irrelevant material. Designers can't always do this. Designers generally are subjective, intuitive and facile with physical concepts. . . . Programmers and designers are separate specialists because the problems of each are very complex and require two different mental capabilities, one for analysis, another for synthesis.

A number of important points arise from this simple statement:

- A brief that clearly expresses, in words, the functional mission of the project and the criteria by which the project will be judged a success is a necessary precursor to design.
- Concept design commences once the brief is completed and agreed with the client.
- Designers should produce a number of optional concept designs that answer the brief and highlight different perspectives that may be taken.

The concept design study is a value review of the initial plans, elevations, spatial relationships, sections, outline specifications and cost plan of the optional solutions to the provision of the constructed assets. The study will focus on choosing and validating a concept design or assisting the further development and design of further options or improvements. An assumption is made that the client has agreed to the project brief although this would be tested as part of the study process. Administratively, the concept design study should be undertaken prior to an application for detailed planning permission. Many clients consider the obtaining of detailed planning permission as a 'no return gate' and therefore, clients should avoid an application for planning permission with a less than perfect design.

Orientation and Diagnostics phase

The Orientation and Diagnostics phase of a concept design study, undertaken following a briefing study, requires only the VSL meeting with the project manager and the design consultants. The meeting with the project manager will update the VSL on events since the implementation meeting of the briefing study. The meeting with the design consultants will allow the value manager to understand the optional design concepts being considered by the lead designer and the stage reached by the various design consultants.

The value workshop phase

The workshop phase undertaken following the preparation of a brief through a facilitated workshop comprises a short meeting to audit design options against both the strategic brief and the project brief. It is a characteristic of good design that the design consultants will present at this stage several optional design concepts that illustrate their interpretation of the project brief. The role of the project team is to consider the options and endorse the continuance of design on the option that appears to demonstrate the best functional suitability and whole life value. The workshop delegates will comprise the same individuals as those attending a briefing workshop.

Indicative agenda

Table 3.3 presents an indicative agenda for a value study type 3: concept design workshop

Table 3.3 Indicative agenda for a concept design workshop.

09.00	Attendee introductions and agenda.
09.15	Presentation by project manager of the essential requirements of the strategic brief and the project brief.
10.00	Presentation by the design consultants of the optional concept designs and the thinking behind design options.
11.00	Discussion (possibly in small groups) on the merits and disadvantages of the various options based on the requirements set down in the strategic brief and the project brief. Generation of ideas for improvement.
12.00	Consolidation of all views and ideas for improvement. Consensus on the option that appears to offer best functional suitability and whole life value.
12.45	Action plan.
13.00	Concluding remarks and end.

Implementation phase

The design consultants modify the chosen concept design and the cost plan as necessary to accommodate the requirements detailed in the action plan section of the value study report. It is at this stage that the team moves forward to the application for planning permission with the confidence that the requirements of the strategic brief and the project brief have been met.

The outputs resulting from the concept design study would include the following:

- A statement of the direction of the design.
- Dimension and outline drawings and an outline specification for all systems.
- A detailed cost plan and a detailed budget.
- Project timeline.
- Project execution plan including the preceding bullet points and
  - The procurement strategy and the options explored,
  - Key milestones,
  - Key performance indicators,
  - Risk management strategy and the risk register, and
  - The site layout and access including the indication of ground conditions and any planning constraint.

Concept design – discussion

There is considerable debate on what constitutes a briefing process, when it commences, what it is comprised of and when it ends. That it is important is generally agreed by researchers and authors of commonly cited reports. The Latham Report (Latham, 1994: p.18) states 'getting the design brief right is crucial to the effective delivery of the project'. The National Audit Office (2001: p.22) states that one of the major barriers to improving construction performance was 'poor briefing and definition of requirements with insufficient focus on user needs and the functionality of the construction'. The Office of Government Commerce (OGC, 2003a: p.4) citing the HM Prison service stated that 'HM Prison Service has found that the only way to improve on quality and price was to get the brief right in the first place'.

The debate on briefing is typified by the research of Newman *et al.* (1981), Mackinder and Marvin (1982), White (1991), Brown (2001), Barrett *et al.* (1999a, 1999b), Kamara, Anumba and Evbuomwan (2001), Smith, Wyatt and Jackson (2003). Those that surveyed architects found that approximately 60% had no structured briefing methodology, a fact criticised by clients. The majority conclude that briefing is comprised of two discrete stages, the strategic brief and the project brief. They further conclude that project briefing should end with the production of the concept design. Barrett and Stanley (1999a: p.13), in a discussion that argues against too prescriptive an approach, states that an organisation that requires a building is, by definition, in a state of change, and as the state of change is ongoing this mitigates against an accurate definition of the organisational requirements following the change, that is, as the project develops, then so the goals are moving. This view is not endorsed by the other commentators including

Blyth and Worthington (2001) and OGC (2003b), which anticipate an accurate description of the client requirements sufficient to support a business case and a freezing of those requirements once the business case is approved.

Although alternative concept designs are often sought, they are rarely given. The advantage of Value Study 2 is that it offers a clear basis for the generation of alternative technical solutions that can be reflected in several optional designs. These options are usually variations on a theme. In a recent primary school project (2010) with two value studies, the architect produced three concept designs to illustrate options discussed at the briefing workshop.

The recommendation of this discussion is that a structured briefing exercise through value studies 1, 2 and 3 gives efficiency in the process, reduces time to planning permission and gives the client confidence.

3.11 Value study: Charette

The Charette[1] is a hybrid study. It is an audit of the project brief and concept design. In North America the study is often referred to as being undertaken at 10% design. It should be stressed that by definition the Charette is an audit study and not a developmental study as value studies 1 and 2. This means that the Charette is always an examination of decisions already made in order to validate those decisions and develop the project for the next stage; the development of the design.

The most common reason for a Charette is that following the completion of the concept design and the cost plan it is realised by the client that either the project has lost focus or that the cost plan exceeds the budget often significantly. Therefore, the Charette is commonly the first study undertaken on a project. It implies that the client has reached the decision to build, completed the project brief, appointed the design team and then undertakes a value study. The study is wide ranging, and in the case of tracks 3 and 4 (Table 3.1) incorporates elements of value studies 1, 2 and 3 as appropriate. The study focuses on validating the project mission, the project brief and frequently the concept design to ensure that the client's project value system and the strategic mission of the project can be fulfilled. This aim is more straightforward where the strategic brief has been evolved through a value study (Track 2).

The authors' experience is that the Charette is a common type of value management exercise undertaken on construction projects where value management is a single event. On completion of the Charette the client project value system will have been made explicit, the project brief will have been validated and any outline design audited against

[1] It is acknowledged that the Charrette is an architectural term referring to an intensive design study usually undertaken by a group of architects in a workshop environment to achieve a considered design in a short period of time. The term Charrette is from the French for 'cart' and believed to originate from the time when architectural students of the Ecole des Beaux-Arts in Paris wheeled their drawings and models to the crit session in a cart. The misspelling in this book is deliberate and an acknowledgement to Robert P. Charette, a professional engineer, certified value specialist, and an Adjunct Professor at Concordia University, Montreal, Canada, whose insights into the application of value management early in the project lifecycle had a profound influence on the thinking of the authors during their research endeavours of the 1980s and subsequently.

the client project value system, strategic brief and project brief. A complete Charette value study will potentially take between two to three weeks with the workshop taking between one and three days of the time. The length of time for the study will be influenced principally by the amount of prework undertaken by the team, and the complexity of the project.

Orientation and Diagnostics phase

The extent of the Orientation and Diagnostics phase depends largely on whether the Charette is the first or second study. If it is the first study then much of the activity described in the Orientation and Diagnostics stage of value study 1 and value study 2 will need to be undertaken. In theory the Orientation and Diagnostics stage of the Charette as a first study should be a simple task since a large proportion of the preparation work should be included in the project file. The VSL undertaking preparation work for a Charette will be involved in document examination and interviewing client representatives, key stakeholders and members of the project management, design and cost control team.

The Charette value workshop phase

The Charette workshop will focus on reviewing the information leading to the development of the concept design and completing those activities from a value study 1 and a value study 2 that have not previously been undertaken. The agenda for a Charette could therefore potentially include:

1. *Issues analysis* – To understand all of the issues of the project team specifically those that are of significant importance and those that could potentially seriously disrupt or halt the project if the issue is not addressed.
2. *Client project value system* – The criteria by which the success of the project will be judged.
3. *Strategic function analysis* – The diagram that displays the mission of the project and its subfunctions in a needs/wants hierarchy. This defines the functional requirements.
4. *Function space analysis* – A diagramming technique that maps the key usage and circulation flows within the proposed facility and the relationship of individual spaces one with another.
5. *Function space specification* – Functional space size schedule, servicing, ICT support and quality. Room data sheets may be available at this stage.
6. Analysis of procurement options, timeline and budget.
7. Options and option appraisal – Innovating options both to satisfy the project mission and functional space requirements. Normally undertaken as a brainstorming exercise, the aim is to present ideas to formalise the optimal way forward.
8. *Action planning* – Taking the best options as improvements to the developed project and tasking members of the value team to carry forward discrete pieces of work.

Implementation phase

The implementation phase will be identical to the implementation phase of the concept design workshop, that is, the design consultants modify the concept design and the cost consultant will modify the cost plan as necessary to accommodate the requirements detailed in the action plan section of the value study report. Undertaking a Charette will give the client confidence that the project is proceeding towards its intended mission with all members of the project team understanding the whole life value benefits being sought by the client.

The outputs from a Charette are those of the Strategic Brief, Project Brief and Concept Design. Table 3.4 summarises the tools and techniques applicable to these four value study phases. Value studies 1, 2 and 3 are assumed to be a set of sequential studies (track 1) or where only value study 1 has been undertaken before concept design is complete (track 2). If no studies have been undertaken before the completion of concept design (tracks 3 or 4), then the appropriate study is the Charette. Details of the tools and techniques described in Table 3.4 are found in the Toolbox.

Note: value studies 2 and 3 assume that earlier studies have been undertaken.

3.12 Value studies 4 and 5: Value engineering

The completion of the concept design study and/or the completion of the Charette signify the end of value management activity during the development of the project. Many clients see the acceptance of a concept design and the obtaining of full planning permission as a non-return gate. The project will now move forward into the detailed technical design phase ending with the production of working drawings prior to construction on site. Dependent on the procurement route chosen, the production drawings may be produced by design consultants employed by the client or maybe a task undertaken by the contractor or a specialist trades contractor.

A consequence of the completion and acceptance of the written brief and the concept design by the client means that the mission of the project and its required subfunctions are well understood and the criteria for project success is explicit. Therefore, the design and construction team should be fully aware of the client's intentions. The job of the design and construction team is to provide the technically driven asset required by the client. The client is less involved in the myriad of technical decisions that have to be made by the design and construction team and the role of the project sponsor becomes more one of stakeholder co-ordination, monitoring progress and budget.

Part 1: Tactical design of the component parts of the project

The first stage of the tactical design of the project adds considerable detail to the concept design such that all of the elements of the design are understood and specified. The completion of this stage is commonly called sketch design or 35% design. Irrespective of its title, it is commonly acknowledged that the largest proportion of the total project

Table 3.4 Summary of the tools and techniques applicable to the first four value study phases.

Activities Tools and Techniques (See Toolbox)	Value Study 1 Strategic Briefing	Value Study 2 Project Briefing	Value Study 3 Concept Design	Value Study Charette
Orientation and Diagnostic Phase				
Interviews	✓	✓		✓
Stakeholder mapping – acid test	✓	✓		✓
Document analysis	✓	✓		✓
Questionnaires	✓	✓		✓
Post occupancy evaluation of a similar facility	✓	✓	✓	✓
Benchmarking information from similar projects	✓	✓	✓	✓
Site tour		✓	✓	✓
Facility walk through			✓	✓
Workshop Phase				
Presentations and teambuilding	✓	✓	✓	✓
Issues analysis, group, theme, prioritise	✓	✓	✓	✓
Client project value system	✓	**review**	**review**	✓
Stakeholder analysis	✓	**review**	**review**	✓
Strategic time line	✓	**review**	**review**	✓
Project driver analysis	✓	**review**	**review**	✓
Goal and Systems modelling	✓	**review**	**review**	✓
Time/cost/quality analysis	✓	**review**	**review**	✓
REDReSS		✓	**review**	✓
Process flowcharting		✓	**review**	✓
Function analysis	✓	✓	**review**	✓
Function logic diagram	✓	**review**	**review**	✓
Function space analysis		✓	**review**	✓
Spatial adjacency analysis		✓	✓	✓
SWOT – strengths, weaknesses, opportunities and threats		✓	✓	✓
Element function analysis and costing			✓	✓
Brainstorming alternatives/ innovation	✓	✓	✓	✓
Evaluation and development	✓	✓	✓	✓
Presentations from working groups	✓	✓	✓	✓
Plan for implementation	✓	✓	✓	✓
Prepare action plan	✓	✓	✓	✓
Prepare and circulate study report	✓	✓	✓	✓
Sign off workshop report by participants	✓	✓	✓	✓

budget is now committed. Citing the 80: 20 theory, it is said that at sketch design stage 80% of the costs have been committed but only 20% of the technical decisions have been taken. This statement applies irrespective of the procurement route being followed. It is right therefore to undertake a value engineering study at 35% design with the objective of steering the technical development of the project in the most effective direction.

In practice, the design of a construction project does not progress in a uniform manner such that it can be said that the whole design has reached sketch design or 35% design stage. Engineering design, and particularly mechanical and electrical engineering design tends to lag behind architectural design. Nevertheless, when the architectural sketch design is complete useful studies can be undertaken including the value engineering of the proposed mechanical and electrical design.

There are two approaches to undertaking value engineering at sketch design stage:

- The first is to take a proactive holistic view of the project and analyse each element in turn for its function and cost efficiency.
- The second is more reactive and focuses on a limited number of elements that appear to be functionally inefficient or are returning an uncharacteristically high or low cost in the project budget.

The advantages of the first approach are:

- The proactive analysis of the whole project and the examination of all elements whether or not a functional or cost problem has been identified.
- The full understanding and acceptance by all designers of the impact of a design decision on one element on any other element.
- The setting of a date for a full value engineering design review encourages all designers to advance their design thinking to 35% design by the date for the workshop.
- The workshop will be a formal workshop led by a qualified VSL and, depending upon the complexity of the project, lasts between one and three days.

The disadvantage of the first approach lies in the breadth of expertise that has to be represented in the workshop and the time taken to analyse each element. This can be inefficient of some designer's time (offset by an increased understanding of the whole project) and will be more expensive.

The second approach reacts to the situation identified by one or more designers in the development of the sketch design usually involving an inefficient design solution to achieve specified requirements. Alternatively, the cost consultant may highlight that an element design solution significantly increases the cost of that element in the elemental cost plan. This situation is commonly reported in a design team meeting and results in a value engineering workshop scheduled to resolve the problem. The advantages of this approach are as follows:

- A targeted problem is addressed at the workshop.
- Only those designers involved or impacted by the design of the problem element need attend the workshop.

- The workshop can be short duration – commonly half a day.
- The numbers attending the workshop will be relatively small therefore reducing the cost of the workshop.
- The workshop can easily be facilitated by a project manager but only if they are knowledgeable in the process of value engineering.

The disadvantage of the second approach lies in the lack of a holistic technical overview and thereby the danger that decisions taken by a small group of designers may adversely affect the subsequent design of elements, systems and components, and the overall functionality of the project.

The workshop structure described next is common for either value engineering approach.

Orientation and Diagnostics stage

During the Orientation and Diagnostic stage, the VSL will gather together the relevant design information, including the strategic and project briefs. Interviews may be held with designers and specialists to inform the compilation of the value engineering workshop team. This value team may include the cost consultant and facilities manager in addition to the relevant designers and specialists. The VSL will set the date for the workshop, arrange the venue and prepare the agenda.

The value engineering workshop

The value engineering workshop will focus on the function/cost review of all or selected elements of the project. The agenda may include the following:

1. Review of the project mission, value system and criteria to determine project success.
2. Review of the concept design, project timeline and cost plan.
3. SWOT on the sketch design (Strengths, Opportunities, Weaknesses and Threats analysis – see Toolbox).
4. Highlight elements which appear on a *prima facie* basis to offer poor value.
5. For all selected elements undertake function listing.
6. For all selected elements undertake whole life costing and benchmarking against other projects (Some of this work may have already been carried out and is examined during the workshop).
7. Identify elements that are proved in point 6 to offer poor value based on function/cost analysis.
8. Brainstorm alternative technical solutions to meet the element functions identified.
9. Evaluation of solution list and selection of preferred options.
10. Whole life costing of preferred options and selection of an option that meets function at least whole life cost.
11. Action plan for design implementation.

Implementation phase

The implementation phase involves the relevant designers amending their designs to accommodate the results of the value engineering workshop. The cost consultant revises the cost plan. The project manager will revise the project execution plan including for example key milestones and targets, the risk register, and so on.

Part 2: Operations workshop – Execution of design, manufacture and/or construction of systems and components

The Operations study converts elemental design into systems, components and construction operational sequences. It is undertaken during detailed design, prior to construction work being undertaken on site, or during construction. The structure and the nature of the workshop is exactly as the elemental sketch design workshop described earlier with the focus on the design, manufacture and construction of systems and components. For example, within the element 'heating', the system will describe the heat source, control systems, pumps and/or fans, convection and/or radiation media. The components will focus on individual items within the system, for example, the control of air temperature, the circulation of hot water and the co-ordination of the services design. Construction is concerned with the best method of assembling components to create efficient systems and thereby create functionally effective elements.

Operations studies are typically short workshops to address a particular system, component, manufacturing or construction issue that has arisen during detailed design or prior to construction. Relevant to this stage is the procurement method adopted, as the operations study will necessarily introduce supply chain and technical development issues and involve the updating of the risks associated with the project.

The characteristic of the operations workshops is the transferability of the lessons learned from project to project. This was typified by a short workshop on the changes necessary to the manufacture of doorsets for a large housing scheme to enable their efficient installation within a number of partition types. Working with the doorset manufacturer, the contractor was able to introduce efficiency savings on site. Clearly this knowledge was transferable although it also brought with it issues of intellectual property discussed later.

This section concludes the description of the most common study styles. Section 3.13 introduces variations on the theme including contractor focused co-creation services.

3.13 Other study styles

Value creation – Co-creation

Value creation is a term used primarily in the manufacturing and service sector that acknowledges that service is the common denominator in the exchange process between supplier and customer. Co-creation recognises that the value creation process occurs when a customer consumes or uses a product or service rather than value only occurring during the manufacturing or service design process. Value co-creation occurs when a supplier works with a customer with the aim of delivering a superior value proposition based upon an understanding of the value system of the customer. It is the cooperative venture that leads to co-creation (Payne, Storbacka and Frow, 2008).

Co-creation can occur in a business to consumer relationship and in a business to business relationship. In either relationship co-creation opportunities are the recognition of strategic and technical options to creating value for the customer. Payne, Storbacka and Frow (2008) state that good co-creation opportunities are those provided by technological breakthroughs, changes in industry logistics and changes in customer preferences and lifestyles. In all situations it is the responsibility of the supplier organisation to understand the functional requirements and value system of the customer. However, co-creation can both be offered by the supplier organisation and/or be required by the customer within a system demanding good communication and cooperation.

Within construction, co-creation generally occurs in a business to business relationship in which the contractor seeks to fully understand and co-operate with the client organisation in the improvement of a technical solution. The shift by contractors from the traditional bid–build model to an integrated service provider (ISP) model where the service may include financing, ongoing maintenance and occupancy services means the ISP contactor will become a critical part of the client's supply chain. The contractor will be in a position to advise on through life operation and cost of a proposed facility and be able to contribute effectively to co-creation exercises.

Generally, however, co-creation opportunities occur within procurement systems that include a design and build–bid situation in which the tendering contractor is required to bid on the basis of a technical solution to given plans elevations and sections that have received detailed planning consent. In this situation the contractor may submit both a compliant bid based on the bid documents and an alternative bid based upon an improved technical solution that may require a slight change to the proposed plans elevations and sections. Such changes may be, for example, a proposal to change the structural grid to optimise the foundation solution or minimise the number of columns. The contractor may also offer to join with the client, post-tender, in a co-operative, co-creation exercise to reduce costs. The service offered by the contractor goes under a number of headings including co-creation, value creation, value enhancement and value improvement. However, whatever the name, the exercise is best carried out using the principles of value management and value engineering described in this book.

Other exemplar study styles

The value management process has been used by the authors in a variety of different situations. This section discusses other study styles that build on the generic process used for construction projects. Examples include the following:

- *Single project versus Programme of project studies.* This chapter outlines approaches relevant for different stages of individual projects. However, the same process can be used to develop the strategy for a Programme of projects, where the focus will be on identifying the objectives of the overall Programme, individual projects within the Programme and how they fit together holistically. Programme level VM studies focus on understanding and resolving competing objectives and resources between projects making up the Programme. An example of this is provided in Chapter 7 and developed further in Chapter 9.

- *Organisational change studies.* The value process and functional analysis has proved a very powerful technique in assisting the authors to facilitate organisational restructuring of divisions, departments and teams. Organisational change studies have involved assessing current organisational units and analysing where the organisation needs to be in the future, perhaps over different time frames. A prioritised issues analysis assists in targeting the important change issues, what is critical for success and where the important risks might lie. Functional analysis can be used to describe the essential functions that the new organisational unit must perform in the future, with skill and resource requirements being worked out to meet the functional structure developed by a value team. Normally, a migration strategy will also need to be developed to articulate how the organisational unit will get from its current state to the future state described by the function diagram. Underlying the process described is a continued questioning of which functions will add value to an organisational unit in the future. The process has also been used to implement a risk framework within a company across all of its subsidiaries, again using functional analysis to define the reason why the risk framework needs to be implemented and its purpose in the organisation. An example of an organisational study is set out in Chapter 7 - Case Study 9.
- *Facilities programming studies.* The authors have conducted a range of studies undertaken before the client has appointed design consultants and often before the appointment of a project manager. This is a 'safe' option for the client who wishes to develop the technical or project brief for a project and/or define the appropriate procurement route and business case without engendering an expectation that the project will go ahead within a specific time frame or at all. The focus of this type of study is to ensure that business and technical projects are in alignment and that the technical/project brief reflects this alignment in specifying performance requirements for elements of a building.

  A full independent value team comprising architect, mechanical and electrical engineering, structural, quantity surveyor (QS) and contracting members is used to brief the project with the client and end users, including defining the project mission, the size of functional space, spatial adjacencies, elemental performance specification, procurement route and budget. The term facilities programming is used in this instance to describe this type of study since the technical/project brief leaves the client totally free to choose the best supply team to deliver the project. Post-occupancy evaluation studies can also provide a good source of information into the briefing process by using cross-project learning. The facilities programming study goes beyond a normal project briefing study, which is usually conducted with the client appointed design team. Male *et al.* (2007) describes this type of study as a 'hybrid' as it draws together some of those responsibilities normally adopted by the client-appointed design team within a value study commission. The independent value team works alongside client personnel to develop and implement solutions and be held accountable professionally for that involvement. Typically, in this type of study, the orientation and diagnostics phase could be extensive and workshops used in a variety of ways. Implementation is an ongoing process throughout. The authors have used this type of hybrid study to develop strategic and design briefs simultaneously, including an outline output specification, a budget and procurement strategy. The output of this type of study is a fully worked up brief ready to be handed to the client-appointed design team. The advantage of this type of study is the assurance that it gives to the client that the project is necessary and is configured in a manner that assures best value for money. An example of this type of study is set out in Chapter 7 – the third value study in Case Study 5.

- *Project audits and value-for-money studies*. The value process can be used to undertake project audits and/or value-for-money studies. The authors have used this approach to independently validate a high cost, high risk or mission critical project in the situation where external endorsement of value for money may be subsequently called upon. A full 'shadow team' has been utilised to provide recommendations and opinions covering a broad spectrum of expertise on whether the service/project to that stage is providing value for money. This approach is similar to North American-style VE studies. The approach also has considerable merit for undertaking best value public accountability exercises. An example of this type of study is set out in Chapter 7 - Case Study 1 and the first value study in Case Study 5.
- *Procurement studies*. These have been wide-ranging in form but with two distinct characteristics:
    - *Client-led procurement studies* – Where the value process is used to develop and understand in detail the client project value system. Subsequently this is translated into an analysis that attunes the client project value system to the appropriate procurement route, including decisions on attitudes to risk and its allocation. While the authors have conducted procurement studies in their own right, it is not uncommon for procurement to be addressed as part of another type of value study as indicated earlier. An example of this type of study is set out in Chapter 7 - the third value study in Case Study 5.
    - *Bid conferences* – Where the value process has been used to assist contractors to develop a bid strategy under a particular procurement route and subsequently consider supply chain procurement issues. Bid conferences have taken a variety of forms:

      Traditional design and build. The value process is used comprehensively to understand the bid documentation, design and construction interactions, risk, and determining usually by implication the client's strategic functional requirements and the client value system. Tender development teams tackle areas that need to be developed further for the bid. The advantage of using the process in this way is that bid documentation can be broken down in a structured, comprehensive way, with value engineering options also being developed as part of the process. One disadvantage of using the value process in this way is not having direct access to the client in a competitive bidding situation to fully understand the client project value system. However, there is usually sufficient information within the bid team to be able to construct a robust and comprehensive understanding of the client project value system, albeit a second guess. This permits the bid team to develop the project value system.

PFI, prime contracting and NHS Estates Procure 21 and 21+ procurement systems. The authors have used the value process to assist teams at either pre-qualification, invitation to tender, best and final offer, preferred bidder or post-contract stages. For one particular project at PFI preferred bidder stage, a combined value management and value engineering exercise was undertaken at risk to the consortium. It involved the end users assisting the consortium to finalise the scheme and drawings prior to contract close. The value process has also been used at postcontract award stage to ensure that the project organisation has been set up appropriately for the remainder of the contract. The key benefits of using the value process under these forms of procurement are that it speeds up project learning, defines the important issues early on in the bid process and can also save a bid team time by increasing cohesion, enhancing commonality of thinking across the supply chain team, assisting forward planning of the bid process and the project, understanding client drivers and identifying critical success factors. Using the value process also enhances a partnering ethos and assists embedding VM and risk management early into supply chain clusters, where the procurement system requires this approach. Typically, clustering strategies will also be developed using the value process.

- *Partnering studies*. The authors consistently approach partnering from a value process perspective. Partnering comes in many guises and is understood to be anything from good teamwork within an otherwise traditional contractual framework, to a situation where there is no formal contract and full partnering exists. Within this spectrum there are recognised to be two primary partnering types: project partnering and strategic partnering or alliancing. Project partnering is a partnering framework for a single project. The partnering may evolve at an early stage and incorporate a selection procedure or may be instituted after a traditional tendering process and after a contract has been signed. In strategic partnering or alliancing the partnering agreement exists across organisations and is independent of specific projects. In either case it is common in construction for partnering contracts, such as PPC 2000, and NEC 3, to be used or partnering procurement approaches that require it as an overlay on standard forms of contract.

  The value approach involves understanding and respecting each party's issues and objectives whether commercial or social. It is often difficult for public sector clients to understand, accept or respect the fact that a commercial organisation has a culture based on profit and is entitled to earn a profit, and for private sector organisations to understand that the public sector client has a duty to procure socially orientated services representing best value. An understanding of the cultural issues of each party is fundamental to effective partnering, which is generally characterised by trust and openness between the parties, a robust system for sharing gain and pain, and a recognition that tasks should be undertaken by the best person for the job irrespective of the organisation to which that person belongs.

  Normally, the full gamut of VM tools and techniques will be used in a series of partnering workshops to set up the ethos from the outset, and define the charter and the important components of the partnering memorandum of agreement. This is successfully achieved using issues analysis to understand all parties' issues as indicated earlier. Function diagramming is used to derive the partnering mission and the level 2 functions described in the function diagram provide the components of the partnering memorandum. Typically, partnering workshops will combine process analysis, where appropriate, and define incentives, risk management and risk sharing systems.

- *Strategic studies.* The authors have also adapted the value process for use on complex studies that combine elements of both corporate and project strategy. These types of studies have included rationalising plant locations, improvements to industrial processes where temporary construction activity may impinge directly on the delivery of industrial products, and the development of business cases to demonstrate the benefits of new ways of working compared to existing methods.
- *Lessons learned studies and post-occupancy evaluation.* Feedback and analysis are an effective way of introducing project team learning. In this type of value study the Orientation and Diagnostics phase requires a detailed examination of the project history to identify and analyse periods of project stress and also a structured post occupancy evaluation (POE) to examine the success of the project after its incorporation into the core business of the client organisation. The Value Workshop phase involves the design and construction team in a workshop with the client to make explicit the benefits realised by the project and where these are not as expected, to record the reason why and suggest methods of correction through an innovation activity. The workshop report is a final sign-off on the project.

The study styles reviewed in this chapter have as their common structure an orientation and diagnostics phase, a value workshop phase and an implementation phase. In the future, with advancing technology, it is conceivable that the workshop phase is replaced with an analysis and synthesis phase conducted without the value team being commonly located in either space or time. In the review of the study styles a common approach and indicative agendas have been presented. These are for the purpose of illustration only and should not be slavishly followed. Similarly, Table 3.4 gives the tools and techniques in approximately chronological order, which may be used at each of the first four generic value study opportunities. These too need to be selected as appropriate in the same way as a joiner selects the appropriate tool for the woodwork task being undertaken. A chisel will work as a screwdriver but that is not what the chisel was designed to do. Thinking through the design of the study and selecting the most appropriate tools and techniques to use is one of the most important challenges facing the VSL commissioned to undertake a value study.

3.14 Case study

The case study is fictitious but is based on a real project on which the authors provided value study services. The unusual element in this case study is the fact that one of the authors was known to the Director of Community Services (DCS) through a previous project and was contacted at a very early stage in the project's development. The strategic brief was prepared using a value study approach; however, there was no further value study intervention until the Charette, which occurred after the development of the project brief and after the completion of concept designs. A further value engineering workshop was held, prompted by an indication that the cost plan exceeded the budget.

Inception

At a meeting of the Old Cross Council, the Director of Community Services presented a paper regarding the provision of library services in Old Cross. Old Cross library is currently housed in a timber-framed, flat-roofed structure constructed in 1972 on the perimeter of the grounds of Old Cross Primary School. Children from the primary school make good use of the library and could be considered, along with those living adjacent to the school, the library's main customers. The library is some distance from the main shopping centre of Old Cross, is served by a half hourly bus service and has no off-street parking.

The building does not comply with the Disability Discrimination Act (DDA) and it is unsuitable for people with mobility restrictions and parents with prams and buggies. Three years previously, the Council approved in principle the reconstruction of the library. It was recognised at that time that the existing library could not be refurbished to comply with DDA as the building is sited 1.5 metres above pavement level and is accessed by a set of steps. There is level access via the primary school entrance but the recent installation of security fencing around the primary school restricts this access. A ramp is impractical due to space constraints on the site. The structure plan for Old Cross anticipates an increase in projected population of 25% from 10 000 to 12 500 over 5 years.

The Director of Community Services reminded the meeting of the Council's statutory obligation to provide a local library service that is comprehensive and efficient, conveniently located and is available to all who wish to use it and to meet any special needs required by members of the local community.

Concurrently, the Chamber of Commerce has made representation to the Council for an increase in provision of IT skills training and workforce development. It is a policy of the Chamber of Commerce that local retailers, tradesmen and other service providers make best use of IT in the provision of competitive services and online purchasing and that they suffer no disadvantage from being required to engage in e-tendering.

The resolution of the council meeting was to invite the Chief Executive of the council to compile a Strategic Outline Case for improved library provision in Old Cross.

Appointment of the project sponsor

At a meeting between the Chief Executive and the DCS, it was decided that the DCS would be the project sponsor for the project. It was at this point that the DCS appointed a VSL.

Strategic briefing

Appointment of the initial project team

The DCS appointed a project team drawn from council employees as:

- Senior Librarian
- Old Cross Librarian
- Director of Education
- Director of Enterprise
- Business Learning Advisor
- Media and Communications Officer

First meeting of the initial project team

The first meeting of the initial project team:

1. Introduced the project and the project team.
2. Identified method of information gathering as
   a. Document review – list relevant documents,
   b. Draft interview schedule,
   c. Plan visits to other authorities cited as having best in class library facilities,
   d. Review and adapt standard stakeholder questionnaire, and
   e. Identify other council and noncouncil stakeholder recipients of the questionnaire.
3. Identified nature of public consultation.
4. Identified contents of press release.
5. Propose schedule for development of the Strategic Outline Case including dates for
   a. Completion of public consultation,
   b. Full project team workshop,
   c. Implementation workshop, and
   d. Recommendation report to CEO.

Information processing

The DCS (Project Sponsor) seconded an assistant librarian to assist in gathering information, specifically to collate relevant policy documents, undertake selected interviews and to visit librarians in two authorities who had recently completed community libraries. This information was gathered over a 4 week period and organised under the checklist headings (see Toolbox in the Appendix).

The DCS invited the VSL to a meeting to synthesise the information to date and to identify those stakeholders to be in receipt of a questionnaire. The VSL's standard stakeholder questionnaire was further modified in the light of new information and circulated.

A public consultation took the form of an open meeting held at the existing library at which attendees were asked for opinions largely in line with the questions in the questionnaire.

Collation of questionnaire data and results of the public consultation

The DCS and VSL collated data from the stakeholder questionnaire and the public consultation and invited the following to join a value team in addition to the project team:

- Chair of the Chamber of Commerce
- Principal Old Cross College
- Head Community Learning Old Cross College
- Chair of the Old Cross High St Retailers Association
- Head teacher of Old Cross Community School
- Chair of the Community Council
- Head teacher of Old Cross Primary School
- Assistant librarian seconded to information gathering exercise
- Academic researcher specialising in community libraries

The value team of 16 members was invited to a full 1 day workshop to be facilitated by the VSL.

Workshop agenda (Table 3.5)

Extracts from the value study report

An issues analysis highlighted the following primary issues:

- Low educational achievement in Old Cross
- Above average unemployment
- Higher than average single tradesman and micro-enterprises
- Lack of study space in the average home
- Low IT skills amongst local traders

Through function analysis, the following mission was developed:

> The project will enhance the educational, social and commercial development of the Old Cross community by encouraging learning, accommodating meetings, supporting the IT development in local commerce and advertising local events.

Through analysis of client values, it was agreed that:

> The user should experience a comfortable learning environment, within a facility that is popular and accessible by the whole community, with minimal operational cost and low impact on the environment. Income generation was seen to be of no importance. Further the client and stakeholders were willing to sacrifice floor space in order to reduce capital cost and maximise the achievement of the four primary functional requirements.

Table 3.5 Agenda for a strategic briefing workshop.

Time	Task	Method
09.00	Introduction of the team members to each other and to the objectives of the workshop.	
09.15	An exploration of the issues surrounding library provision in Old Cross. Many of the issues will have been raised in the public consultation and the stakeholder questionnaire. The team will add other issues. Ranking of issues in order of importance.	Issues analysis, group theme and prioritise Strategic time line Project driver analysis
10.30	Break	
10.45	An exposition of the functional requirements of library provision in Old Cross and the organising of the functions in a functional analysis systems technique diagram or operational hierarchy.	Function diagram
12.00	An exercise to determine the client project value system – those factors by which the project will be judged a success.	Value System Matrix
13.00	Lunch	
13.45	Weighting the functional requirements in line with the issues analysis, driver analysis, timeline and value system.	Weighting and scoring
14.30	Formalise the goals of the project and analyse systems currently in place to satisfy those goals.	Goal and Systems Modelling
15.00	Break	
15.00	Generate ideas to satisfy the functional requirements.	Brainstorming
15.45	Identification of best ideas.	Voting
16.00	Preparing the action plan and date for implementation meeting.	Action Planning
17.00	End	

Extract from the strategic outline business case

The following options were considered:

1. Do nothing – whole life cost of facility management over 10 years is £500 000.
2. Refurbish existing library with new entrance pathway through school grounds (rerouting perimeter fence) – whole life cost of refurbishment and facility management over 10 years is £600 000.
3. Accommodate a new library on Council-owned ground to the rear of High St shops (this would require negotiated or compulsory purchase of access lane) – whole life cost of new build and facility management over 10 years is £2.5 million.
4. Rearrange main Council offices in town centre to accommodate library by relocating education department staff to new office on existing secondary school site 2 miles from town centre. Whole life cost of new build offices, refurbishment of existing council offices and facility management over 10 years is £3.5 million.

In recommending option 3 to the Council the DCS highlighted that to do nothing met none of the criteria but still cost £0.5 m over 10 years. Option 2 was a viable option costing little more than doing nothing but did not meet the project's mission or values. Option 4 met all criteria but was disruptive to staff and cost more than Option 3, which also met all of the criteria. Note – Chapter 12 describes a validation method for Whole Life Value to support this conclusion.

Briefing

Following the strategic brief workshop, the DCS appointed an architect and consultant project manager to develop the design for a new library on Council-owned ground to the rear of High St. The director's vision was to provide a facility for adults, juniors and teenagers with:

- Lending of books, cassettes, compact discs, videos, computer software, talking books and books in large print.
- Daily newspapers and magazines available in a comfortable seating area with a franchised coffee vending outlet.
- Games consoles and Internet accessible computers to be provided in two rooms (one room for play and one room for study).
- A flexible space to accommodate open learning and Chamber of Commerce and other meetings.
- Small bookable study rooms to be provided together with a photocopying and document shredding facility.
- A display area to accommodate temporary cultural displays and large plasma display screens to advertise community events.
- The library shop would supply any book in print, videos and DVD's with a target 10% discount on the normal retail price. The library shop would stock a range of local history publications, postcards, maps, stamps, magnifying sheets, greetings cards, wall charts and educational books.

The architect prepared a concept design that formalised the director's vision within a two-storey structure. Two factors caused the DCS to discuss a Charette value study with the VSL. First, the concept design proposed a new library building of 850 m^2, which the quantity surveyor estimated the capital cost to be £2.325 million. The fittings and fixtures added a further£260 000 and the running costs over 10 years were approximately £520 000. The overspend on the budget of £2.5 million was approximately £600 000. Second, the negotiation for the right of access to the library from the High St through the privately owned lane was proving difficult. Although the council has good access to the land it would entail a walk of approximately 1 km from the High St.

Charette

Orientation and Diagnostics exercise

The value study leader reviewed the strategic brief and the project file held by the Director of Community Services. The VSL subsequently met the DCS, the project manager, the architect and the quantity surveyor. All agreed to give a brief presentation of the development of the concept design at a Charette. In discussion with the project manager a value team for the Charette was agreed to include from the council:

- Director of Community Services
- Old Cross Librarian

- Business Learning Advisor
- Media and Communications Officer
- Deputy Director of Estates (at the request of the VSL)

Other members of the value team included:

- Chair of the Chamber of Commerce
- Head Community Learning Old Cross College
- Chair of the Old Cross High St Retailers Association
- Head teacher of Old Cross Community School
- Chair of the Community Council
- Head teacher of Old Cross Primary School
- Project manager
- Project architect
- Quantity surveyor
- Structural engineer
- Mechanical and electrical engineer

Workshop agenda (Table 3.6)

Extracts from the value study report

The issues analysis highlighted the following primary issues:

- The whole life cost budget of £2.5 million cannot be exceeded
- Access problem
- Focus on single tradesman and microenterprises required
- Easily supervised study space required
- Low IT skills amongst local traders (carried forward from strategic brief)

The mission statement was confirmed:

> The project will enhance the educational, social and commercial development of the Old Cross community by encouraging learning, accommodating meetings, supporting the IT development in local commerce and advertising local events.

The client values were confirmed:

> The user should experience a comfortable learning environment, within a facility that is popular and accessible by the whole community, with minimal operational cost and low impact on the environment. Income generation was seen to be of no importance. Further, the client and stakeholders were willing to sacrifice floor space in order to reduce capital cost and maximise the achievement of the four primary functional requirements.

Table 3.6 Agenda for a Charette workshop.

Time	Task	Method
09.00	Introductions and review of the agenda.	VSL
09.15	Presentation of the strategic brief, the project brief and progress to date.	PM
10.00	Development of the project brief and concept design.	Architect
11.00	Presentation of the Whole Life Cost Plan.	Quantity Surveyor
11.30	Issues analysis. Covering issues remaining or arising after the strategic brief. Organise and prioritise.	Issues analysis Review of Timeline and Project Drivers
13.00	Lunch break	
13.45	Confirmation of project mission and value system.	VSL
14.45	Analysis of functional space requirements and adjacency. Audit of concept design against requirements. Review of procurement options.	Function space analysis. Adjacency analysis
16.45	Summarise and outline agenda for following day.	VSL
Day 2		
09.00	Recap previous day and outline tasks for day 2.	VSL
09.30	Generate ideas to meet functional requirements.	Brainstorming
10.30	Evaluation of best ideas.	Evaluation
11.00	Action planning.	VSL
12.00	Concluding remarks and end.	VSL

Ideas generated included:

- Omission of library shop (not supported by mission or value system and unpopular with High St traders – saves 60 m^2).
- Omit computer games room (not supported by mission or value system, requires supervision – saves 40 m^2 and through life cost).
- Approach existing successful and popular coffee shop in High St to determine if willing to take up franchise in cultural centre/library (Council is the coffee shop's existing landlord – Estates Director was confident idea will be accepted – reduces through life cost through assured income).
- Have a single large study room and IT suite arranged in an 'L' shape to allow to be supervised by a single member of staff (saves 30 m^2 and through life cost).
- Extend opening hours into evening (increases through life cost but meets mission).
- Provide meeting room with own entrance and toilets to allow to be used by registered key-holder when library closed (small increase to capital cost but meets mission).
- Demolish corner shop on High St and build two-storey library on site.

All ideas were carried forward to the action plan. The value team were confident that with the space savings and reduction in operating costs the £2.5 million whole life cost budget could be achieved. Many value studies have their 'eureka' moment. For this study the idea came from the Estates Director who knew that a Council-owned corner shop, with vacant flat and garden, on the High St was currently occupied and poorly utilised by the Citizens Advice Bureau. The building was in bad condition structurally and internally, and required expensive remedial work. The Estates Director proposed that if the shop were demolished the library and cultural centre could be accommodated as a two-storey building occupying the entire site. Space could be found for the Citizens Advice Bureau perhaps in the soon to be vacated, existing coffee shop.

Value engineering workshop

The VE workshop was held pre-tender. The cultural centre library has been designed as a two-storey building. The library and coffee shop occupy the ground floor with the study room, meeting room and IT suite on the first floor. There is a large fully glazed single storey entrance vestibule that gives access to the coffee shop, library and a central hallway and staircase. Toilet and cloakroom facilities are in the hallway. The frontage of the building is set back from the street to the depth of the entrance vestibule. Two problems have arisen during the development of the sketch design:

- As the vestibule is south facing there are concerns regarding solar heating.
- The building was to be part naturally ventilated but concerns over the security of opening windows onto the area adjacent to the street have caused the mechanical ventilation installation to be substantially upgraded with significant cost increases leading to a projected project overspend.

Orientation and Diagnostics

A pre-workshop design team meeting chaired by the VSL identified the following areas as requiring value engineering:

- Vestibule orientation and construction
- Mechanical ventilation

A 4 hour value engineering workshop involved

- The VSL
- The project manager
- The project architect
- Quantity surveyor
- Mechanical and electrical engineer
- The contracts manager from the local authority's framework contractor
- A glazing specialist
- The local authority's facilities manager

Table 3.7 Agenda for a value engineering study workshop.

Time	Task	Method
09.00	Review of project mission, criteria for project success, concept design and cost plan.	VSL
09.30	Confirmation of scope of value engineering study.	VSL
09.45	Function listing of elements.	Element function analysis
10.15	Brainstorm alternatives to meet function.	Innovation
11.00	Evaluate and select alternatives for further development.	Evaluation
12.30	Agree action plan.	
13.00	End of workshop.	VSL

Workshop agenda (Table 3.7)

Workshop proceedings

The VSL introduced the value engineering workshop by briefly reviewing the project strategic and technical briefs and inviting the architect to briefly introduce the design. The VSL then asked for the functions of the entrance vestibule. These were given as:

- Identifies entrance (from street)
- Welcoming space
- Environmental interface
- Orientation opportunity
- Informs visitor
- Demonstrates access (to various parts of the building)
- Parking Prams
- Secures building

The VSL asked for the functions of the mechanical ventilation system, which were to:

- Ventilate library
- Ventilate toilets
- Ventilate coffee shop

Finally, the VSL asked for the functions of the glazing, which were described as:

- Light entrance
- Attract visitors
- Create aesthetically pleasing entrance
- See outside
- See inside (from outside)

The costs of the entrance vestibule and the mechanical ventilation were given by the quantity surveyor.

The functions having been agreed, the VSL led a structured brainstorming session at which a large number of ideas were generated to meet the various functions identified. The ideas were reduced to the following, which became an action on the appropriate workshop participants:

- Create dedicated secure pram store adjacent to the entrance,
- Separate mechanical ventilation to the library from that to the coffee shop,
- Use solar control glass in the vestibule,
- Use internal security shutters to secure windows,
- Create solar-powered convection ventilation utilising a full building height glazed entrance atrium,

- Investigate photovoltaic glazing and solar fans, and
- Move toilets to an outside wall and simplify ventilation.

Implementation

A design team meeting held 10 days after the workshop agreed to:

- Redesign the entrance with a full height glazed entrance atrium. The atrium is to be the generator of solar-powered convection, which was calculated to be sufficiently strong to ventilate the library and the coffee shop supplemented by opening windows at the front and rear of the building.
- The opening windows are to be secured through attractive internal insulated shutters that can be drawn after dark in the winter.
- It was decided to include, in the upper sections of the entrance atrium, grid-connected photovoltaic glazing that would be energy neutral in powering ventilation fans during the hours of darkness (the contribution to the grid in daytime would be recovered at night).
- A heat retaining wall at the rear of the atrium would act as a heat sink during the summer and a heat store during the winter.
- The entrance to the library to be redesigned to delete hallway and include a dedicated pram store.
- The coffee shop and the toilets to be accessed adjacent to the librarian station at the entrance.

The quantity surveyor stated that the agreed solution including the photovoltaic glazing was slightly more expensive than the original design with powered mechanical ventilation. However, from a whole life cost perspective the new design became cost neutral at year three and thereafter the solution saved operating cost. The team made reference to the client's project value system in their report to the client who approved the new design and the slight additional capital cost.

Points to be drawn from the case study

The following points can be drawn from the case study:

- Early appointment of the VSL. It was fortuitous that the VSL was known to the Director of Community Services through a previous project. Without previous knowledge those responsible for the procurement of construction work can only be made aware of the necessity for value studies through guidance documentation and companies/authority standing orders.
- It is vital that every project has a project sponsor, one member of the client organisation who acts as gatekeeper for the project.
- It is important that the client is made aware of the necessity for a budget for information gathering at the earliest stage of the development of the project. In this case an assistant librarian was seconded to this task.

- Similarly, a budget is required to pay for a value study at the strategic briefing stage. As this stage precedes the business case it is often difficult for clients to allocate funds to this task.
- The strategic briefing study accelerated the progress of the project by establishing the project mission and those factors that would lead to the project success.
- In this case, the technical brief and the concept design were developed without the benefit of a value study. A budget overspend led to the Charette, which re-established the project direction and budget. Having the right people as part of the workshop team is vital as was shown in this case study.
- A value engineering study is always worthwhile and need not necessarily involve a VSL, where the project manager is sufficiently knowledgeable of value engineering techniques.

The case study demonstrates the power of a suite of value study interventions at appropriate points in the development of the project. It was acknowledged that the case study project would have encountered significant delays without the value study interventions.

3.15 Conclusion

This chapter, value study styles, draws on the theoretical work of the benchmarking study of 1998, the theory developed up to 2004 and described in the first edition of this book, and the authors' subsequent further practical experience as VSLs. This chapter develops and refines these theories by reflecting on extensive consultancy-based case studies and through further research. The methodologies described in this chapter are accompanied by a high level of confidence. The three generic phases of a value study:

- Orientation and Diagnostics
- The Value Workshop
- Implementation

have been proved as a model for both value engineering and value management.

Value studies in the form of value management or value engineering are variable in form but the characteristics of studies are confirmed with the highest level of confidence. These occur at:

- Strategic briefing (project planning and business definition).
- Project briefing (performance specification and the establishment of systems).
- Concept design (the technical expression of the project brief).
- Charette (C) (undertaken in the place of the studies at points 1, 2 and 3, see Chapter 2, Figure 2.4).
- Detailed design.
- Specialist design of the component parts of the project.
- Operations, manufacture and/or construction.
- Acceptance of the project back into core business.

Of particular note are the conclusions:

- To do nothing in a situation where a problem exists is not a zero-cost option.
- An operating budget is always required to undertake any form of strategic briefing.
- There is no zero-cost alternative to undertaking a value management strategic briefing exercise.

The authors have undertaken a number of studies that are variations on the value management theme and these are described under the heading of other study styles. The reasons for a project existing at all and the factors to be considered by a client contemplating a value study have been investigated at length both in research and through postcompletion analysis of studies undertaken by the authors as consultancy. This work demonstrates that value management has the characteristics described in this chapter and is a powerful and adaptable process.

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4 Function Analysis

4.1 Introduction

The word function is a homonym having several meanings that become clear when considering the context of its use. For example, the varying uses of the word function in philosophy, computer science or mathematics. In the context of value management/value engineering (VM/VE), function is defined as a characteristic activity or action for which a thing is specifically fitted or used, or for which something exists. Therefore, something can be termed functional when it is designed primarily in accordance with the requirements of use. There is a close link between function, specification and performance. A service (education, banking, insurance, etc.) is functional when all the energy input into the specified service is focused 100% on the customer; a project is functional when its output contributes 100% to the defined core client business; and an element or component is functional when its purpose in the context of the whole is fit for purpose and 100% efficient.

Accurate function analysis cannot exceed the quality of the project information on which the analysis is based. For this reason this chapter describes techniques for the discovery and synthesis of project information during the workshop phase. The information is that discovered and collated during the Orientation and Diagnostics phase and validated and supplemented in the workshop, by the value study team, in a form conducive to accurate function analysis.

As stated in Chapter 2, strategic and organisational issues and functional space are the domains of value management, while the technical space, element, system and component issues are the preserve of value engineering. Space is the preserve of value management when proactively looking forward, and the preserve of value engineering when reactively examining the designed technical space. In this chapter, strategic function analysis is described separately from the functional approach to elements, systems and components. This chapter is a synthesis of literature together with data derived from action research studies. The developments described in the previous chapter are drawn together with the data in this chapter to form a holistic approach to whole life value, which is developed and discussed in Chapter 12.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

This chapter commences with an initial discussion on function, and subsequently explores the process of establishing functions through a workshop process. The chapter presents a series of function diagramming techniques, and uses a case study to explore a number of these.

4.2 Discussion of function as a concept

The identification of function is a fundamental feature of value management since value cannot be managed unless function is understood. Function is of itself inert, it attracts no measures of cost or performance; only when a technical solution to the function is developed can cost and performance be measured. For example, the function of an electric lamp is to 'emit light'. This is an accurate, comprehensive and complete description of the function of an electric lamp. The function description does not require a measure of efficiency, effectiveness or cost; these are specification matters that follow the determination of function. Kaufman and Woodhead (2006) state that the description of function is normative and lacks dimension. They further state that a measurement of function is the measurement of a solution that performs the function. This is helpful, excepting the comment that the description of a function is normative, which implies a standard or mean assessment. Functions of themselves truly lack any sort of dimension being a description that is completely inert or inactive. This is an important concept referred to later in this chapter under weighting and scoring function diagrams. A specification is developed from the function requirement. For example, the function 'light desk surface' is an inert functional statement whereas a specification may require a desk to receive 500 lux in light intensity, which can be measured.

Function definition – Active verb and descriptive noun

The traditional and most accurate description of function is achieved when that description can be expressed in groups of two words, an active verb and a descriptive noun. An active verb is a verb that implies strong action, examples being support, transmit, emit and insulate. A passive verb implies weak action or no action at all, examples being provide, afford and allow. A descriptive noun is generally finite and conducive to specification. For example, heat, light, ventilation, liquid, load, space and people. When considering the security of an art gallery, for example, the function description 'provide security' is weak whereas 'secure paintings' and 'protect paintings' are both strong complementary functional descriptors.

The focus has to be on strong and accurate descriptors. In the same art gallery 'provide light' is a weak descriptor. 'Emit light' is a strong descriptor but inaccurate if considering a device for bringing in natural light. In this case 'transmit natural light' is a more accurate descriptor but may be inaccurate if the intention is to 'filter natural light' to protect the paintings from damage by UV light. Note here that the strict two-word descriptor advocated by some has been adapted in the interest of heightening accuracy. However, any increase in words above two has to be in the interest of accuracy and not obfuscation.

In considering function descriptors, it is more efficient to brainstorm all descriptors and then delete duplicates (choosing the strongest of the options). In considering apparent duplicates, be aware that both descriptors may be required as the 'secure paintings' and 'protect paintings' from the earlier example.

Function definition – Basic and secondary functions

The basic function is defined as: the performance characteristics that must be obtained by the chosen technical solution. For example, a technical solution to the function 'filter natural light' in the earlier example may be an ultraviolet light resistant glass to protect the paintings from damage from light in the ultraviolet spectrum. The technical solution is driven by the requirements of the function definition, highlighting the necessity for accuracy.

Secondary functions are:

- Functions that assist the performance of the basic function. For example, in considering the maintenance function of 'replace light emitting units' in the ceiling of an art gallery, there is a secondary function of 'support operative'.
- Alternatively, the secondary function is the performance characteristics of the technical solution chosen other than the required basic function. For example, a basic function of a window may be to transmit light. A technical solution to the function could be a sheet of glass. Secondary functions of the design, required by the choice of a sheet of glass as the solution, are prevent solar glare, control solar heat gain, prevent condensation, facilitate cleaning and prevent cold radiation.

Secondary functions also require a technical solution which can, in some circumstances, cost a disproportionate amount of the total cost of the project. By definition, a secondary function can add no value to the project. The definition of the secondary functions immediately identifies areas of unnecessary cost that may be alleviated by innovation. For example, if light emitting units were capable of being lowered to the ground then 'support operative' would be at zero cost. This solution may result in higher capital cost but considerably lower whole life cost. Similarly, solar control glazing, or the design of large areas of insulating glazing on the north elevation of the building (in the northern hemisphere) may meet the primary function whilst negating air conditioning to resolve the problem of solar heat gain and blinds to resolve solar glare.

Function definition – Value engineering

The function definition of components, systems and elements is normally generated as a simple list. The process for generating the list is described in detail later in this chapter. The functions in the list are without dimension and, as a general rule, are not listed in any order of importance. For example, in value engineering when considering the external wall of a house it is pointless debating whether 'support roof' is more or less important than 'secure space' since both are clearly needed and therefore can appear in a list in a random position.

A further function of the wall appearing in the list may be 'support fittings'. This leads to another consideration. Unlike 'support roof' and 'secure space', which are needed, 'support fittings' may be a desire or a want. For 'support fittings', to drive a particular technical solution may therefore introduce a constraint and an additional cost that is unnecessary for the client. Every function in the list should therefore be examined and assessed through a needs/wants analysis. All wants must be carefully considered to ensure that their influence on the technical solution is not disproportionate. A value engineering approach to function is discussed in detail later in this chapter.

Function definition – Value management function hierarchy, how/why logic and needs/wants

Function listing is a useful procedure when dealing with components, systems and elements where asking the question 'how?' will lead to a technical solution. However, when dealing with strategies, complex products, processes or services function has to be treated differently for two reasons:

- Asking the question 'how?' will generate a further function, a subfunction of the primary function. There may be a number of levels of questioning 'how?' before the only answers are technical solutions.
- Although the function definition itself is inert, strategic functions can be subject to a hierarchy of importance.

For example, the primary function of a hospital is judged to be:

- Organise diagnosis
- Treat patient
- Heal patient

Considering the function 'heal patient' may give rise to a number of subfunctions, such as the following:

- Rest patient
- Administer drugs
- Monitor patient
- Entertain patient
- Accommodate visitors

The function 'accommodate visitors' is a complicated function since it embodies functional requirements for visitor parking, visitor waiting and bedside seating. Additionally, admitting visitors brings a further dimension to infection control and the operational programming of healthcare. At first sight 'accommodate visitors' is an expensive function that needs to be addressed by further function analysis. Assuming the function is to 'involve patient' in the day-to-day activities of friends and family or 'reassure relatives' then the question is 'how can this be best achieved?' leading to more functions and ultimately alternative technical solutions.

The focus on needs and wants and primary and secondary functions sensitises the team on those functions that are vital to the project and those that are nice to have but do not contribute to project success. Furthermore, in the consideration of technical solutions, it is useful to reflect on how much is being spent to satisfy a want or to address a secondary function.

Understanding the hierarchy of importance is vital when dealing with functions at a strategic project level. Taking the hospital example earlier, the first stage is to consider which is more important, the diagnosis, the treatment or the healing. There are two reasons why a value management team may be unable to reach a decision and organise functions into a hierarchy:

- The functions are of equal importance and are so interconnected that they have to be expressed as a single function statement, for example, diagnose, treat and heal patients.
- The functions describe discrete activities of importance in their own right and may represent discrete projects, for example, project 1 – diagnosis, project 2 – treatment, project 3 – healing. The discrete project approach may assume that a patient attends hospital for diagnosis only or treatment only. Recognising a Programme of projects is a significant outcome of function analysis at the strategic level.

Testing whether a project can be broken down into a Programme of projects can be helpful in the organisation of resources.

In most cases functions can be organised in order of importance. In the hospital example the value management team may decide that the order of importance of subfunctions is from most to least important:

1. Monitor patient
2. Rest patient
3. Administer drugs
4. Entertain patient
5. Accommodate visitors

The subfunctions associated with 'rest patient' may be in order of importance:

1. Optimise posture
2. Minimise disruption
3. Control environment
4. Please aesthetically

The functions and associated subfunctions are displayed in a diagram, as Figure 4.1, which resembles a tree on its side with the primary strategic function at the trunk and associated subfunctions as branches, twigs and finally leaves. The diagram is organised with the highest order needs at the top and the lowest order wants at the bottom. The logic of the diagram answers the question 'why?' when reading from left to right and 'how?' when reading from right to left. For example, 'heal patient' is at the left of the diagram. Asking the question 'how?' gives the five subfunctions including 'rest patient'. Asking 'how?' again gives the four subfunctions including 'optimise posture'.

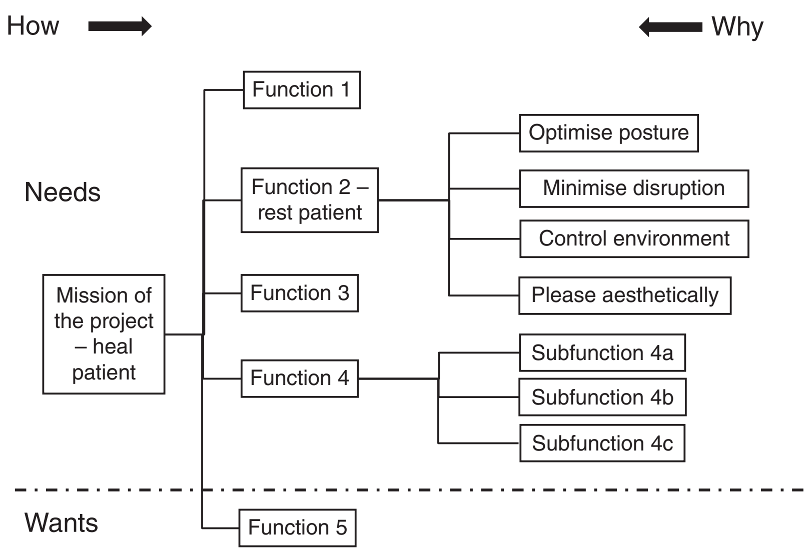

Figure 4.1 Function heirarchy expressed as a function/logic diagram.

To test the logic of the diagram, the question 'why?' is asked when approaching the diagram from right to left. Asking 'why optimise posture?' gives the answer 'rest patient' and asking 'why rest patient?' gives the answer 'heal patient'. The logic of the diagram is found to be intact. If, on checking the diagram, the how/why logic appears strained, then it is necessary to consider

- Are the functions in the correct position?
- Is there a function missing?

4.3 Strategic function analysis – Information discovery and synthesis

A project is defined as 'a process, operating in parallel to the core business, to deliver an investment within a programmed time to effect change to the core business of the client organisation'. This is a simplistic definition discussed in more detail in Chapter 9 but one which is adequate for the purposes of this chapter. In a value management study undertaken at the strategic stage of the project's development it is important to:

- Analyse all available information and be fully aware of the problems and issues which exist at the commencement of the project.
- Define the project's function or mission as a simple, clear and understandable sentence.
- Make overt the client's project value system – the criteria used to judge the project's success.

The client's project value system is described in detail in Chapter 11. This chapter addresses the first two bullet points, namely to discover all of the necessary information and to define the project's mission.

The mission of any project is generally founded upon factual information, expert opinion or simply someone's intuition or vision. The mission of the project has to reflect the strategic intent and/or strategy of the client organisation and is included in the business case for the project. Where expert opinion is sought on issues relating to the mission of the project, for example on matters relating to the anticipated future of the client's business, the opinions of experts should be capable of proper corroboration. Information seeking and analysis is influenced by the following:

- No decision can rise above the quality of the information upon which it was based.
- Obtaining good quality information is a necessary precursor to the correct definition of the mission of any project in functional terms.
- The cost of information seeking in order to be 100% correct may be unjustified.
- The time taken in information seeking may result in an opportunity missed.
- The risks involved in proceeding with a function analysis based upon incomplete information should be understood.

Acting upon initial awareness of the necessity for a project is always a development stage within the client organisation. How this stage is undertaken has a significant bearing on the success of the project. It is important to note that the development of the strategic mission of the project is the responsibility of the client alone and where expert consultancy is engaged then care is required to ensure that the mission statement reflects the intent of the client and not the consultant(s). Ideally, a project sponsor/manager will be appointed to add detail to the basic strategy and a Value Study Leader (VSL) may be appointed to manage information synthesis and plan, organise and run value management studies. At this stage the need for a construction project to satisfy a corporate objective has yet to be determined.

The following sections outline the practical method of information gathering and processing prior to function analysis.

Stage 1: Orientation and Diagnostics phase – Plan strategic information discovery

An overview of the value study process is given in Chapter 3. The focus of this section is on the gathering of relevant information to support the function analysis process, assuming the appointment of a VSL.

The VSL will first undertake an orientation exercise either through interviews or by holding an orientation workshop. Preworkshop interviews can be undertaken with a number of objectives:

- To focus the VSL, PM and client team on the strategy.
- To introduce the VSL to the key stakeholders.
- To brief key stakeholders on the aims of the value study.
- To outline the likely approach to the project concerned.
- To assist with the compilation of briefing documents for circulation to those due to attend a value study workshop.
- To compile the workshop agenda for circulation to participants prior to the workshop.
- For the VSL to ascertain which of the key stakeholders has the primary information, influence and executive authority. This will permit the VSL to compile the value workshop participants' list, often in discussion with the client.

The orientation exercise may also be undertaken at an orientation workshop. However, the identification of absent stakeholders with primary information may be difficult and hidden agenda are more likely to remain hidden.

The VSL can work with the client in selecting the members for the value management team or can request that the client build the membership of the team based on the inclusion of those stakeholders with an input relevant to the strategic development stage of the project. The ACID test, described in the Toolbox in the Appendix, is used to determine who should be a member of the team. Generally, team membership is greater in number (15 to 30) at the strategic stage of projects when a large number of issues are being considered and smaller (6 to 10) later in the project when the technical details of the project are being investigated.

Stage 2: Value workshop phase – Strategic information discovery

Morris and Hough (1987) in their study of major international projects identified that the probability of project failure was high when certain key information was missing. In their study this failure could be attributed to a number of identifiable factors. It appears logical that if this information were present at a value study then the probability of project failure would be diminished. The following have been adapted from the Morris and Hough list and form a useful checklist of strategic information required:

1. *Organisation:* The client's business is identified together with the positioning of the project within the business and the users of the project (who may not necessarily be a part of the client organisation). Under this heading there would be an investigation of the client's hierarchical organisational structure, and the key activities and processes that impact the project for example, approval structures and governance. Most organisations are dynamic and therefore subject to continual change, which should be recognised and recorded. In addition it is important to record the decision making structures of the client and the way in which these will impact the project. These decision making structures become more important in situations where a single client project sponsor or project manager represents the project team. The limits to the executive power of the project's sponsor or project manager should be clearly defined. Following the discussion of the organisational structures it should be possible to identify all those who have a stake in the project. Stakeholders should be listed and their relative influence assessed.
2. *Context:* The context of the project recognises such internal and external factors as culture, tradition or social aspects. Cultural aspects may include the relationship of one department with another or the fitting out and general quality of the environment, for example, a courthouse. Tradition can cover such aspects as corporate identity, which may be important in such areas as retailing. Social aspects will generally relate to the provisions made by the client for the workforce, such as dining and recreation facilities, sports and social club activities, and crèche.
3. *Location:* The location factors will relate to the current site of the project, proposed sites or the characteristics of a preferred site where the site has not to date been acquired.

4. *Community:* It is important to identify the community groups who may require to be consulted with respect to the proposed project. Some market research may have to be undertaken to ascertain local perceptions. The positioning of the project within the local community should also be completely understood.
5. *Politics:* The political situation in which the project is to be conceived should be fully investigated through the analysis of local government and central government policies and client organisational politics. The latter is often difficult to make overt at a workshop of representatives of different client departments; however, client politics are a key driver behind any project.
6. *Finance:* The financial structuring of the project should be determined by considering the source of funding, the allocation of funding and the effects of the project cash-flow on the cash-flow of the client organisation. The latter is particularly important when dealing with organisations working with annual budgets.
7. *Time:* Under this heading are the general considerations regarding the timing of the project including a list of the chronological procedures that must be observed in order to correctly launch the project. In situations where the project is to be phased, time constraints for each stage of the project should be recorded. These data become the basis of the construction of a timeline diagram described later.
8. *Legal and contractual issues:* All factors that have a legal bearing on the project are listed under this heading including procurement issues and the extent to which the client is risk averse and requires cost certainty. Also included here are data relating to the client's partnership agreements with suppliers and contractors.
9. *Project parameters and constraints:* A primary objective of the value study at the strategic briefing stage is to fix the primary objectives of the project. Therefore, it is important that the team understands that the value workshop is the end of one stage in the development of the project. Discussions must take place on how the project has evolved prior to the workshop and to measure the extent to which key stakeholders believe that the project is still evolving. Any constraints surrounding the development of the project should be discussed and recorded.
10. *Project drivers:* A project driver is defined as any factor that gives impetus to the project. The factor may be legislation, a champion or a change within the organisation. In some situations drivers may be nested and become confusing. For example, an internal enclosed room is to be created within an existing naturally ventilated building. The room requires mechanical ventilation. The installation of the mechanical ventilation poses problems and begins to drive the design. All effort is then transferred to solving the problem of mechanical ventilation, which is seen rightly or wrongly as the driver.
11. *Change management:* As discussed in detail in Chapter 9, to ignore change management is to prejudice the project. Issues of change management must be explored and the extent of control, flexibility and risk appreciated.

Typically, an exploration of these issues in a workshop environment will sensitise the whole team to the breadth and depth of information that is held about the project. Furthermore, the authors have often found that key functions will be buried as issues in this structured information sharing type of analysis. The reshaping of such issues into function statements permits them to be used in the function analysis and function diagramming activities within the workshop.

Value workshop phase – Working with the team: Issues analysis

The issues analysis is first mentioned in Chapter 3 and described as an opening technique that makes explicit all issues pertaining to the strategic project. The method described here for undertaking an issues analysis is typical of a value management workshop at the strategic stage of projects. At the commencement of the workshop the VSL will ask the team for all factors impacting the project. The issues will tend to be uncovered in a relatively random fashion and therefore the VSL records the issues on repositionable sticky notes. After the team has exhausted all of the issues impacting the project – typically about half an hour to one hour – the team is asked to sort the sticky notes under the 11 generic checklist headings described earlier on a master issues sheet mounted on a working wall. Where a particular checklist heading has no notes attached to it, the VSL will ask for any issues under that heading. During the checking process it is common for additional headings to be uncovered.

An alternative to the procedure is for the VSL to request issues under each heading in turn. This tends to ensure that each heading is addressed, but it is time consuming, can stifle the spontaneity of the random generation of issues, is less dynamic, and restricts the introduction of new headings.

When involved with large team facilitation or when the full workshop team has superior–subordinate, employer–contractor or other perceived hierarchical membership it may be necessary to split into smaller teams for the brainstorming of issues. Ideally in this situation it would be preferable to have a facilitator per group but practically and logistically it is probably necessary to ask a team member to act as facilitator for their small group. Splitting into small groups ensures that no one is constrained in the presence of their superior or employer and in this situation hidden agendas tend to be exposed. At the end of brainstorming, all the issues from all teams are put under headings on the master issues sheet. Invariably there will be duplicate issues and these are removed.

Once the master issues sheet is complete the VSL will read the issues back to the team. Any queries as to meaning are answered by the team and any extra issues added. Where an issue is thought to have been incorrectly attributed to a heading, it is moved; or where the team believe that the issue should appear under more than one heading, multiple sticky notes are written.

Value workshop phase – Working with the team: Prioritisation of issues

Brainstorming issues can easily result in over 100 issues being raised. It is impossible within a reasonable time to focus on all issues and a means of reducing the issues to those of high importance is required. The team is therefore asked to undertake a prioritisation exercise.

One method found to be successful in practice is for the VSL to hand to each team member some black sticky dots, in number approximately 10% of the number of issues on the master sheet, that is, if there are 100 issues on the master sheet each team member is given 10 dots. The dots are spent on those issues that the particular team member believes important. On completion of this exercise each team member is given three to five red sticky dots to spend on those issues that already have black dots and that the team member believes are so important that the project is compromised unless that issue is resolved.

Value workshop phase – Working with the team: Investigating the high priority issues

Once all issues are under headings and ranked by importance the VSL asks for more information on the high priority issues, that is, those denoted by multiple black dots or more than one red dot. Further information is recorded. It is common for some issues to be ranked highly important by the majority of the team. The issues analysis and the further information on key issues gained through discussion is pinned to the working wall and surrounds the team for the remainder of the workshop. It is a rule of a workshop that what is displayed on the working wall is agreed. There is plenty of opportunity for any member of the team to raise disquiet about any point either in a team forum or in confidence with the VSL during a break.

Value workshop phase – Working with the team: Information review

A review of all information is assisted by the use of:

- A simple timeline
- A project driver's analysis
- The REDReSS technique

A *simple timeline* can be drawn with commencement dates, completion dates and major milestone events. This is an appropriate stage to ensure that all members of the team are in agreement as to what the various time-related terms mean. For example, the term 'completion' has been misinterpreted at a number of workshops and can mean:

- *Practical completion* – complete for all practical purposes and the client can take possession although some minor external works, snagging and heating and ventilation adjustment may need to be completed.
- *Fully complete* – the facility has no further building work to be carried out and commissioning of all of the services systems is complete.
- *Operational* – the client fit out is complete and the building is fully functional.

Anecdotal evidence abounds regarding multiple interpretations of the word 'complete' by different members of a value management team. The time difference between practical completion and operational on some projects can be measured in months rather than weeks.

A *project driver analysis* might be required where this has not been addressed within the issues analysis. Project drivers are those factors that give the project momentum and generally relate to the reason for the project, take those drivers away and the project loses its momentum, and perhaps reason to exist.

REDReSS is an acronym for the final stage of the information review and validation exercise. Key prompts allow a final analysis of the information to ensure that it precisely represents the project.

- Reorganisation – A final check is made to determine the extent to which the client is likely to reorganise during the project's life cycle. In the event that a decision to build is taken, the question becomes one of determining the extent to which the client is likely to reorganise during the design and construction period and/or immediately thereafter. It is tempting to address this problem by maximising flexibility in the solution; however, it should be recognised that this generally entails a cost penalty. There are a number of examples of clients who have briefed based upon the present and have ignored the future even though that future could reasonably be anticipated. The discussion can prompt a change management strategy for the project where such a control strategy did not previously exist.
- Expansion – This question invites an assessment of whether the project will remain fixed or whether a further phase is likely. In the event that a decision to build is taken the question becomes one of 'what expansion is likely and how can it be accommodated in terms of space and services within the existing and/or planned operating infrastructure?'
- Disposal – A physical asset will have a predetermined life whether through economic redundancy or physical failure necessitating refurbishment or reconstruction. When this stage is reached, some disposal activity will occur. The question posed here is whether there are policy considerations or anything worthwhile can be incorporated into the design of the project that will assist 'disposal'.
- Refurbishment and maintenance – What are the client's refurbishment and maintenance policies? Can anything be factored into design thinking that will assist those policies? For example, it could be that maintenance has to be carried out in a secure, dust-free or pressurised environment at predetermined and designated times. This may put stress on reliability and redundancy issues.
- Safety – All projects will have to comply with the requirements of health and safety legislation. However, some clients may wish to extend the issue of safety for instance so that it is clearly demonstrable rather than just compliant.
- Security – Some facilities will attract higher security than others. This factor has to be expressed in a manner such that it can be measured. Again consideration of the future might allow security systems to be easily incorporated at a later point in the project's lifecycle.

The aim of the review is to finally capture any missing information and to sensitise the team for the function analysis exercise. Information discovery is an opening exercise that relies on information being presented in a manner entirely untainted by interest, motives and hidden agenda. This is achieved through balances and checks being present within the team. The following stage uses the information to derive functions in a closing exercise as illustrated in Figure 4.2.

The preceding text outlines an approach to information discovery and processing prior to function analysis. The process is one of logically seeking information through orientation activities of documentation review, interview, questionnaire, and so on,

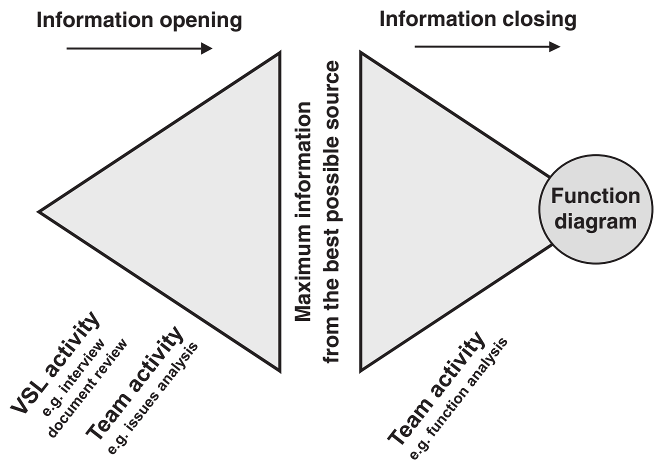

Figure 4.2 Information management.

and through the workshop process of issues analysis. The information validation processes of timeline, project driver analysis and REDReSS undertaken in the workshop add confidence to the state of completeness of the relevant information.

4.4 Strategies, programmes and projects

The issues analysis highlights the complexity of projects. Often projects are nested within Programmes or Portfolios of projects, which themselves make up a strategy as illustrated in Figure 4.3. The strategic cascade is a useful way of determining the place of projects in a situation that is complex. Programmes and Portfolio of projects are described in detail in Chapter 9.

Function diagramming is an effective way to clarify the relationship of projects within Programmes and strategies. Function diagramming is discussed in Section 4.5.

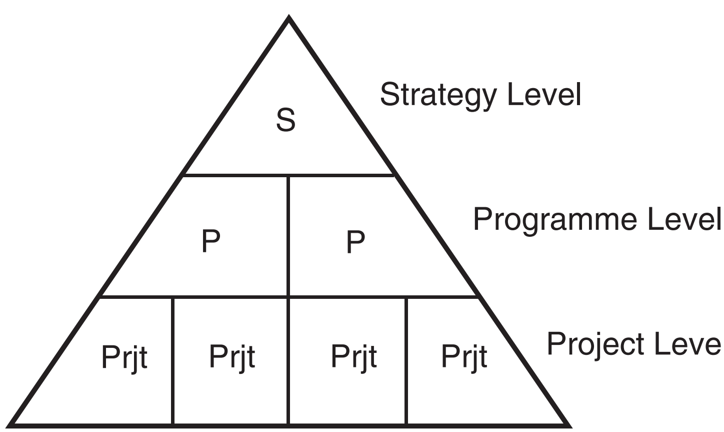

Figure 4.3 Strategic cascade.

4.5 Strategic function analysis – Function diagramming

This section introduces the use of functional analysis at the strategic briefing stage of a project to derive the project's mission through function diagramming. The technique of function diagramming is attributed to an American VE practitioner, Charles Bytheway (Bytheway, 1965), who gave it the acronym FAST (function analysis system technique). The general rule of a function diagram is that it is a logical portrayal of related functions in a logical hierarchical sequence independent of cost, time, efficiency and effectiveness.

At the strategic briefing stage of constructing the diagram, the solution to the primary requirements of the project has not been formalised and therefore the project is defined as a business project simply as 'the investment of resources for return'. Indeed, one of the objectives of the use of functional analysis at the strategic briefing stage is to lay the foundation for the solution to the project problems that offers the best value for money. The functional analysis technique relies upon the discovery of all relevant information through the issues analysis and the structuring of that information in a way that leads to the recognition of the primary objective of the project. Function diagramming is a closing technique as illustrated in Figure 4.2. The VSL's task, once all of the information is available, is to focus the team on the prime function of the project. The closing technique begins with a brainstorming exercise concerned with 'Why does this project exist, and what is its purpose?'

Working with the team – Strategic function diagramming

The team, informed and sensitised to the information surrounding the project, brainstorms project functions that may span between high-order executive needs to relatively low-order wants. All functions are expressed ideally as an active verb plus a descriptive noun, and are recorded on sticky notes and scattered randomly across a large sheet of paper positioned on the working wall. The VSL will continually prompt the team to generate functions by referring back to the information from the issues analysis, timeline and REDReSS analysis.

In some situations, largely resultant from a procurement route involving early design team and/or contractor involvement, the team may include those who are not members of the client organisation responsible for, or influential of organisational strategy. In this situation it is only members of the client organisation who determine the function of the project. If the team includes members who are not client stakeholders then those members should learn from the activity but not participate. It is important that the VSL strictly controls the strategic function diagramming process. This restriction on involvement also applies to the determination of the client's value system discussed in Chapter 11. There is no such restriction on the issues analysis exercise, timeline and REDReSS analysis, which is an opening technique to which the whole team should be invited to participate. It is because Strategic Function Diagramming is a closing technique resulting in the strategic mission for the project that those members of the team who are not part of the client stakeholder team are excluded. This point is most likely to be relevant to a Charette style study where a strategic briefing study has not been completed before concept designs are developed and where the team will almost certainly contain those who are not part of the client's strategic decision making body.

At the completion of the brainstorming session the team is invited to sort the sticky notes into an organised form by putting the highest order needs into the top left-hand corner of the paper and the lowest order wants into the bottom right-hand corner. All other functional descriptions are fixed between these two extremes. It should be emphasised to the team that this is an iterative process and therefore any team member is entitled to suggest the movement of a previously ordered sticky note to promote or demote the importance of the function. Although this sounds confrontational it is very rare for disagreement to occur and ultimately the correct ordering of all of the functions is achieved.

How the next phase is undertaken is the subject of some debate. Some VSLs will allow the team to construct the diagram in its entirety. However, this can be difficult where there is a large team. Confident VSLs will build the diagram in front of the team taking suggestions for alternative placement of functions. Alternatively, the VSL and perhaps one or two team members from the client organisation will complete the diagram whilst the team is having a break and present the completed diagram on the team's return. Further discussion takes place on whether the diagram and particularly the prime function is correct.

The methodology used in the compilation of a FAST diagram is illustrated in the case study presented later. During the appreciation of the case study it is important to recognise that the function diagram produced is a factual statement of functions in a logical sequence independent of cost, time, efficiency and effectiveness. However, the process is of itself a highly efficient and effective way for stakeholders to agree on the primary mission and the project function breakdown structure.

Example case study

A local authority has purchased hill and scrub land with an area of approximately 20 square miles from the Crown Estate to form a country park adjacent to a large industrial town. The authority intends to undertake forestry, and farm deer and trout as a part of a job creation scheme. The authority is also keen on using the country park to promote conservation particularly within the town's schools. The authority wishes to establish a campsite to attract tourists to the park and wishes to discourage the tradition of wild camping in the area. The authority has instituted a project to build a visitor centre at the site with facilities, craft shops and a restaurant. It is recognised by many that the authority will become a significant employer in the area. The site chosen for the visitor centre is 1 mile from the outskirts of the town but is separated from it by a river. A project manager has been appointed and has suggested a value management study as a means of making clear the primary mission of the project whilst addressing the opinions of the stakeholders.

The issues analysis has highlighted amongst many other factors the potential for conflict with neighbouring landowners and also the fact that any commercial development at the visitor centre will compete with local shops.

Functions of the whole project were generated by the team in a random fashion on sticky notes and placed on a large sheet of paper as illustrated in Figure 4.4. The descriptions shown comprise the raw data from an actual workshop facilitated by the

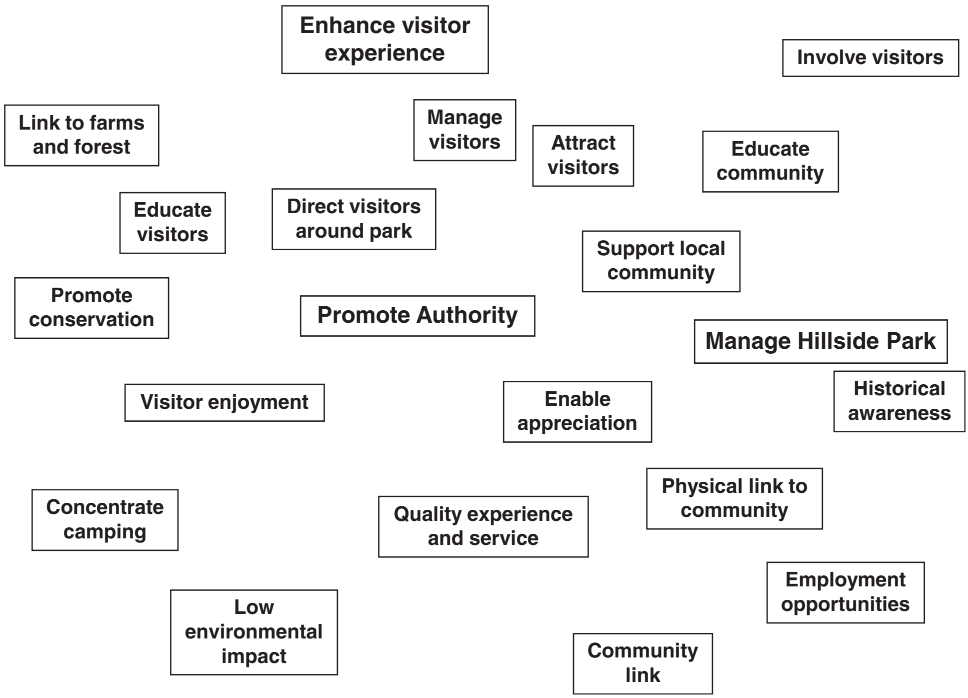

Figure 4.4 The strategic project function in random order.

authors and demonstrate, in the interests of contextual accuracy, a relaxation of the strict two-word verb–noun description that occurs within a live workshop.

Following the generation of functions undertaken as a brainstorming process, the team is invited to order the functions by putting the highest order need at the top-left corner of the paper and the lowest order want at the bottom-right. This is illustrated in Figure 4.5.

The ordered sticky notes illustrated in Figure 4.5 are restructured to form the function diagram illustrated in Figure 4.6. The diagram illustrates a client orientated strategic diagram. The logic of the diagram answers the questions 'how' when working from left to right and 'why' and 'when' working from right to left. The strategic mission is very rarely a single verb/noun combination but rather a short sentence word crafted from the very highest order functional needs illustrated in Figure 4.5. To the right of the mission the highest order needs are placed at the top of the diagram and the lowest order wants at the bottom. A scope line divides the project mission statement from those functions seeking innovative solutions.

Diagram 4.6 explains a complex interrelationship of Programmes and projects linked to a strategic mission:

1. The strategic mission is to manage Hillside Park, promote the authority and enhance the visitor experience.
2. The three Programmes: to promote conservation, to attract visitors and to link with the community, are divided from the projects by the second scope line.
3. The Programmes spawn a number of projects of which educating visitors and supporting the local community are but two.

Figure 4.5 High-order needs to low-order wants.

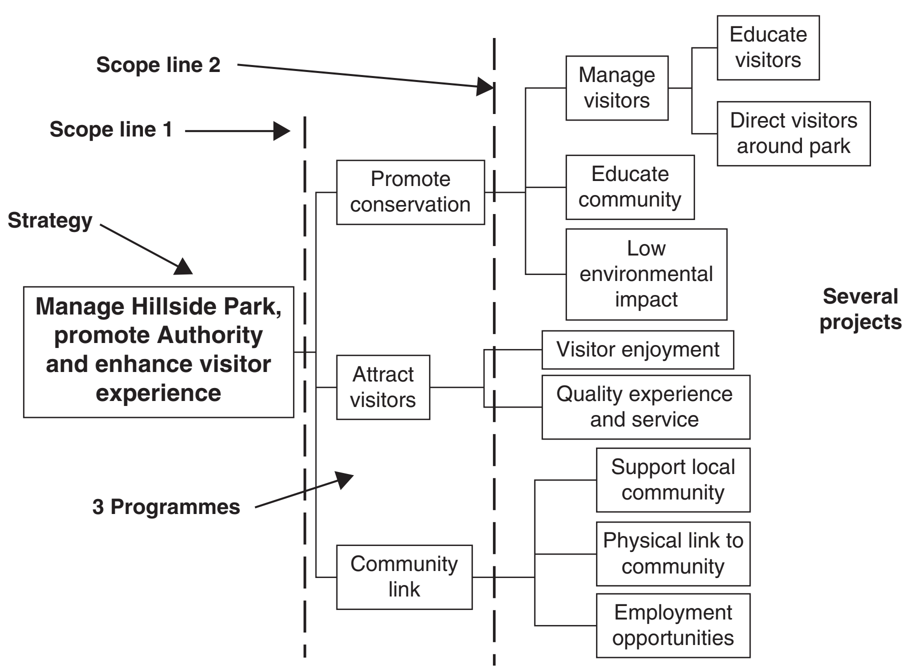

Figure 4.6 Strategic FAST function diagram.

It is relatively rare for the analysis of a project to reveal a strategy, Programmes and projects in this way. Normally, the diagram shows the project mission and the subfunctions of the project. However, the diagram in Figure 4.6 demonstrates why the client of this particular 'project' was having so much difficulty in progressing. This is because the 'project' was not a single project but rather a series of projects in three Programmes to answer a more complex strategy. Once this had been 'unpicked' in the presence of and with the agreement of all contributing stakeholders using function analysis, the future direction was plain to see.

Strategic function diagramming is an efficient and effective way of breaking down and ordering the project/Programme to achieve the mission. It is also an efficient way of agreeing the scope and parameters of the strategic mission with stakeholders and leads to the analysis of individual projects, which is the subject of the next section.

4.6 Project function analysis – Function diagramming

It was stated earlier that the general rule of a function diagram is as a logical portrayal of related functions in a hierarchical sequence independent of cost, time, efficiency and effectiveness. Diagramming at the project level is one level of abstraction lower than function diagramming at the strategy or Programme level. Whereas function diagramming at the strategy or Programme level will always take the form illustrated in the case study, function diagramming at the project level can be represented in three ways:

- Strategic diagramming. The objective is to understand the project mission in strategic terms. This diagramming technique is referred to as Client or Customer orientated FAST and in the United States as Task FAST diagramming. Asking the question 'how?' of the client stakeholder team describes the meeting of the mission in functional terms at varying levels of abstraction. Brainstorming can occur at any level of abstraction but usually most beneficial at level 1 (project mission) and level 2 (immediately to the right of the project mission; the first level of abstraction).
- Technical diagramming. The objective of technical diagramming is to represent and understand the project in a logical sequence of functional tasks. Technical diagramming involves the whole value team and comprises:
  - Technical FAST.
  - Critical Path FAST.
  - Function Space diagramming, which investigates both the strategic and tactical use of space through a series of techniques.

This is the point where particularly the design and construction consultants can bring their expertise to bear. This task can be made easier by first considering a technical solution that meets the primary function followed by an analysis of the functions achieved by the technical solution. For example, consider the function 'facilitate passage across river'. An approach is to consider the functions provided by a footbridge. The technical functions in the logical sequence are:

- Support people is the primary objective.
- Position people, protect people, control people and establish rules are the secondary objectives expressed in a logical sequence.

Brainstorming the functions gives the potential for a range of technical solutions.

- Critical path FAST. Critical path fast is an appropriate diagramming method where the functional investigation is focused on understanding the process in terms of its time sequence. At first sight this appears to be contrary to the general rule of a function diagram, namely, that it is a logical portrayal of related functions in a logical hierarchical sequence independent of cost, time, efficiency and effectiveness. However, in this context time is not being measured and is only relevant to the extent that functions are ordered on the basis of functional activities which precede and follow the function being considered. Critical path FAST is appropriate and useful in situations, such as, industrial processes and work procedures for example flow of work through an office or patient pathways in a hospital. Critical path FAST is an activity that precedes function space analysis discussed later. Function diagramming at the project level is illustrated in the case study presented next.

Example case study

Figure 4.6 illustrates the breakdown of a strategy for the fictional Hillside Country Park development into three Programmes and several projects. This case study illustrates the progress of one project namely, the physical link to the neighbouring community, which requires the crossing of a river. The three FAST diagrams described earlier are constructed for illustrative purposes; normally, the VSL would choose the most appropriate of the three techniques and construct a single FAST diagram. The procedures in the construction of a FAST diagram are as follows:

1. The VSL discusses with the client the compilation of the value team for the project study. Having recognised a number of projects within each Programme the client establishes value teams for each project. The value team that is to consider a single project may not have the same membership as the value team that was selected for the strategic briefing study. The value team for the single project is likely to be the project team plus additional relevant stakeholders.
2. In the value workshop the VSL facilitates the value team in examining the information relating to the physical link with the community and specifically the crossing of the river.
3. The team brainstorm the functions in a similar way to that described for strategic briefing. This might give rise to the functions illustrated in Figure 4.7. As previously mentioned in a live function analysis illustrated here, pedantic adherence to a strict verb plus noun definition may compromise the accuracy of the function description and affect the maintenance of a good team dynamic.

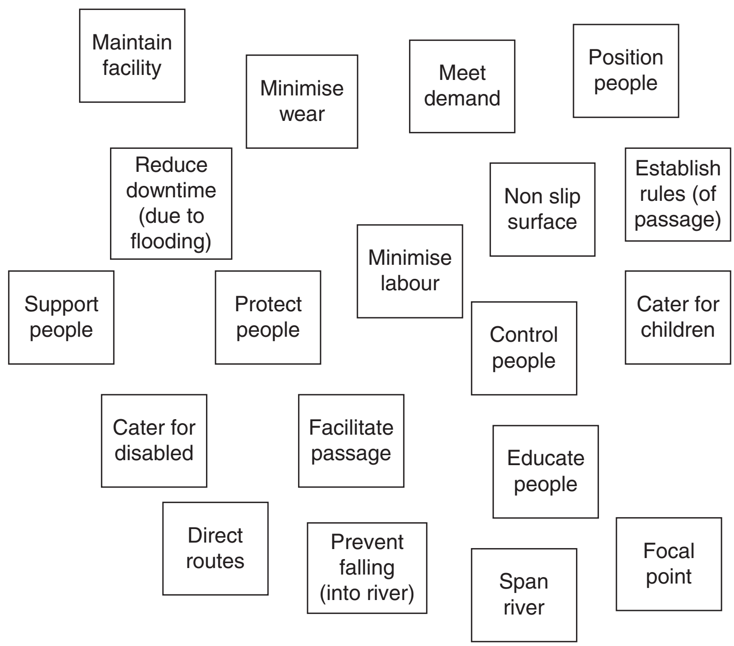

Figure 4.7 Generation of project functions.

4. A matrix is constructed as illustrated in Figure 4.8. Functions are separated into strategic needs and wants and also into tactical needs and wants. Within each of the four quadrants functions are ordered hierarchically.
5. A strategic FAST diagram is constructed using the sticky notes from the strategic needs and strategic wants quadrants only as illustrated in Figure 4.9. Tactical functions are set aside for consideration at the specification stage of the briefing process. Again it is emphasised that this is raw data from an actual study. It is acknowledged that 'maintain facility' might have been better expressed as 'facilitate easy maintenance' but the VSL has to make a judgement on the extent of intervention in a value team that is working productively.

Technical FAST

If the VSL wished to produce a technical FAST diagram, then this would be constructed using the sticky notes from all quadrants of Figure 4.8 as illustrated in Figure 4.10.

It should be noted from Figure 4.10 that the prime objective is a technical objective and the brainstorming of ideas following the construction of the diagram will therefore lead to the exploration of technical solutions. The brainstormed solutions, for example, a suspension bridge, a simply supported span bridge and stepping stones will be audited back against the diagram to determine the extent to which the ideas meet the functions.

Figure 4.10 is structured in such a way that the prime objective of the project is situated on the left-hand side of the scope line. The prime objective 'support people' is situated immediately to the right of the project objective. Parallel objectives are below the prime objective, in this case 'span river'. Secondary objectives appear to the right of

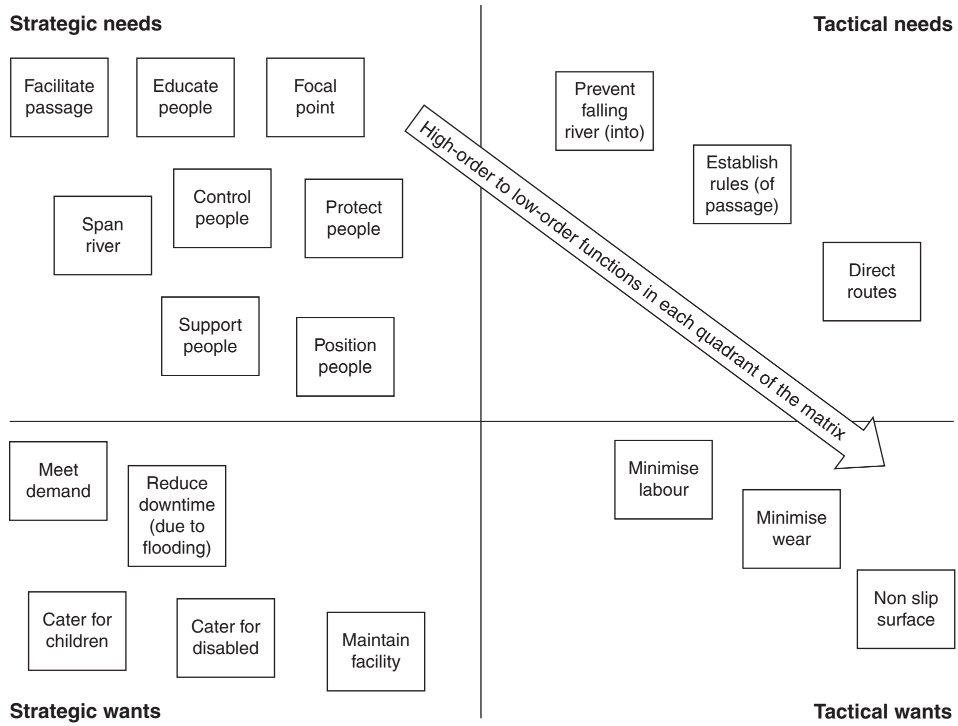

Figure 4.8 Project function priority matrix.

the prime objective and design objectives are situated immediately above. Desired objectives are located at the top-right of the diagram above the secondary objectives. It is the structuring of the diagram that prepares the value team for brainstorming.

The two FAST diagrams illustrated in Figures 4.9 and 4.10 may lead the value team towards different technical solutions. For example, although there is a high correlation in terms of the sticky notes used, the emphasis as judged by the team with Figure 4.9 is on a focal point and the use of the solution for educational benefit. The final solution might not be a bridge but an old-fashioned cable-stayed ferry boat, which would use the power of the river acting on the rudder to move it across the river. A full-time ferryman could operate the ferry working between two covered shelters, one of which might be an exhibition centre. This solution is less likely to be generated by Figure 4.10.

Critical path FAST

Should the VSL wish to construct a critical path FAST diagram then the same sticky notes from Figure 4.8 are used in a diagram that is process focused. Process in this context is a number of activities in a logical sequence having a beginning and an end. Although Figure 4.11 is a simplistic illustration this type of diagram can be invaluable in the analysis of a production facility. In a value study of a food processing plant undertaken by the authors, such a diagram usefully highlighted tensions in the production facility and allowed a complete reorganisation of the refrigeration plant.

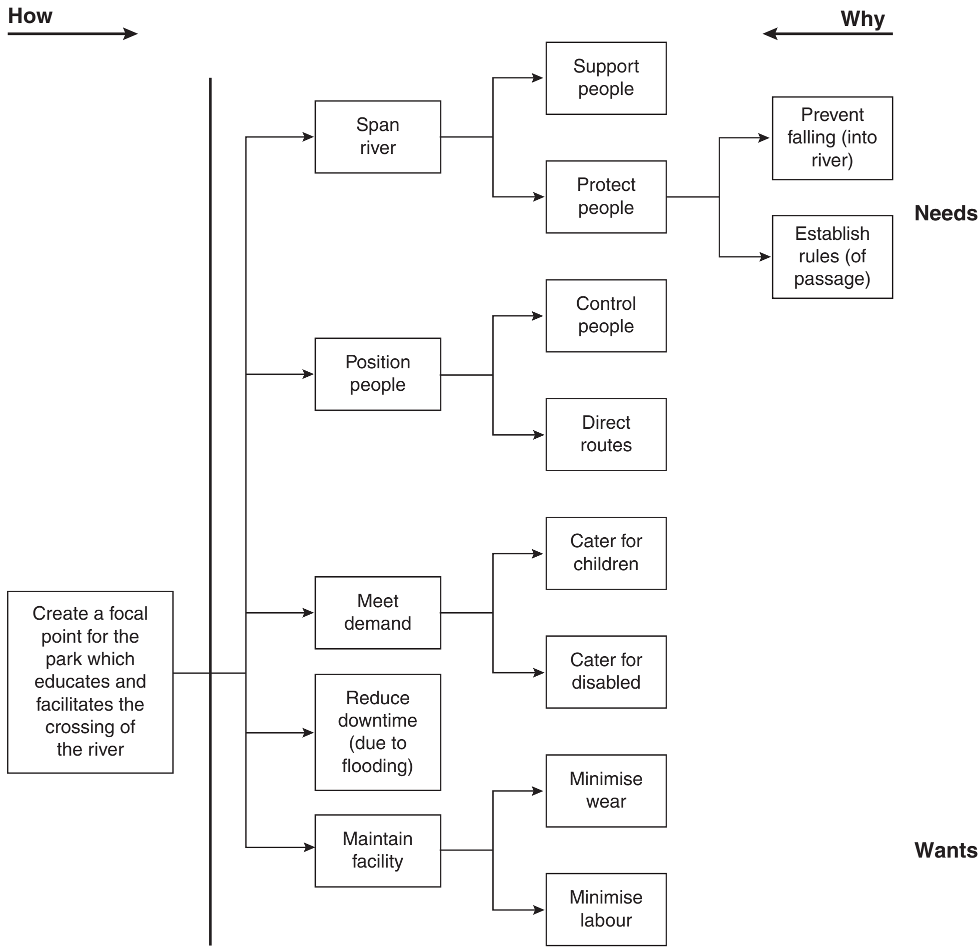

Figure 4.9 Client or customer orientated FAST.

Project function diagramming – Kaufman's FAST diagramming

Kaufman (1990) introduces a number of paradigms into the function diagramming process that results in the diagram being a language of functional representation. In other words the rules of composition themselves introduce meaning into the diagrams. The annotations to Kaufman's diagramming illustrated in Figure 4.12 are as follows:

- *Highest order function:* the objective or output of the basic function.
- *Lowest order function:* a low-order function starts or initiates the subject under review.
- *Basic function:* the mission of the study under review.
- *Concept:* describes the approach to achieve the basic functions.
- *Objectives or specifications:* not functions, but may influence the method selected to achieve the basic functions and satisfy user requirements (Optional on diagram.)

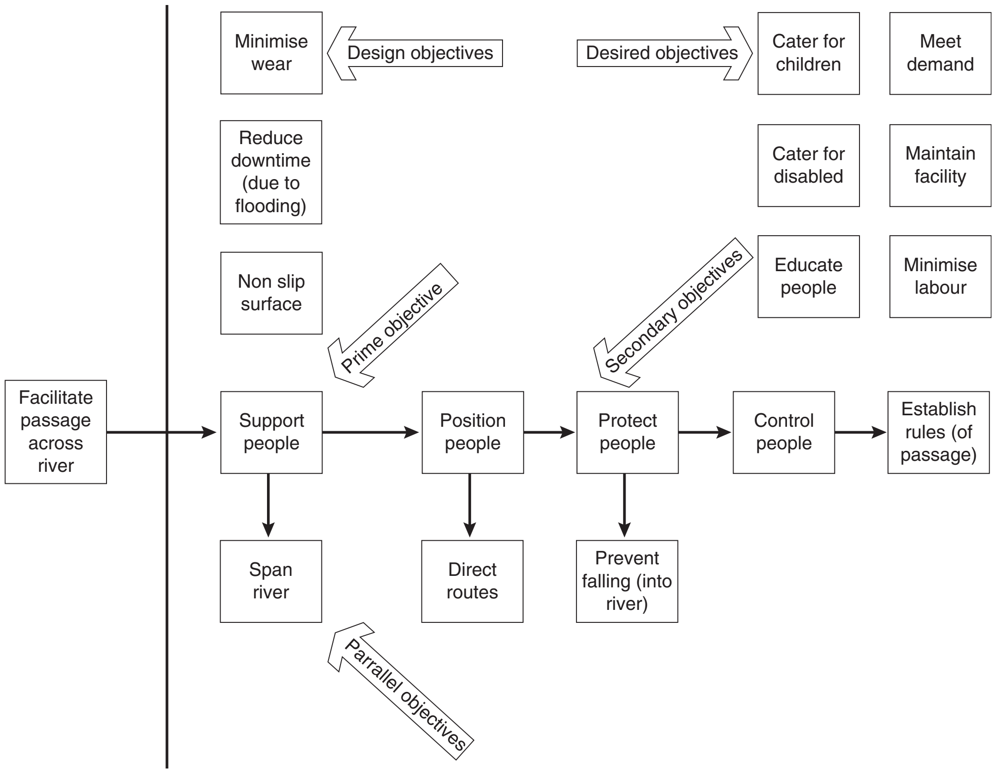

Figure 4.10 Technical FAST.

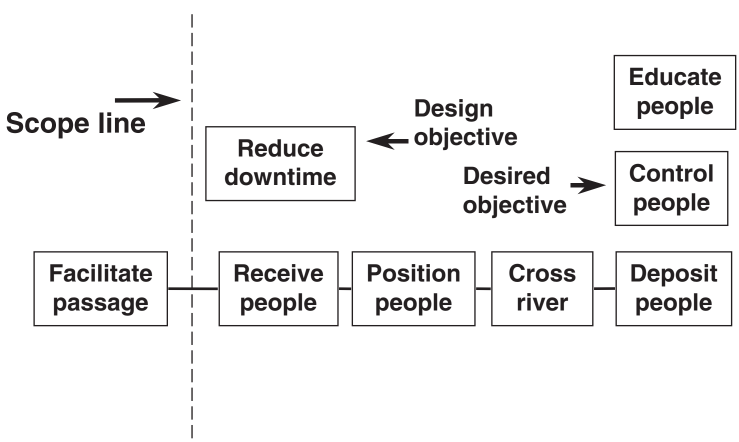

Figure 4.11 Critical path FAST.

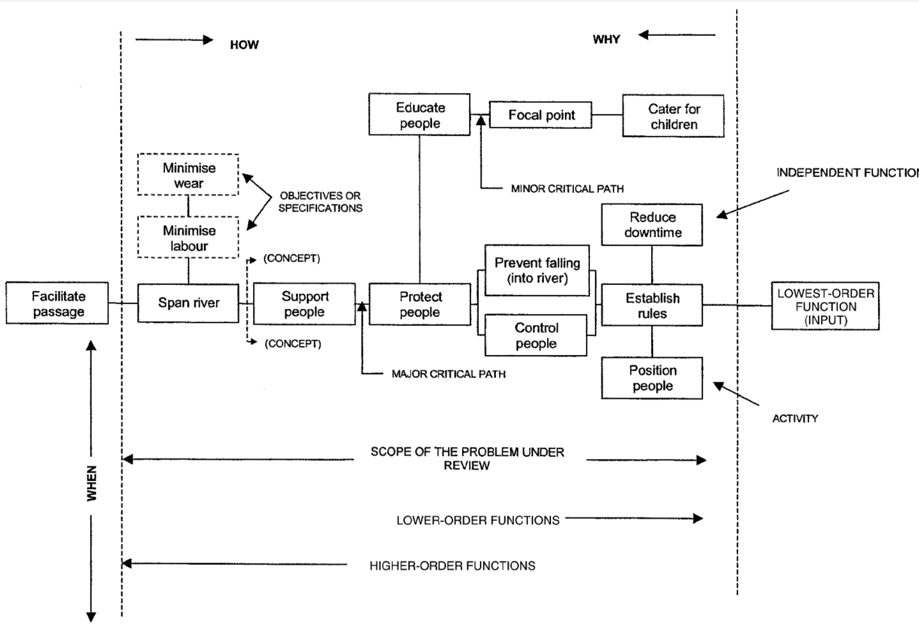

Figure 4.12 Kaufman's FAST diagramming rules illustrated.

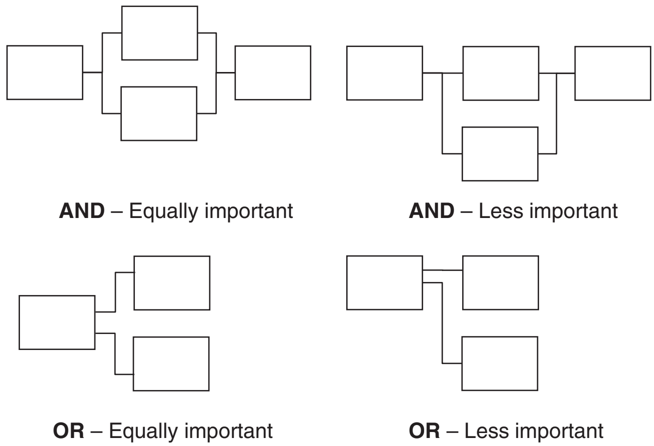

Figure 4.13 OR and AND diagramming rules.

- *Critical path functions:* any function on the how/why logic path. If it is at the same level as the basic function it is a *major* critical path; otherwise, it is an independent or supporting function and a *minor* critical path.
- *Dependent functions:* those dependent on the functions to the left of the basic function answering the how/why logic.
- *Independent (or supporting) functions:* secondary with respect to scope and appearing above the critical path line.
- *Activity:* the method stated to perform a function (or group of functions).

Kaufman also introduces additional rules into the drawing of the diagram such that the importance or hierarchy of the functions can be determined by reading the way in which the diagram is compiled. These rules are illustrated in Figure 4.13.

SMART

SMART is an acronym, in a value management context, for Simple Multi Attribute Rating Technique (SMART). Green (1992) advocates the SMART methodology for any design process that has multiple objectives, and most do. The methodology relies upon the construction of a diagram, similar to FAST, which represents a hierarchy of design objectives. The highest-order objective at the left-hand side describes the resultant and the branches to the right the means to achieving the resultant. The primary difference between a FAST diagram and a SMART diagram is that a FAST diagram is project function orientated with the mission of the project contained in a statement on the left of the diagram, whereas SMART is object orientated with the resultant describing the object of the design.

SMART also has a focus on decision support and uses weighting and scoring systems to assist value teams in reaching an appropriate decision.

For example, for an area community office for a local authority a SMART diagram produced in an iterative and discursive process is as Figure 4.14. The diagram represents the design objectives with the community office being the resultant descriptor. In

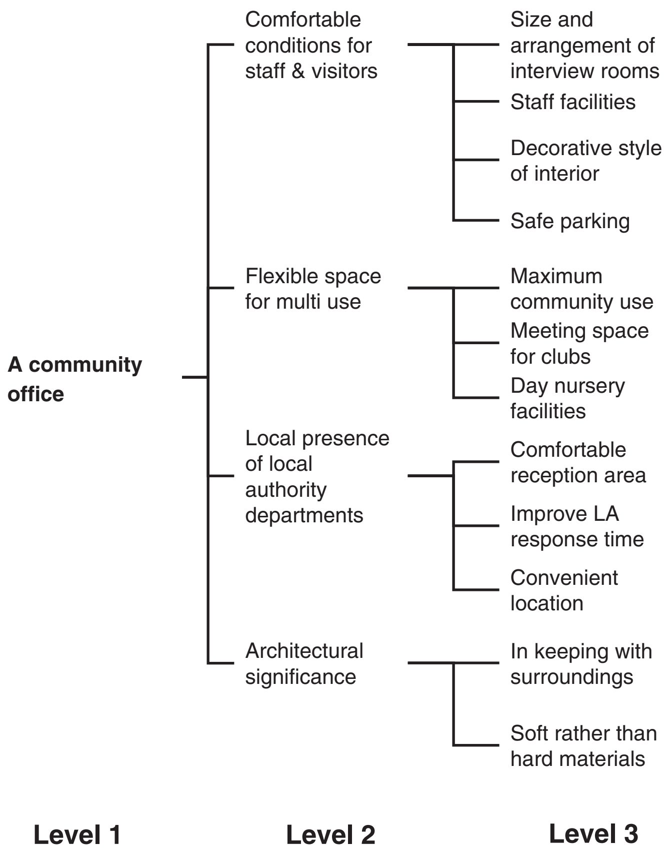

Figure 4.14 A SMART diagram of an area community office.

contrast a FAST diagram seeks the mission of the project in functional terms with the branches of the diagram representing the strategic functional needs and wants without referring to the design or indeed any technical provision.

The power of the SMART technique comes from the stage following the completion of the diagram where a numerical value is attributed to each level of the diagram. At level 2, the branches of the diagram, there are four objectives. The value team is asked to decide on an importance weighting for each objective such that the summation of the values equals 1. The values are shown in Figure 4.15. In the example the team has decided that ‘flexible space for multi use’ is of primary importance and have weighted this at 0.40.

The next stage is to take each of the level 3 clusters in turn and carry out a similar weighting exercise. A level 3 cluster is the subdivision of each branch, for example, ‘flexible space for multi use’ has three subdivisions. In the weighting exercise each cluster must sum to 1.

Multiplying level 2 by level 3 gives a product value that if summed through the whole diagram will equal 1. For example, the product of ‘flexible space for multi use’ (value 0.40) and ‘maximum community use’ (value 0.50) gives a product value for ‘maximum community use’ in the context of the area community office of 0.20. SMART therefore demonstrates to the value team the relative emphasis to be given to the various design objectives.

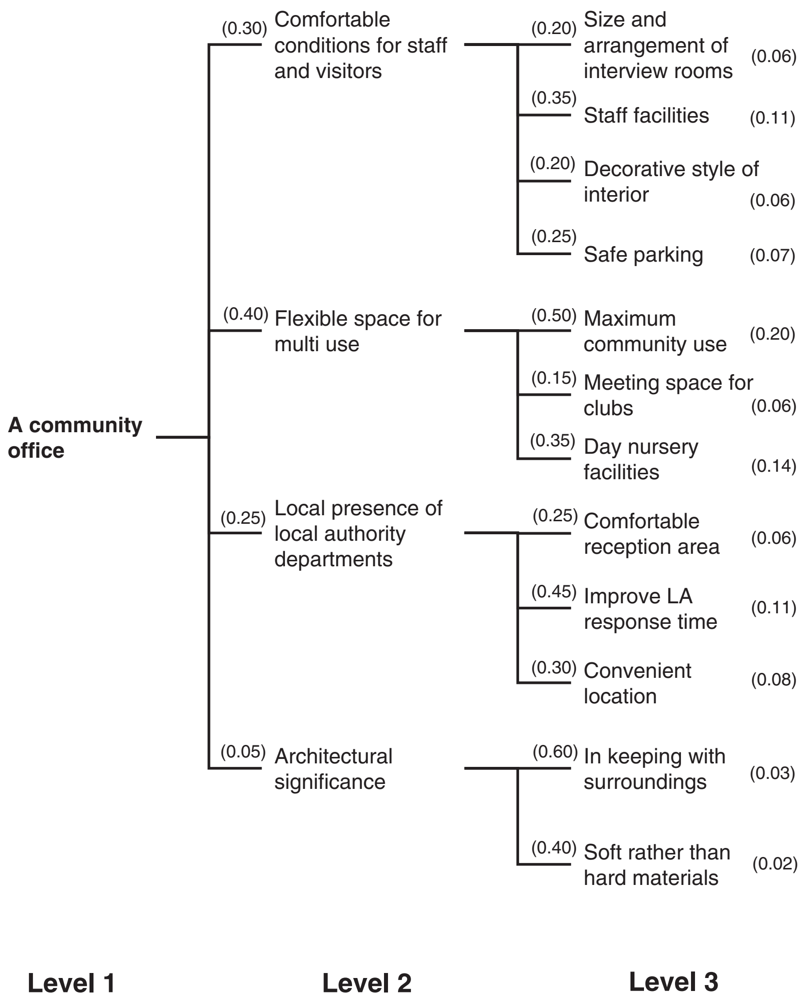

Figure 4.15 A SMART diagram with decision weights applied.

It might be argued that the weighting and scoring exercise is highly subjective and that the multiplication process may lead to distortion. This argument can be countered by undertaking sensitivity studies, in this case changing the value of the weighting given. For example if 'flexible space for multi use' (value 0.40) were to be reduced to 0.35 and 'local presence of local authority departments' were to be increased to 0.30 then what is the impact on the relative positions of the level 3 objectives. In this case 'maximum community use' (new value 0.175) and 'day nursery facilities' (new value 0.14) retain their position as the two highest objectives with 'improving local authority response time' (new value 0.135) still in third position albeit with a decreased margin. Such a sensitivity analysis may assist the decision process.

The methodology employed in Chapter 12 for the derivation of the Whole Life Value (WLV) index uses the basic premise of SMART to weigh the FAST diagram. Areas of concern regarding the subjective nature of the weighting and scoring have been overcome through the use of scaling.

Summary

This section has outlined the functional analysis system technique methods described by a number of authors, notably by J.J. Kaufman and by Snodgrass and Kasi (1986). The functional analysis system technique is a useful closing technique that involves the client stakeholder team in a structured exercise to highlight the primary mission of the project. Function diagramming is important because it rehearses in front of the design team all of the factors that need to be taken into account in the design exercise. In the event that technical FAST or Critical Path FAST is undertaken, the activity would involve the whole team. Once FAST diagramming is completed, it is recommended that members of the client organisation outline the daily activities of users as an activity that precedes the client and the design team working together to derive the function space diagrams. In this way a functional specification is created that leads to a more exact project brief. Function space diagramming is discussed in Section 4.7.

4.7 Function space diagramming

The business project is defined at the strategic briefing stage in the form of a strategic FAST diagram of the type illustrated in Figure 4.6. The process of strategic FAST diagramming identifies main functional attributes and the component parts of the business project and determines whether the business investment requires a single project or a Programme of projects. The technical FAST diagram, in one of the three forms described earlier, describes the functional requirements of the technical project. For infrastructure projects, the technical FAST leads to technical briefing and the concept design. For building projects, a further diagramming exercise is required, that of function space diagramming.

Function space diagramming follows the decision to build and describes a series of techniques for understanding a building subdivided into functional space, a necessary precursor to the specification of space and the writing of the concept or technical brief. All space within a building must perform a necessary function, for if it does not then space is wasted and cost is incurred to no value. For maximum efficiency each space should have the highest degree of usage consistent with its function and therefore the timetable of usage is reflected within the brief. A further necessary action for the designer is to ensure that circulation space, defined as essential nonfunctional space, is kept to the minimum consistent with the requirements of organisational efficiency.

Organisational efficiency implies that the space should be configured to maximise the value of the business project recognising that the very fact that the client is undertaking a project means that the client organisation is about to change. The organisational structure referred to here is the one which will be in place once the change has taken place. Function space diagramming requires the following activities:

- *Activity 1: Determine users*

  The first stage in function space analysis is to identify all of the users of the building. Invariably this will be a longer list than at first anticipated.

- *Activity 2: Flowcharting exercise*

  Each user from the list in activity 1 is studied in turn and a flow chart prepared of their use of space. This is undertaken by anticipating each activity as part of the user's daily routine within the building where each activity is connected by arrows to the next activity. It is presumed that each activity will require space. Even the activity of entering the building will require an entrance lobby of some sort, and the activity of moving from one space to another indicates circulation space. In a situation where there are a significant number of users, it is more effective and manageable to characterise users into those that are regular users, those that are irregular users and those that are likely to test the building's design to its limit. Having done this, it is useful to select perhaps two to three from each group that are representative of each user group and conduct the flowcharting. For example, in a value study on a hospital extension, the VSLs and value team identified some 35 or more different types of users. To undertake a user flow charting exercise would have been unworkable and unnecessary. Users were separated into groups that represented medical, nursing and administrative staff, the general public, patients and their families, those with special needs, and supplier firms. Representative users were taken from each group.
- *Activity 3: Space specification*

  Each activity undertaken by the user will require space and that space will have the functional attributes of size, environment (heating, lighting, ventilation, acoustics, etc.), quality (normally defined by finishings, fittings and furnishings) and finally the technology to support the required function. Much of the information that is contained within the space specification will be absorbed into room data sheet specifications during a later exercise. On completion of Activity 3 all of the required spaces to be contained within the structure should have been identified and their attributes understood. It is important for this process to remain dynamic as it is easy to get bogged down if spaces are considered one at a time from the flow charts. It is more efficient to list all spaces from the flow chart and then group those spaces that are similar in terms of their attributes.
- *Activity 4: Adjacency matrix*

  Each space is identified with a distinct name. These names are transferred to the adjacency matrix diagram that illustrates the adjacency requirement on an index scale of +5 (spaces are required to be adjacent) to −5 (spaces should be designed so that they are not adjacent). In this context adjacency means that there is a physical link between one space and another, normally a door or a short length of corridor. Spaces with an adjacency index of 3 will be within easy reach of one another separated by for instance one flight of stairs or a reasonable length of corridor. Spaces with an adjacency index of 0 give the indication to the designer that the spaces have no adjacency importance one with another and therefore can be anywhere in relation to the total structure.

  Spaces with an adjacency index of −5 should be completely separated one from the other in terms of environment, sound and physical linkage. This does not mean that from a geometrical perspective the spaces cannot be separated by a single wall. However, it is presumed that one space cannot be accessed from the other without travelling through many other spaces. A good example of a −5 would be two bedrooms in separate apartments within an apartment block. A solid wall separates the bedrooms and to get from one bedroom to the other would necessitate leaving one apartment and entering the one next door. In this situation separation of physical and acoustic environments is highly important.

- *Activity 5: Rationalisation prior to the preparation of room data sheets*

  A final study is undertaken of all spaces with similar services and environmental attributes. For example, in a value study undertaken by the authors of a headquarters building it was determined that the conference centre and the employees' sports and social club both had the same structure and servicing requirements, both were two-storey height spaces and both required high levels of ventilation. The two spaces were therefore placed geometrically together although under the rules of Activity 4 both have an adjacency index of −5. The brief highlighted this situation and left the designers to ensure environmental and acoustic separation. In the final design the entrances to the two spaces were entirely remote yet both spaces were able to share a dedicated plant room.

  A space usage exercise is carried out to ensure that spaces with a similar functional specification are used to the highest degree. For example, if the function space analysis has highlighted spaces of identical functional specification that do not conflict on the organisation timetable the client would need to decide whether these two spaces could be combined and be the same space used for different functions at different times.

  The adjacency matrix, user flow diagrams and space usage studies can also be a powerful audit tool during a value engineering exercise focused on an evolving or existing design.

Example case study

The case study relates to that used earlier, the Hillside Country Park development and illustrates the function space analysis of the proposed visitor centre with administrative offices. As part of the Orientation and Diagnostics phase of this stage of the value study the VSL would discuss with the client the compilation of the value team. Following the decision to build, the team is likely to include client operational staff and design consultants.

Activity 1: The VSL determines the users of the facility as:

- Head Ranger
- Assistant Rangers (3)
- Secretary/Receptionist
- Shop assistant
- Catering assistants (2)
- Public visitors (up to 50 at any one time)
- Authorised visitors
- Cleaner
- Janitor/Maintenance

Activity 2: For each user prepare a flow chart of daily routine. The daily routine of the Head Ranger is illustrated in Figure 4.16.

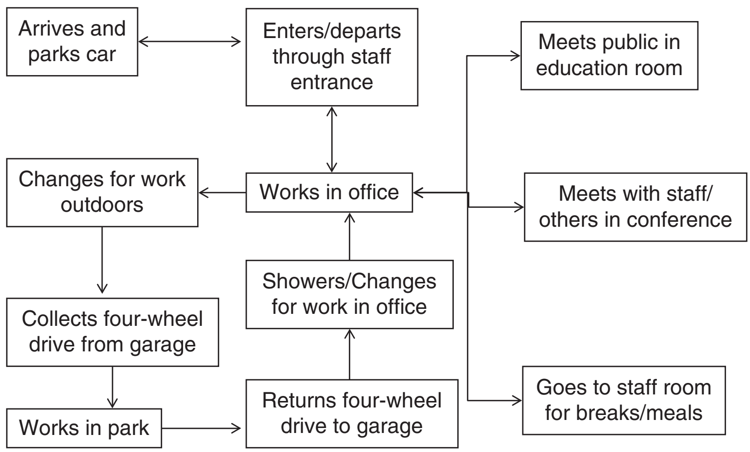

Figure 4.16 Flowchart of typical use of the visitor centre and offices by the head ranger.

Activity 3: Specification of space. The flow charts for the head ranger and the assistant rangers are identical. There is therefore a requirement for car parking, entrance lobby, office space for four people, meeting space, staff room, locker room/showers/toilets, and garaging for an off-road vehicle. Specification of each space in terms of internal environment and C and IT support is recorded.

Activity 4: Having identified all spaces required in the visitors centre an adjacency matrix is compiled. An example is shown Figure 4.17.

Activity 5: Rationalisation. The rationalisation of conceptual space at this stage can be undertaken efficiently and effectively. Simplistically, if a building costs £2000/m^2 and through rationalisation 10 m^2 can be saved then the cost saving is £20 000. In the

Public entrance, toilets, reception										
+5	**Exhibition space**									
+5	+5	**Children's play space**								
–2	–2	–5	**Rangers' office**							
–5	–5	–5	+5	**Staff meeting room**						
–5	–5	–5	+3	0	**Staff locker room/ shower/toilets**					
+3	+4	+3	0	–2	–5	**Education room**				
+4	–5	–5	0	0	0	–5	**Parking / garaging**			
–5	–5	–5	+2	0	+5	–5	+5	**Staff entrance**		
–5	–5	–5	+2	0	+5	–5	0	+5	**Staff room**	
+5	+5	+5	–5	–5	–5	+3	–5	–5	–2	**Cafe**

Figure 4.17 Adjacency matrix of spaces in the visitor centre and administrative offices.

example, the adjacency matrix leads naturally to a building with public space at one end and staff space at the other. Other conclusions are as follows:

- Public entrance, toilets, reception, exhibition, children's play space and café require grouping together with the minimum of circulation space.
- The ranger's office could be open plan with a small private meeting room incorporated.
- The education room is the link between the public space and the staff space.
- Meetings too large for the ranger's office can be held in the education room following the logic that rangers will not be presenting and attending meetings at the same time.
- The staff room could be off the rangers' office next to the staff entrance, toilets and showers.
- The garage can be a separate building or wherever is convenient.
- With careful arrangement the building could have two entrance lobbies and no corridors.

Clearly, this is a simplistic example but demonstrates the advantage of a careful and logical approach to the planning and design of functional space. Value study activity to this point has been proactive value management, that is, laying the foundation for subsequent design through a value study. Some of the techniques, particularly those of functional space analysis, can be very powerful in the reactive analysis of a concept or scheme design. If used in a reactive way the value study would be termed value engineering. Following project briefing all value studies will be a reactive study of a concept, sketch or detailed design and is therefore value engineering. Function space analysis, in value study terms, sits at the watershed of value management and value engineering. The removal or reconfiguration of substantive amounts of space as a cost cutting exercise can radically alter the concept of a building. Value engineering will fine-tune spatial requirements and leave the overall concept intact. Value management, on the other hand, may well alter the perceived concept but, ideally, prior to any design work. Section 4.8 describes the value engineering approach to element and component design.

4.8 Elemental cost planning and elemental cost control

In 1961, the Building Cost Information Service (BCIS, 2012) of the Royal Institution of Chartered Surveyors in the United Kingdom defined an element as follows:

> An element for cost analysis purposes is defined as a major physical part of a building that fulfils a specific function or functions irrespective of its design, specification or construction.

The introduction to the BCIS document, *The Standard Form of Cost Analysis*, states that the list of elements is a compromise between this definition and what is considered practical. However, apart from the elements within the subsection building services, the definition works well. This is fortuitous for all those involved in value engineering exercises that have a cost plan in elemental format as, by definition, the building costs are distributed according to element function.

Elemental cost planning is one of a family of techniques based upon parametric modelling. The technique relies upon an extensive database of building costs broken down into elemental costs. In the United Kingdom, it is normal practice for procurement requiring a lump sum, firm price tender for the whole of the works or for work packages to be tendered based upon detailed bills of quantities. The bills of quantities are normally arranged in elemental format such that following the selection of the lowest tender an elemental cost analysis of the project is prepared. Quantity surveyors submit the elemental cost analyses to the BCIS. The cost analysis is presented as a list of element costs, expressed as both element costs per square metre of gross floor area and per element unit cost. For example, internal doors will be expressed as £35.00/m^2 of gross floor area and £650.00 each. The BCIS service gives quantity surveyors the opportunity to share tender data for a wide range of construction projects.

To plan the cost of internal doors for an office building of say 2000 m^2 gross internal floor area the surveyor uses the rate per square metre for the element doors in a similar office building project in the BCIS database, termed here the base project. For example, to arrive at an approximate cost for internal doors, the quantity surveyor takes the cost for the element internal doors from the base project expressed as a cost per square metre of floor area and multiplies this by the proposed office building area, that is, £35.00 $\times$ 2000 m^2 = £70 000.00.

In constructing a cost plan for the complete project, the surveyor will need to make a large number of adjustments, such as the following:

- Inflation in prices between the date of tender of the base project and the date of tender of the proposed project.
- Difference in prices between the location of the base project and the proposed project.
- Any major differences between the likely specification of the proposed project and the base project.
- Differences in the market prices due to demand for construction work.
- Differences in risk costs brought about by choice of a particular procurement method or other factors.

After these and a large number of other adjustments are made the surveyor will have an elemental cost plan that displays a reasonable degree of cost certainty. This is the point when the cost plan is presented to the client for the building and thereafter the budget becomes firm. It should be noted that the cost plan compiled in this way can precede sketch design but rarely does. When sketch drawings are available the cost plan can be refined. Using the same example, the surveyor can count the actual number of doors, say 95 nr. The cost for the internal doors element can then be refined as £650.00 $\times$ 95 = £61 750.00. The overestimate of £8250 (£70 000 – £61 750) will be added to the contingency sum to pay for those elements that may have been underestimated.

Two important points to note here are as follows:

1. While value engineering will address the functions of all elements, cost planning generally only triggers action in the event of an overspent element. In the example of internal doors, value engineering will seek to identify unnecessary cost in the

function of the element whereas the action of cost planning will only trigger action when the element in question is judged to be overspent by reference to the cost plan.

2. The sketch design will assume the client's project value criteria. If these have not previously been discovered or made explicit the designer will assume them. The debate on the alignment of project value system and client's project value system is in Chapter 11.

The publication of the Ministry of Education, Building Bulletin No 4, in 1951 authored by James Nisbet (Nisbet, 1951) advocating a system of elemental cost planning and the subsequent development of elemental cost planning through the 1960s gave quantity surveyors a unique tool to control construction costs. This tool has served well for over 50 years. It gives a firm foundation for an enhanced approach to cost control and value for money based upon the correct application of value engineering described in Section 4.9.

4.9 Element function analysis

Two ingredients are essential to the undertaking of elemental function analysis:

- A database of costs in elemental format which may be used for benchmarking projects.
- A common understanding of the costs that are contained within a particular element. For example, the BCIS definition of the cost of the internal door element includes the costs of forming the opening in additional to the cost of the door, its frame and ironmongery.

Element function analysis is undertaken by the whole value team. Element function analysis comprises the stages presented next.

Stage 1: Identify the cost dominant elements

In practice, it is not realistic to value engineer all 34 elements of building construction as defined by BCIS. Therefore, some method must be derived for determining, at first sight, which elements appear to be offering poor value for money by being either unreasonably expensive or indeed unreasonably inexpensive. The production of a histogram of element costs of the project in development against benchmarked projects is a useful way of presenting data in order to make an informed decision. Often the attention of the value engineering team is directed towards those elements containing the largest proportion of the total cost and those elements that appear in comparison with the benchmark projects, to be uncharacteristically different.

Building type will have an impact on characteristic element cost. For example, the element 'roof' is expected to have a proportionately high cost in a single-storey primary school whereas a multistorey acute hospital will tend to have proportionately low cost for 'roof' and a proportionately high cost for the element 'services'. These elements may be worthy of investigation purely on the basis of their high proportion of total cost but may also trigger investigations in other elements, for example, if the external walls were significantly the highest cost element in a single-storey school then an investigation into the external wall element is probably worthwhile. Notwithstanding this, it is often the case that an element will appear to be offering reasonable value for money but can still be value engineered without loss of function.

It is unfortunately the case that cost reduction activity through specification reduction and therefore a diminution of quality is termed value engineering which it clearly is not.

Stage 2: List all the functions of the selected element

As elements are defined as being 'components of construction that fulfil a specific function or functions irrespective of design, specification or construction', it is logical to deduce that a generic list of functions could be derived for each element in the BCIS list (see Element function analysis in the Toolbox). In undertaking element function analysis it is easier to consider all the functions that could apply and then delete the functions which are not required rather than trying to generate only those functions that apply.

For example, an internal wall will have one or more of the following functions irrespective of the project context:

- Support load
- Divide space
- Separate environments
- Attenuate noise
- Transmit light
- Secure space
- Ensure privacy
- Support fittings
- Facilitate finishing
- Restrict fire spread
- Minimise distraction

Stage 3: Select functions for project context

An internal partition is a good example of an element that may have a number of different functions within the same building. Therefore, it would be necessary for the value team to undertake a study of internal partition type before proceeding further. For example, such a study of a university building may reveal the following partition types:

- Division between lecture rooms
- Division between laboratories
- Division between storerooms
- Division between lecture rooms and corridor
- Division between offices
- Division surrounding computer rooms

This illustrates a number of partition types that display differing functional characteristics. For example, a division between two lecture rooms is required to 'attenuate noise' to a very high degree while a division between stores needs only to 'divide space' and perhaps 'support fittings'. In each design situation the partition, as designed, is reviewed based upon functional need. The review may highlight the functional properties of the partition as inadequate and/or the partition as designed may be wasteful of resources.

To take the functions of a partition between lecture rooms as an example of function selection, the process would be first to delete those functions that do not apply in this situation (see Table 4.1).

Stage 4: Brainstorming solutions

The brainstorming exercise will be undertaken on a functional element definition basis following the complete analysis of the elements. In the partition example, ideas are generated to meet the retained functions. The rules relating to brainstorming are described in Chapter 6.

Stage 5: Evaluation and development

During the evaluation phase the large number of ideas generated through brainstorming are reduced through a logical process of option reduction. In a situation similar to the partition example earlier, where the number of technical solutions is limited, the use of a weighting and scoring matrix is useful (see Chapter 6 and Toolbox). The development stage takes the highest scoring or most promising technical solution for further technical development. The preferred solution must pass the test that it is technically feasible, economically viable, functionally suitable and acceptable to the client.

Table 4.1 Selection of relevant functions for a partition between lecture rooms.

Function	Reason for Deletion or Retention
~~Support load~~	Framed building
Divide space	Required function
~~Separate environments~~	Heating, ventilation, etc. – same requirements either side
Attenuate noise	A primary requirement
~~Transmit light~~	Not required
Secure space	Lecture room contains ICT equipment
Support fittings	Boards, screen, display panels, etc.
~~Ensure privacy~~	Individual privacy not required
Facilitate finishing	Hard surface, easy to clean
Restrict fire spread	Required function
Minimise distraction	No visual or other sensory distraction is permitted between lecture rooms

4.10 Managing element clusters

Figure 4.18 highlights the characteristic feature of all buildings, which is that key functions are aligned to groups of elements or clusters. For example the substructure, frame and upper floors all support and transfer load. On the other hand the internal walls, internal doors and stairs, the wall, floor and ceiling finishes, the fittings and furnishings, the plumbing and the sanitary ware, all directly impact the client's organisation. The client should be able to work with the building and its arrangement, and should not need to adapt to it and certainly not work against it. In the context of the new building, the design and arrangement of spaces and the elements containing and servicing those spaces should achieve a perfect strategic and operational fit. Furthermore, it is important that those elements that directly interface with the client's business should reflect the value system of the client.

Figure 4.18 is useful for managing a workshop where it has been decided to cluster members of the supply chain for smaller, shorter, more focused value engineering workshops. However, Figure 4.18 is only an aid and account should be taken of, for example, the following:

- The structural cluster's responsibility to understand the client's use of the building in respect of the specific live loading, which is related to the client's business.
- The fact that external and internal walls may be load bearing.
- Building regulations require a minimum number of sanitary fittings, fire protection and fire escapes, insulation, day lighting, dry risers, hose reels, fire alarms and detection, external fire hydrants, fire access roads, and so on.
- Although internal environment maintains client function there is an extra requirement that results from the client's use of the building, primarily impacting air conditioning and specific electrical loads.

Figure 4.18 has application in identifying those costs, from the elemental cost plan, that can be assigned to function, the topic discussed in Section 4.11.

4.11 Evaluating function

At the commencement of this chapter, reference was made to Kaufman and Woodhead (2006) who state that the description of function is normative and lacks dimension. In the discussion that follows it is accepted that functions of themselves lack any sort of dimension being a description that is completely inert or inactive. However, the identification of a function leads to a number of questions:

1. To what extent is the project compromised if the function were not provided?
2. What is the cost of meeting the functional requirements?
3. How much value is given by the identified function?
4. What is the implication on the project's timeline of not meeting the identified function?

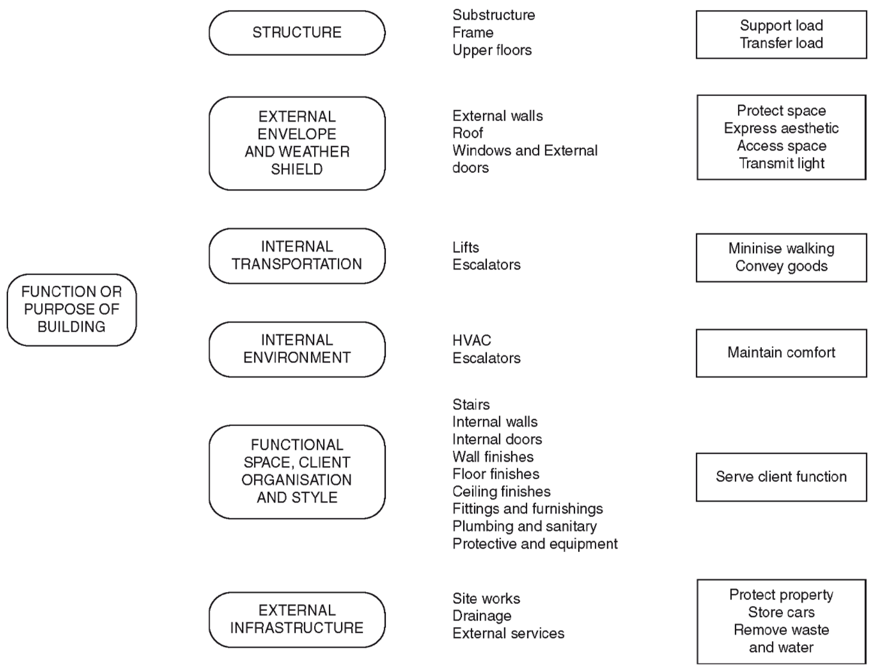

Figure 4.18 Functions aligned to building component clusters.

5. Who will be responsible for specifying/designing/managing the identified functional requirements?
6. How much risk is associated with the provision of the identified function?

These questions require a judgement to be made and that judgement will be influenced by some type of measure. Therefore, although the statement of function is without dimension, the next stage of consideration will require dimensioning. The tools relating to each question are described in the Toolbox.

Question 1 – Is the function required?

Assessment based on:

- Gap analysis
- Goal and systems modelling
- Advantages and disadvantages
- Primary and secondary function analysis

Question 2 – What is the cost of meeting the functional requirements?

This commonly asked question has exercised value management and value engineering researchers, authors and practitioners since the beginning of value management itself. Miles (1989) devotes a significant proportion of his book to the accurate assessment of the cost and worth of components of manufactured products whose function definition is relatively straightforward. Buildings are generally assemblies of manufactured components that form elements to surround and service functional space. The function analysis of a component, for example, a door, a window, a central heating pump; shares a commonality of function, cost, worth approach with manufacturing. Functional space cost analysis and element cost analysis is more complex. Added to this complexity is the longevity of built infrastructure, which drives the consideration of whole life cost.

Figure 4.19 illustrates that the function analysis of an existing component (readily available from a stockist) is characterised by high cost certainty and low function complexity. A design incorporating a defined component carries only slightly less cost certainty. Only when a component needs bespoke manufacturing does the functional complexity begin to increase and cost certainty decrease. Where functional complexity is tending towards low, assessments will be based on the following (described in the Toolbox):

- Unit costing
- Function/cost/worth matrices

Figure 4.19 also illustrates the range of cost certainty as a project develops from an outline strategy to a sketch design in which the functional space and elements are defined. As described earlier the elemental cost analysis of a completed building reflects high cost certainty in the evaluation of an element, the elemental cost analysis of a proposed building intimates less cost certainty. Building projects are generally the result of a developed strategy and are normally specified in terms of functional space, for

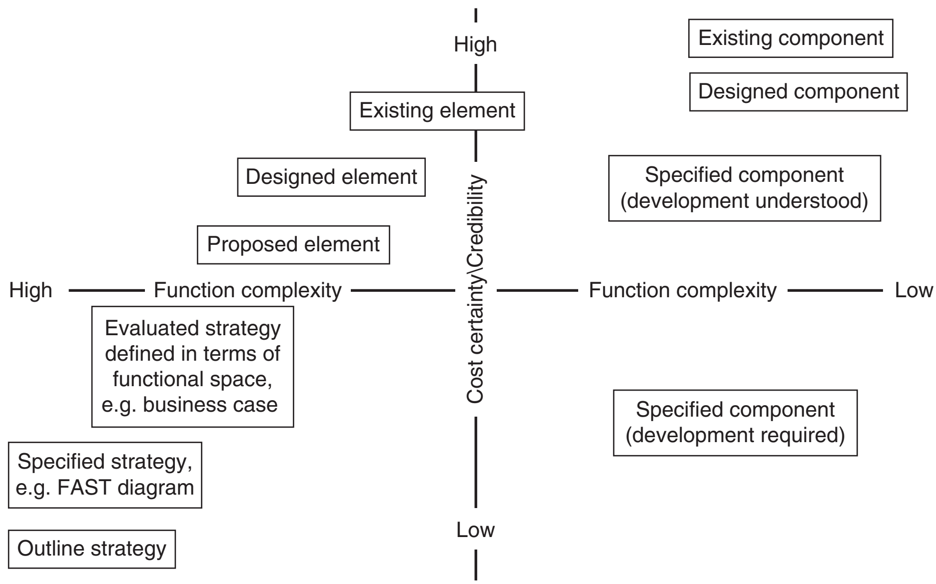

Figure 4.19 Functional complexity and cost certainty matrix.

example, a primary school of 10 classrooms. Functional space is an interesting concept from a costing perspective since the space that is used for living, working, recreation, and so on, of itself attracts no cost. Indeed any space has been in existence since the beginning of time. The cost of providing functional internal space in a building is the cost of the elements that surround and service the space. Space can therefore have varying costs dependent on the element/component solutions. The cost of space is normally expressed in function average costs, for example, office space costs £2000/m^2 of gross internal floor area. Clearly the cost certainty at this level of description is tending towards low. Some VM/VE practitioners attempt to divide the budget cost of the project, often expressed as an elemental cost plan, amongst the functions on a function diagram. However, this exercise is time consuming and its value in terms of a credible answer has to be debated. Assessments where the function complexity is tending towards high will be based on the following (described in the Toolbox):

- Elemental cost analysis
- Benchmarking
- Function space costing
- Function description costing (on the FAST diagram)
- Technology road-mapping
- House of Quality
- Whole life cost/whole life value

Question 3 – How much value is given by the identified function?

Value is commonly expressed as a relationship between function and cost. However, as discussed at length previously, function by itself has no dimension and therefore the quasi-mathematical expression discussed in Chapter 2 logically can have no meaning. The methodology for overcoming this impasse is discussed in detail in Chapter 11. At the component level cost/worth analysis can be used but remembering that worth relates to utilitarian worth and value is more complex than this. The statement 'value increases as cost tends to worth' is simplistic and incorrect. Assessments of value will be based on the following (described in the Toolbox):

- Function/cost/worth analysis
- Simple Multi Attribute Rating Theory
- House of Quality
- Whole Life Value methodology (see Chapter 12)

Question 4 – What is the implication on the project's timeline of not meeting the identified function?

Time is a key component of value and risk. There are two elements to time in the context of the question. The first relates to decision gates within the project timeline at which key decisions are made, for example, authority to proceed, outline planning permission and detailed planning permission. It may be important that the project has proceeded to a particular state of advancement to qualify for passing through a decision gate. The second relates to the time taken to develop the technical solution to meet the functional requirement. Where a function can be satisfied by an existing and available component then there is no time consequence, but where the function can only be satisfied through the development and manufacture of a new component then clearly there is a time consequence.

Question 5 – Who will be responsible for specifying/designing/managing the identified functional requirements?

This question emphasises the importance of planning the development of functional requirements. Shillito and DeMarle (1992) and subsequently Kaufman and Woodhead (2006) describe matrix-based methodologies for specifying, designing and managing identified functional requirements of complex projects. Highly complex projects can be expedited by breaking down the project into its functional elements by function diagramming, followed by identifying the design work to satisfy a particular function. Design work can be distributed amongst several design teams working in parallel. In this way the most complex designs can progress through parallel working of many different functional requirements with maximum innovation. Division of labour and subsequent effective and efficient control is undertaken through technology and responsibility road-mapping.

Question 6 – How much risk is associated with the provision of the identified function?

Risk is associated with the technical solution to the function rather than the function itself. However, if the potential technical solutions to a particular functional requirement all carry an unacceptable risk then the question has to be asked whether the function is a required need? If the answer is yes then the risk has to be managed (see Chapter 10).

4.12 Conclusion

This chapter is an overview of function analysis specifically applied to construction. In this context the view has been taken that there are three distinct applications: strategic function analysis undertaken by the client stakeholder team, function space analysis and element function analysis undertaken by the whole study team. There are a number of texts and papers that refer to function analysis as an abstract technique, where examples are given they are generally given as examples of the function analysis of fully costed elements. This chapter is a synthesis of that literature together with data derived from action research studies. The developments described in Chapter 3 are drawn together with the data in this chapter to form a holistic approach to the value management service.

It has already been stated that those things that make value management and value engineering different from other management techniques are the three factors of making explicit the client's value system and the project value system, the application of function analysis and the use of value teams. The next chapter examines the theory and practice of teams, team dynamics and management.

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5 Managing Value Study Teams

5.1 Introduction

A value study is typically an intervention during the inception, development and execution of a project built around different study styles. Study styles have been discussed in detail in Chapter 3 and are addressed further in Chapter 13. Any value study style will comprise the three key aspects of the *Orientation and Diagnostics phase,* involving fact-finding, preparation, the identification of value challenges, finalizing the study design and workshop planning; the *Value Workshop phase,* involving an intensive investigation of the project with the value team in a workshop environment; and the *Implementation phase* in which innovations are embedded in the project. Understanding, analysing and planning for team behaviour and dynamics is an important requirement in each of the three phases, and for the Value Study Leader (VSL) across all three phases. Important aspects of the value study methodology will typically take place in intensive workshop activity involving a value study team.

In the context of this chapter, a value study team could comprise one of the following:

- The client's internal team or an externally appointed project team, which comprises, depending on the procurement strategy, designers and constructors, supplier chain members, and important stakeholders, complemented by in-house client representatives. These will work under the leadership of the VSL.
- An externally appointed 'shadow team' of experts selected by and contracted to the VSL for the purposes of a value study.
- A variation of the two, a hybrid, which is explored later in this chapter.

Individual members of the value team are chosen based on their expertise and skills, job function and organisational role, rather than individual personality traits – an important factor that should be borne in mind when reading this chapter.

This chapter synthesizes literature together with the authors' conclusions from action research and consultancy activity. It addresses the role of the Value Study Leader in designing and implementing a value study and discusses the understanding and management of team dynamics and behaviour. The chapter integrates methods for the facilitation of a value study with lessons learned from practice by the authors.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

5.2 The Value Study Leader

This section addresses the role of the Value Study Leader in designing and managing a value study, and explores the skill and knowledge requirements of the VSL.

The skills and selection of the VSL

The job of the VSL is to design and implement the value study. It is often argued and reported that the VSL role in a value study is solely about workshop facilitation. This is incorrect and inappropriate. It underplays the expertise required for conducting a value study in its entirety in which facilitation is only one skill set of many required of a VSL. The skill profile of the VSL covers the following:

- *Generic skills*: To be able to think strategically and tactically, understanding projects and project management in its broadest sense, problem identification, definition, redefinition and resolution, to synthesise and integrate information, to sense and manage interpersonal relationships and negotiation. To understand the purpose, strengths and limitations of a diverse range of management tools and techniques and to use them appropriately.
- *Orientation and Diagnostics phase*: To synthesise, integrate and structure a diverse range of design, financial, contractual and other types of information quickly and to identify key value challenges. To interview in a confidential and tactful manner. To design and plan a value workshop, and related agenda, whilst taking account of team processes and behaviour and team dynamics.
- *Value Workshop phase*: To present information succinctly, to manage team processes to take participants through a structured and intensive value workshop or workshops to achieve an agreed outcome(s), to think spontaneously and creatively and to be confident in meeting unexpected/emergent workshop issues without undue time for contemplation; to manage and resolve conflicting views if and when they arise and engender consensus; action planning.
- *Implementation phase*: Report writing and presentations to key stakeholders.

Hence, the skill set required to conduct a value study can be categorised into three main areas, cognitive skills, interpersonal skills and 'doing' skills. An important aspect of the VSL's role within a value study is to be able to act objectively and independently and tactfully challenge assumptions, decisions, working practices and approaches.

The VSL can be appointed on the basis of two major options, each with its own sub-option:

1. Appointed from within the sponsoring organisation undertaking the value study and
   a. Internal to the organisation and the project under study.
   b. Internal to the organisation but external to the project under study.
2. An external commission by the sponsoring organisation:
   a. External to the project team and working with them as the value team.
   b. A VSL appointed together with a 'shadow' independent team for a study.

c. A hybrid, whereby the VSL appoints their own external independent 'shadow' experts. The value study team comprises, the VSL, the shadow experts and members drawn from client departments and other organisations involved with the project.

The foregoing, whilst they are inherent within the study styles identified in Chapter 3, have implications for the manner in which the VSL runs the value study. The different emphasis for each will be explored further later.

Commissioned from within value study sponsor organisation

Internal to an Organisation and Internal to a Project

For a VSL, this is probably the most demanding environment to work within. The VSL will be embedded in the organisational culture of the project, work alongside colleagues that might be involved in the project under study, and also be subject to political pressures depending on the requirements and outcomes of a value study. One of the key issues under this approach to appointing a VSL is the extent to which the person can remain objective and independent, and be seen to be so by those involved in the value study team and in their wider organisation. This situation would be helped immeasurably when the VSL has organisational seniority and/or respect based on a skill set and knowledge appropriate to the value study.

Internal to the Organisation but External to a Project

A VSL who is external to the project under study is the preferred position compared to option 1a listed earlier. The key here is the measure of perceived externality, impartiality, objectivity and independence. In this situation one primary rule has to be observed: while acting as a VSL, an organisational employee has to assume a position, in the perception of the value study team and the wider organisation, of being independent. Again, this can best be served where the VSL has the appropriate seniority and respect to challenge assumptions and decisions, especially where significant political sensitivities are involved. This is important since the VSL can often sense a need to explore an issue in detail which may be uncomfortable for one or more members of the team. Using a military analogy, if the VSL is a lieutenant and the uncomfortable member of the team is a major or colonel, they may pull rank to ensure that the particular issue is not explored. Organisations with considerable value study activities and in-house study leaders may create a VM Unit, which can be responsible to the board of directors or, for example, as in the case of one local authority, the VM unit is within that part of the Treasurer's Department, which authorizes capital and revenue expenditure. Other examples might include reporting directly to the Head of Capital Investment, or Finance. There remain, however, challenges to this approach for appointing the VSL, not least the fact that internal organisational political pressure can still be brought to bear on the VSL even if senior and respected by the value study team, and the wider organisation.

Externally commissioned by the value study sponsor organisation

An independently commissioned VSL overcomes many of the issues discussed earlier since the VSL has no formal position within a particular organisation and is not part of the organisational power structures. The externally appointed VSL may be the preferred option where

- An organisation that does not undertake sufficient value studies to make an in-house VM Unit worthwhile,
- A particular study is likely to be highly politically sensitive, or
- Prefers the independence of an externally appointed VSL.

Additionally, the external study leader's independence will also be an advantage in complex projects with difficult problems to solve and with different factions to be brought together. The external VSL will bring with them a broad experience of conducting value studies in other parts of the industry that could help with the problem solving required. There should be no question in the mind of any member of the study team as to the VSL's independence. Therefore, the VSL can feel comfortable in effectively challenging assumptions, practice and procedure, options and solutions. The appointed external VSL can operate under the following operational modes:

a. External to the value team. In this role the VSL acts as the designer, implementer and process manager of the value study and importantly can challenge the value team's thinking. This is typical of the UK and Australian approaches.
b. Externally appointed with a 'shadow' team appointed under contract to the VSL. In this role the VSL acts predominantly as a process manager throughout the study and it is the VSL's own team that provide the challenge function. This is the approach typical of the majority of US public sector organisations commissioning value studies.
c. A hybrid of a and b. The VSL is commissioned externally and also appoints a 'shadow team' under contract to work alongside the project team members. In this role the VSL and the appointed team members provide a challenge function, and also act in an advisory capacity, particularly where a required skill is missing from the project team at the point in time when the study is held.

There are two fundamental points of view concerning the make-up of the value team. The first, common in North America on public sector projects, is that the 'shadow team' should be a totally independent review team that provides an oversight of the work of the project team. The advantage of this approach lies in its total independence, the potential for technology transfer and bringing fresh ideas to a project and satisfying the public sector's requirement for public accountability. The 'shadow team' has no pre-conceived ideas, brings no legacy to the value study, can have a membership designed for the particular study and can be totally objective. The disadvantage lies in the fact that the 'shadow team' can only be a reactive, backward-looking audit team and where proactively identifying a better way of proceeding can only make suggestions to the project team. It has also been argued that an independent 'shadow team' faces a steep learning curve in the understanding of the project's development to the date of the workshop. The counter to this statement is that a carefully selected team with the right expertise, knowledge and skills that has worked on similar projects before should be able to adapt quickly. In implementation of ideas and solutions, the independent 'shadow team' must convince the project team of the merit of any of its suggestions and proposals to the extent that the project team will accept the liability of putting those suggestions into practice. Therefore, to be effective, members of the independent 'shadow team' must be allowed time to familiarise themselves with the project and, after the value workshop phase, prepare a convincing case for the client and the project team to implement 'shadow team' recommendations and outputs. The 'shadow team' approach is costly due to the number of experts employed for the study. However, this must be balanced against the value that this approach can bring to a project. In the United States it is commonly cited that a study with a 'shadow team' results in suggested savings of 10 times the investment in the cost of the team. Furthermore, a VSL using a 'shadow team' will have a network of contacts and therefore resourcing a study is rarely a problem even when a study is required immediately.

The advantage of using the project team as the value study team is the converse of the one just presented. Whether or not a value study is held, the project learning task still has to be undertaken by the project team and implementation of proposals is easier due to ownership by the project team of the developed solutions and options. Compared to the 'shadow team' approach, costs are considerably less. The disadvantage of using the project team is the danger that it will not be objective or willing to change that which it has already decided upon. The counter to this is that the primary role of the VSL is to challenge existing assumptions, practice and procedure, and to use the value study process proactively. Thereby the team plans the future of the project to the point where another workshop might be required. Setting a schedule of value study dates at the commencement of the project mitigates against the problem of clearing project team members' diaries for the study. A schedule further sensitizes the team to the dates by which a particular stage of project development must be achieved.

The authors have acted as VSLs under all scenarios noted earlier, and each has brought its own individual challenges.

The VSL's role and team dynamics

In this section the role of the Value Study Leader is explored under the three phases of a value study with reference to team dynamics, team behaviour and management in respect of the study styles set out in detail in Chapter 3.

The Orientation and Diagnostics phase

The phase typically commences with a senior client representative, project sponsor or project manager approaching and commissioning a VSL, either through a competitive proposal or fee bid, or through a negotiated proposal. This phase covers the following:

- *The Orientation Meeting.* This will typically be a wide ranging discussion with the commissioning client to obtain an outline of the project and its current situation, together with establishing the objectives and outcomes of the value study. The discussion could encompass whether one or more workshops will be undertaken depending on the project circumstances, value workshop durations, and time available. The discussion will also encompass whether interviews should be included within the study, who should be interviewed and why, and initial thoughts on who should attend the workshop and why. As a consequence, the VSL will get a sense of the numbers likely to be attending the workshop and start to form a view on workshop team management. Normally, multiple representation of participating organisations/departments would be avoided in the interests of restricting workshop numbers and ensuring an even representation. The discussion will also encompass the location, venue and requirements for the workshop.

- *Documentation review*. The review will cover a wide range of project documentation. It provides the VSL with a good overview of the project and the potential value challenges to be addressed. This will highlight questions to be addressed to a particular team member during interviews. It might also provide the VSL with some insight into inter-team relationships that may affect the workshop.
- *Interviews*. Wherever possible the VSL should conduct interviews with key members of the proposed study team. These provide the VSL with insights into how each person is viewing the project under study and how that individual might operate in a workshop environment; it may uncover hidden agendas but equally may not necessarily do so and it permits the VSL to explain the purpose of the value study, and how the workshop phase typically operates. Where interviews are impractical questionnaires are a helpful substitute.
- *Workshop Planning*. This is multifaceted. The VSL will typically
  - Form an agenda that describes the tools and techniques to be used and in what order.
  - Decide on team composition, team management and whether the team is likely to operate in small working groups and their potential structures.
  - Consider the role of plenary sessions as part of the workshop process. Plenary sessions are a very useful team control mechanism; they enable information sharing, peer review and momentum to be maintained.
  - Decide on who should be asked to present at the commencement of the workshop, and why.
  - Consider the format of a workshop briefing pack and its subsequent sending out within a few days of the workshop commencing. In the authors' experience, it is highly unlikely that the briefing pack will contain information of working group membership, as this may need to change or be adapted as the workshop unfolds.
  - Consider the use of a value questionnaire appropriate for the investigation of whole life value as detailed further in Chapter 12.
  - Discuss with the commissioning client the dress and behaviour code for the workshop. It is important for people to feel at ease and whether this means casual or formal or a mix of dress code should not matter.

The Value Workshop phase

An understanding of team dynamics, team behaviour, and team management is an essential skill during this phase, along with facilitation skills, information structuring, synthesis and restructuring. The workshop process can oscillate between full team and working group operations. It is also likely that particular workshop tools and techniques will be challenging to the value team either in terms of practicalities of running them or because they will test the team's knowledge and 'political' sensitivities. The VSL would have to consider this within workshop planning.

The physical workshop environment is also important for team working and small group working. An appropriate room with clear walls for displaying drawings and key information resulting from the workshop activity is important. Sufficient space is also required to allow the team to be at tables arranged in a horseshoe formation so that all members of the team have eye contact with other team members and a clear view of the VSL. Round tables, whilst useful for working group sessions, can cause difficulties during full team working. Table arrangements may change during group working sessions, and therefore breakout rooms where available are very useful. It is preferable that the workshop is held ideally away from any member of the team's normal place of work to ensure an interruption free workshop. The use of flip charts is widespread with other electronic forms of visual presentation via laptops and projector commonplace. As with white boards, this information tends to disappear from view, whereas if a workshop record is made on flip charts it can be displayed for the duration of the workshop on walls. Other standard office equipment, including repositional sticky-notes, pens, card and so on, are used regularly.

One of the key functions of the VSL during the value workshop is to provide direction and a sense of common purpose by talking through the workshop objectives and agenda initially, establishing workshop norms, roles and skills as early as possible. It is important that each workshop participant introduces themselves briefly, and name plates can assist throughout the workshop. An 'ice-breaking' activity could be considered at the start of the workshop, although the authors prefer to get right into the workshop process, typically with an overview of the agenda, and the aims and objectives of the workshop, followed by presentations and/or an Issues Analysis.

Workshop Norms

The VSL should be clear regarding the code of behaviour for an efficient and effective workshop and get agreement from the commissioning client and the value study team on what are reasonable workshop norms. Specifically, the VSL should consider:

- The use of mobile phones (when and how).
- What happens if a person has to leave early, or arrives late.
- Agreement with presented information specifically, that if a person does not agree with what has been written on the flip chart, they should say so and that anything displayed on the wall is agreed by the team.
- Where plenary sessions are used a member of each of the working groups and not the VSL should undertake the plenary session presentations and also the final presentations if appropriate at the end of the workshop.
- All participants are acknowledged as being equal, and that one person talks at a time, with every idea or comment seen as valid.
- No judging during any brainstorming.

- What is said in the workshop should stay in the workshop to ensure confidentiality and open and frank discussion.
- Workshop outcomes must be seen to be owned by the value study team.
- How different stakeholder positions are understood and respected, particularly in respect of organisational hierarchy or financial dependence within the team.

During the workshop, the VSL should acknowledge individual contributions, restrict irrelevant discussion and storytelling, and encouraging observations and comments from noncontributors. Equally, observation and maintaining a sense of the workshop climate is important; this can change quickly depending on what tools and techniques are being used, and the topic under discussion. It is important that all team members participate in the discussion to encourage an atmosphere of frankness and openness. The VSL should also be observing body language and resist the avoidance of contentious issues or difficult questions that are important to the successful outcome of the workshop.

Workshop Planning

The VSL should consider the design of the workshop process to recognise differences between facilitating small teams and big teams. Big teams will normally require breaking down into smaller groups, who may have their own facilitation requirements. This may lead to a loss of overall VSL control if not planned for and factored into workshop processes, perhaps using a higher incidence of plenary sessions. Equally, an important aspect of workshop planning is consideration of whether there will be more than one VSL, especially where there is a large team. When there are a number of working groups operating at different points of a workshop the VSL would expect them to be self-managing but would visit them regularly. It is not uncommon where more than one VSL is present that a working group may need facilitation if it has become locked into a particular mindset, is not moving forward, or there are interpersonal tensions coming to the fore.

The VSL has to consider the position or role of voting within the workshop process. When consensus is difficult the alternative is to ask for a vote. However, the VSL should be aware that not all members of the team have voting rights. For example, for exploring and discovering the client's value criteria it would be inappropriate for the client's consultants to vote. A nonbinding vote could be useful as a way of testing the level and extent of consensus about a topic or way forward.

Managing the Workshop

Much of the workshop process is about sensing interpersonal relationships within the team and maintaining good eye contact is essential. Wherever possible emotive arguments or point scoring should be avoided and sticking to the facts should be encouraged as a way of dealing with this. Hidden agendas are almost certain to emerge at some point, and that is why interviews are a useful way of anticipating these and preparing for them during the Orientation and Diagnostics phase. They should be dealt with sensitively and tactfully.

The VSL should synthesise and integrate information during workshop activities, summarizing after each major agenda item, or important points in the workshop, to maintain momentum, avoid revisiting earlier discussions and controlling the workshop climate. Summarising helps to clarify issues, positions and also provide forward momentum. The VSL's use of questioning and feigning ignorance to ensure full team understanding can be helpful. Silence should not be feared by the VSL. Teams go quiet on occasions and provided this is for constructive thought there is no major concern.

A further important skill of the VSL is to intervene and modify the workshop process as necessary. The use of negotiation skills such as role-reversal, identifying common ground, and adjournments and so on, to resolve awkward situations are very helpful techniques in managing difficult team dynamics. In extreme situations it may be necessary to use counselling, conciliation or reference to a superior.

Part of workshop planning, and also managing the workshop process itself is to consider whether to employ a recorder. They can take notes of the workshop proceedings and entering the flip chart information direct into a computer can significantly reduce the effort required in producing the value study report.

In conclusion, from this discussion, the VSL requires skills in team management, organisation, recording, team guidance and aspects of being a chairperson. Additionally, the VSL will need skills associated with assessing the mood of the team and include reading body language in corroboration of what is being said at the time and in what manner. Tension within a value study team is not uncommon, but if allowed to ferment can become destructive. The VSL should be skilled in negotiation and conflict resolution. In sum, the skills required during the value workshop phase are heavily reliant on capabilities in team and information management within an intensive workshop environment.

The Implementation phase

Understanding team dynamics and behaviour during implementation revolves around understanding the dynamics of a meeting at which the value study report is presented, particularly if to senior client decision makers. If an implementation workshop is to take place the same considerations as the earlier value workshop phase come to the fore. Typically, the Implementation phase can have four important activities associated with it:

- It is not uncommon at the close of the workshop for members of the value study team to arrange follow-up meetings shortly after the workshop to review the next steps. To assist with this, the Action Plan will be forwarded to all team members immediately after the workshop to ensure that option development can continue quickly.
- Production of the draft and final value study report. This will be a factual report of the conduct of the value study and the outcomes of the workshop phase in particular. The authors' normal practice is to forward the draft report to the team that attended the workshop to check for any factual errors.
- A value study debriefing meeting. Once the draft report has been updated from comments received, a debriefing meeting is often held with the study sponsor to go through the report in detail, seek any final feedback, and also to review the value study process. This meeting will normally occur as soon as possible after the updated report has been produced. The final version of the report will be forwarded to the value study sponsor for wider circulation as required. Typically this is the close of the value study.

- An Implementation workshop. On more complex and high value projects, the authors have held an Implementation workshop with the value team(s) to go through the action plan in detail, and review progress. Workshop planning will be conducted prior to the event, and would be built around particular actions, or groups of actions, with working groups selected on that basis. Short plenary sessions would be conducted where the focus is on progress and next steps. The Implementation workshop would be held three to four weeks after the main value workshop, would continue the momentum of the value team, and would be in the order of half to one day duration. It should be stressed that implementation workshops are rare in the authors' experience. More likely is the reporting at the next scheduled project team meeting of the development of the options described in the final workshop report.

Two Value Study Leaders may be appointed in a situation where value study teams are likely to be large, where workshop momentum is critical to maintain or where small working group activity will dominate workshop activity. Their role will cover one or more of the following in each of the three value study phases:

- *Orientation and Diagnostics phase*: To efficiently expedite interviews, workshop planning and so on.
- *Workshop phase*: To maintain the momentum throughout, and in particular during working group sessions, plenary sessions, and during full team working techniques, such as Issues Analysis, Function Analysis – FAST, User Flow and Adjacency. More than one VSL is helpful where a workshop has to address strategic (VM) and tactical (VE) value challenges simultaneously.
- *Implementation phase*: The role will again be complementing the VSL in report writing and feedback sessions.

There are differing views on the appointment of more than one VSL to a value study. The principle disadvantage is cost. However, this can be mitigated to some extent by judicious and targeted use of the additional VSL's time input leading to efficiency; maintaining momentum, especially in more difficult or very short duration workshop environments, where considerable working group activity is required or where a working group requires intensive facilitation to move it forward. Complementary skills are in diagnostics, analysis, synthesis and integration of information. As stated earlier, the presence of a recorder can be invaluable in expediting report production and can be helpful if the recorder is sufficiently skilled to assist the VSL at stress points in the workshop.

Having set out the role of a VSL, a number of important parameters and influencing factors in team behaviour are addressed further in the following sections.

5.3 Groups, teams and team dynamics

A value study as a team-based intervention and methodology requires an understanding of the psychology, principles and dynamics of groups and teams. This section sets out the main principles and a number of selective models for working with teams in a value study.

Groups

There are numerous definitions of a *group*, for example:

- Schein (1980) defines a group in psychological terms as any number of people who interact with one another, are psychologically aware of one another and perceive themselves to be a group.
- Hellriegel, Slocum and Woodman (1988) define a group as comprising people with shared goals who often communicate with one another over a period of time and are few enough that each individual can communicate with all the others, person to person.
- Cook, Hunsaker and Coffey (1994) define a group as two or more people who regularly interact with and influence one another over a period of time, perceive themselves as a distinct entity distinguishable from others with shared common values, and are striving for common objectives.

These definitions are wide-ranging but they highlight the need for interaction and a perceptual awareness of a common identity for a group to exist. Importantly, the definitions imply individuals within a group will sacrifice their individuality for some form of collective view built around shared values, goals and objectives. There are different categories of groups, but they split down into two major types: *formal groups*, established explicitly within an organisation to accomplish a specific task, and *informal groups* emerging naturally and spontaneously, and which tend to be more socially motivated (Furnham, 2005). Formal groups can be *Permanent*, and are unlikely to be disbanded but individual membership may change over time. Formal groups can also be *Temporary*, will cease to exist at some point in time, and they will have a life cycle from formation to cessation. The difference between the two is one of longevity of existence. Equally there are primary groups, who have regular and frequent interactions with each other in working towards some common interests or tasks. Examples include a small work group and a project team. Group members usually have an important influence on members' values, attitudes and beliefs. There are also s*econdary groups* whose members interact less frequently, can often be larger than primary groups and their members have less opportunity to get to know each other well. Typically, they are less cohesive than primary groups. An example is a large committee (Kakabadse, Ludlow and Vinnicombe, 1988). In this context, a value study team is a formal, primary and temporary group.

Group dynamics

Group dynamics is a psychological and social process. A number of important dimensions have been identified that impact on group dynamics and the performance of a group (Furnham, 2005):

- The inputs to and outputs from the group process itself.
- Group member continuity and morale.

- The primary task of the group, and whether it is challenging and/or complex. This is also linked to group objectives.
- The composition and structure of the group in terms of its size and diversity. Group size impacts a sense of participation and satisfaction with the way the group is working.
- Cohesiveness, which is the sense of bonding within the group. The extent and nature of contact, the degree of interdependence of group members and also the extent of shared values has an impact on cohesiveness.
- The roles of members making up the group and its leadership, either formally or informally.
- Group norms, the emergent implicit or explicit codes of behaviour.
- The context or external environment, which comprises those factors that are outside of the group and impact its operations.
- The nature of the group dynamics itself, which are analogous to the way group processes function and operate.

The next subsection addresses working groups and teams, extending the ideas set out earlier.

Working groups and teams

The working group is an extension of the group concept, and with a closer affinity to the notion of teams, but there are important differences (Hayes, 2002; Furnahm, 2005). A working group comprises a set of people whose work keeps them in regular contact, whereas a team comprises a set of people that work together to achieve a specific task. Hellriegel, Slocum and Woodman (1988) and Cook, Hunsaker and Coffey (1994) define a team as a type of group that has complementary skills, competencies and knowledge, who act in a cohesive manner, are coordinated and are committed towards achieving a common purpose or task. They will have a set of performance goals and hold themselves mutually accountable. Thus, a team engages in collective work, has a shared commitment and a joint, coordinated effort to produce results that are more than the sum of the individual efforts.

Katzenbach and Smith (1993) focus specifically on team performance and distinguish five different types of group and team formation:

- A *'working group'* is not driven by any clear need to develop or strengthen its performance. Its function is more to enable an individual to undertake their own area of responsibility and focus more on sharing information, making decisions or coordinating practices.
- A *'real team'* is committed to a common purpose or goal, has complimentary skills, takes shared accountability for outcomes and for the approach that the team adopts. A real team will produce more than a working group in terms of achieved outcomes.
- A *'pseudo-team'* is one that has the potential to become 'real team' but lacks the coordination to achieve a common purpose. Members focus on their own areas of

responsibility and departmental/organisational unit interests. This is a team in name only.

- A *'potential team'* is one that has a sense that there is a need to improve performance, but is often held back by a lack of clarity around shared goals and purpose. Working practices that emphasise individual attainment over a shared attainment of objectives.
- The *high-performance team* is deeply committed to outcomes through a shared and ongoing responsibility for outcomes. The team will achieve stretched targets. A value study team should strive to be of this type.

Hayes (2002) has also differentiated between different types of teams but more in terms of their functions rather than performance:

- The *production or service team* is actively involved in the operational level of an organisation, with their work often characterized more by routine and maintaining a steady flow of production or service outcomes. They can be considered the front-line production workers who are directly responsible for translating inputs into outputs.
- An *action or negotiating team* comprises highly skilled individuals with clearly defined roles that come together to achieve a specific task. They are highly task focused and their individual skills contribute to the achievement of a common purpose. Task, which defines team process, is often complex, unpredictable and requires that the use of expertise is at the forefront of team functioning. External management define the task and team leadership within the team is focused on coordination and timing.
- A *project or product development team* may operate across longer time frames, which may be the case in particular with product development teams, or come together for a specific project. These teams are characterized by a mix of highly skilled technical or professional people that often have high degrees of autonomy, including over working practices.
- An *advice and involvement team* that provides organisational advice and decision-making. Typically, they contain specialists, and may operate at different levels in an organisational hierarchy. They could also be viewed as problem-solving teams. Scope is often restricted as might be autonomy, and team members will normally have other roles in an organisation.

Baguley (2002) categorises teams into what they do as 'tools' in an organisational context:

- Teams that *run* or *control* things. The purpose of this team is to run and co-ordinate activities that are typically close to an organisation's mission or purpose, and function in an ongoing manner. Examples quoted include Executive or management teams.
- Teams that *make* things. The purpose of this type of team is to create tangible outcomes and products that add value to an organisation. Examples quoted include assembly, machine shop or erection teams.

- Teams that *do* things. The purpose of this team is to create intangible outcomes or products that add value to an organisation. Examples quoted include design teams and project teams.
- Teams that *evaluate* something and then make *recommendations*. The purpose of this team is to analyse a problem or situation, come up with solutions that will introduce changes and then subsequently make recommendations. Examples quoted include task teams, audit teams and quality review teams.

Drawing these together, a value study team is one that defines, evaluates and solves value problems and challenges, develops solutions and makes recommendations for introducing change either into a design and/or on a project. The value study team, depending on the procurement strategy in place, can bring together project team members that Evolve, Run and Control activities on a project. At the commencement of a study, the value study team will have the characteristics of a secondary group; it is unlikely that not all, or any, of the team will have worked together before in such an intensive type of study on the project. As far as the VSL is concerned, in the early stages of a project the value study team is a ‘potential team’ and the role of the VSL is to ensure that the individual team members are fully functioning and performing as a team as quickly as possible for maximum effectiveness. As a minimum the VSL role has to be one of melding them into a ‘real team’ and preferably a ‘high performing team’ to ensure the best value workshop and study outcome. During the value study workshop phase, in particular, the team will be acting with advisory, negotiating and decision-making skills, which will be in evidence during full team and working group operations. A value study team must have sufficient time to become a ‘high performing team’. With insufficient time for example in a short duration/half day value workshop, as highlighted by Ellis, Wood and Keel (2005), the value study team may never move beyond a ‘pseudo-team’.

Having reviewed groups, different types of groups and teams, the next section explores the different stages in team development.

Team development

Hunt (1992) indicates that studies of teams have demonstrated two behavioural patterns that impact team development. He refers to these as task orientated and maintenance orientated behaviour. Hellriegel, Slocum and Woodman (1998) reinforce this by stating that all team members will perform task-orientated, relations-orientated and self-orientated activities:

- Task-orientated activities relate to a project, for example initiating new ideas, seeking information, giving information, coordinating and evaluating.
- Relations-orientated activities relate to encouraging, harmonising, consensus seeking, conflict resolving and integrative processes.
- Self-orientated activities are self-centred and will make themselves apparent through blocking of progress, seeking recognition, domination, and so on.

Maintenance behaviour therefore comprises relations orientated and/or self-orientated behaviour. Hunt (1992) suggests that contributors to a team will, over time, sort out task and maintenance behaviour amongst themselves in order to enable the task to be undertaken. An observation by Male in numerous simulated task centred, multidisciplinary team situations that involve dealing with real life cases also suggests that personal problem solving styles, professional background and personality interact in a complex way in problem solving situations. These observations suggest that where there is a ‘fit’ between team dynamics and the variables presented the team is more concerned with task performance. However, if there is a degree of imbalance between these variables the team will spend more time on managing itself rather than concentrating on the task. If there is a severe imbalance, usually in the area of preferred problem solving style and personality rather than professional discipline, the team can ‘lock’ into managing team processes and maintenance behaviours almost to the total exclusion of task performance.

Bringing together the views of Tuckman and Jensen (1977), Hunt (1992) Adair (1987), Hellreigel *et al.* (1998), Hayes (2002), and Furnham (2005), the development of a team is typically represented in the following stages:

- Forming: This phase is about getting to know each other. In terms of behavioural dynamics, Task Orientated behaviour is attempting to grapple with the requirements of task performance. Maintenance Behaviours are concerned with socialisation issues, overcoming anxieties and working out power relationships in the team.
- Storming: This phase is characterized by power struggles emerging. Competition and conflicts between contributors emerge and the formal leader may be challenged. The management of conflict rather than its suppression becomes essential. Polarisation of ideas can occur as can psychological withdrawal from the team. The feasibility of the task is questioned.
- Norming: This phase is characterized by a reduction in conflict and power is distributed. Rules of behaviour emerge implicitly or explicitly and the team identifies a sense of common responsibility for task performance. Task Orientated behaviour ensues in the form of the free sharing of information and the acceptance that opinions may differ, and the team searches for compromise on tasks and objectives. Maintenance Behaviours are directed towards establishing cohesion and support.
- Performing: This phase is characterized by task performance. Contributors’ roles are clearly identified, understood and accepted. A frank exchange of facts, opinions and preferences occurs. Trust is established and problem solving is free flowing; decision making occurs and the team experiences a high degree of cohesion. The team has worked out a structure to achieve the task or objective and maintenance behaviours, whilst still important, will fade into the background.
- Adjourning: This phase is characterized by the task being completed and the team disbanding. There may be signs of reluctance or regret. Maintenance will come to the fore again.

Herriot and Pemberton (1995) have been highly critical of the team development model noted earlier. They argue that *Context* determines *Task* and *Process* and hence team roles are a consequence of other more important things. It is useful therefore, when designing a value study and, in particular the workshop stage, to be clear about the organisational context within which the study is taking place, the outcomes expected and the task and objective of the study and workshop. Once understood, the consequence for team dynamics in the workshop setting can be considered. The VSL should reflect on how to take a team through the forming, storming and norming stages, and how the structure, tools and techniques of the workshop might permit these stages to develop. There is an argument that states that to only perform and adjourn is highly efficient though it may detract from good team building. Whilst the presented normative team development model is well known, and it has its detractors, it is also widely accepted that a team might well regress to earlier stages depending on what is happening at any given period within a team, and this cannot be viewed as a simple linear process. The normative model is useful for understanding team dynamics and behaviour and it allows the VSL to be sensitive to where a team is in its development and where it needs to be to achieve a successful outcome. This is developed further in Section 5.4 dealing with team management and value studies.

5.4 Implications for team management in value studies

Overview

Value studies comprising the three phases of Orientation and Diagnostics, Workshop, and Implementation are typically of short duration, often 4 to 8 weeks depending on the size and complexity of the project. Understanding team dynamics and behaviour is important at each of the three phases and aspects of this have been explored earlier.

One of the defining features of VM is the bringing together of a diversity of people across a project, representing potentially different interests, skill and knowledge sets, organisations, and from a client perspective, often different departments/work units within the same organisation. Project teams in construction are temporary formal teams that bring together the knowledge and skills of people from various professional and business backgrounds to identify tasks, solve and resolve problems in the realisation of a construction project. In developing potential solutions, they are empowered to take action within defined limits. Project teams in the construction industry have also been termed 'temporary multiple organisations' (Churns and Bryant, 1984) or project coalitions (Winch, 1988), the former label denoting the fact that project teams comprise representatives from different organisations brought together to achieve a particular task while the latter denotes that power structures will also exist within project teams between different organisational representatives.

One of the further defining elements of how a value team will operate is the study style within which it will function. For example, value studies conducted at the earlier stages of a project are likely to have much larger teams than those later in the project. Equally, the skills mix will change depending on the study style and intervention point. Value studies conducted in the early stages of a project are commonly dominated by client representatives compared to technical specialists. This is often reversed in later stages of the project. The Charette study style is challenging to manage at the Value Workshop phase due to the fact that it is both a review of previous decisions made and a look forward into the next stages of a project. The Charette value team is probably in the range of 15–25 people depending on the size and nature of the project. Furthermore, it is usually a team balanced between client representatives and those from the design team.

The selected procurement route will have an impact on the composition of the value study team particularly if it is overlaid with or has an inherent collaborative working partnering requirement. The collaborative procurement routes with early contractor involvement such as Prime Contracting, P21+ or PPP tend to require larger teams with a greater diversity of skill and knowledge mixes than projects following a traditional procurement route. For example, Prime Contracting type structures have a closer team composition and size to that of the Charette, plus key specialist subcontractor involvement.

The team development model discussed earlier can assist the VSL in designing the value study, and in particular the workshop process and agenda, the role and purpose of a particular tool or technique, its strengths and weaknesses and what it can achieve in terms of team behaviour and information elicitation, structuring and processing. This becomes important especially if the VSL needs to adjust the workshop format to suit the time available. Table 5.1 sets out the team development model and how it can manifest in a value workshop.

Subsequent sections will discuss further other factors that can affect team behaviour during the value study and the workshop phase in particular.

Table 5.1 The Team Development Model and the Value Workshop Process.

Team Life Cycle	Workshop Stage	Typical Value Study Tools and Techniques Used	Consequences for Team Behaviour and Dynamics
Forming	Information sharing	Presentations by key stakeholders; Issues Analysis; prioritisation of Issues; Time Cost Quality analysis; Project Drivers analysis; REDRESS; Client Value System Matrix	A pre-workshop meeting, and the briefing pack may assist this phase. The tools and techniques used are eliciting, exploring, structuring and restructuring information. The VSL may be challenging assumptions and invigorating the team. These are essentially information sharing techniques to relax the team and getting them to communicate information openly and frankly. The techniques provide the basic informational infrastructure around which the remainder of the workshop depends. This phase is led by the VSL.
Storming	Back-to-basics	Function analysis	Function analysis is a very challenging technique and takes a team back to basics by asking and answering the questions of why, what and how. The team is placed under considerable pressure at this point, especially as a FAST diagram is structured. It is at this stage that major differences of view might emerge and need to be debated. Depending on the sensitivities resulting from

(*continued*)

Table 5.1 (*Continued*)

Team Life Cycle	Workshop Stage	Typical Value Study Tools and Techniques Used	Consequences for Team Behaviour and Dynamics
			the analysis, it may be the team reverts to the Forming stage prior to progressing. Value mismatches are explored in a VE study. The conclusion of this stage is that a team knows what value challenges need to be resolved. This phase is led by the VSL.
Norming	Innovation and creativity	Brainstorming ideas, idea selection	The team has accepted the need to move forward quickly, resolve value mismatches, define the shape of the future project and brainstorm ideas, options and solutions to achieve this. Ideas are prioritised and restructured into options for further development. This phase is led by the VSL.
Performing	Development and evaluation	Working groups	This stage of the workshop is characterised by small working groups developing and working up prioritised options, including associated risks. Brief plenary sessions are often used to share information and peer review evolving solutions. This phase of the workshop is likely to be completed with detailed team presentations that are peer reviewed by other working groups and the VSL. This phase will be co-ordinated and plenaries led by the VSL.
Adjourning	Action planning	Identification of next steps; Develop Action Plan; Review and close	Having identified the options/ solutions that are taken forward into the project, this phase will discuss the next steps and will be completed by the development of an Action Plan. The VSL will also undertake a very brief review, noting when the Action Plan will be sent out and when the draft report will be circulated for comment. The workshop will be closed by the VSL, typically thanking everyone for their contribution. This phase is led by the VSL.

Team leadership

Formal leaders can be those that are enforced upon the team or are appointed to lead the team. In formal work teams, hierarchy, authority and managerial style affect team structuring (Hunt, 1992). There may be a formal leader appointed to manage a team but sometimes an informal leader(s) may also emerge in addition to the formal leader. Informal leadership tends to grow over time and usually reflects a unique ability in an individual to help the team reach its goals. Occasionally, depending on the balance between the perceived expertise of the formal leader and those who perform task centred and maintenance behaviours, formal and informal leaders may clash. Team norms, the subject of a later section, will have a very strong guiding influence on who is ultimately recognised as the leader of the team.

In a value study the VSL becomes the formal workshop leader. However, that position has to be earned very quickly given that within the workshop there will be a number of other formal leaders representing their own organisational interests as well as those of the project under study. There may be instances where one of those formal organisational leaders can challenge the leadership role of the VSL. In the context of the value workshop, they are taking on the role as an 'informal' leader. For example, a challenge that can occur early in a workshop process is the legitimacy of the value study, and by implication the role of the VSL in running the study. The perceived credibility of the VSL in terms of skills, experience and respect is vital for being accepted as the formal leader of the workshop team.

Team coherence

Team coherence or cohesiveness has been mentioned earlier. It is the bond that binds the team together and reflects the strength of the members' desire to remain in the team and their commitment to it (Hayes, 2002). This will depend in part on the frequency of team meetings, the importance of attaining workshop objectives through task performance, and the degree of compatibility between team goals and individual member's goals. Where team members have a strong desire to remain in the team and personally accept its goals this leads to highly cohesive and possibly powerful teams.

It is the role of the VSL to try and establish a high degree of cohesiveness from a workshop team as soon as practicable. This can be achieved through effective participant selection, workshop planning and workshop design.

Team norms

As noted earlier, team norms are the unwritten and unspoken rules and patterns of behaviour that are accepted and expected by members of a team (Furnham, 2005). They emerge from team interactions and the shared expectations. They will either overtly or covertly control member behaviour in a manner that members believe to be necessary to help them reach their goals. Team norms take time to emerge and therefore the longer the team is operating together the more likely that strong norms will develop. Hunt

(1992) contends that the degree of conformity to team norms will depend psychologically on:

- A person's desire for the team to accept his or her membership – acceptance.
- A person's desire to avoid displeasure, punishment or isolation from the team – pleasure.
- A person's belief that team norms are a reflection of personal views – congruence.
- A person's ability to handle the doubt that they may not be able to stand alone – isolation.
- A person's belief in team goals – agreement.

The development of team norms also operates in the context of the structuring present within a team.

The development and management of team norms forms part of the team dynamics of a value workshop. Each member of the value team will have developed over time their own personal expectations of behaving in a team and what norms to expect when attending a workshop. Given that value teams in a workshop setting only exist for a relatively short period of time, the VSL must set out during the early stages of the workshop what is expected of the team and individuals in the team. Equally, the choice and order of particular tools and techniques may assist the development of workshop norms. Finally, the VSL may also need to start laying the ground rules for workshop norms as part of discussions during any pre-workshop interviews and within the briefing pack. One issue that the VSL also needs to consider in managing a workshop is that the VSL has to remain outside of the norming process, as well as being accepted as part of the team process. This is a delicate balancing act, and if the VSL uses his or her background disciplinary skills within a workshop the psychological distance is likely to be reduced considerably as they become part of task resolution activity.

Team building, decision making and group think

Hayes (2002) has set out a useful approach for considering building a team. The first and main consideration is to create a strong sense of belonging within the team, that it is a cohesive unit with a collective sense that it is working as a team rather than a group of individuals. Second, it is important to understand and take account of the wider organisational context within which a team will be working. Hayes notes five common approaches to team building:

- The *interpersonal approach*, which focuses on developing high levels of a shared interpersonal awareness between team members of their personalities, experience and how communication can be improved within the team. The key is an open, shared and frank expression of relationships, areas of conflict or disagreement, and any hidden agendas in order to develop mutual trust. In a value workshop the VSL should endeavour to create this climate from the outset.
- Focusing on *roles and team norms* by clarifying role expectations, the norms of the team as a whole and the shared responsibilities amongst the team members.

The focus is much less on the interpersonal aspects of team and more on what people do and need from others to help them achieve the team's objectives. A focus on roles and team norms involves, therefore, an individual understanding their positioning, role and responsibility within the team. Part of the value workshop design is to generate team norms as quickly as possible as noted earlier and also create shared expectations – the use of presentations in the early stage of the workshop, the Issues Analysis technique, and the use of frequent plenary sessions will help to achieve this as an ongoing process.

- Developing a clear understanding of *values*, and associated aims and a shared vision. The thrust of this approach is for a team to understand the underlying shared values and principles around which it will operate. To work effectively it requires the team to develop a shared vision and purpose of what the team is to achieve. This approach tends to work well with teams that are established and work together for longer periods of time. In a value workshop, the use of FAST diagramming establishes the shared vision of the project, and other techniques such as the Issues Analysis and Project Drivers analysis will also help to explore, shape or confirm the project's vision or mission.
- Focusing on the team's *task* and how each person can contribute to achieving that task through the use of the skills available to the team. There is considerable emphasis on information sharing, a realistic analysis of the resources available and the practical steps to achieve the task. The task is the overriding concern and the team explores the challenges it faces, and the implications of achieving the task explicitly. This can be assisted by the team working through the range of problems that are embedded in high level challenges and tasks to be achieved and breaking this down into prioritised goals. Typically, as part of a value workshop, the VSL will establish the high level value challenges as part of the prioritized Issues Analysis. This will be further refined using other techniques such as Project Drivers, Strategic Timeline, Time/Cost/Quality analysis and the Client Value System Matrix.
- A *mixed* approach that uses each of the preceding approaches to address the specific context and situation the team is facing. Hayes proposes this as the *social identity* approach to team building, and the fact that each individual belongs to different social groups, which helps shape their social identify and behaviour (Hayes, 2010). This approach is based on the underlying premise that people classify things into groups they work or interact with, and derive a sense of self-esteem from group membership. This approach is a deeper and more fundamental way to building strong and cohesive teams. The underlying mechanisms for this are, first, to create a strong sense of unity and belonging amongst the team members. Second, to create a strong climate and sense of mutual understanding as to how skills, capabilities and tasks contribute to what is to be achieved by the team as a whole. Third, engender a sense of worth and pride in the outcomes and the contribution they make. As an ideal, it is this approach that the VSL should be aiming for in a value team. By planning the workshop process, agenda, tools and techniques appropriately, this could be achieved, especially where the VSL stresses the importance of individual skills, expertise and knowledge contributions that each person brings to the successful outcome of the value study.

In an organisational context, teams also have to not only be built and continue to operate, but they also have to reach decisions. There are numerous models of team decision-making processes (Furnham, 2005); however, typically these will cover the following:

- *Identify and delineate the problem* usually through an extensive information search.
- *Define the objectives* or *outcomes* from the decision and what is trying to be achieved.
- *Decide how to make the decision*, that is, what method is to be used.
- *Generate alternative solutions*, which should include as many as possible to ensure that nothing is overlooked.
- *Evaluate the solutions*, which usually involve using a set of criteria to make the evaluation.
- *Make the choice, or choices*.
- Undertake a *follow-up*, and *consequences analysis*, in other words was the decision implemented appropriately, what worked well or did not work, what might need to be adjusted.

This aligns well with the conventional Work Plan stages, and in effect, as noted by Male and Kelly (1999), the Work Plan mirrors and encompasses a good problem solving and good decision-making process.

A phenomenon called 'group think', a term coined by Janis (1972) and discussed in more detail by Janis and Mann (1977), can appear as the team development process proceeds. It tends to occur in highly cohesive, conforming teams and depends upon the balance of expertise, power distribution, problem solving styles and leadership behaviour coupled with the degree of team isolation from outside influences. The characteristics of group think are:

- Task-orientated behaviour is terminated, and there is a disengagement from maintenance behaviour.
- There is an illusion of invulnerability leading to over optimism and extreme risk taking.
- Team rationalisation without revalidating assumptions prior to taking action.
- An absolute belief in the moral integrity of the team.
- Stereotyping of outsiders.
- Uncompromising pressure to conform to team norms, uncritical thinking and self-censorship and an illusion of unanimity.

Hunt (1992), based on his own observations, adds an additional three characteristics to the list:

- A belief that all contributors have expressed their views and that the outcome results from a consensus of divergent views.
- A concern for any answer regardless of its merits.
- A failure to identify expertise among contributors.

It is the VSL's responsibility to ensure that a value team does not adopt 'groupthink' in a workshop. One way to ensure this does not happen is to act as the 'Devil's Advocate' and challenge assumptions, mindsets, solutions and outcomes as a matter of course, and also link these back to project and organisational realities outside of the workshop process.

To summarise briefly, a primary function of the VSL is to build a value team from the outset. This is achieved through careful workshop planning in particular. Unfortunately, the VSL does not have the luxury of a long period to do this, and it has to be achieved within a very short time once the workshop has commenced. The vital role of workshop planning in the Orientation and Diagnostics phase cannot be underestimated.

Team membership, roles, skills and team composition

The membership and composition of the value team will influence behaviour, dynamics and outcomes during the Workshop phase. This is a function of the similarities and differences within the team membership. In this context each team member has a set of expectations about how they as an individual will behave. They will also hold expectations, beliefs and assumptions about how other people will behave. These two sets of impressions combine to give an individual a situational view of the world, termed a role (Hunt, 1972). Hayes (2002) notes that these situational views form part of the personal constructs, or mental models, each individual has built up over time and modified for the work situation. Constructs are reflected in how individuals behave.

Belbin (1981, 1993) is probably the most well-known advocate of team roles. He defines a team role as 'a tendency to behave, contribute and interrelate with others in distinctive ways'. The importance lies in the characteristic behaviour of one person in relation to another or in relation to the progress being made by the whole team. Belbin identified a series of discrete team roles and has also developed a psychometric test whereby an individual's underlying personality traits and behaviour can be determined, allowing team matching. The nine personality traits are combined into the following:

- Action orientated roles:
  - Shaper – challenging, dynamic, thrives on pressure, overcomes obstacles.
  - Implementer – reliable, disciplined, efficient, turns ideas into actions.
  - Completer finisher – conscientious, anxious, seeks errors and delivers on time.
- People orientated roles:
  - Coordinator – confident, seeks goals, delegates and promotes decision making.
  - Team worker – cooperative, diplomatic and averts friction.
  - Resource investigator – extrovert, enthusiastic, communicative, seeks opportunities and contacts.
- Cerebral role:
  - Plant – creative, imaginative and unorthodox in solving difficult problems.
  - Monitor – strategic, seeks all options and evaluates accurately.
  - Specialist – single-minded, dedicated, providing knowledge and skills within a narrow focus.

Belbin's basic premise is that teams should be balanced or at least aware that if, for example, there is no completer finisher in the team then the probability of completion on time is remote. Belbin's work on team roles, whilst often used by trainers and management consultants, is not without its detractors (Furnham, Steele and Pendleton, 1993; Furnham, 2005). In a value workshop situation it is difficult, if not impossible, to engineer team composition based around the types of roles that Belbin has outlined. The important thing is that the VSL has to be aware of role characteristics within teams and the consequence for team dynamics.

Hayes (2002) has suggested that considering team skills is an alternative approach to considering team roles. He argues that a balanced set of skills is required within a team. Building on the work of Katzenbach and Smith (1993), Hayes argues that these skills can fall into three main groups:

- *Expertise* is concerned with technical or functional skills, and requires a certain type of expert knowledge. In a value study this is invested in an individual based on their professional background, and comes to the fore in a value workshop.
- *Problem-solving and decision-making skills* are the source of creative and innovative ideas, and taking these through into a decision outcome. In a value study this is more of a generic skill set that arises from individual, professional and intrateam activity. It is the role of the VSL to ensure this happens effectively in the value workshop.
- *Interpersonal interactive skills* involve the ability to communicate, get on with people, and also resolve conflicts when they arise. In a value study context, as a learned behavioural skill, this skill set has the potential to create a positive workshop climate or conversely cause considerable difficulties. The VSL will need to use a complex combination of cognitive, interpersonal and 'doing' skills to manage this effectively throughout a value workshop.

Expertise, problem solving and decision making skills relate to task behaviour rather than interpersonal interactive skills. The latter relate more to maintenance behaviours. The choice of particular team members for a value study is more determined by expertise, job function and related skills than by individual personality traits. The VSL needs to take this into account when designing and planning the value study and, in particular, the workshop process. When designing a study, the focus of attention for the VSL is 'hard' team skills of expertise, job function and organisational role, followed by problem solving and interpersonal skills, and finally team roles. However, during the workshop itself, that focus may well shift to the 'soft' team skills that comprise the interplay of interpersonal skills and team roles depending on emerging team dynamics, issues and topics under discussion.

Selecting team members

Members of value teams should be chosen for their skills, ability to contribute information and enable or undertake decision taking. The ACID test is a useful aid to selecting team members:

- Authorise: Include in the workshop phase those who have the authority to take decisions during the value workshop process.

- Consult: Include in the workshop phase those who have to be consulted prior, during and after the value workshop process and without whose consultation the workshop would be suspended, or fail to achieve its purpose and objectives.
- Inform: Exclude those who merely have to be informed of the outcome of the value workshop and do not need to attend the workshop phase.
- Do: Include those in the value workshop who have to translate the outcomes of the workshop into action.

In selecting members of the team, multiple membership of one department or organisation should be avoided wherever possible to ensure a cross section of views is sought. For example, it may be unhelpful to have three architects plus one representative of each of the other professions of the design team. Similarly, three members of a finance department might dominate a team with one member of each of the other departments of the client's organisation. However, depending on how the VSL intends to structure the workshop process given the size of the team, it may be necessary to have an element of duplication of functions and skills if workshop outcomes requires multiple and/or parallel working group activity. This typifies the situation of a Charette, where VE and VM options may be developed in parallel working group sessions, require thinking through, working up and evaluating.

Team size

Team size affects team performance. In a value study it is one of the more obvious parameters that needs to be handled. Factors that will affect team size in a value workshop will include: the intervention point in a project – earlier studies tend to have larger teams during the workshop phase, and later interventions smaller teams; the procurement strategy, with collaborative routes tending to have larger teams due to a wider involvement of supply chain organisations and project size and complexity, with higher value and higher complexity projects tending to have larger teams due to the number of stakeholders involved. The VSL needs to consider how to handle large teams during a value workshop, and there is a danger that team size can creep up without a robust review of the role and skills that each member will bring to the workshop phase.

When confronted with large teams, it is the authors' experience that it may be necessary to consider appointing additional support for the VSL only during the workshop phase by using other externally appointed assistant VSLs (AVSLs). Examples of this situation are in Chapter 7 Case Study 7 – Social Housing, and with case studies presented in Chapters 8 and 9.

Furnham (2005) has summarised a number of issues around team size. His work has been extended further in Table 5.2 in the context of value studies.

The size of an effective team can range from two members to an upper limit of about 16 members, although 12 members is probably the largest size that allows each member to interact easily face to face (Hellriegel, Slocum and Woodman, 1998). Optimally, the team size is between 6 and 10 people (Hunt, 1992). In some circumstances it is necessary to subdivide a large team to form a subteam of between five and seven members to

Table 5.2 Effects of Team Size on VM Studies. *Source*: Adapted from Furnham (2005) Table 10.3, pp. 486.

Table Key: Value Workshop Management: VSL = Value Study Leader; 2 × VSLs = second VSL appointed; AVSL = Assistant Value Study Leader – value workshop phase only					
	Group or Team Size				
Category/ Dimension	**2–7**	**8–12**	**13–16**	**17–50**	**Commentary for Value Study**
Demands placed on VSL	VSL = Moderate	VSL = Moderate to High Moderate = 2 × VSLs	High = VSL Moderate = 2 × VSLs	Very High = VSL AVSL = Moderate	Demands on VSL will depend on whether two VSLs are also involved in the study. The lower value operates if a second VSL is present.
Perceived psychological distance between VSL and team members	Moderate	Moderate	High	High = VSL AVSLs = Moderate	The assumption is that team cohesion will be greater the smaller the team, and require less active VSL intervention. Cliques are likely to form with larger teams and require greater VSL intervention.
Level of direction required by VSL	Moderate	Moderate to High	High = VSL Moderate = 2 × VSLs	Very High = VSL AVSL = Moderate	With increasing team size the VSL will need an increased level of intervention due to the likelihood of cliques and hence probability of fragmentation. The direction is maintained by using plenaries.
Team Members					
Tolerance of direction from VSL	High	High	Moderate to high	Moderate to high	The larger the team the more likely cliques will impact team dynamics and informal leaders emerge.
Domination of group interaction by a few team members	Low	Low to moderate	Moderate to high	High to very high	The smaller the team, the easier it is for the VSL to maintain the involvement of other members and also restrain the impact of informal leaders.

Table 5.2 (*Continued*)

Table Key: Value Workshop Management: VSL = Value Study Leader; 2 × VSLs = second VSL appointed; AVSL = Assistant Value Study Leader – value workshop phase only					
	Group or Team Size				
Category/ Dimension	**2–7**	**8–12**	**13–16**	**17–50**	**Commentary for Value Study**
Inhibition of participants by team members	Low	Low	Low to moderate	High to very high	The larger the team, the greater the tendency for individuals to refrain from speaking out. Using working groups throughout is advisable for large teams.
Team Process					
Need for formalisation of rules and procedures	Low	Low	Moderate	High	The larger the team, the increased need to standardise the workshop process.
Time required for reaching judgment decisions	Low to moderate	Moderate	Moderate to high	High to very high	The larger the team, the wider the diversity of views that need to be integrated and/resolved.
Tendency for subgroups to form within the team	Low	Low to moderate	Moderate to high	High to very high	The larger the team, the greater the incidence of cliques forming and informal leaders emerging. The use of working groups supported by plenaries mitigates against this.
Examples of this team size within a value study	VE Teams; Contractor bid teams.	VE Teams; Some VM teams; Contractor bid teams	VM Teams and Charettes; Partnering and supply chain teams; Asset management studies, Programme studies	VM Teams and front-end studies + Charettes; Partnering and supply chain teams; Asset management studies, Programme studies	These are typical examples of teams encountered by the authors in practice.
Team management required for Value Study	Typically 1 × VSL	Typically 1 × VSL but also 2 × VSLs; use of plenaries	Greater incidence of 2 × VSLs; high use of plenaries	1 × VSL or 2VSLs: plus also AVSLs, very high use of plenaries	These are examples of how the authors have managed different team sizes.

consider specific matters in greater detail. In a value study this is normally undertaken using working groups.

It should be noted that workshop value teams tend to be large (18–20) at the front end of a project and very rarely are below 10 members. A Charette, in particular, would comprise key members from the client organisation, say six to eight in total, plus perhaps a facilities manager, architects, cost consultants, structural, mechanical and electrical engineers, project manager, construction manager, and depending on the procurement route, perhaps key members from the contractor and the contractor's supply chain, say four or five in total. This brings the team to a minimum of 19. The largest workshop team the authors have operated is close to 100 members on a very politically challenging and wide ranging business review across a significant number of local authorities. From the outset, the workshop had to be operated with small working groups, multiple plenaries and multiple AVSLs. In contrast, depending on the task, a value engineering study workshop can be small, often not exceeding six to eight members.

5.5 Value workshop management skills

During a value study, the VSL acts in the role of value workshop facilitator and process manager. The VSL is also a formal leader whose presence can frustrate the normal development of a team if that person does not understand fully the dynamics of teams such that the forming, storming and norming stages described earlier could be negated. In the context of a value study a skilled workshop facilitator can efficiently manage a temporary team so that maintenance behaviour is minimised and task behaviour is maximised. However, from a project management or organisational perspective, it is important that the leadership roles of the VSL, project manager and/or directors, sponsors or other types of manager are recognised and respected in a workshop setting. It is highly likely that members at a value workshop may not have met before, and depending on the project procurement strategy adopted many of the client representatives are also unlikely to meet the design and construction team formally again.

Facilitation skills are an important attribute of the VSL in conducting a value workshop. In a workshop setting, there are no set rules on what type of person makes an ideal facilitator (Cameron, 1998). For example, introverts appear to make good facilitators as well as extroverts. However, a common feature of most workshop facilitators is that they have self-selected themselves for that role and gain enjoyment from it. There are, however, some practical aspects regarding the sourcing of workshop facilitators and some generally accepted rules.

Facilitation defined

Facilitation involves the controlling and leading of a team through a process that uses analytical, arbitration, guiding and influencing skills. Facilitation is distinguishable from chairmanship in a workshop setting such that the facilitator is not a member of the team, contributes nothing more than facilitating and information management skills, has no decision-making power, has no vote and certainly has no casting vote. Their work is not recorded in the final report of the value study. The facilitation work therefore becomes invisible once the value study is complete.

Value workshop management styles

The VM benchmarking study (Male *et al*., 1998) highlighted three distinct value workshop management styles operated under the banner of value study practice, including the role of facilitation. These styles were defined as

- Workshop management Style 1: Facilitate a workshop only. There is no Orientation and Diagnostics phase; there is a Value Workshop phase and the Implementation phase is likely to involve a report.
- Workshop management Style 2: Facilitate a workshop with some advanced preparation. There is a very truncated Orientation and Diagnostics phase; a Value Workshop phase, and the Implementation phase will involve a report.
- Workshop management Style 3: Facilitate a workshop with full preparation prior to the workshop. There is an extensive Orientation and Diagnostics phase; a Value Workshop phase, and the Implementation phase will involve at least a report.

These workshop management styles are closely linked to the design of a value study overall. Each style will be discussed in turn.

Workshop Management Style 1: Workshop facilitation only

Style 1 assumes no preparation on the part of the VSL, who professes no knowledge of the subject to be discussed and relies on the client to choose the value study team. In a strict sense, this style only involves turning up at a workshop and facilitating it. In this situation the opening technique is likely to involve inviting issues from the team and/or inviting presentations from those team members who believe that they have key information. Following the discussion of issues, the facilitator would:

- Summarise the information and gain team consensus on the problems to be addressed.
- Configure the problems in a form conducive to the generation of innovative ideas.
- Direct an idea generation session.
- Assist team members in the selection of ideas for development.
- Direct team members in the development of the selected ideas.
- Conduct a presentation session following which the best ideas are taken forward for further development.
- Record the workshop proceedings and write a report.

Under Workshop Management Style 1 the VSL is relying totally on facilitation skills for a meaningful workshop. The absence of a key team member and/or vital information from the workshop may result in the full potential of the workshop not being realised. Also, the lack of sufficient project knowledge by the facilitator could result in a lack of focus and an inadequate agenda. However, it is inexpensive.

Workshop Management Style 2: Workshop facilitation with some advanced preparation

Under Style 2, the VSL prepares for the workshop by holding a pre-workshop meeting. This allows some influence on the selection of the team for the workshop in that any missing key members can be identified. The prime objective of the pre-workshop meeting is to ensure that all information required for the workshop will be available and that the main issues will have been identified and perhaps prioritised. Having held a pre-workshop meeting, the VSL will conduct the workshop in a similar manner but with the confidence that the main issues have been identified, that the agenda for the workshop is appropriate, and that key team members and all information will be present at the workshop.

The advantage of Style 2 is that it is still relatively inexpensive, and the workshop can proceed with a set of prioritized issues established. It can work well for small teams, relatively straightforward or relatively repetitive projects where hidden agendas might not be so prevalent. It has the potential for commencing the team building process. There are a number of disadvantages. First, with large teams it would appear inefficient to assemble the team for a premeeting, and if a representative group is selected there are no guarantees that all the issues will have been identified and prioritized appropriately from different stakeholder perspectives. Second, depending on who attends the premeeting, it is unlikely that sensitive issues or hidden agendas will emerge. Third, the VSL may not have the opportunity to explore issues in depth prior to the workshop commencing that occur with interviews.

Workshop Management Style 3: Workshop facilitation with full preparation

Style 3 involves the VSL in several preworkshop meetings or interviews with the client, key stakeholders and members of the design team. The VSL may, as a part of the information gathering exercise, review all available documentation, including strategic and project briefs, the business case, cost plan, drawings, and other relevant documentation, and may conduct a post-occupancy evaluation of an existing facility occupied or owned by the client, or another similar project. During the Orientation and Diagnostics phase, the VSL will begin to identify the issues and any mismatches in information received and to understand any hidden agendas. The membership of the team is fully discussed with the sponsoring client, ideally to restrict multiple representations from one unit wherever possible, and add any stakeholders perceived to be useful to the workshop process. Having undertaken the pre-workshop activity described, the VSL will have greater confidence that the main issues have been identified, the agenda for the workshop is appropriate, and that key team members and all information will be present at the workshop.

The advantage of this approach is that the VSL will have had an opportunity to explore key information and any information mismatches in confidential interviews. The authors' experience is that those interviews are highly likely to be open, frank, and will uncover sensitive information. The VSL can also commence the team building process by explaining the workshop process in meetings and interviews. There is a high probability that the VSL can move forward into the workshop with confidence that all of the key issues have been identified and this helps to shape the workshop process significantly. The main disadvantage is one of cost, although this has to be balanced with the value this style can bring. A further disadvantage that Style 3 will take longer than Styles 1 and 2, and to make the process more time efficient, it may require the use of an additional VSL.

5.6 Conclusions and lessons from practice

This chapter has presented theories of groups, teams and team dynamics, debating small team (common in value engineering studies) and big team workshop management (common in VM, Partnering and Supply Chain Value Studies). That the latter are more challenging to manage is without doubt, and the important thing is to undertake the Orientation and Diagnostics phase in sufficient detail such that surprises, in terms of either team member behaviour or hidden agendas, are mitigated during the value workshop phase. Three styles of workshop management have been distilled and presented. The authors' experience of running value teams has been presented. A value team development model has been presented that integrates the theory of team development, with the stages of a workshop and the typical tools and techniques that can be used and their consequence for team working.

Value studies involve consideration of team dynamics at each of the different phases of a value study and facilitated team activities during the Value Workshop phase. This chapter has presented and summarised theory in respect of groups and teams. It has outlined characteristics and methods for the management of value teams in a workshop environment. It has been stated that the choice of the individuals for the value team is more related to job function, role, skills and expertise than to individual personality traits, and this is an important factor for the VSL to bear in mind. More importantly, however, is the VSL's strategy for the value study and the value workshop phase in the context of the personalities present. Figure 5.1 sets out the three phases of a value study and implications for team management.

The operation of teams and team behaviour in the workshop setting has proven to be one of the key challenges in a value study. Observations from the authors' practical experience on teams are as follows:

- Discussing with the study sponsor the structure of the team and team skills is vital in the initial briefing/orientation meeting. That dialogue should include the sponsor's thoughts on who should be attending the workshop, the likely size of the team, the VSL's initial thoughts on attendees from prior experience, and also workshop duration and how the skills of the team members would be used. Those initial thoughts would be revisited as the Orientation and Diagnostics phase develops, but are typically frozen once documentation has been reviewed and initial interviews conducted. Wherever possible the VSL should reserve the right to add to the workshop value team if subsequent circumstances during the Orientation and Diagnostics phase dictate.
- Interviews are very useful for not only fact finding on the project under study but also for the VSL to consider how individuals might work in the value team and during break out working group sessions. During interviews it is also useful to outline to

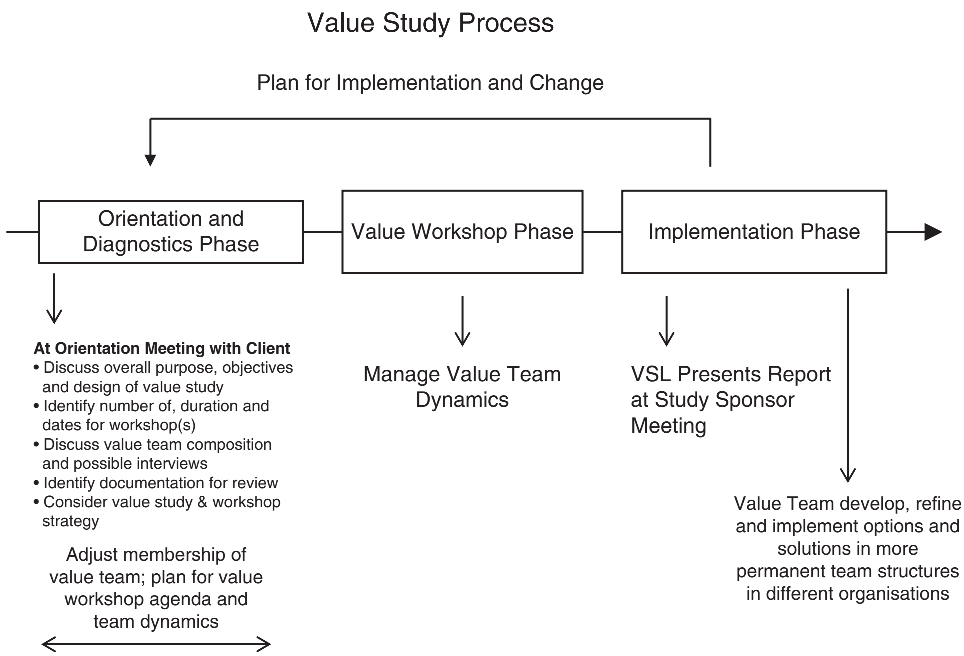

Figure 5.1 The impact of team dynamics on a value study.

team members how the workshop might operate, and to potentially initiate a dialogue on what might need to change in a project or in a design from a stakeholder perspective. This will act as a preliminary assessment by the VSL of the perceptual and psychological gap that has to be closed across participants during the value workshop process – termed here the 'value gap'.

- The planning of team working is a very important consideration in the Orientation and Diagnostics phase. Considerable time will be spent on working how best to structure an agenda and workshop team to ensure study objectives are achieved. The composition of working groups will also be considered during workshop planning.
- The authors have found that plenary sessions – short 5 min presentations at key points in the value workshop from each of the working group on emerging thoughts – are a useful mechanism to maintain control of the workshop, maintain direction and momentum, and continue the information sharing process such that there are no surprises when the final workshop presentations occur on solutions and options going forward into the Implementation phase. Plenary sessions also help a value team to coalesce quickly towards a consensus on the appropriate way forward.
- It is the area of team dynamics and the emergence of previously unknown information, or the presence of hidden agendas that come out into the open unexpectedly, that are the most likely incidents to disrupt a value workshop process. The authors have found that the combined use of confidential interviews and subsequently the Issues Analysis technique at the start of the value workshop has the best chance, but not always, of reducing this impact. There have been instances where hidden agendas have emerged unexpectedly and the value workshop process adjourned briefly to

permit the VSL to have one-to-one dialogues or to readjust the workshop agenda and process.

- Brief presentations by value team members at the start of the workshop is often a useful mechanism to permit key stakeholders to impart important information from their perspective, the design team to explore the design development to date, and the contractor to present contract programme issues. Presentations relax participants and also permit individuals to make explicit their view of the project for future discussion. This flows easily into the Issues Analysis. This aspect of the workshop does, however, require careful management by the VSL to ensure presentations remain brief, focused and do not generate prolonged debate.
- The authors have used, in more 'politically charged' value workshop settings, a brief presentation from top management to set the scene and the climate of the workshop, and subsequently to return at the end of the workshop process to receive and comment on working group presentations. This generally adds an additional important momentum to the workshop process by reinforcing the importance of the project to the executive of the client.
- Where working groups are involved at different points of the value workshop it is important to consider whether multiple assistant VSLs are required, or whether a working group has the skills within it to run as a self-managing group. The authors have used, at times, more than one AVSL to manage the overall workshop process and support and intervene in working group activity when team dynamics require.
- For very large team workshops – typically 20 to 30 attendees – the use of multiple AVSLs is essential. The VSL has to consider and balance carefully the cost of this versus the impact on workshop dynamics of not having them present. The authors have run a few major stakeholder workshops with the team size range of 50 to 100. The creation of working groups from the outset is vital, including how they will interact with each other. The key role of the VSL is one of workshop leader, managing multiple AVSLs and keeping the overall value workshop on track, providing a sense of forward direction and momentum.
- Value Workshop Management Style 3 is the preferred approach by the authors, but they have also adopted styles 1 and 2 when required, typically due to time constraints or cost.

In conclusion, a value study is not only about facilitating a workshop. It comprises three phases and understanding team behaviour, development, dynamics and management are underpinning skills that are required throughout a value study. Skills of facilitation are only one set of skills required in a value study, but they are one of the more important skills during the value workshop phase.

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6 Innovation, Implementation and Benefits Realisation

6.1 Introduction

In Chapter 4, the Issues Analysis is described as an opening technique, and Function Analysis as a closing technique. In a similar way, innovation, comprising the techniques of creativity and judgement, is an opening activity, and evaluation and development are closing techniques. Innovation is defined here as the generation of an idea for potential use, and in a value study is the stage following function analysis. It involves answering the question 'how can this function best be achieved?' Innovation comprises two integral steps: the generation of the idea (creativity) and a judgement as to whether the idea is of potential use. Innovation seeks technical solutions. In this context, 'technical solution' is the operable way of meeting the function and may be a product or a process. The technical solutions that have the highest probability in meeting the function will be evaluated and subsequently developed. In the process of innovation and evaluation an audit function is introduced to ensure that the technical solution satisfies the benefits originally identified for the project as a whole. This latter stage is called the benefits realisation.

The cognitive ability of people engaged in problem-solving by innovation is variable. A discussion of cognitive psychology is well beyond the scope of this book, which accepts that people have different abilities in the gaining of knowledge through thought, experience and the senses. Studies in innovative problem-solving particularly those by a team describe methodologies that heighten knowledge acquisition by stimulating the senses, enhancing the thought processes and maximising access to the experience within the team. Representative samples of these methodologies are discussed in this chapter.

Judgement and evaluation techniques used in value study workshops tend to be multistage sifting processes with increasing degrees of sophistication and consideration at each stage. Characteristic techniques are debated.

Benefits realisation comprises an audit process that considers developments at each project progress stage against the original planned requirements to ensure that the

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

benefits identified in the business case are embodied in the developing project. Benefits realisation has two levels of audit:

1. To ensure that the governance procedures for the project described in the business case have been and are being adhered to.
2. To ensure that the developing design of the project is compliant with the value system for the project as defined by the stakeholders.

The process of innovation (comprising creativity and judgement) is an activity undertaken as a part of the workshop stage of a value study. Evaluation may be undertaken as part of the workshop or alternatively can be undertaken post-workshop in which case idea champions are tasked to investigate the ideas further and report back to an implementation meeting. Benefits realisation is an ongoing activity undertaken at key stages during the development of a project and most importantly as a part of the post project review after it is absorbed into core business and is in use.

6.2 Innovation

Innovation is the response to a requirement to change something by introducing new methods, ideas or products. Innovation requires two steps: creativity and judgement. Creativity is a mental process that is concerned with sifting, manipulating and reconfiguring information which, when combined with imagination, leads to the generation of original ideas. The process is often subliminal but one that can be stimulated consciously by tools, techniques and procedures. The creativity stage in a value study is a particular form of creative thinking since it is a response to the question 'how can this function best be achieved?' where the answers being sought are potential technical solutions. Judgement is a decision exercise that identifies the best solution to the functional requirement by analysing the ideas generated during creativity. The characteristics of the creativity stage in any value study are as follows:

- Idea generation by the value study team in a spontaneous, free-thinking environment facilitated by the VSL.
- To suggest many ideas without restriction to number.
- All consideration or judgement of any idea is suspended until the creativity stage is complete.

The primary characteristic of the judgement stage is to efficiently reduce the large number of ideas generated during creativity to a manageable number conducive to processing through the evaluation and development stages. The process is illustrated in Figure 6.1.

Creativity – Brainstorming

Structured brainstorming is the technique most commonly used during the creativity stage of a value study.

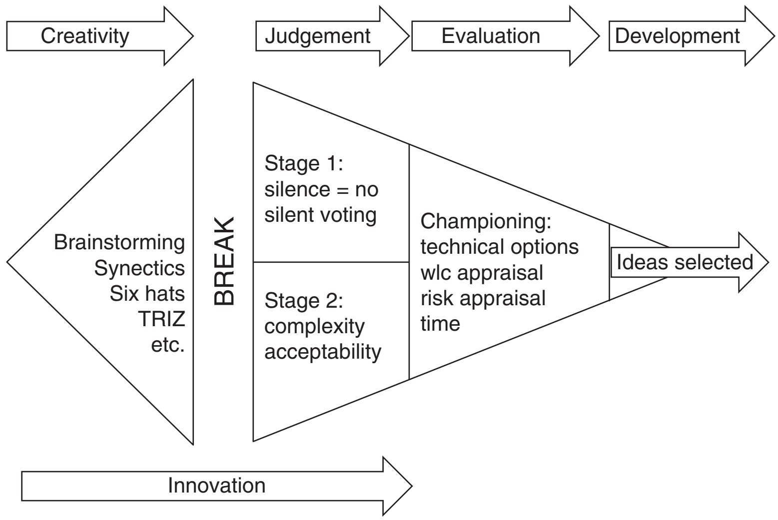

Figure 6.1 The innovation, evaluation and development process.

Brainstorming is accredited to Alex F. Osborn who used the technique in the late 1930s in connection with his work as an advertising executive. Osborn (1963) subsequently developed the technique more formally and authored several books on creative thinking. Justice and Jamieson (1999) and Wilson (2010) suggest a number of procedures for conducting successful brainstorming sessions where the team has been gathered for the purpose of brainstorming under the guidance of a workshop facilitator that may not be known to them. The advantage of conducting a brainstorming session as part of a value study is that by the time brainstorming is reached in the value workshop agenda the team has coalesced under the guidance of the VSL. Furthermore, since the team has generated the functions that are to be the subject of brainstorming, the team is familiar with the subject matter. The following guidance for conducting a structured brainstorming session as part of a value study takes this important factor into consideration:

- Brainstorming is a team activity facilitated by the VSL.
- The size of the brainstorming team should not exceed 12 (see Chapter 5 on team size). If the value study team exceeds 12 then it is advisable to break down into smaller cross discipline teams facilitated by a member of the team. The VSL becomes an overall manager of the process. Teams brainstorm in isolation but combine to collate and add to the ideas generated. This form of breakdown is sometimes referred to a Buzz Session or the Philips 66 technique (Parker, 1985).
- The problem to be resolved is expressed clearly and concisely.
- Each strategic function, element or component is examined in turn.
- All ideas should be legibly recorded and displayed on the working wall and be visible to the team during the brainstorming exercise.
- The VSL should take into account the method for judging the ideas when setting out the recording sheet.

- It may be necessary to have a recorder to assist the VSL in recording ideas during brainstorming.
- Taking one function at a time keeps the brainstorming problem manageable; however, this is not a rigid rule and ideas 'out of sync' should be encouraged.
- Record duplicates; these can be edited out later. Discourage such comments as 'we have had that before'.
- No consideration or judgement of any idea is permitted until the creativity stage is complete.
- Brainstorming works best with a cheerful, motivated and engaged team.
- No criticism whether by voice or by body language should be permitted.
- It is the quantity of ideas that is important. Good ideas tend to be a constant proportion of the total ideas generated. Therefore, the greater the number of ideas, the greater the number of good ideas.
- Wild and 'out of the box' ideas are to be encouraged as they can prompt good ideas from other members of the team. This is particularly true of those not constrained by years of education. For example, nonengineers should be encouraged to produce engineering solutions. They probably will not work but may well prompt a more sensible but innovative idea from an engineering member of the team.
- Building on and modifying ideas should be encouraged. Prompts by the VSL such as bigger, smaller, lighter, stronger, faster, cleaner, etc can be helpful.
- Team discipline is important during brainstorming, having more than one person talking at once, storytelling and side conversations amongst individuals can easily disrupt and destroy the brainstorming session.
- Brainstorming is an exhausting process and the VSL should aim to complete the process within 1 hour.
- Consider the timing of a brainstorming session. If the study is to exceed one day then brainstorming can be a useful end to the day's agenda. The team members end the day on a high note and usually continue thinking overnight such that a brief review and an 'additional ideas session' the following morning can be very fruitful.
- Momentum should be maintained by the VSL. However, teams do go silent occasionally and the VSL should not close the session without testing that there are definitely no further ideas. Instructions such as 'can we please have just 10 more ideas before we close the session' can sometimes lead to another outpouring of ideas.

Blocks to effective brainstorming by individual members of the team are to be recognised if they are to be overcome. Adams (1987) identifies a number of potential blocks:

- Perceptual blocks, including difficulties in function relevance through a certainty of the solution, the introduction of misleading information or filling in information where none exists, the self-imposition of artificial limits or constraints.
- Emotional blocks, including the fear of taking risks and of looking foolish, and inability to handle ambiguity, an inability to relax or suspend judgement, a lack of motivation.
- Cultural blocks, including cultural taboos, the denigration of playfulness, the use of humour and fantasy, and an unreasonable requirement for logic, numeracy and reason.

- Environmental blocks, including a lack of trust in colleagues, superior – subordinate autocracy issues leading to reserved behaviour, physical distractions, lack of management support for the process.
- Intellectual or expressive blocks relating to terms and acronyms by some members of the team and lack of understanding of where the team is going.

Creativity – Variations on the brainstorming theme

Different techniques, which are variations on the brainstorming theme described earlier, have one or more of three characteristic objectives:

- To increase productivity by stimulating creativity.
- To suppress the negative impact of blocks and thereby increase effectiveness.
- To enable brainstorming by a team that is geographically spread.

A sample of these techniques is described next.

Reverse brainstorming

Wilson (2010) suggests reverse brainstorming in situations where the group is very judgemental and where traditional brainstorming is perceived to be difficult. Additionally, it is suggested for situations where a product or service that is complex to implement is being considered. As the name suggests it requires brainstorming on the negative aspects, for example, how do we make the building inaccessible to customers? In what ways is this product or service likely to fail? The VSL will enter all the negative statements on one side of the flip chart paper and at the completion of the session require the team to consider positive statements against their negative counterpart.

Gordon technique

The Gordon technique described by Parker (1985) is a brainstorming session in which no one except the workshop facilitator knows the exact nature of the problem under discussion. The aim of the Gordon technique is to remove team certainty of the one right answer within a particular context. For example, the team may be asked to brainstorm ideas to reduce queues at a supermarket checkout. The real purpose of the brainstorming session was to generate ideas for reducing overcrowding in an airport check-in area. In a value study it may be possible to divert the team's attention away from the project function by proposing an analogous scenario; however, the team would always be aware of the true function and it would require a very quick thinking VSL to think of relevant scenarios.

Synectics

The Australian Department of Defence, DRB37 (Departmental Reference Book 37), Value Analysis (Australian Department of Defence, 1983), contains a full description of

Synectics, which is said to be derived from the Greek word *synectikos*, and described as meaning 'the joining together of different and apparently irrelevant elements'. There were two main players in the early development of Synectics, Price (1970) and Gordon (1961). Similar to the Gordon extension of Brainstorming, the workshop facilitator identifies a problem comparable to the problem to be solved. The team is then guided through problem solution by requiring them to consider four contexts:

Context 1 – Direct Analogy. The team is asked to consider different fields in which a successful solution was found to the problem. There are reported examples of Velcro being influenced by the multiple burrs on the seeds of thistle-type plants and power free ventilation systems being influenced by the cooling technology within termite mounds. Nature is a useful source of such ideas.

Context 2 – Personal Analogy. Individuals within the team are asked to place themselves in either an animate or inanimate position. For example, an individual might be asked to put themselves in the position of the user of the system or a machine. Alternatively, the individual might be asked to put themselves in the position of the machine itself. For example, a team member may be asked to put themselves in the position of a tin of beans at a supermarket checkout then transfer the analogy to luggage at the airport check-in.

Context 3 – Symbolic Analogy. In this analogy the team is asked to reflect on impersonal objects or images in the expression of a measure of size, weight, density, noxiousness, purity and so on. For example, as tasty as a burger, no thicker than a human hair, no heavier than a cup of tea.

Context 4 – Fantasy Analogy. In this analogy the team sets aside all existing laws of physics and so on, in order to fantasise solutions to functional objectives. For example, in the absence of gravity, luggage could be floated by the passenger onto an aircraft.

The primary aim of Synectics is to take the team into unfamiliar territory to cause them to think of solutions without being bound by familiar conventions.

Lateral thinking

Similar to Synectics, the team is encouraged to depart from the familiar in order to think in new ways. The six thinking hats of De Bono (1999) is a good example. The logic states that in a traditional discussion all team members are thinking in an uncoordinated manner. The hats require the team to think in a particular way as dictated by the colour of the hat in use.

- White: The white hat requires attention to information, what information do we have? What is required? What is missing and how do we obtain it? What questions need to be asked?
- Red: When the red hat is in use team members have the opportunity to express feelings and emotions without any need to explain or justify these.
- Blue: When blue is in use the team considers organisational and global impacts of the proposed change.

- Green: The green hat requires everyone to make a creative effort, to generate new ideas or modify an existing idea, to generate new possibilities, and so on.
- Black: Black is judgemental; directing thinking down the negative track considering risk, unaffordable costs, environmental disadvantages, and so on.
- Yellow: When yellow is in use the team considers benefits, the positive impacts of an idea, listing only advantages.

Six hats is one of a number of creative thinking strategies described by De Bono in a series of books. When looked at as a sequence, the thinking hats follow an analogous and similar pattern to the Work Plan, and good problem solving and decision making.

Check-listing

A check-listing technique suitable for use in value studies is a precompiled list used by the VSL to stimulate new ideas. An example is the check-listing technique beginning with the word ‘can’:

- Can the requirements be restated or specification changed?
- Can the stated number be changed?
- Can the location be changed?
- Can the orientation be changed?
- Can departments be merged?
- Can it be bigger/smaller?
- Can the process be altered/reversed?
- Can it be made stronger?
- Can roles be changed/combined/reversed?

TRIZ

TRIZ is a Russian language acronym for ‘*Teoriya Resheniya Izobreatatelskikh Zadatch*’ or ‘The theory of creative problem solving’ or ‘inventive problem solving’. Spain (2003) states that in the late 1940s, Genrich Altshuller and Raphael Shapiro researched 200 000 Russian patents to select 40 000 for a study from which the following five levels of innovation were discovered:

- *Level 1*– 32% involved little innovation and addressed routine problems resolved by contemporary knowledge.
- *Level 2*– 45% were minor improvements of an existing system or technology.
- *Level 3*– 18% were fundamental improvements resulting from new thinking from outside of the technology.
- *Level 4*– 4% resulted from the application of scientific knowledge to derive new principles to address primary functional requirements.
- *Level 5*– Only 1% was dependent upon a new scientific discovery.

Furthermore, 95% of problems classified in levels 1–3 had already been solved in another technological context.

Table 6.1 Altshuller's list of contradictory parameters (adapted from Spain (2003).

List of Contradictory Parameters					
1	Weight of moving object	14	Strength	27	Reliability
2	Weight of stationary object	15	Duration of action by a moving object	28	Measurement accuracy
3	Length of a moving object	16	Duration of stationary state of a moving object	29	Manufacturing precision
4	Length of a stationary object	17	Temperature	30	External harm affects the object
5	Area of a moving object	18	Illumination intensity	31	Object-generated harmful factors
6	Area of a stationary object	19	Use of energy by moving object	32	Ease of manufacture
7	Volume of a moving object	20	Use of energy by stationary object	33	Ease of operation
8	Volume of a stationary object	21	Power	34	Ease of repair
9	Speed	22	Loss of energy	35	Adaptability or versatility
10	Force	23	Loss of substance	36	Device complexity
11	Stress or pressure	24	Loss of information	37	Difficulty in detecting and measuring
12	Shape	25	Loss of time	38	Extent of automation
13	Stability of objects composition	26	Quantity of substance/ matter	39	Productivity

Altshuller took this research further during the 1950s and discovered from the analysis of patents that many successful ideas resulted from resolving a physical contradiction. For example, to make something stronger it becomes heavier. Altshuller discovered 39 generic contradictory parameters of the physical properties of objects as Table 6.1.

Altshuller also discovered 40 generic inventive principles illustrated in Table 6.2.

By creating a matrix with the 39 contradictory parameters on both the vertical and horizontal axes, Altshuller was able to insert one or more inventive principles in each of the cells of the matrix. For example, if an object is required to be longer then, all things being equal, it will be heavier. Reference to the matrix of contradictory parameters will show that the intersection cell of 'length of stationary object' and 'weight of stationary object' makes reference to the inventive principles; '28 mechanical substitution', '29 pneumatics/hydraulics', '35 parameter change', and '40 composite'. The inventive principles are further described in the TRIZ system with examples from the TRIZ database. This provides information and focuses the brainstorming session. Altshuller's findings that 95% of new problems have already been solved in another technological context, together with the database structure, gives a useful stimulus to brainstorming, which is undertaken with the assurance that the wheel is not being reinvented.

Delphi

The Delphi technique is named after Delphi, the sanctuary of the God Apollo who in Greek mythology was said to be able to foretell the future. The technique was

Table 6.2 Altshuller's inventive principles (adapted from Spain 2003).

Inventive Principles					
1	Segment into parts	15	Make dynamic	28	Mechanical substitution
2	Take out interfering property	16	Slightly less/slightly more	29	Pneumatics/ hydraulics
3	Local quality – change part of object structure	17	Another dimension	30	Thin films and flexible shells
4	Asymmetry	18	Mechanical vibration	31	Holes/porous attributes
5	Merge	19	Periodic action	32	Colour change
6	Universality – multiple functions	20	Continuity of useful action	33	Homogeneous
7	Nested doll – Russian doll?– one part inside another	21	Hurry to avoid harmful effects	34	Discard and recover
8	Counterweight	22	Blessing in disguise turns harmful factors into positive effects	35	Parameter change
9	Prior counter action – to control harmful effects	23	Feedback	36	Phase transition
10	Prior action	24	Intermediary/interface	37	Thermal expansion
11	Cushion	25	Self-service	38	Enrich
12	Remove tension	26	Copy	39	Calm/make inert
13	Other way around	27	Cheap disposable	40	Composite
14	Curve				

developed in the 1950s by the RAND Corporation for eliciting expert opinion amongst geographically dispersed experts. Langford and Male (2001) describe the technique as involving a co-ordinator/facilitator and a team of experts who are given an explicit problem and a questionnaire that seeks further questions and opinions on the solution to the problem. The experts are required to provide reasons for their opinions, which are subsequently critiqued by the team as a whole. The process is cyclic, the coordinator summarising the responses and producing a further questionnaire. The cycles of questionnaire and responses continue until the experts concur on the solutions to the problems. Clearly, in the 1950s, the cyclical process of circulating questionnaires and feedback is undertaken by traditional mail with the inevitable delays. Nowadays, this process is dramatically assisted by electronic media such as e-mail, intranet and web drop-boxes.

In the context of a value study, the Delphi process can be used to carry out any or all of the following value study tasks:

- Generate and analyse issues in situations where the stakeholders are geographically dispersed and/or have an important but small contribution to make.
- Generate, sort and structure functions.
- Generate and judge ideas.

For example, the following is a proposed process for the discovery of functions from an international team engaged on a project to establish a national distribution and servicing hub for a packaged electricity generating plant:

1. The VSL considers the problem and identifies an expert constituency.
2. A team of experts is identified with individuals selected on the basis of their professional expertise.
3. The VSL produces an introductory statement to the project under review accompanied by a questionnaire that focuses on function. The statement and questionnaire is circulated to the team.
4. Within a specified time the team returns the questionnaire to the VSL who collates the functions, opinions and questions.
5. The VSL circulates the opinions and questions for comment and clarification by members of the team who respond within the specified time.
6. The VSL processes the clarifications and then circulates a second questionnaire seeking any further missing functions based on the previous exchange to which the team responds.
7. The VSL circulates a collated function list and/or function diagram together with a further questionnaire seeking comment and confirmation. Team members respond with suggestions for improvement.
8. The process in the preceding point 7 iterates until the team reaches a consensus on the functional requirements of the national distribution and servicing hub.
9. When the team reaches consensus, the function diagramming Delphi task is complete.
10. A new Delphi is commenced focused on idea generation. Undertaken in the same way, the VSL obtains lists of ideas from individuals, which are collated and circulated. This process is repeated until the VSL is satisfied that there are no more ideas available from the team. A tight time constraint is required for this stage to work well.

Group decision support systems

Group decision support systems (GDSS) is commonly considered to be a decision support system conducive for use within team situations where the team is:

- Geographically dispersed.
- Operating within a culture that restricts participation particularly amongst superior/subordinate members of the team.
- Likely to benefit from codified knowledge or sophisticated data processing tools.

Group decision support system is defined by Huber (1984) as ‘a set of software, hardware and language components and procedures that support a group of people engaged in a decision related meeting’. The DeSanctis and Galluple (1987) definition is ‘GDSS, also known as group support systems, is a computer technology that combines computing, communication and decision support technologies to facilitate the formulation and solution of unstructured problems by a group of people’.

Fan (2009) describes the role of GDSS in the support of value studies as being:

- Creation, administration and analysis of questionnaires.
- Enabling the simultaneous and anonymous generation of ideas during brainstorming even where the brainstorming session is conducted face-to-face. This is particularly helpful where the culture of the group may block idea generation.
- Rapid sorting of ideas into categories using keyword or content analysis.
- Displaying pictorially ideas related to functions.
- Attachment of comments to functions and ideas.
- Any participant may express an idea using a drawing tool.
- Rapid sorting by team members using voting.
- Rapid weighting and scoring against established criteria.
- Rapid comparison using whole life cost or whole life value toolkit.
- Incorporation of database management, web search engines, and so on.
- Rapid action planning and reporting.

Value studies generate large quantities of data recorded on cards and flip chart wall displays. The value study report is generally an edited transcription of all the data. There is always an attraction of recording the data in real time in a form that permits button push processing. It is easy to see the attraction of GDSS in the three situations outlined at the commencement of this section. To work well in a traditional face-to-face value workshop, to experience no cultural constraints would require the participants' work-stations to be ancillary to the focus on the room and the activity of the team members.

Judgement

Notwithstanding the method of idea generation, it tends to be an emotional, adrenalin fuelled activity after which follows the considered judgemental phase. In a value workshop, a break in the agenda is called for between these two activities either by running the brainstorming session at the end of the day or introducing a refreshment break. The first task of the judgement stage is to reduce the large number of ideas generated during brainstorming to a number which can be managed. The authors commonly experience in excess of 100 ideas during a workshop brainstorming session, and more rarely in excess of 300 ideas on multifunctional complex projects. The challenge is to recognise the 10% to 20% good ideas, as judged by members of the team, to carry forward to the evaluation and development stage.

Judgement – Stage 1

Technique 1 – Silence means no

In the first stage of the judgement phase the aim is to reduce substantially the number of ideas. It is at this stage that the nonsensical, completely impractical, duplicated ideas and ideas that fail to secure any interest by the team are deleted. This deletion must be done efficiently and effectively. Clearly if there were 120 ideas generated and the VSL permitted a 2 min discussion of each idea, then this first stage would take 4 h. Therefore, The VSL reads out each idea in turn from the brainstormed list and seeks an idea champion to say ‘keep it’. If there is no idea champion, then the team remain silent, and after 2 seconds the VSL will delete the idea and read out the next idea from the list.

Technique 2 – Silent voting

As an alternative to ‘silence means no’ the VSL may opt for silent voting. Each member of the team is given a number of sticky dots, the number being about 20% of the total number of ideas. The facilitator asks the team to consider voting only for those ideas that individually they would be willing to champion, whether or not they have the technical expertise to do so. The dots are placed on a column to the right of the description. Those ideas that have the highest number of votes are considered at the next stage; the remaining ideas are deleted.

Judgement – Stage 2

Technique 1 – Complexity

For the ideas remaining the VSL will ask the team to make a *prima facie* judgement of the complexity of implementing the idea. The categories are:

- NB – ideas that are simple to implement and apparently pose zero risk (no-brainer).
- SW – ideas that at first sight require Some Work (SW) in terms of the redesign of an existing technological solution and/or a requirement for detailed discussions with suppliers but which have:
  - A very high probability of success
  - Very low or low risk
  - Potential for high payback
- CD – ideas that at first sight require Considerable Development (CD) work and/or other disadvantages including:
  - A new planning application
  - Extensive redesign work
  - New technology or use of existing technology in the new situation
  - With medium to high risk
  - Unknown or marginal payback

Technique 2 – Acceptability

An alternative or additional test is to consider the acceptability of the idea based upon the following four criteria:

- CA – the idea is likely to be Client Acceptable (CA) and meet approval from other stakeholders.
- FS – based on a function diagram and/or function listing the idea appears to be Functionally Suitable (FS).
- EV – at first sight the idea would appear to be Economically Viable (EV).
- TP – the idea would appear to be Technically Practical (TP).

Those ideas that meet all four criteria just mentioned in a value workshop would be amalgamated wherever possible or remain as single ideas for further development.

They will either be worked up in outline within the workshop using working groups, then refined outside of the workshop or, only developed outside of the workshop. Those items meeting criteria FS and TP are likely to require further research outside of the workshop environment. Other combinations of criteria often require further clarification as part of the workshop process.

Judgement – Group and combine

Prior to seeking champions for the evaluation and development of ideas it is beneficial to examine the ideas that have survived the judgement process to determine whether any of the ideas are sufficiently linked or at least have a close correlation one with another that they may be considered together. In this context grouping may occur because:

- The ideas are complementary and may be used in combination.
- The ideas are competing and are mutually exclusive.

The overriding criterion for selecting ideas for a group is that they require common skills for their evaluation and development. This exercise is useful in the presence of many ideas remaining in order to make the idea champion's task appear more manageable.

Judgement – Action planning and appointment of idea champion

At the close of the judgement phase the VSL will summarise the actions to be taken on the evaluation and development of the ideas, grouped and combined as necessary, and record who will be responsible for evaluating the idea (the idea champion). Choosing an 'idea champion' is an essential conclusion to the judgement phase of the creativity exercise. An idea champion is someone who is willing to take responsibility for the evaluation of the idea including its technical merit and economic consequences. It is advantageous but not essential for the idea champion to have the technical ability to undertake the development of an idea but has sufficient interest in the idea to convince others with the technical and economic ability to undertake the investigation. Evaluation and development continues as a workshop activity with individual and/or small group working on the ideas contained in the VSL's summary. The final accepted developed ideas will be described in the workshop report as a basis for further detailed design/development.

In some cases the VSL's summary of actions is the final stage of the workshop in the situation where evaluation and development of the ideas is undertaken by individuals postworkshop. In this case the summary is the workshop action plan and will appear in the workshop report as such. Postworkshop championing of idea evaluation and development should not be delegated to someone who has not attended the workshop. Furthermore, the technique of postworkshop evaluation and development is only practical where the workshop team is the actual project team taking the project forward. The VSL will, for each idea record:

- By whom – Who will be responsible for evaluating the idea (the idea champion).
- By when – A realistic timeframe will be agreed with the team for the completion of the evaluation and development phase.

6.3 Evaluation and development

The aim of the evaluation and development phase (whether undertaken during or post-workshop) is to increase the level of certainty on the factors pertaining to the adoption of the idea. The four factors to be considered are:

- Technical development
- Whole life cost appraisal
- Risk assessment
- Consequences for the project programme

Generally, the time between the completion of the workshop and the implementation meeting is relatively short, commonly 3 to 4 weeks. The idea champions will be looking to reach some initial conclusions on the viability of competing ideas in the context of the four factors mentioned and report on these to the implementation meeting in a one page summary.

Development of ideas involving products and construction work

In undertaking the development of ideas involving innovation in products and construction work, reference will be made to the functions required and which gave rise to the ideas. Construction requires the design of structures that are an assembly of manufactured components or requires work to be carried out on site (generally excavation, concrete work, masonry, roadways, drainage, etc.). For the manufactured components an assessment can be made of whether:

- The development is minimal, using products that are manufactured to stock and are readily available.
- The development is minimal, using products that are manufactured to order.
- The development requires some design work to make a product bespoke for the project but this activity is commonly undertaken by one or more manufacturers.
- The development requires the design of a new product for which a manufacturer must be found.

For designed work, carried out *in situ*, the assessment takes into account whether the technology proposed is:

- Commonplace and its implementation well understood.
- A new development of an existing technology, requiring little or no modelling and testing.
- Entirely new and will require significant modelling and testing.

Whole life cost appraisal

The subject of whole life costing is addressed in detail in Chapter 10. In order that a like-for-like comparison can be made across all ideas in the development and evaluation stage, a common approach should be adopted and specifically the following should be agreed:

- The method for undertaking the appraisal specifically the level of detail required.
- The length of the WLC study period – the WLC study period should be established for the project as a whole and not for individual elements.
- The discount rate – a common discount rate should be used.
- A common approach to terminal and residual values.

It is likely that in the evaluation and development stages the whole life cost appraisal will be based on a reasonably low level of detail with a number of assumptions. The assumptions will be recorded and an assessment made of the confidence in the appraisal.

Risk assessment

Methods of risk assessment are discussed in detail in Chapter 10. For the purposes of a report to the implementation meeting an outline of the risks should be included in addressing:

- Brief description of the risk of incorporating the technical solution resulting from the idea, the stage of the project when the risk may occur, and the potential owner of the risk, that is, the client, the design team, contractor, specialist subcontractors or suppliers.
- The factors that could cause the risks to arise and the likelihood of those occurring.
- The extent to which the project will be affected.

A risk assessment at the evaluation and development stage is at a level of detail sufficient for general appreciation by the team of the risks associated with all of the ideas.

Programme

Based on the factors in the other three sections of the evaluation and development stage, a short report is given on the likely impact on the construction programme of incorporating the ideas and the confidence associated with the assessment.

6.4 Implementation

Review workshops or the implementation meeting form a natural conclusion to the study. The implementation meeting is best planned to occur 3 to 4 weeks after the value study workshop has taken place, often taking the place of a design team meeting. It is good practice for the feedback information (the one page summary) from the evaluation and development stage to be circulated prior to the implementation meeting.

The ideas that are approved at the implementation meeting are carried forward into the design. It is a feature of the evaluation and development stage that ideas become modified once the practical implication is understood. For example, an engineer may say that the idea for air circulation within a building, as described at the workshop, is problematic but with a modification may significantly enhance ventilation.

The implementation phase has been identified as the Achilles heel of value studies in that it is rarely formally carried out. Client organisations that have a systematic approach to value studies tend to be those who adopt a methodical organisation of workshop outcomes and track ideas through to incorporation. These clients are also much more likely to have a systematic approach to benefits realisation, the subject of Section 6.5.

6.5 Benefits realisation

The OGC (2007) defines benefits as the measurable improvement resulting from an outcome that is perceived as an advantage by a stakeholder to the project. Benefits are anticipated where change is conceived. Benefits realisation can only occur when a business case has been developed for the programme or project. A business case is the statement by the client organisation that describes the intended investment or change to be instigated by the Programme or project and demonstrates that each project is accurately specified, technically and economically sound, financially viable, and will be well managed. A full description of the business case is given in Chapter 10 and the governance arrangements discussed in Chapters 8, 9 and 13.

The benefits realisation exercises should follow each value study and additionally at the end of the project as part of the postproject review. The exercise following a value study is undertaken to check that the intended functional requirements of the project, the benefits, are being provided efficiently; reference being made to the function diagram and the client's project value system. Furthermore, that the client governance procedures for the project as described in the business case or client operating procedures are being complied with. The exercise is a part of what OGC (2007) describes as benefits realisation management, which in a value study context comprises the following:

- Ensuring all benefits are identified and defined clearly at the outset, linked to strategic outcomes, functional requirements and the client's project value system.
- Ensuring all client business areas are committed to realising the defined benefit.
- Benefits are defined in measurable terms and the decision trail for the achievement of benefits is to be overt. Benefits realisation management includes the measurement, tracking and recording of benefits as they are realised.
- The expected beneficial outcomes of the project are to be mapped onto the project schedule such that organisational change is recognised as it is realised.
- All risks and issues impacting the provision of benefits are addressed at each benefits realisation exercise.
- Changes in business objectives brought about, *inter alia*, by public/consumer demand, should be confirmed at the benefits realisation exercise and the current alignment and integrity of the business case re-examined. The consequence of any changes should be made explicit.

- Any change in the business case should reflect the impact on other projects within the Programme.
- The benefits realisation exercise should be an opportunity for continual analysis of and engagement with stakeholders.

Defining the benefits through a value study and recording benefits in the business case are activities precedent to the proper undertaking of benefits realisation management.

6.6 Conclusion

Innovation, evaluation, development, implementation and benefits realisation all have their place in the effective development of the project to meet the identified functional requirements. It is the case that many value studies end with an action plan after judgement, leaving the evaluation and development stage as a post-value workshop activity. As previously described, implementation then tends to be an activity subsequently undertaken by the project team. A benefits realisation exercise is rarely undertaken. This is clearly an area for improvement in the whole Programme/project management structure.

The discussion in Part 2 of this book focused on the mechanics of a value study from study design, delivery and choice of study styles; through function and function analysis; the organisation of teams, team dynamics and workshop management; and finally this chapter on innovation, implementation and benefits realisation. Chapter 7 completes the anatomy of a value study by describing a number of case studies undertaken by the authors that illustrate and comment upon topics discussed in earlier chapters.

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7 Case Studies

7.1 Case studies

Introduction

The nine case studies described in this chapter are representative of several hundred value studies undertaken by the authors as Value Study Leaders (VSLs). The value studies were carried out over a number of years and have been chosen as illustrative of a number of value study styles. The case study descriptions incorporate the three phases of a value study: the Orientation and Diagnostics phase, the Value Workshop phase and the Implementation phase; however, their deployment varies across the different case studies presented in the chapter.

In this chapter, a project is defined as encompassing the process to deliver an investment into a physical asset as a corporate resource. A common format has been adopted for the case studies. It has been adapted from that used by the OGC (2007) publication on value management (VM). The case studies cover the following:

- A description of the project/process. This includes some of the work undertaken during the Orientation and Diagnostics phase.
- The design of the value study. This is carried out in the Orientation and Diagnostics phase and incorporates the tools and techniques adopted in the value study. This will cover those initially planned during the Orientation and Diagnostics phase and also used during the Value Workshop phase.
- The use of function analysis in the value study. This will cover how it was initially planned during the Orientation and Diagnostics phase and delivered subsequently during the Value Workshop phase.
- The value study team, stakeholder management and team dynamics and implications during the value study. This will cover how it was initially planned for during the Orientation and Diagnostics phase and adjusted as circumstances arose during the Value Workshop phase.
- The outcomes and benefits from the value study, covering the Implementation phase.
- The lessons learned from the value study.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

The authors have selected the case studies to demonstrate the different styles of value studies that they have encountered in practice. In the authors' experience each value study has unique circumstances that require a tailored design of a value study, but remains one based upon an underlying value study methodology and philosophy. The case studies are as follows:

1. Case study 1 – Headquarters for a financial institution. This is a value engineering (VE) study with an independent 'shadow team' on a construction project. This is an example of a study style similar to a US public sector approach.
2. Case study 2 – A replacement silo storage for a food manufacturing company. This is a value engineering study on a process plant project.
3. Case study 3 – Rail infrastructure. This is an example of a value management programme incorporating value engineering and value management studies carried out on each part of this complex rail infrastructure project.
4. Case study 4 – A Magistrates Court project. This started as a value engineering study but moved to value management. VM and VE aspects were run in parallel during the Value Workshop phase.
5. Case study 5 – A college library. This case study presents a series of value studies on the same project. First, value engineering involving the project design team and the client. Second, a project audit using an independent 'shadow team' operating in a similar vein to a US public sector approach. Third, a value management briefing study using an independent 'shadow team' working alongside the client – a hybrid study style.
6. Case study 6 – The replacement of a materials manufacturing plant. This is a value engineering study on a manufacturing materials production process project involving the client and the design and build contractor.
7. Case study 7 – Social housing. Two value studies were conducted on a tower block refurbishment construction project. First, a value engineering study with the client, design team and the lowest tenderer. Second, a partnering study using the value study process involving resident groups, the client, the design team and the contractor.
8. Case study 8 – A Crown Court. This is a value engineering study at final sketch design stage.
9. Case study 9 – An organisational study. This is an example of the value management methodology adapted to suit the requirements of restructuring a university Estates Department. It uses a hybrid study style approach.

Following the description of case studies 1–8, the practical issues illustrated are highlighted in Table 7.1, and recognises the differences and similarities in the characteristics of value studies for construction projects. Case study 9 follows and represents a study approach that is an exemplar for other case studies set out in subsequent chapters. The lessons learned from Chapter 7 are subsequently revisited in Chapter 13, where a review, analysis, and proposed repositioning of value management is offered for the UK construction industry.

7.2 Case study 1 – Headquarters for a financial institution

Project description including stage of development and programme

The value study was initially commissioned as a value engineering assignment although a number of more strategic value management proposals were ultimately made. The project comprised the demolition of existing buildings and the construction of a large office with other facilities to house the headquarters of a financial institution in a city centre location. The institution was consolidating a number of satellite offices that it had acquired over time, into a centralised head office providing an efficient working environment with state-of-the-art technology. Through its design, the project was also intended to raise the profile of the institution while delivering value for money. One major objective of the project was to accommodate the predicted future increase in the number of staff. The design of the project was between RIBA design Stage C outline design and Stage D scheme design, now Concept Design and Developed Design RIBA 2013.

From appointment to completion, the three phases of the value study took place over a 2 month period. The objectives for the value engineering study were to assure the institution that value for money was being achieved in the design, that the project could be built for the budget set, and that the project would satisfy the institution's future aspirations.

The design of the study

The value study was designed in three phases. First, the Orientation and Diagnostics phase involved a 2-week information gathering and analysis period. Second, the Value Workshop phase comprised a 5-day combined value management and value engineering workshop period. Finally, the Implementation phase involved a week-long report production period. The study aim was to examine the project design and to review the institution's strategic objectives to ensure they would be met and delivered by the design. The value study was designed in a similar way to the typical 5-day value study carried out in the United States. The value study team comprising 11 personnel in total was commissioned as an independent 'shadow team' appointed specifically for the value study. None of the existing project team members were involved in the value study apart from initial interviews and the final presentation of recommendations at the end of the workshop. The 'shadow team' included three VSLs, one architectural, one structural engineering, two quantity surveying, one mechanical and electrical engineering and one specialist space planning consultant. In addition, two members of the client's senior project team participated in the study. Although the study was conducted over five consecutive days it did not follow directly the approach adopted in 5 day studies in the United States in that two senior managers of the client involved with the project design team participated in the value study. In a traditional US public sector approach the client would make a presentation at the commencement of the value workshop, leave and then return for the 'shadow value team' presentations at the end of the workshop. The study was designed to include a value management approach analysing the strategic aspects of the project while also undertaking value engineering on the project space, elements and components included in the design.

During the Orientation and Diagnostics phase, design and other important information was obtained from the client and the existing project design team. A number of interviews were held with the client's facilities management team and members of the project design team. The VSLs analysed the information obtained and prepared a 5 day value study workshop agenda incorporating tools and techniques as follows:

- Examination of key issues impacting the project;
- Establishing project drivers;
- Identify strategic risks;
- Considering the relative importance of key time, cost and quality criteria;
- The creation of a function diagram for the project;
- Creation of strategic ideas for change;
- Sorting strategic ideas for change;
- Identifying users;
- Creating user flow diagrams;
- Identifying the required spatial adjacencies;
- Identifying the functional quality, environment and technology requirements;
- Comparing the briefed space with the design response to identify value mismatches;
- Identifying space and construction risk;
- Creating spatial ideas for change;
- Carrying out a function analysis of elements and components including their associated risks;
- Creation of further ideas for change;
- Sorting spatial and element and component ideas for change;
- Development of strategic, spatial and element and component ideas for change into proposals for presentation to the project design team; and
- Presentation of proposals to client and project design team.

The Value Workshop phase addressed the agenda as follows:

- Day 1 examined the strategic issues impacting on the project. A function diagram was generated, which identified the value criteria against which strategic ideas were compared. Strategic ideas were created and sorted by referring to the function diagram. These sorted ideas were set aside for further development during days four and five.
- Day 2 studied the spatial configuration of the project including user flows and spatial adjacencies and compared this with the client's organisational requirements. The techniques were also used to assess the proposed design and identify any value mismatches. Ideas for change to the spatial arrangement were created and sorted using the function diagram and the user flow and adjacency analysis. These sorted ideas were set aside for further development during days four and five.
- Day 3 studied the elements and components, or major function systems, for the design of the project to date. Ideas for change were created and sorted using the function diagram.

- Day 4 focused on the development of all the sorted ideas that had resulted from the previous 3 days investigation into a number of value proposals for change. The 'shadow value team' was divided into smaller groups, which were allocated tasks to perform according to their particular skill set.
- Day 5 continued and finalised the proposal development. A presentation of the value proposals was produced and presented to a senior client manager and members of the project design team for their consideration for implementation into the project.

The Implementation phase included the production of a value study report within 1 week from the date of the workshop. The report described the value study process and included a description of the value proposals for consideration for implementation by the project design team. Following consideration of the value proposals by the client's management team and the project design team many were incorporated into the project.

The use of function analysis

Function analysis was used to determine the client's purpose for the project. Other function analysis techniques were used during the study in connection with the examination of space and also in the study of the elements and components included in the design. The function analyses created were used to compare with the existing design to identify value mismatches and as one key comparator used to sort ideas for change.

Value study team: Stakeholder management and team dynamics

The value study was commissioned by the client and the 'shadow team' was chosen and subsequently appointed following a successful bid submission made by the value study leaders. The criteria for selection of the team was as follows: first, they had the required skill set to address all matters to be discussed at the workshop; second, that they were sufficiently respected and of a sufficient standing to be credible with the client and the project design team in making proposals for value improvements to a prestigious project; and third, that they had the potential team working skills to work together as a closely knit team over a number of days. During the Orientation and Diagnostics phase the VSLs undertook preworkshop sessions with the 'shadow value team' to inform them of the process and to introduce them to each other. During the workshop a social evening was arranged to increase team bonding.

The key stakeholders were to some extent involved in the study. The client senior manager was involved in determining the strategic issues on Day 1 and was present at the final workshop presentation. The Client's facilities manager who was involved in briefing the project attended and contributed to all workshop sessions. The project design team and the newly appointed management contractor were not included in the workshop. However, they were interviewed during the initial information gathering phase and they attended the final workshop proposal presentations.

The VSLs were not involved in the project after the production of the value study report. There was an atmosphere of reluctance on the part of both the client and the design team to accept the value proposals made at the presentation; although subsequently many of the high value suggestions were incorporated into the final design. This is a definite drawback of using independent 'shadow teams' in a value study. Although the 'shadow value team' was unconstrained in their work, the authors as VSLs have very rarely used independent 'shadow value teams' in value studies in this way. It is considered that there is greater benefit in taking the project design team through the process proactively and achieving concurrent implementation of proposals into the project. However, there are circumstances where independent 'shadow value teams' can be beneficial (for example, see value studies two and three in case study 5 on the college library project, and the organisational and asset management case studies in Chapter 8).

Due to the size and complexity of the study the VSLs used a team of three workshop facilitators at the workshop. This approach enabled a sharp focus on key issues to be maintained and in particular enabled the value management and the value engineering aspects of the study to proceed in parallel during the workshop. It assisted greatly in the management of the small working groups during the Development stage of the workshop.

The outcomes of the value study

The outcome was a value study report that listed proposals for change in relation to strategic issues, spatial change and change to the elements and components of the building. The objectives of the study were to assure the client institution that value for money was achieved in the design, that the project could be built for the budget set, and that the project would satisfy the institution's future aspirations. A number of significant savings resulted from the proposals made and this benefitted the client in meeting their objectives for the project. Risk management of the design and the proposals made were key aspects of the value study outcome.

The benefits of the value study

- The value study identified a large number of value proposals for change. Identification of the client's requirements through function analysis was a key benefit and justification for the eventual value proposals presented to the client and the project design team. Without this value analysis the proposals would have had little influence on the client's and the project design team's thinking.
- Confirmation that the project could be completed within budget, which would require the adoption of some of the value proposals.
- The value approach kept the client's value system at the forefront throughout the study.

Lessons learnt

The key lessons learnt from this study were the following:

- A value study can be successfully carried out using the independent 'shadow team' model. However, the implementation of proposals from such an approach is problematic and requires a client and project design team who are willing to adopt change from the process. It was beneficial to have a client representative present throughout the workshop process.

- It would have been very beneficial if more members of the complex client body were present at the workshop. This would have ensured a wider client stakeholder engagement.
- The choice of the independent ‘shadow team’ members was sound. The value team had the necessary skills, gravitas and team management abilities, which contributed greatly to the success of the study.
- The need to have a full toolbox of techniques from which the VSLs can draw upon is essential. The tools and techniques required for the various parts of this study were very different. The client’s value criteria were the common thread, which was used to maintain the continuity of the different parts of the study.
- The team dynamic of the project design team needs to be very carefully planned and handled with an independent ‘shadow team’. More consideration could have been given to this important aspect.

7.3 Case study 2 – Replacement of silo storage and process plant in food manufacturing facility

Project description including stage of development and programme

The study was commissioned as a concept design stage value study of a change to a manufacturing process. The value study at this stage was conducted to establish the brief for the new process plant following a change in manufacturing methods. The study involved establishing the key size and configuration of the plant and the manufacturing process. It did not determine the actual specification of the storage and process plant involved. The maintenance of the production manufacturing process during the plant change was vital and this aspect was an important part of the study. The risks associated with the manufacturing process during the plant change were identified and necessary management actions also identified. The risk management analysis and project management development were undertaken but not as part of the value study. There were a number of other large projects planned to run concurrently with this process change project on the same site.

From appointment to completion the value study took a period of 3 weeks. The value driver for the project was the replacement and upgrading of assets while maintaining current production at the manufacturing plant.

The design of the study

Due to the nature of the project on a process plant facility, the value study had a primary focus on value engineering process equipment. However, the consequence of this aspect had a knock-on effect for the production process and consequent business case for the investment decision on the equipment concerned and production process adjustments. The value study was designed in three phases. First, a week-long Orientation and

Diagnostics phase. This included an initial meeting with the manufacturing plant site managers, a visit to the site and a guided tour of the manufacturing process, including the location of the proposed changes in the plant and the processes involved. Interviews were held with the Design Department designers and the project manager. Second, a 1 day value engineering workshop was held during the second week of the study and examined the upgrading of process plant in a food manufacturing facility. Third, the Implementation phase incorporated a report with the result of the value study. The value team of eight personnel included two VSLs, three members of the plant design team, two managers from the manufacturing plant and one senior manager from the client's head office.

The design of the agenda for the value engineering aspect of the study was as follows:

- An examination of strategic and key project management issues impacting the manufacturing process change.
- Establishing project drivers.
- Determining the relative position of time, cost and quality for the project.
- Consideration of the most appropriate procurement route to suit the client's needs.
- The Project Task and function diagram.
- Review of design against function and a review of the key elements in the change to the manufacturing process to establish a brief for the principal elements of storage, material conveyance, material preparation and final input into the manufacturing process. A weighted criteria scoring analysis was proposed to refine the comparison of alternative options in the material storage and material preparation.
- The use of strengths and weaknesses and weighted criteria scoring methods for alternative options identified for each key element of the process.
- An Action Plan to take the design, programme and procurement of the project forward within the client's procurement process.

During the Value Workshop phase an examination of the production process was undertaken and the main task and function diagram for the project was created. In addition the project drivers were identified and the time, cost and quality criteria considered. The change in the manufacturing process was outlined and the process itself considered in detail from material delivery to the production of the product. The discrete elements of storage capacity, transport logistics, material conveyance, material preparation and final delivery into the manufacturing process were all considered individually and in a sequential manner to reflect the order of the manufacturing process. In addition to the process plant issues considered, there were associated project management issues related to site logistics, workspace, craneage and maintenance of production to consider. Options were identified and solutions established to ensure that there was no impact on the production of the manufactured product. The risks associated with the project during installation were identified and a number of management actions developed. The probability and impact of the risks were not analysed and this was undertaken separately outside of the value study.

In the third phase of the value study, a value study report was produced within 1 week from the date of the workshop. The report described the value study process and included a description of the value study proposals for implementation.

The use of function analysis

Function analysis was used to determine the client's purpose for the project. It enabled the team to focus on the implications of both the design and also the impact changes would have on the existing manufacturing process.

Value team: Stakeholder management and team dynamics

The value study was commissioned by the food manufacturing client. The study involved in-house plant Design Department designers and project manager, managers from the manufacturing plant and the senior management from head office, and represented the skills required for the concept stage value study.

The choice of workshop attendees was influenced by the information gathering meeting and interviews. During the second stage of the value study (the Value Workshop phase), two VSLs managed the workshop process. This approach enabled a sharp focus on key issues to be maintained in what was a very detailed study over an intensive one-day period.

The outcomes of the value study

The outcome was a value study report that listed solutions for the change in the manufacturing process including storage capacity, an output brief for key elements of the process plant, the operational manufacturing process and the project management of the manufacturing process 'change project' on site. It also identified and addressed the cross impacts of other projects concurrent with the proposed changes in production method and identified primary risks in this and in the project delivery generally.

The Benefits of the Value Study

- The value engineering study, over a 3-week period efficiently brought together key stakeholders from the client's Design and Project Management Departments, and the manufacturing site process management team. The 1-day workshop addressed the key issues involved in a complicated change to the manufacturing process. The resulting project brief was used to take the project forward to the next stage in the client's procurement process.
- The workshop used tools and techniques to identify the most effective, value for money solutions, for the client to include in the business case for the project to be presented to senior management.
- The value study approach kept the client's value system at the forefront of the study.

Lessons learnt

The key lessons learnt from this study were as follows:

- The value engineering process was successfully used to identify the strategic brief for a manufacturing process plant upgrade together with identifying the project management implications involved in the project delivery process.

- It is essential to have all key stakeholders present to ensure that a technically complex study such as this is successful.
- It is important for the VSLs to understand the principles of the manufacturing process and the implication of change to the process during the Orientation and Diagnostics phase so that a Value Workshop agenda is designed to address these issues.

7.4 Case study 3 – Rail infrastructure programme

Project description including stage and programme

A Programme of projects had been established to deliver this large-scale rail infrastructure major project in and around a major city in the United Kingdom.[1] The study comprised a programme of value studies as part of a cost plan validation exercise. The project, among other things, was intended to increase the frequency and physical length of trains that pass through the city stations. The project was at an early concept design stage. The work on stations and routes was, in some areas, to be the subject of a Transport and Works Act Order necessary for the compulsory purchase of land and property. There was a business imperative to deliver the project at or below the set budget.

The value study programme took place over a 3 month period with a series of value studies scheduled approximately weekly within this period. Two teams, each comprising two VSLs worked in parallel. Figure 7.1 sets out the value study programme.

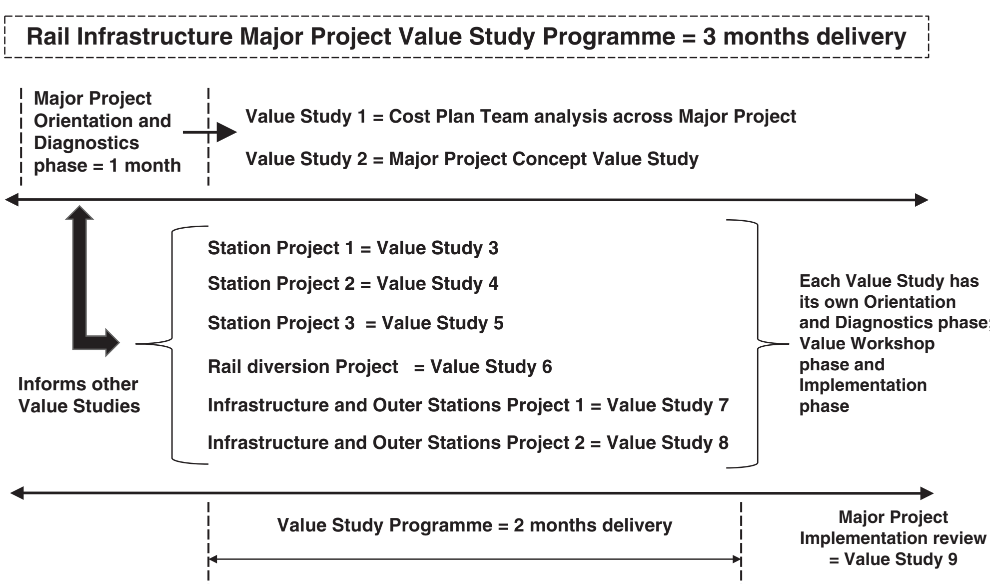

Figure 7.1 Value study programme for rail infrastructure major project.

[1] See Chapter 9 for a full exploration of a major project; briefly however, a major project is an exceptionally challenging project that can have one or more of the following present: of high value, where there is time urgency, having multiple levels of complexity, and at the forefront of knowledge – managerial and/or technical. Case study 3 comprised a number of these.

The value teams for each of the studies comprised:

- Value Study 1: Two VSLs, and 25 quantity surveyors drawn from across all projects.
- Value Study 2: Forty personnel comprising two VSLs, and representatives drawn from each project – designers, quantity surveyors, client project managers, a risk manager, and the Project Sponsor.
- Value Studies 3–8: Approximately 12 team members including two VSLs for each study, designers, quantity surveyors, and client project managers.
- Value Study 9: Approximately 30 team members comprising four VSLs, and two design team representatives from each of the six preceding value studies, client project managers and the Project Sponsor.

The value drivers for the project were defined in the then Office of Passenger Rail Franchising (UK) (OPRAF) (now the Strategic Rail Authority) agreement and included the necessity to meet the requirements of the directive at the lowest cost without compromising the design requirements and to identify any opportunities for improvement of the rail system and commercial development for the track operator during the process.

The design of the study

The major project comprised a Programme of projects, each significant within its own right. The design stages reached for the constituent projects varied. The design of the major city centre components were more advanced than the outer infrastructure components and stations. The value study process at the major project level comprised a series of discrete, overlapping but also interdependent value studies, each with their own three-phase structure.

At major project level, in the Orientation and Diagnostics phase for this, the VSLs undertook an information gathering exercise, which included information available on the overall project. In addition, interviews with senior management personnel were undertaken. This information was analysed and the VSLs proposed that a programme of value studies should be undertaken. At the major project level, its Orientation and Diagnostics phase included the following:

1. Meetings with key stakeholders to discuss fully the scope of work, the detail of the design and the cost plan. The value study was also to be undertaken in conjunction with a risk management review of the major project.
2. The risk manager was interviewed for each discrete value study within the programme and also attended the major project Value Workshop for the second value study. Any risks highlighted at each of the project level value workshops were noted and the risk manager included them in his review. No analysis of the risks identified during the value study was undertaken. It was carried out as part of the risk management commission being undertaken separately.
3. A number of the existing station and infrastructure sites were visited.
4. Interviews were undertaken with identified key stakeholders for each of the subsequent project value studies.

5. All available relevant documents and drawings were studied.
6. The information gained was analysed and an agenda prepared for each of the structured value studies in the value programme.

There was a series of nine value studies that took place over the 3 month period.

- The first value study – at major project level – was to focus the cost planning team, and give them a step-by-step introduction to the major project issues that would be covered in subsequent value studies.
- The second value study – again at major project level – adopted a strategic approach with key stakeholders to review the purpose and key issues impacting the whole of the major project as an infrastructure programme. This informed the base agenda for each of the subsequent value studies. This base agenda was adapted to suit the particular circumstances/issues impacting each of the other projects forming the major project. The generic agenda was as follows:
  - Introduction to the project by the Client Project Sponsor and an introduction to the value study process by the VSLs.
  - An exploration of the issues impacting the project under study and the particular part being studied.
  - Identification of the Project Drivers.
  - A function analysis of the project.
  - A comparison of the design with the function analysis, listing any value mismatches.
  - The generation of ideas for change to the design and/or management of the project including identifying any opportunities that may be available.
  - Sort the ideas generated and evaluate the high level worth of these ideas.
  - Develop and evaluate the surviving ideas to produce proposals for change.
  - Prepare a detailed action plan for implementation of proposals.
  - Present the proposals to the Client Project Sponsor for adoption into the project.

After the first two value studies just noted, each of the other value studies overlapped and was enabled by utilising the two VSL teams working in parallel but also maintaining ongoing dialogues and lessons learned.

- The programme of a further six value studies adopted a value engineering approach to various discrete parts of the major project. The typical three-phase value study approach was adopted for each study. The generic value study agenda created during the second value study earlier was considered and adjusted to suit the particular requirements of a project comprising the overarching major project. The Orientation and Diagnostics phase for each project-level value study involved a review of documentation, and interviews with designers. The second phase of each study – the Value Workshop – was a 2 day exercise held residentially away from the daily working environment. The project level Implementation phase was a value study report on the project level proceedings and the proposals made for implementation into the design of each part of the major project. As noted in Figure 7.1, of the six value studies:

  - There were three value studies associated with major station reconfigurations,
  - There was one rail diversion project value study, and
  - There were two infrastructure and outer stations value studies.
- At major project level – its Implementation phase involved a final value study held with members from all value teams across the value study programme to review the development and implementation of all proposals from each of the various value studies.

Following each value study, a report was produced within 1 week of the date of the Value Workshop phase. The proposals for change usually fell into a number of categories as follows:

1. Design changes
2. Construction method changes
3. Site management proposals
4. Project management proposals to save time, and proposals for the management of key interfaces with third parties
5. Identification of property development and other commercial opportunities resulting from the project
6. In addition, the risks highlighted during the value study programme were listed for ongoing analysis

The use of function analysis

Function analysis was used in all the value studies with the exception of the Implementation study, first to analyse the major project in terms of its mission in value studies 1 and 2 in particular. This was subsequently used to inform function analysis at each of the other project-level value studies. Second, the function of each project within the major project was analysed to determine what was required to perform and deliver the functionality of the programme as a whole by that project. The analysis was developed by each value team during their Value Workshop phase. The function analysis was used in each case to compare against the design solutions. Any mismatches were noted. Function analysis was also used during the evaluation stage to sort ideas into embryo proposals for further development.

Value team: Stakeholder management and team dynamics

Due to the complexity of the major project, there were a great many stakeholders. The Client Project Sponsor, who had commissioned the study, was a common thread throughout. The Client Project Sponsor introduced the project at each value study workshop in the value programme and attended the last session of each workshop to receive the presentations on team proposals. Different design teams were involved with each project in the programme. Although the teams were working together on the design, the value team dynamic had to be built up during each of the value studies. The

Value Workshop phases also had the benefit of informing other team members of the progress of other parts of the project.

The identification of stakeholders for interview and for attendance at each of the value studies was carried out by the leader of the cost plan validation exercise. The VSLs interviewed key stakeholders and reviewed data provided during the Orientation and Diagnostics phase prior to each of the workshop phases. The value team workshop attendees were chosen for their expertise on each part of the individual projects within the overall major project.

In terms of the VSL team structure, VSLs were assigned to each value study and in total the VSL team comprised four VSLs. The two VSL approach per value study, with differing pairs of VSLs for each study, enabled continuity and cross-study learning to be maintained. This also enabled the VSLs to discuss and solve team dynamics issues which arose during the value studies. In general the value study teams worked well but in some cases, designers with designs already developed became entrenched and displayed a reluctance to change. This was disruptive and time was spent deflecting this attitude. The adverse team dynamics was addressed by the VSLs with no effect on the study outcome.

All the value study team members were working on the project and no independent consultancy advice was sought by the VSLs.

The outcomes of the value study programme

The outcome of the value study programme was a report from each of the value studies. Each value study generated many proposals, and an Action Plan for implementation of proposals was developed. A number of proposals that were related to design changes produced substantial savings in time and cost whilst delivering the project requirements. One major designed element was deleted entirely with no impact on overall function. There were many proposals related to commercial development opportunities, project management, site management and construction method. Some of these latter proposals would have substantial benefits to the track operating company and others which would have cost neutral management efficiency benefits for the client.

The benefits of the value study

- A rigorous programme of value studies on every part of the major project was undertaken as part of a cost plan validation exercise. The client therefore had the assurance that the project was subjected to very detailed scrutiny before proceeding to the next major project stage.
- The active encouragement and interest of the Client Project Sponsor at the commencement and conclusion of each workshop resulted in enhanced team enthusiasm for the workshop task.
- The value study approach kept the client's value criteria at the forefront. The use of function analysis was a key tool used to compare against existing designs solutions.

- Stakeholders were fully involved in the process. The major and sub-projects benefited from the enhanced team dynamics engendered and the knowledge shared by the team during the value workshop sessions.
- Substantial time and cost benefits were obtained for the client through the value study programme. Implementation of proposals was greatly enhanced due to the involvement of designers who were working on the major project during the value study programme.
- The benefits to the client were enhanced by the identification of commercial development opportunities during the value studies.
- The inclusion of an implementation review value study to bring all teams together and review the progress on the various Action Plans and implementation of proposals assured the client that designers were implementing proposals into the ongoing design of each project in the Major Project.

Lessons learnt

The key lessons learnt for this programme of value studies were:

- Careful consideration and planning of the value study programme at the proposal stage established a robust methodology that was thorough and rigorous. The programme of value studies to address each main part of the major project together with the first, introductory value study, and the final, Implementation review value study, was a powerful approach to delivering value studies on such a large and complex major project.
- The 2-day residential Value Workshop phase held away from the workplace was sufficient to carry out the required value studies and had the added benefit of improving the value team dynamics during full team, working group sessions and in interaction outside of the workshop.
- The creation of a generic value study baseline agenda for studies can be successful if it is adjusted to take account of key emerging issues both before and during subsequent value study. It was efficient and effective.

7.5 Case study 4 – Magistrates Court project

Project description including stage and programme

The value study was commissioned by a local authority whose responsibility included the provision of Magistrates Court premises. The main driver for the project was the functionally inappropriate existing court accommodation. The value study was initially commissioned for value engineering. However, this changed during the course of the study into a combined VM/VE value study. The value management aspect challenged the location of the project by examining the client's strategic requirements and comparing the proposed location with a number of potential alternatives. The value engineering aspect examined the existing design in detail. The driver for the value engineering aspect was that the project was 50% over budget, and a contingency approach had to be adopted if the strategic site component within the VM aspect could not progress. Achieving a 50% savings was beyond the ability of normal cost saving exercises and a fundamental look at the value of the whole project was needed if that level of budget reduction was to be achieved.

The design of the study

The design of the project was between RIBA design Stage C and D, now Concept Design and Developed Design RIBA 2013.

The value study was undertaken in three phases. The Orientation and Diagnostics phase included a review of the project design drawings and the associated cost plan. Interviews were undertaken with the design team members, the then Magistrates Court Committee (MCC) and the Court Service project manager. Note that the Court system in England has since been reorganised. Information gathered was analysed and used to create an agenda for the structured workshop. The Value Workshop phase was initially designed as a 2-day value engineering exercise to examine the project design, driven by the need to bring the project back on budget. The study included members of the project design team, members from the MCC and the Court Service. The value team of 22 personnel comprised 2 VSLs, 15 design team members, 3 local client representatives, 1 central government client representative and 1 representative from the MCC. The MCC had concerns that the chosen site did not meet their strategic needs.

A 2-day value engineering workshop agenda was developed during the Orientation and Diagnostics phase. The agenda was as follows:

- Day 1
  - Examination of key issues impacting the project
  - Establish project drivers
  - Determine the relative position of time, cost and quality for the project and whether the procurement route matched the client's needs
  - Project task and function diagram
  - Review of design against function
  - Creation of ideas strategic options for change
  - Examine the technical and detailed spatial proposals to identify value mismatches
- Day 2
  - Examine the proposed spatial adjacencies
  - Strengths and weaknesses of the existing design
  - Create ideas for spatial and technical change to the existing design
  - Sorting of created strategic, technical and spatial ideas
  - Focussed benchmarking study of similar projects
  - Development of ideas
  - Action Plan

It became apparent during the Value Workshop phase that it was necessary to reconsider the location of the project as it did not meet the MCC's needs, an alternative location could provide synergies with other justice facilities and potentially enable substantial cost savings to be achieved. The Value Workshop process had to be reconfigured to accommodate both a value management analysis on the strategic site location, and a value engineering exercise on the existing design solution.

The first day of the workshop phase of the value study examined the strategic issues impacting the project. The analysis carried out at the workshop included site issues, organisational and technological change, safety, security, programme and budget. Project drivers were established together with an examination of time, cost and quality and procurement. A function diagram was generated and the spatial configuration of the existing design analysed.

The second day included a benchmark comparison of similar projects on 'greenfield' sites. The space requirement schedule was reviewed and a strengths and weaknesses exercise undertaken on the existing design. Following this, a large number of ideas for change were generated. The ideas included both site location ideas as well as ideas for change to the existing design. Ideas were sorted using a high-level sort criterion comprised of achieving the functional need, client acceptability, technical feasibility and economic viability. An ideas development session was undertaken by the value team to work up those surviving ideas into embryonic proposals for change. An Action Plan was created to enable the key ideas to be taken forward. In this case, the key ideas were divided between the strategic high-level management decisions required before the project could proceed further and a number of tactical design proposals to bring the presently proposed project back on budget.

In the Implementation phase, a value study report was produced within 1 week from the date of the workshop. The report included a description of the value study process, why it was changed during the workshop stage, a list of the proposals made – strategic and tactical – and an Action Plan to take the proposals forward.

The use of function analysis

Function analysis was used to determine the client's functional requirements for the project. This enabled the team to consider alternative locations for the project, a key strategic value mismatch that had occurred in the development of the project to that point in time. Function analysis was also used to highlight mismatches in the design as developed.

Value team: Stakeholder management and team dynamics

There was no management representative from the Local Authority at the value study and the study would have benefitted from their involvement particularly in respect to the site location issue. The then Magistrates Court Committee was administered by the Court Service. The client body was therefore fairly complex. The design team was led by the Local Authority Architects Department. The structural, mechanical and electrical engineers were appointed external consultants.

The initial interview with the members of the design team, the MCC and the Court Service project sponsor took place over 2 days before the Value Workshop phase commenced. It was during this stage that the key issues on site location and budget were highlighted. The value team who attended the workshop were drawn from those who were interviewed beforehand.

Two VSLs managed the workshop stage, an approach that enabled a sharp focus on key issues to be maintained and in particular enabled the value study to proceed with VM and VE components operating in parallel during the workshop. The VSLs adapted the agenda and the value team working sessions to the changing workshop circumstances.

The outcomes of the value study

The outcome of the value study was a report that listed proposals relating to possible alternative sites for the project and also proposals for tactical change to the design to bring the project back on budget. The study achieved savings amounting to a 30% reduction in the capital cost of the project. However, this was insufficient to meet the client's budget. It was recommended that a more detailed examination of the synergies gained by changing the site to be closer to other justice-related assets could produce more substantial savings and bring the project back on budget.

The benefits of the value study

- The value study identified that an inappropriate site had been proposed for the project and developed ideas on how to solve this issue. While this was not necessarily a benefit, the study was the catalyst for the realistic identification of the client's requirements and allowed the site location and budget issues to be highlighted for management action.
- The value study, through the application of the tools and techniques used enabled a large number of ideas to be generated to produce savings without compromising the functional requirements of the project.
- The value approach kept the client's value system at the forefront in the study.

Lessons learnt

The key lessons learnt from this study were:

- The value study process can be successfully utilised to highlight key issues in the project concept and can be used as a catalyst to address such a situation notwithstanding that this also highlights abortive work.
- The value study would have benefited from the attendance of all members of the complex client body including a senior Local Authority representative. The senior Local Authority managers were not interviewed and this was probably a missed opportunity. The site location issue needed input from all client body members.
- A value study held with representatives of the complex client body at an earlier stage would have identified the budget and site location requirements.

- The ability of the VSLs to change the focus of the workshop was greatly aided by having two VSLs present who were then able to manage the separate VM and VE aspects of the study concurrently.

7.6 Case study 5 – College campus library project

Project description including stage and programme

Three value studies were carried out over a 9 month period on this project. The value studies developed over time as the results of earlier studies were made explicit to the client body. Each of the value studies can be noted as follows:

1. A VE study conducted at tender stage.
2. A VM study that was essentially a project value audit.
3. A VM combined Briefing and Procurement Study.

The project was the construction of a new library to meet the increasing needs of the college. There were two phases proposed for the project. The first phase of the project was planned to be constructed adjacent to the existing library. Upon completion of the first phase the existing library was to occupy the new building. The second phase involved demolition of the existing library and construction of the second phase of the new library and as adjoining extension to the first phase.

The first value study comprised an examination of the project process to date and an analysis of the documentation produced during the tender period in order to assess:

1. The risks related to the design that had evolved over time, and
2. The sufficiency of the project documentation to provide a robust tender that would satisfy the client's requirements.

This study was conducted with the project design team, client estate office personnel, and senior college staff. The objectives for the first value study were threefold. First, to clarify the roles and responsibilities of the project team that had become blurred due to procurement difficulties and consequently the team was not functioning well. Second, to check that procedures were in place to achieve the client's strategic objectives. Third, to identify the risks associated with the project at tender stage. An Action Plan was agreed to deal with any issues arising from the value study.

Once tenders had been received and reported, a second value study was undertaken at the request of the client with an independent 'shadow value team'. The objectives for the second value study were threefold. First, to establish the extent to which the proposed design reflected the requirements of the architect's brief, and, the strategic needs of the project. The degree to which the tender documents reflected the design and assignment of risk and the reasonableness of the tenders received, together with the project's construction schedule. Second, to receive an opinion on the extent to which the technical construction elements of the architect's brief added to or subtracted from the capital and whole-life cost of the project. Third, to offer preliminary advice on the procurement of the project and how this process could be best managed.

Following the second value study the project in its current form was abandoned. The VSLs were commissioned to carry out a third value study. There were five objectives for this study: (i) to confirm a number of policy areas and to clarify issues within the Business Case, (ii) to develop a technical brief, (iii) to review the time, cost and quality parameters for the project, (iv) to scope the procurement strategy and clarify roles and responsibilities, and (v) to confirm a schedule for the project.

The design of the studies

The first value study was initially designed to determine if the threefold objectives stated earlier were being achieved. The tender documents for the project were about to be issued and the client became concerned that the project budget was being exceeded and tension between the client project manager and the other design team members was becoming apparent. Notwithstanding the objectives of the value study, this was an opportunity for all the members of the team to have a full and frank discussion on the issues to date and attempt to rebuild the disparity among the team members. The value team of 20 comprised 3 VSLs, 6 client representatives, 2 project managers, and 9 design team members.

The study was undertaken in three phases. The Orientation and Diagnostics phase gathered information through interviews undertaken with the client body both at estates level and college management level. The documents available were the design drawings, the cost plan and other documentation gathered from members of the design team. Interviews were held with each member of the design team and a visit to the site undertaken to view the constraints involved.

Following the analysis of the information gathered, a value management agenda was prepared – even though the project was a late stage – for a 2-day value workshop, which would enable the key study objectives to be examined in detail. The agenda covered the following:

- A prioritised project issues analysis focussing on the stage the project had reached, an examination of the site location, phasing, design documentation, procurement, tendering, hand-over and occupation stage.
- An examination of the strategic timeline.
- Determining the project value drivers.
- Creating a project function diagram.
- A review of the procurement, form of contract, project interfaces, hand-over and migration strategies.
- An analysis of how the phasing and phased occupation would operate in practice.
- An examination of the budget and contingencies together with a review of the cost savings available and how they related to the client's value criteria.
- The development of a management strategy for managing the project through the construction stage to assure the client that proper quality, budget and risk management procedures and processes would be in place.

- Determine the priority project and client management issues to be resolved in the project moving forward.
- Developing proposals for the management of the project going forward in the short, medium and long-term.
- Establish an Action Plan with stakeholders and time periods identified to implement the acceptable proposals.

The Implementation phase of the first value study comprised the production of a report on the value study that included a description of the value study process, a list of the developed proposals and an Action Plan agreed at the workshop to address the concerns of the client body.

Tenders for the project were subsequently received, which were over budget and the client had many concerns that the outcomes agreed at the first value study had not been implemented. Therefore, the client had little confidence that the project and the tender being recommended would satisfy their needs.

The client commissioned the VSLs to carry out a second value study. The second value study comprised a value team of 12 and included VSLs (3), the client's estates team (2), client's users (2) together with an independent 'shadow team' (5) of architectural, structural engineering, mechanical and electrical engineering, quantity surveying and main contractor members.

The second value study had three phases. The Orientation and Diagnostics phase comprised the independent 'shadow team' technical members of the value team taking the opportunity to discuss the technical design issues with members of the project design team. The review of the design and interviews with the project design team took place over a three week period. Following this the VSLs met with the independent 'shadow team' members to discuss the information gained and an agenda was prepared for a 3-day value workshop.

The 3-day value workshop synthesised, interrogated and integrated information from the separate findings of the technical members of the value study team. In addition, a risk analysis of the procurement options going forward was undertaken. The value workshop team developed a series of project validation conclusions.

The value management agenda prepared for the second value study workshop was as follows:

- Day 1
    - Presentation of the analysis carried out by the independent technical 'shadow team' members including an assessment of the phased programme, site layout and location.
    - Creation and prioritisation of key issues impacting the project including issues relating to reorganisation, disposal, refurbishment, safety and security.
    - An examination of the relative weight attached to the time, cost and quality criterion.
    - The development of a strategic time line.
    - Creation of a strategic function diagram from statements made in the project and architect's brief, and subsequently validated with the client team in the workshop.
    - A review subsequently of this function diagram with the Brief and the design as proposed.

- Day 2
  - A spatial analysis of the project including:
    - User flow
    - Operational and working patterns analysis
    - Adjacency requirements
  - Comparison of spatial analysis with the Brief and drawings.
  - An analysis of the elements and components, including buildability aspects within the project design as follows:
    - Structure
    - Envelope
    - Internal environment and technology
    - Internal transportation
    - Function space, organisation and style
    - External infrastructure
  - Comparison and review of designed elements and components against the Brief, including commissioning and the phasing of the project.
  - A consolidation and review, including a value for money assessment, of the spatial, elements and components, buildability and construction analysis.
- Day 3
  - The development of the risk analysis for the project going forward.
  - Development of report recommendations.
  - Review and creating of an Action Plan.

The Implementation phase of the second value study was the preparation of a value study report, which was presented to the college management for consideration. The report contained a description of the value study process, a statement that addressed the college's concerns in regard to the current design and tender, and a statement on potential procurement methods going forward together with a high level project timeline.

Following consideration of the report from the second value study, the college took the decision to cancel the project, and subsequently after a number of months commission a third value study to prepare a new project brief. The value study would comprise the following:

- To confirm a number of policy areas and to clarify issues within the Business Requirement.
- To develop a technical brief.
- To review the time cost and quality parameters.
- To scope the procurement strategy and clarify the roles and responsibilities.
- To confirm a schedule for the project.

For the third value study the VSLs proposed the same client estates and user group and the independent technical 'shadow team' who took part in the second value study – a value team of 12 personnel.

A three-phase value study was proposed. The VSLs undertook the Orientation and Diagnostics phase of the value study using information already available from the client and the needs of the project. The independent technical 'shadow team' were asked to consider the implication for the briefing of a new project. The VSLs met with the independent technical 'shadow team' and developed an agenda for the Value Workshop phase.

A value management agenda was prepared for the 2 day workshop. By this time the value team had a very good working knowledge of the issues impacting the project. The agenda comprised:

- Day 1
  - A presentation by the technical 'shadow team' of areas that required clarification and confirmation.
  - Confirmation of a schedule of user requirements.
  - Development of user flow diagrams.
  - Development of adjacency requirements.
  - Identification of staff work flow patterns.
  - Consideration of storage capacity, methods and out-turn space.
  - Identification of areas norms.
  - A function analysis of the elements and components for the project.
- Day 2
  - A project location study with options and identification of a preferred option.
  - Establishing a project budget by RICS/BCIS element-function analysis.
  - A procurement study.
  - Final consideration of a project timeline.

Following the completion of the value workshop, the Implementation phase was started. The independent 'shadow team' architect examined all the information and developed a Brief of user space and spatial areas. A final workshop was held to review and synthesise the briefing information. The client team members reviewed the analysis of the client user requirements and the independent technical 'shadow team' reviewed the elements and components descriptions to be included in the Brief. The 'shadow team' and the client estates and users group worked closely in working groups throughout this activity. The Briefing document for the Library Project was presented to the college management for final approval.

Subsequently, the project was procured and constructed in accordance with the Brief and revised budget on the site selected through the third value study.

The use of function analysis

Function analysis was used in a number of ways during all three value studies:

- Strategic function diagrams
- Function analysis to validate and propose change to the existing brief
- Function definition of space
- Function definition of elements and components in a design

The function analysis was used to compare with the existing design solutions. Any value mismatches were noted. Function analysis was also used to create the new project brief as described earlier.

Value teams, stakeholder management and team dynamics

The three value studies spanned a period of approximately nine months. During this time the client's stakeholders remained constant. As noted, after the second value study the college took the decision to cancel the previous project and to start afresh. The appointments for the project manager and the design team for the first project were terminated. Following the termination of the original project, an independent technical 'shadow team' was appointed through the VSLs to develop a new brief for the project.

During the first two value studies the disparate team dynamics was palpable. In the authors' experience one of the advantages of value studies is the concurrent generation of positive team building. In this case the opportunity for the team to rebuild was there in the first value study but could not be grasped. This was an important reason for the failure of the project at that stage.

The client stakeholders were in three distinct groups; the client senior management, the library user group and the estates department management. The interaction among these three stakeholder groups was fairly close knit in the value study environment. Once the first two value studies had taken place and the first project was terminated on the original proposed site, the client groups worked closely together with the VSLs and the 'shadow team' to develop a new project brief on what resulted in a different site.

The workshop approach and the focus on client value systems throughout helped greatly in keeping the client team together during this difficult period. It is to the client team's credit that the new brief was completed, which matched the client's requirements, the project procured and constructed all within the time frame of the original abandoned project and for a lessor out-turn cost.

The outcomes of the studies

A series of three value studies were undertaken. These were not foreseen at the start and there was a progressive series of outcomes. The outcome of the first two value studies was to identify that there were serious shortcomings in the project that had been tendered. These shortcomings were as follows:

- The out-turn cost was very likely to exceed the client's budget for the project as the design had not fully been completed and it did not meet the client's brief in many respects. Therefore, there was a serious risk that the tender did not reflect what the final design would need to be. There was also a risk of significant contractual claims.
- Dividing the project into two phases added capital cost and time and meant that the library would have to function during the second phase with adjoining construction

work being carried out, and thus substantially increasing the risk of operational disruption to the library. There was also the unnecessary loss of the existing library building as an asset, which could be used for other purposes by the college.
- The existing procurement route was considered to be high-risk for the college.

Following a senior management decision by the college, the outcome of the third value study to develop a new project brief and the decision to change the site ensured that the new project matching the client's requirements progressed to be procured and constructed within a very advantageous time frame and cost that aligned totally with original requirements.

The benefits of the value studies

- The first two value studies helped the client come to the considered opinion to terminate the initial project which had reached tender stage. The key aspect of this decision was that there was a high risk that the project as designed would not meet the client's needs and that significant change would be needed to achieve this with consequent additional cost.
- The third value study created a brief for the project that matched the client's needs and allowed the project to be procured and constructed within the time frame of the initial project and at a lessor cost. In addition, the existing built asset was saved for reuse.

Lessons learnt

The key lessons learnt for this study were as follows:

- Project 'creep' can seriously distort the brief and design of a project to the extent that it does not fulfil the client's needs and requirements.
- The project team working with a positive dynamic is one of the most crucial aspects that contribute to the success of a project, and a value study. If it breaks down, there can be serious repercussions for the project and importantly for the client. In this project, the relationship between the project manager and the design team had significantly deteriorated to the point where it had an adverse effect. This series of value studies demonstrated clearly that the development of a project brief can be successfully carried out quickly using the value study methodology. The selection of the correct value study team members is crucial to the success of this process.

7.7 Case study 6 – Material production facility expansion project

Project description including stage and programme

The project was a large production process and associated building and civil engineering works. A value engineering exercise was undertaken as part of the design and build bidding process. The client required, as part of the bidding process, that a value engineering exercise be undertaken by both tenderers. The VSLs were employed by one of the tendering contractors. The study involved both the material producer client, the process plant contractor and the design and build contractor tendering for the work. There was to be no contractual relationship between the process plant and the building contractors. The project, among other things, was intended to increase the capacity of the material manufacturing plant by 200%. The plant was one of a number of plants operated by the client. The increase in capacity was also associated with the rationalisation in the number of plants operated. There were two tenderers bidding for the work.

The value study was undertaken during the design and build tender stage with one of the tendering contractors. The value driver for the project was identified prior to the workshop as the need to maintain the safe production of the material during the refurbishment of the works.

The design of the study

The value team of 10 personnel comprised 2 VSLs, the client Managing Director, 5 client managers, and 2 representatives from the design and build contractor.

The value study was designed in three phases. The Orientation and Diagnostics phase of the value study took place with a structured meeting held with the design and build contractor to identify the key issues to be discussed during the Value Workshop phase. This identified seven topics to be addressed with the client body. The seven topics were included in the value study agenda and were manufacturing process related. The topics were as follows:

1. The overall manufacturing process
2. Raw material storage
3. Fuel storage
4. Product production and manufactured product storage
5. Material transfer routes and systems
6. Nonprocess buildings
7. Transport routes to and from the plant, hard standings and refuelling

A value engineering agenda was developed for the Value Workshop phase. This agenda was adapted to suit, in particular, the seven topics noted earlier, and was as follows:

- Introduction by the design and build contractor.
- Introduction by the VSLs on the value study process and its use in the project at this stage.
- Identification of project objectives and project drivers.
- Review of strategic issues and the seven identified topics.
- Creation of ideas for solutions in relation to the seven topics; the proposals to be created under each of the topic headings.

- High level sorting of ideas by testing against the criterion of client acceptability, economic viability and technical feasibility.
- The sorted ideas were divided among those that the client would develop further and those that the design and build contractor would develop further.
- The workshop highlighted a number of areas of uncertainty. These areas were part of the employer's requirements, which were unclear and could not be resolved at the workshop. These areas required further clarification from the client after the study.

The Value Workshop phase comprised a 1-day workshop with an information gathering meeting to highlight key topics for discussion held 1 week before the workshop. The VSLs were constrained by the time available to a single day and this dictated the design of the workshop.

The Implementation phase included the preparation of a value study report, which included a description of the value study process and listed the proposals for change. In addition, an Action Plan for implementation of the proposals was included.

The use of function analysis

Function analysis was used to determine the client's purpose for the project. This changed the primary focus of thinking on the project design from maintaining safe production during the works to maintaining supplies of product to customers. This enabled the value team to be far ranging in the ideas for change that they created.

Value team: Stakeholder management and team dynamics

Initially, the client managing director had intended to introduce the workshop and then leave. However, having stayed for the first 30 min of the workshop, he decided to clear the rest of his day to enable him to remain in the workshop as the key client stakeholder. His input was vital in refocusing the design team on the actual project requirements and enabled a much more open reconsideration of the design of the project. The contractor was keen to gain a commercial edge in the bidding process, although both tenderers were given (and took) the same opportunity. The competing contractor elected to have a brief half day workshop which occurred prior to the workshop described here.

The initial interview with the design and build contractor during the Orientation and Diagnostics phase enabled key topics to be highlighted and raised by the VSLs during the workshop phase. The workshop attendees were drawn from both the client team, the design and build contractor's team and the client's main process plant contractor.

Two VSLs facilitated at the workshop. This approach enabled a focus to be maintained and the VSLs were able to discuss progress amongst themselves and resolve team dynamics issues that arose during the workshop. In general, the value team worked well.

No further outside consultancy advice was sought by the VSL as all expertise was available in the value team.

The outcomes of the value study

The outcome of the value study was a report that listed ideas for change, which benefited the client directly once the ideas had been developed into actual proposals. In addition, items were identified which, when developed, would benefit the design and build contractor in the preparation of their bid. The clarity in defining the project purpose was of advantage to both the client and the contractor. As it transpired, the contractor did not win the bid for commercial reasons and a number of the ideas created during the value study were incorporated into the winning contractor's design post tender.

The benefits of the value study

The value study, through the use of function analysis, refocused the project purpose and enabled a large number of ideas for improvement to be generated. This demonstrated the power of function analysis in the review and design development stage of projects.

- The value study approach kept the client's value system at the forefront of the study.
- The use of a value study in a design and build tendering situation was of great benefit to the client, but not necessarily the design and build contractor who may have provided ideas that were subsequently adopted by the winning contractor. Through the detailed analysis the contractor obtained a heightened awareness of the project risks, which they may have subsequently priced for in their tender. The client benefitted from focussing on beneficial change to the project and the contractor benefitted from being able to produce a project bid that would match the client's strategic and tactical needs.
- Substantial time and cost benefits were obtained through the generation of over 300 ideas for improvement.
- The benefits to the client were enhanced by the identification of commercial opportunities during the study.

Lessons learnt

The key lessons learnt from this study were as follows:

- The value study process can be successfully utilised during a design and build tender period. Careful thought needs to be given to the commercially sensitive nature of carrying out such a study during this period. The contractor involved did not win the bid. However, the ideas created were shared by the client with the winning bidder after the bidding process was complete. These ideas were incorporated into the winning contractor's design post-tender.
- The single day workshop session was not enough to fully resolve all the ideas into proposals for design development.

- The involvement of key stakeholders in the workshop process is vital to the success of such a study.
- While the bidders knew the situation with regards to the sharing of information from the value studies, each undertook it nonetheless and this raises ethical issues in relation to value studies undertaken in such circumstances. The client would have benefitted from a value management study to determine their needs from the project at an earlier stage, and this may have assisted the subsequent tendering stage for the design and build contract.

7.8 Case study 7 – Social housing project

Project description including stage and programme

The project comprised the external and internal refurbishment of two multistorey residential blocks in a prominent position within a city centre location for a newly formed housing association. A series of two value studies were commissioned by the preferred bidder contractor. The first was a value engineering study immediately after tender stage commissioned to bring the project back on budget and only if this was achieved would the project proceed. The second, and slightly later study, was a proposal that emerged during the first value study to agree a partnering arrangement for the construction stage of the project.

The housing association had been formed following a stock transfer from the local authority. The project was the first of a Programme of improvement projects and the housing association needed to give their funding body and their Board the confidence that the Programme agreed could be delivered for the budget that had been set. This requirement was one of the key drivers for the value studies as the project construction cost at tender stage was some 16% over budget. The first value study identified a large number of proposals for improvement that would deliver the project within the set budget. The study also highlighted that there was a need for all parties to work closely together to ensure that the quality standard and schedule were achieved within the budget during the construction stage. One of the key decisions that emerged from the study was to develop an overlying partnering arrangement among the parties during the construction stage of the project.

The study was carried out over a 2 week period with stakeholders from the client housing association, the design team (the city property services department) and design and build contractor who was the lowest tenderer. The project had been tendered using a design and build procurement route where the design team was to be novated to the contractor.

The second value study was commissioned to identify the partnering arrangement required, together with the processes, procedures and management structure to support it. This study was also undertaken during a 2 week period. It was convened after the value engineering proposals had been developed and built into the revised accepted tender for the works. The contractor had been only just been appointed and the partnering study included key members of the community groups representing the tenants in both blocks, the housing association, the design team and the design and build contractor.

The design of the study

The first study was carried out in three phases. The Orientation and Diagnostics phase included the VSL undertaking interviews with members of the existing design team, who comprised the city council property services department, members from the newly formed housing association and members from the lowest tendering contractor selected in the design and build tendering process. Drawing and tender cost information was obtained. Following analysis of the information gathered, the VSL prepared a 2 day value engineering workshop agenda.

The value team of 22 personnel for the first study comprised 2 VSLs, 4 client representatives, 10 design team members, and 6 representatives from the contractor.

The Value Workshop phase took place during the week following the first phase. The first day of the workshop examined the strategic issues impacting the project, and included identification and prioritisation of business issues, funding, tenant's expectations, political commitments, site issues, organisational and technological change, safety, security, programme and budget. Project drivers were identified through an examination of the client's overall business context and the project's position in relation to that. A function diagram was generated, which defined the client's value needs for the project. The latter part of the first day of the workshop involved an analysis of the construction stage project management and of primary technical elements included in the design of the project. The outcome of this working session was the identification of the need for the parties to work very closely together during the construction stage. It was proposed that this be carried out by the introduction of a partnering 'overlay' to the existing design and build contract. The outcome of the technical review of key elements in the project was the creation of a list of ideas for change to bring the project back on budget. The technical review sessions included an examination of the existing design, the creation of a functional requirement for the elements and components and the generation of alternatives to satisfy the functional criteria at a lessor cost. The ideas were presented and the value team evaluated them to determine which were to be developed further.

The second day of the value workshop included an evaluation of the ideas and the workshop team operating in small working groups to develop the ideas into embryonic proposals for change. These proposals were presented to the full workshop team and an Action Plan agreed for implementing the ideas into the design and subsequently into a revised tender sum.

The Implementation phase was the production of a value study report on the value process, the proposals for change incorporating the Action Plan for implementation of these proposals.

The second value study was carried out a number of weeks later and was also undertaken in three phases. All key stakeholder groups were interviewed during the Orientation and Diagnostics phase. The groups comprised the design team, the contractor (not yet fully appointed) the housing association and groups representing tenants from the two tower blocks included in the project. From the information gathering, the VSLs prepared an agenda for a one day partnering workshop to identify the parameters and content of an overlying partnering agreement to the design and build contract.

The value team of 40 personnel comprised 2 VSLs, 3 AVSLs, 10 client representatives, 6 housing association and community representatives, 10 design team members, 1 project manager, and 8 representatives from the contractor.

The partnering workshop was designed using a value study approach and methodology. It was a project requirement that the tenants were not to be decanted during the refurbishment of the tower blocks. There were a large number of workshop attendees and to manage this group the two VSLs were supported by three assistants. The workshop phase of the value study was attended with almost equal representation from the client, the tenant groups, the design team and the contractor. The first workshop session enabled the stakeholders to identify all the issues that they felt were needed to be delivered from the project. These issues were analysed and prioritised using function analysis techniques to establish which issues were actually needed and which were 'good to haves' but not essential. This analysis formed the basis of agreement on the project Partnering Charter. Following the agreement of the Charter the value team developed the processes and procedures necessary to manage the partnering arrangement during the construction period and created the Memorandum of Agreement. The workshop closed with an agreement of the project Charter and the Memorandum of Agreement together with an Action Plan for the signing the Charter and for implementing the management systems for the delivery of the project.

The Implementation phase was completed within a week of the workshop. The value study report included a description of the process and the Partnering Charter, the supporting Memorandum of Agreement and the Action Plan for implementation of these documents into the ongoing management of the project.

The use of function analysis

Function analysis was used in different ways during these value studies. The project team identified what the project needed to achieve from both a business and project perspective. This approach enabled the creation of ideas for improvement. Function analysis was used in group working sessions in a very detailed manner to establish the functions needed to be performed by key elements and components. This also enabled the creation of more detailed technical ideas for change to match the function criteria needed. In the second value study, function analysis was used to create the mission statement and supporting requirements for the Partnering Charter. This was a dynamic tool where all stakeholders were able to be closely involved in the discussion and decision making.

Value team: Stakeholder management and team dynamics

The value studies were commissioned by the design and build contractor. The contractor had suggested the value methodology in their design and build bid. When the resulting bids were over budget the client body was keen to explore the value study process to deliver their needs and this also led to it being adopted to deliver a project partnering arrangement.

Prior to the first value study the client and their design team had worked together on the project for some time. The contractor was a new addition and there was a relationship that needed to be developed. The design team commissioned by the housing association was to be novated to the design and build contractor for the construction stage. The value workshop process was excellent for building this relationship through discussion, through the detailed exchanges in working groups and also in the social break sessions between the more formal workshop sessions. The development of the relationship was successful and was deepened through the second partnering workshop. The tenant groups were introduced, through discussions with the housing association, into the value team to develop the project partnering arrangement. As the project was to be carried out with the tenants in residence their co-operation was essential. The value workshop session included tenant groups and these were able to gain a full understanding of exactly what the project entailed, enabling them to contribute to the method for project delivery. The resulting Partnering Charter achieved the aim of bringing the tenants into the project in the most effective manner.

Two VSLs were involved in the first value study. For the second value study there was an attendance list of 40 people at the value workshop and 1 VSL and 3 AVSLs were used under the direction of a co-ordinating VSL. This enabled the large value team to be divided into a number of small working groups to carry out specific detailed tasks. This enabled a large number of groups to be used resulting in a significant output during the one day value workshop. The workshop AVSLs needed to be able to adapt to the changing circumstances and advise the VSL on adjustments necessary to the agenda and the working group sessions to suit the emerging situation at any given time.

The outcomes of the value studies

The outcome of the first value study was a report that listed technical proposals for implementation to bring the project back on budget. The key management proposal made at the first value study was to develop a partnering arrangement for managing the construction stage of the project. The second value study created a Partnering Charter and associated Memorandum of Agreement with supporting management processes and procedures from a single 1 day session with a large number of stakeholders.

The benefits of the value studies

The first value study brought the project back on budget and enabled it to proceed to construction. It established the need to manage the construction stage using a partnering overlay to the design and build project:

- The first value study ensured that the housing association could give assurance to their funders that they could manage projects within a set budget, and thus secure the finance for their planned programme of work.
- The second value study developed the Partnering Charter, Memorandum of Agreement with management processes and procedures through involving all the key stakeholders involved.
- The value approach and methodology kept the client's value system at the forefront in both studies.

- A subsidiary benefit was the positive introduction of the contractor and the tenants who would be directly impacted by the project into the project delivery team.

Lessons learnt

The key lessons learnt from this study were as follows:

- The value engineering process can be successfully used even at tender stage to successfully bring a project back on budget. The identification of the client's business project related to the functional requirements of the construction project was a key tool to unlock any entrenched views on the design as it stood at tender stage.
- A value study approach and methodology was a powerful tool to successfully develop a project partnering arrangement.
- The use of a value study at an earlier design stage could have established that the project was over budget and savings could have been achieved. In this project the attendance of the contractor in both studies at the workshop was of added benefit as they identified buildability issues that had led to unnecessary cost, and in the creation of options for managing the construction stage of the project.
- The use of syndicated group working using AVSLs and plenary sessions was a successful method to focus and manage the large value teams in the partnering workshop and to produce a considerable and focussed output in a fairly short period.

7.9 Case study 8 - Crown Court project

Project description including stage and programme

The value study was commissioned by the client's estates group as a value engineering exercise. The project was to bring together the Crown Courts that were currently dispersed throughout an area into a single building centrally located. The value study examined the existing design in detail. The project design was at Final Sketch Design Stage, now Developed Design RIBA 2013. The driver for the value study was the need to fulfil the client's project procedural requirement for such a study at the stage the design had reached.

The value study spanned a total of 3 weeks. One week for the Orientation and Diagnostics phase, 1 week for the Value Workshop phase and 1 week for the Implementation phase. The value driver for the project was to obtain efficiencies by consolidating the administration of justice into one location from the four currently in operation.

The design of the study

The value study was based on a three phase approach. The Orientation and Diagnostics phase included interviews with the client's project sponsor and the project design team. During the interviews drawings and documented information was obtained by the VSLs, who subsequently prepared an agenda for the Value Workshop phase.

The value study was designed to examine the project's elements and components, included in the final sketch design, in function terms to ensure that the design delivered the client's requirements for the project without unnecessary cost. The 3-day residential workshop agenda was as follows:

- Day1
  - Examination of key issues impacting the project.
  - Establish project drivers.
  - Determine the relative position of time, cost and quality for the project.
  - Project task and function diagram.
  - Creation of a list of functions that the elements and components in the project needed to perform.
- Day 2
  - Small working groups to review elements and components included in the design against functional requirements, with ideas for change created during the working group discussions.
  - Sorting the ideas created using function criteria into ones to be developed in the value proposals.
- Day 3
  - Development of ideas into proposals for change and prepare presentations.
  - Presentation of the proposals for change to senior managers from the client.

The value team of 12 personnel comprised 2 VSLs, 1 Project Sponsor, 1 project manager, and 8 design team members.

The first day of the workshop examined the strategic issues impacting the project. Project drivers were established together with an examination of time, cost and quality. A function diagram was generated for the project and the functions required of the elements were established.

The second day of the workshop comprised a detailed study of the elements and components included in the final sketch design. The workshop team was divided into two working groups. One group studied the elements and components associated with the different user spaces within the building and the other group studied the enveloping elements and components of the design. The latter group also studied the key building services elements as they related to the building as a whole. Each working group identified any value mismatches and created ideas for change during the group session. The whole team was brought together to initially judge and evaluate the ideas for change. The second day of the workshop extended into the evening with the workshop team developing the ideas that survived the initial sort.

The third day of the workshop started with some ideas being discounted following the development work that had already been undertaken. The surviving ideas were developed into proposals for change. The value team presented the developed proposals to senior members of the client estates organisation.

The Implementation phase of the value study involved the production of a report. The report contained a description of the value study process, a list of proposals to be considered for implementation and an Action Plan, which indicated the person and timescale involved in taking each proposal forward.

In recent times, a 3-day workshop phase period is rare. Recent workshops are more likely to finish after the initial ideas evaluation stage with little or no time available for development of evaluated ideas at the workshop. An Action Plan to take evaluated ideas forward for development outside of the workshop is often how a workshop is drawn to a close. The reasons for this shortened time period are cost of personnel involved, pressures in the project schedule and now the familiarity of project teams with the value study process. This issue is debated further in Chapter 13.

The use of function analysis

Function analysis was used to determine the client's purpose for the project. As part of the element/component analysis the team created the function requirement for each element in each user space to which the designed component solution was compared. This method was used to identify function mismatches and was also used to create alternatives to the designed components. These alternatives were assessed in relation to the detailed functional requirement prior to their development into proposals.

Value team: Stakeholder management and team dynamics

A team of two VSLs managed the value study and workshop. This approach enabled a sharp focus on important issues to be maintained, delivering time efficiencies, particularly during the two parallel working group sessions on the user space and enveloping component analysis. The VSLs needed to adapt to the changing workshop circumstances and adjust the workshop agenda and the team working sessions to suit the emerging situation.

The project design team and the project manager were from one multidiscipline organisation and had worked together with the client representative on the project for some time. They had also worked together on other similar types of projects. The project design team was a well-established team. As a value team they were receptive to the value engineering approach and understood that it was part of the client's project delivery procedures. The design team had been involved in a value study at a previous design stage. The key team management issue was for the VSLs to lead the study over a short timescale within the overall project schedule. The VSLs adopted a non-confrontational approach, which helped them integrate with the project design team over the value study process, enabling the team to take 'ownership' of the process and the resultant outcomes.

The involvement of the senior managers from the client organisation in receiving the value team's presentations of proposals at the end of the workshop demonstrated to the project design team how seriously the client took the value engineering process.

The outcomes of the value study

The outcome of the value study was a report that listed four differing types of outcome. First, detailed technical component proposals initially worked up at the workshop. These proposals did not affect the functional needs of the project and amounted to a saving of

7.5% of the estimated construction cost. Considering that a value study had already been conducted at an earlier design stage this was a significant saving at this stage in the design process. Second, proposals that required more time to develop outside of the timeframe of the workshop to establish their worth. Third, proposals for project management change which would benefit the efficient delivery of the project, and fourth, proposals of a more strategic nature for the client to consider in future court projects.

The benefits of the value study

- The value engineering study, carried out late in the design stage, through the application of tools and techniques used, enabled a large number of detailed proposals to be generated to produce savings without compromising the functional requirements of the project.
- The approach kept the client's value system at the forefront in the study.

Lessons learnt

The key lesson learnt from this value study was as follows:

- The advantage of having two VSLs at the workshop enabled more work to be produced in the time available. The non-confrontational approach adopted by the VSLs ensured that the closely knit client and design team embraced the value engineering process fully. The proposals made by the project design team could be readily implemented into the project.

7.10 Project level: An overview of case studies 1 to 8

Table 7.1 shows the lessons which were learnt from the various case studies.

7.11 Case study 9 – Organisational change

Project description

The value study was commissioned by a major university. It involved the re-engineering of that part of a university's administration dealing with the corporate estate. A value methodology was used to introduce organisational change into a university's Estates Division. The case study is an example of 'organisational technology transfer' through the application of a value study methodology used for construction projects to implement structural change and process improvements in an organisational unit within a substantive organisation.

Table 7.1 Lessons learnt across case studies.

Lesson Heading	Lesson Learnt	Case Study							
		Financial Services Co HQ	**Food Manufacturing Silo**	**Materials Manufacturing Plant**	**Magistrates Court**	**College Library**	**Social Housing**	**Rail Infrastructure Program**	**Crown Court**
Value study process	Used successfully to create the project brief		✓			✓			
	Used to identify PM issues		✓	✓	✓	✓	✓	✓	✓
	Important to understand issues before workshop phase		✓						
	Final implementation workshop for programme							✓	
	Residential workshops excellent for intensive study and improved team dynamic					✓	✓	✓	
	Base line study agenda created at first workshop helped in VM programme							✓	
	Value study must be flexible to cope with exposure of fundamental errors in project concept				✓				
	Project ‘creep’ affected project functionality					✓			

(*continued*)

Table 7.1 (*Continued*)

Lesson Heading	Lesson Learnt	Case Study							
		Financial Services Co HQ	**Food Manufacturing Silo**	**Materials Manufacturing Plant**	**Magistrates Court**	**College Library**	**Social Housing**	**Rail Infrastructure Program**	**Crown Court**
	Value study can be used successfully at design and build tender stage			✓			✓		
	Workshop time pressures means activity needs to be very focussed		✓						
	Value study would have been more beneficial earlier in the project	✓	✓		✓	✓			
	Used as a partnering catalyst						✓		
	Substantial benefits delivered even at late stage in design process	✓			✓		✓		✓
	A single day workshop is not always sufficient time to fully address the work required			✓					
Value study Team, etc.	Use of the existing project team and client representatives delivers a result with almost immediate design implementation		✓	✓	✓		✓	✓	✓

Table 7.1 (*Continued*)

Lesson Heading	Lesson Learnt	Case Study							
		Financial Services Co HQ	**Food Manufacturing Silo**	**Materials Manufacturing Plant**	**Magistrates Court**	**College Library**	**Social Housing**	**Rail Infrastructure Program**	**Crown Court**
	Independent teams can be successful but there is more resistance from project design teams of proposals for change	✓							
	Team members need to be chosen very carefully	✓	✓	✓	✓	✓	✓	✓	✓
	The group dynamic of the value study team needs to be carefully considered before the workshop phase		✓	✓	✓	✓	✓	✓	✓
	It is essential to have all the skills and influence required at the workshop phase	✓	✓	✓	✓	✓	✓	✓	✓
	The use of two (or more) VSLs helped maintain the focus of the study and improved the amount of work that can be carried out in the available time.	✓	✓	✓	✓	✓	✓	✓	✓

(*continued*)

Table 7.1 (*Continued*)

Lesson Heading	Lesson Learnt	Case Study							
		Financial Services Co HQ	Food Manufacturing Silo	Materials Manufacturing Plant	Magistrates Court	College Library	Social Housing	Rail Infrastructure Program	Crown Court
	Contractor involvement in value studies can be very beneficial					✓	✓		
	The use of a team of value leader assistants during the workshop phase enables a large amount of work to be done in group sessions with large value study teams						✓	✓	
	Adopting a nonconfrontational approach to the value study helps integrate the VSLs into existing project teams		✓			✓	✓	✓	✓
Tools and Techniques	The VSLs need a full toolbox of tools and techniques to react to changing workshop phase circumstances	✓			✓	✓		✓	✓

Design of the study

The important principles of value management are that it is problem oriented and uses a team-based approach to address and solve these by the analysis of function, and to recognise the managerial consequences that stem from this for change and to deliver value-for-money. The principles and methods adopted in the value study process for introducing change and process improvements into an organisation have much in common with the procedures adopted for business process re-engineering.

The study reflected a shift by the authors in their involvement increasingly in developing, improving and delivering to the construction industry and its clients an early stage value management methodology for improving projects, and subsequently Programmes of projects to that of organisational change. Inevitably, this involves a deeper understanding of how the organisation manages change itself.

From the outset, as part of the initial proposal, it was decided to appoint a facilities management (FM) consultancy under contract to the VSLs. Two representatives from the FM consultancy worked closely with the VSLs throughout the value study. The value study was designed by the VSLs around three value workshops broken down into the three value study phases as follows:

1. The Orientation and Diagnostics phase.
2. An Orientation Workshop. The first workshop, of half-day duration, comprised a value team of 16 personnel was managed by two VSLs and attended by the University's central administration (12), including the Vice Chancellor, his management team and the senior management of the Estates Division. Two FM consultants were also employed through the VSL, and attended this workshop. The purpose of the workshop was to expose concerns that the senior management team had regarding the Estates Division. Notes were taken at this workshop and used by the facilities management consultancy to guide their work within the overall study. The notes would also be used by the VSLs to design the second 2-day workshop.
3. Prior to the second value workshop, the facilities management consultants produced a report on the existing practices and procedures adopted by the Estates Division, together with some suggestions for improvement. The consultant's work was carried out over a 2 month period and formed part of the Orientation and Diagnostics phase prior to the second workshop. The report addressed the issues of structure and staffing, information management and technology, client interfaces, the direct labour organisation, budgeting and finance, projects and other issues. Prior to the second workshop, the VSLs analysed the consultant's report.

Other information for diagnosis and analysis was obtained from:

- Documents provided from interviews held with university senior managers.
- Interviews with senior managers in academic departments who had recently had an interface with the Estates Division on the briefing and delivery of a diverse range of projects.

The information was analysed by the VSLs and a 2 day value workshop agenda prepared.

- The Main Value Workshop phase:
  - The VSLs analysis identified the purpose of the second 2 day workshop as making explicit to the Estates Division team the concerns of university senior management and, to make explicit the issues highlighted in the report that the facilities management consultant had prepared prior to the workshop.
  - The value team of 23 personnel comprised 2 VSLs, 2 representatives from the FM consultancy, 18 members of the Estates Division, including senior and middle management personnel, and a representative from the university's senior management team.
  - The value study methodology, using the input from the facilities management consultants, created proposals for organisational change that could be presented to the university's senior management for acceptance and for implementation. The developed agenda were as follows:

    Day 1

    - Presentation by the FM consultancy of their findings from their detailed study of the Estates Division and written up in their report.
    - Using function analysis to identify the mission statement and key functions to be performed/delivered by the Estates Division.
    - Identification and prioritisation of issues arising from the FM report and the function diagram.
    - The creation of solutions for change to meet the functional needs identified.
    - Working group activity to refine the created ideas into proposals for change to address the organisation's functional need.

    Day 2

    - Team working continued.
    - Presentation of proposals for change to present to the Pro-vice Chancellor with responsibility for the Estates Division who had remained throughout the Value Workshop.

A report on the outcome of the Value Workshop phase was prepared and issued to the university senior management team prior to the third workshop.

- The Implementation phase.
  - The third half-day workshop, managed by two VSLs, took place approximately 2 weeks after the main value workshop. The value team of 14 personnel, including the 2 VSLs, comprised 8 Estates Division managers, 2 senior managers from the university central administration and the 2 FM consultants. The workshop included a presentation by the Estates Division senior management team covering the proposals for change that resulted from (i) the FM consultant's report and (ii) other development work carried out during the main Value Workshop. The proposals were considered by the university senior management team and initial comments made.

- Further detailed comments were given after the workshop following further consideration by the university senior management team.
- Proposals for change resulted in a reconfigured, rebranded and relaunched Estates Division. This Implementation stage was overseen and supported by the FM consultants over a period of 18 months. The VSLs were not involved during this aspect of the Implementation stage and the FM consultants were appointed under a separate contract to continue the organisational change initiative.

The use of function analysis

Function analysis was used to determine the functional requirements that the Estates Division needed to perform and deliver in the present and in the future. This was compared to the present structure and operation of the Division and mismatches were identified. Function analysis proved a powerful technique in identifying the management functions needed to deliver the mission of the organisation. The functions identified, in outline, the new structure and organisation of the Estates Division, which were developed with subfunctions, including new processes and procedures to enable these functions to be performed. Populating the functional requirements was also considered and the number of staff required identified very quickly. The function analysis created through the workshop process was used to compare against the existing Estates Division structure to identify mismatches. All ideas for change were referenced back to the functional requirements.

Value team: Stakeholder management and team dynamics

The value study was commissioned by the university client organisation through a request for a proposal from the VSLs. The proposal included the use of the FM consultancy to examine and report on the structure and effectiveness of the existing Estates Division.

The value team for the main 2-day value workshop comprised the existing Estates Division since they would have to own and implement the outcomes of the study. It is the experience of the authors' that the most efficient and effective value team is comprised of those who own the problem and will be responsible for implementing change. In the situation where a value study is applied to projects, in the experience of the authors, the value team is best drawn from the project design team. The VSLs felt that there was no reason to change this philosophy in this organisational change value study provided first, they had the required skill set to address all matters to be discussed at the value workshops, and second, they were sufficiently respected and of a sufficient standing to be credible with the university senior management team. The value team met these criteria and were supported by the FM consultancy members who had considerable expertise in the Further and Higher Education sectors. The university senior management team was prepared to be convinced that the existing Estates Division team could be open-minded enough to propose and implement the significant organisational change that was necessary. In the event, the university senior management team was justified in using the Estates Division management team in the workshops.

The use of the FM consultancy as part of the VSLs' team was key to identifying where the organisational problems lay, and in their providing their experience where gaps existed in Estates Division knowledge. They were also key in supporting the Estates Division team during the value study, and in the Implementation stage that took place over a significant period some following the close of the value study.

The outcomes of the value study

The substantive improvements that resulted from the change management process and value workshops were as follows:

- Organisational structure improvements at university level:
  - A review of existing links between the Estate function, university committee structure and academic departments and a proposal to improve these links.
  - Proposed new mechanisms to handle
    - Relationships with university committees.
    - Relationships with academic departments where internal clients' relationships were formed with the Estate function.
    - The restructuring of the Estates function to handle those internal clients.
    - The procurement of new buildings, and also the management of the existing estate.
    - The relationship between the Estates function and the Direct Labour Organisation employed by the university.
- Additional, process improvements to ways of working and implementing new procedures within the Estates function and between it, academic departments or the university administration were as follows:
  - The development and introduction of Service Level Agreements with academic departments.
  - A range of new operating procedures to support the changes to be made were developed and implemented.
  - The creation of a facilities management team operating at university level, chaired by a Pro-Vice Chancellor.
  - The assistance of the FM consultants to support the agreed change process.

An important structural change was the establishment of a university-wide Space Group, comprising the Deans of Faculty and the Pro-Vice Chancellor responsible for the Estates function. Their remit was to examine the whole issue of managing space within the university. Other important changes were:

- The reorientation of the Estates function towards using multidisciplinary teams for capital and maintenance projects.
- A move to a flatter organisational structure with three major geographical teams to handle different locational sectors of the university.
- Revisions to the way the Direct Labour Organisation operates.

- A relaunch of the renamed Estates Division to the university as a customer focused organisation with a new mission.
- Changes to financial and budgetary systems were implemented.
- The development of Service Level Agreements that set performance levels between departments and the estates function and between it and the Direct Labour Organisation.

The benefits of the value study

A tried and tested value management methodology used previously to improve project delivery within client corporate estates was adopted and adapted for use in reviewing and implementing changes to the management of the Estates function within a wider university organisational structure. A value study, comprising a series of interlinked value workshops, led by VSLs and complemented by an FM consultancy, adopted the use of an existing staff team to generate options for change and implementation. It was felt important from the outset to involve the existing Estates team in the process rather than work with a wholly independent 'shadow team'. This proved important in the implementation stage. A combination of the Estates management team and external consultants who were used as a catalyst for change, worked well. The initial report produced by the external FM consultants acted as the springboard for the change process to start within the workshops. However, the report was only one of the drivers in the change process. It enabled staff within the Estates Division to seek out alternative ways to improve their working practices within part of an organisation already going through changes across the central administration. The internal operations of the Estates function were reviewed and its relationship with the broader university structure was also studied. Improvements to both were proposed and were adopted. The change process took two years from the start of the initial workshop phase to full operational implementation.

Lessons learnt

The key lessons learnt from this study were as follows:

- The value management methodology can be successfully used in organisational change studies.
- The use of the specialist FM consultancy was essential to the success of the study both at the Orientation and Diagnostics phase, during the main Value Workshop phase and during the Implementation phase.
- Using the existing Estates Division management team in the value study ensured that the full knowledge of the university and its operation was understood, and that any proposals for organisational change had built-in acceptance. The inclusion of the university's senior management team in the early and later stages of the value study ensured that their concerns were made explicit and that these concerns were addressed. Only after this were they able to accept the implementation of the proposals made.

- Function analysis can be effective in a value study focused on organisational change.
- It may have been beneficial for the VSLs to be involved in structured reviews during the Implementation phase to maintain the momentum of the organisational change.

This value study represents the first exemplar of other organisational studies undertaken by the authors and presented in Chapters 8, 9 and 10.

7.12 The lessons learnt from the studies

This section provides a comparison of the practical issues illustrated in the case studies, highlighting differences and similarities in approach and use of techniques and methods.

There are always lessons to be learnt from carrying out value studies and an hour or so taken after the end of a value study in self-assessment of lessons learnt quickly builds up a library of data that can be drawn upon in the design of future studies.

There are a number of different types of study in the cases presented. In the case of projects and Programmes of projects, the value study type is determined by the client requirements and, typically the stage at which the project has reached. The VSLs will normally advise the client on the appropriate study type to adopt. Value studies can be used for non-construction related situations, and one example is the University Estates Division. The case studies for non-construction related value studies were carried out on business management processes (case study 9); a food manufacturing processes (case study 2) and the building material manufacturing process (case study 6). Whilst there were elements of value management or value engineering encapsulated within the manufacturing process examples, it was the intimate link between the equipment used and the manufacturing process itself that became the key focus. In the case of the organisational change (case study 9), whilst there were facets of that study involving capital and maintenance investment in a corporate estate, the primary focus was that of organisational change and further examples will be explored in Chapters 8–10.

The design of a value study is one of the most important aspects that influence the successful outcome. Each value study will have individual characteristics which need to be taken into account when tailoring the study design. The VSL will normally consider value study design during their bid for a commission and/or it can evolve through discussion with the client body. During the Orientation and Diagnostics phase the VSL will consider the value problem and design the study to suit the particular project or organisational needs.

There are a number of important aspects to consider in the design of value studies:

- The client's objectives for the value study.
- The client's initial brief for the value study and the information available.
- The stage the project has reached.
- Whether the project driver is for example, a management change, a new or refurbished facility, a new or change to an existing manufacturing process.
- The stakeholders involved and their interrelationships.
- The time constraints in carrying out the study.
- The budgetary constraints on the value study set by the client.

The most important aspect to consider is what the client wants to obtain from the study. Defining these study objectives is not always straightforward; at times they are not always clearly defined by the commissioning client at the outset.

The objectives of the two process plant value studies (case studies 2 and 6) were fairly close, whilst those of the construction projects and the university case study (case study 9) varied considerably. Once the objectives of the value study have been considered by the VSL they can identify the most appropriate Value Workshop methodology and the tools and techniques to be applied to fulfil the objectives. The diagnosis of gathered information to identify the client's business requirement for the project is also an essential part of value study design as this will uncover the deeper value challenges to be addressed in the Value Workshop phase. Those value challenges may be explained initially at the outset of a value study in the orientation meeting with the client. However, the experience of the authors' is that it may not be until the Orientation and Diagnostics phase is well underway, or during the early stages of a Value Workshop that the real and underlying deeper value challenges are made more explicit. It is not unusual in a workshop situation for the creation of a FAST diagram to unlock those deeper value challenges.

Typically, the Implementation phase comprises production of a value study report and subsequent debriefing meeting. The use of an Implementation workshop is rare.

No matter what type of value study is needed or stage a project has reached, the Work Plan remains a very robust structure to manage the process. This is true for all the case studies.

While many tools and techniques can be of the same generic description from one value study to the next they are often used in differing ways and it is important that the VSL understand the purpose, strengths and weaknesses of each technique, and how they might be used in different combinations.

Subsequent case studies presented in Chapters 8–10 continue to adopt the three-phase approach to the value study Work Plan as the vehicle for implementing the philosophy and principles of value management in different settings.

References

OGC (2007) *Value Management in Construction: Case Studies*. London: Office of Government Commerce.

Part III
Whole-Life Business Value

Part 2 describes the value study method with sufficient detail in terms of methodology, tools and techniques and indicative agendas to enable a full understanding of the process of undertaking a value study of a single project. Part 3 reflects the extended role of the VSL, as experienced by the authors in research and practice deep within the client organisation, requiring an understanding of the corporate approach of the client to asset management, Portfolios and Programmes of projects. The value studies undertaken at high level within the client organisation require both an understanding of value management and an appreciation of the task being addressed by the client to promote change which is usually mission-critical and potentially of high risk. It is the melding of the value study approach together with the understanding of what the client is trying to achieve that resulted in successful studies being undertaken in this area.

Chapter 8 addresses the relationship between asset management and value management. A description of asset management and the processes and procedures involved in managing a portfolio of assets is followed by three case studies. Two studies focus on the moving of two client organisations from an operational view of asset management to a more strategic orientation for managing physical assets. The third study describes the rationalisation of a physical asset portfolio involving a small value team of senior managers. The chapter completes the analysis of the important role of value management within the discipline of asset management by concluding that the disciplines are complimentary and self-reinforcing. Further that the value management approach is conducive with careful design to the solution of an asset management problem involving value, value for money and whole-life thinking. The final conclusion is that understanding the place of asset management in the corporate value system of the client is a helpful prerequisite for any strategic value management study.

Chapter 9 argues that value management has to go beyond being seen in construction as a single project intervention to one that can be applied within the multiproject environments of a client organisation. The chapter provides an outline of strategic management and organisational strategy set in the context of a review of Portfolios,

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Programmes and projects which are seen as vehicles for delivering investments that will decide the shape of an organisation's vision of the future. The chapter describes the concept of the organisational value chain and the organisational project value chain in the context of value structuring for a value management study within a multiproject environment. The chapter concludes with the proposition for value management operating in the business case realm within the 'line-of-sight' between the policy and strategy domain of the client organisation and the benefits it seeks to provide through Portfolios, Programmes and projects.

Chapter 10 relies heavily on the advice given in HM Treasury Green Book (updated 2011) for option appraisal and business case preparation as a foundation for the discussion of the place of value management in complex, mission-critical and high risk projects and Programes. In addition to the comprehensive analysis of option appraisal the chapter outlines a methodology for use within a value study framework of whole-life costing and risk management. The chapter contributes to the debate on the extent to which risk management can be integrated with value management and also in the context of risk management there is a brief discussion on the benefits and disadvantages of optimism bias. Following the case study description of a value management study of the strategic development of a complex public sector project involving extensive option appraisal is a conclusion which includes, *inter alia*, the benefits brought to the study by a client able to recognise a value methodology which was thorough, rigorous and appropriate.

The chapters in Part 3 describe the application of value management to developmental projects deep within the client organisation. The characteristic of this type of value study is the extensive work required at the orientation and diagnostics stage to appreciate fully the problem to be addressed, the team to be engaged and the design of the appropriate workshop or series of workshops. Whilst studies of this nature rely heavily on the fundamental principles of value management, notably the analysis of organisational values and function, workshop design requires more than the typical agendas illustrated in Part 2. Indeed, as demonstrated in the case studies it is likely that a programme of workshops is required. Part 4 takes the theory and practice of value management forward through an analysis of the 'value' concept to a proposition for the development of a whole-life value factor for use in option appraisal and benefits realisation. Part 4 also contains the conclusion to this book.

8 Value Management and Asset Management

8.1 Introduction

The focus of asset management (AM) is on the strategic alignment of physical assets as a public or private sector corporate organisational resource with the organisation's strategy. At the core of this is how physical assets enable those strategies and as a result add value, either commercially, socially and/or politically. As such, AM manages the linkages between the organisation's strategic plan and the whole life management of physical assets, the subsequent investment decisions associated with managing those assets through time, and any related bundle of 'rights' and 'interests' that may be involved in the use of assets to create value for an organisation. There is a consequent close alignment with the philosophy of asset management and that of value management (VM).

The earlier parts of the chapter set the context for three case studies in the final sections. The case studies explore the relationship between asset management and the use of a value management philosophy and methodology. This is achieved by exploring why AM is important for an organisation, providing a series of definitions, and subsequently positioning it against other related disciplines such as maintenance management, facilities management, property management and corporate real estate management. The chapter adopts the term AM throughout due to its wider strategic remit. Having set out the thinking, concepts and models behind asset management, the chapter subsequently addresses how VM can be adopted as a holistic value-based methodology within AM practice. As a consequence, the chapter provides a point of departure for a Value Study Leader (VSL) to design the most appropriate value study in an asset management context.

The importance of asset management for organisations can be seen from two estimates of the scale of investment required in global infrastructure alone. Infrastructure represents transportation systems – road, rail, ports and airports – power, water and telecommunications (MGI, 2013). The first estimates note that in the order of US$40 trillion of investment will be required globally in new and existing physical infrastructure between 2007 and 2030 (OECD, 2006, 2007). A more recent figure produced by the McKinsey Global Institute places that estimate higher, some US$57 trillion until the same end date (MGI, 2013). The MGI report notes that its figure, whilst approximate, represents the levels of investment required to keep pace with projected global growth

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in GDP. The figure also represents 60% more than the $37 trillion spent on infrastructure over the last 18 years. Regardless of which estimate is closer to the required investment needed, by any measure the figures are substantive. Those aggregate levels of investment are dispersed, prioritised and implemented through a myriad of individual organisations and their managers globally.

Inadequate or poorly performing infrastructure presents major economic and social challenges, with economies unable to meet their full growth potential, and with the consequence that economic and human development suffers. The significant gaps in infrastructure investment occur at a time of high levels of governments' debt burden and the subsequent call for numerous competing priorities on resources for investment.

Within this global context, the UK Government's National Infrastructure Plan 2010 notes that for several decades the United Kingdom's approach to infrastructure investment has been hesitant, uncoordinated, incremental and uneconomic in its procurement (IUK, 2010a). The consequence is an ageing and costly infrastructure with an unclear future plan. The UK Government's Comprehensive Spending Review (CSR), covering the period 2014–2015, focuses on national debt reduction (HMT, 2010). However, the role of infrastructure within the public estate plays a very important part in terms of investment and disinvestment. The CSR argues that the Government believes there could be substantial gains to be made from a more coordinated approach to AM across the public sector.

The case studies presented in the chapter, covering the public and private sectors, explore how the authors have used value management within asset management. Two major case studies are presented, both from the public sector, and a third private sector smaller case study is also presented. The design and implementation of the private sector study is more closely aligned to cases studies 1 to 8 presented in Chapter 7. The two major case studies have a closer alignment to case study 9 in Chapter 7. The determining factor for the differences between the case studies is that of first, the strategic context and consequent agreed scope. Second, the subsequent design of the VM approach together with the outputs expected by the commissioning client. Finally, the extent and nature of stakeholder input, engagement and management required.

A useful framework for providing a prelude to a more detailed exploration of organisational excellence in AM are the following 13 attributes broken down into two major groupings (IIMM, 2002):

- Knowledge of an organisation's physical asset base:
  - Knowledge of Assets owned.
  - Knowledge of the physical condition of the assets.
  - Knowledge of the levels of service required by customers.
  - Knowledge of asset performance and reliability.
  - Knowledge of asset utilisation and capacity.
  - Knowledge of asset value.
- The organisational capabilities required:
  - Ability to predict failure modes and estimated time of failure for assets.
  - Ability to determine the likelihood and consequences (risk) of different failure modes.
  - Ability to optimise maintenance and operation activities.

- Ability to analyse alternative rectification options.
- Ability to prioritise treatment options based on risk.
- Ability to predict future demands for service.
- Ability to prepare an asset management plan demonstrating these capabilities.

The case studies set out in Chapter 7 have highlighted exemplars of how value management and value engineering have been used to enhance decisions in the design and construction phases of projects, including considerations of procurement. This chapter argues that the discipline of asset management should be and is the precursor to and originator of these decisions. The arguments set out in this chapter continue through into the next chapter dealing with Portfolio, Programme and Project Management as interlinked knowledge and discipline bases.

8.2 The importance of asset management as a discipline

For clients of construction, physical assets are often large and expensive to build, maintain and manage through time. In an environment of increasingly constrained resources, those investments need to be justified and prioritised in terms of other investment opportunities available. The management of a portfolio of physical assets comprising buildings, in particular, will often require close integration and co-operation between organisational change programmes, human resources management, information technology, finance, workplace strategies and procurement strategies. Civil infrastructure physical assets, on the other hand, are important for the continued development of communities, society in general and a country's economy. They have the potential to absorb significant levels of investment, impact the environment and communities, and typically have strong political dimensions associated with them. Physical assets also generally raise issues of long-term sustainability and sustainable development.

The prioritisation and delivery of investment in physical assets to ensure value-for-money requires enhanced capabilities and skills in AM within both the public and private sectors. In this context, a way of viewing AM is to answer the question: *why is this organisation investing in physical assets, for what purpose and over what timescale?* Addressing this question is also a fundamental tenet of value management.

For example, the Government's Infrastructure Cost Review recognises that the ability to deliver infrastructure investment priorities more efficiently and effectively is crucial to achieving the United Kingdom's growth objectives (IUK, 2010b). The Review further adds that the United Kingdom is more expensive than its European peer group in delivering infrastructure, noting that significant opportunities exist to reduce costs in infrastructure delivery; some 15% in total, representing £20–30 bn over the next decade.

Furthermore, in May 2011 the Government introduced its Strategy for Construction (HMGCO, 2011), which acknowledges the important relationship between project and Programme delivery and AM (project and Programme Management is addressed further in Chapter 9). The strategy argues that integration of the design and construction of an asset with its operational phase should lead to improved asset performance. Hence, procurement is seen as part of a broader asset life cycle rather than as a stand-alone process. For construction, this includes considering what is to be procured, if design and construction should be procured separately, the disposition of project risk and the relationships to be created between the parties post-procurement. Procurement is seen within the Strategy for Construction as part of a system that commences at the inception stage of a project, and is concluded only when the facility has been brought into use with appropriate arrangements made for AM through the asset's operational stage.

It is argued here that AM provides the overarching framework that links all of the foregoing together with an organisation's strategy. Projects, Programmes of projects and their procurement are an outcome of that close linkage between an organisation's strategic management process and its AM strategies. These AM strategies integrate capital, operational and disposal investment needs across an organisation's physical asset portfolio. Consequently, value management, as a philosophy, set of principles and a methodology, has an important role to play in bringing together the diverse range of stakeholders in a value study to prioritise investment in whole life terms for an organisation's physical asset base in order to obtain value-for-money.

8.3 Defining and positioning asset management

Asset management as a distinct discipline

A small number of definitions provide the essence of an AM capability:

BSi PAS55 defines an asset as (BSi, 2008): *plant, machinery, physical buildings, vehicles, and other items that have a distinct value to the organisation (pp 2)* and an asset system as the: *organisation's asset management policy, asset management strategy, asset management objectives, asset management plans, and the activities, processes and organisational structures necessary for their development, implementation and continual improvement.*

PAS55 defines AM as: *the systematic and coordinated activities and practices through which an organisation optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organisational strategic plan (pp v).*

BS ISO 55000: 2014 has adjusted the PAS55 definition of an asset to: *an item, thing or entity that has the potential to add value to an organisation (pp 13).* Note 2 to the standard deals subsequently with the characteristics of physical assets.

BS ISO 55000: 2014 defines AM as: *the coordinated activity of an organisation to realise value from its assets (pp 14).* The notes to the definition elaborate further on aspects of th definition.

BS ISO 55000 defines an asset management system as: the management system for asset management whose function is to establish the asset management policy and asset management objectives.

The Royal Institution of Chartered Surveyors (RICS, 2008) in its best practice guidance for the public sector notes that: *asset management . . . is the activity that ensures the land and buildings asset base of an organisation is optimally structured in the best interest of the organisation concerned. It seeks to align the asset base with the organisation's corporate goals and objectives. It requires business skills as well as property skills, although only an overall knowledge of property matters is required* (RICS, 2008: p.ix).

> The Royal Institution of Chartered Surveyors (RICS, 2009) in its best practice guidance particularly aimed at local authorities notes that: *assets are a corporate resource and should therefore be managed corporately, in an integrated and comprehensive manner, in order to support a local authority's objectives* (RICS, 2009: p.3).

However, as the IAM Anatomy (IAM, 2012) acknowledges, there have been numerous qualifying adjectives added to the term asset management, which include but are not restricted to the following:

- Enterprise Asset Management.
- Infrastructure Asset Management – a term adopted by CIRIA (2009).
- Strategic Asset Management. This term is adopted by RICS (2008) to distinguish it from the more operational and professional/technically focused Property Management.
- Physical Asset Management.
- Facilities Asset Management, which as a discipline encompasses both a strategic and operational component (Price, 2002).

In this context, enabling research undertaken by the authors in relation to the Civil Government Estate for the then UK Treasury's Office of Government Commerce (OGC), now subsumed within the Cabinet Office, adopted the term Property Asset Management (UoL, 2006). The OGC research defined Property Asset Management as:

> A structured, holistic and integrating approach for aligning and managing over time service delivery requirements and the performance of physical assets to meet business objectives and drivers within a central government organisation (UoL, 2006: p.8).

Physical assets within the scope of this definition also comprise land and built assets. This takes account of buildings and the wider civil infrastructure used by an organisation, public or private, and regardless of tenure, to enable and support service delivery. It was considered within the research team when using the term Property Asset Management that it was vital to not only capture aspects of the definitions noted earlier but also to include those concepts enshrined in Property Law and the legal concept of 'real property' (RICS, 2008). Real property represents all land and related structures, such as any buildings, machinery, wells, dams, ponds, mines, canals, roads, railways, bridges and runways. It also includes improvements made to those structures by human efforts.

Equally, real property also includes equipment, anything growing on the land, and all 'interests' in the property. This may well include the right to future ownership, the right of occupancy for a period, such as a tenancy, and can include, for example, the right to drill for oil, and the right to get the property back if it is not used for its intended purpose. In this sense, the term Property Asset Management was attempting to capture not only those broader aspects of infrastructure and other types of built assets noted earlier but also any associated group or bundle of legal rights.

The concepts outlined earlier also have a close alignment with the discipline of Corporate Real Estate Management (CREM). CREM concerns the management of property held incidentally, owned or leased by an organisation to support its corporate mission. The primary importance of CREM as a discipline is seen not in terms of investment value but how property contributes to business operations (Kenley and Heywood, 2000). Corporate real estate value is created by aligning property and business strategies as well as using capital investment efficiently. It may necessitate downsizing an organisation, the outsourcing of non-core functions and investment in information technology (Roulac *et al.*, 2005). CREM is also seen as a strategic property business function. Then (1997) highlights three themes that still remain relevant for Corporate Real Estate Management:

- The need to link real estate/property decisions to corporate strategy.
- The need to proactively manage functional space as a business resource.
- The need to develop conceptual models and frameworks for integrating evaluation tools and management development skills in business resource management that can be applied to corporate real estate assets and their related support services.

Then (1997) argues further that these lead to at least three requirements in Corporate Real Estate Management for any organisational setting:

- The need for appropriate linking mechanisms to consider the property implications of business decisions through a meaningful dialogue between business corporate planners and the corporate real estate function.
- The need for management processes to monitor the strategic relevance of property requirements and monitoring their performance over time.
- The need for appropriate skills and competencies within the real estate/property function to monitor and continuously review procurement strategies that take advantage of advances in technological development and the market offerings of the supply side.

During the 1980s, it was identified that between 25 and 40% of corporate assets are real estate, and that property occupancy costs make up 10–20% of operating expenses or 41–50% of net operating income (Zeckhauser and Silverman, 1983; Veale, 1989). The Bootle report (RICS, 2002), commenting on the role of buildings-related physical assets in the corporate private sector, noted that for the corporate sector, property is often the second largest cost after salaries facing businesses. The National Audit Office/Parliamentary Accounts Committee indicated a similar picture for the organisations it surveyed (NAO, 2003). The Bootle report adds further that it is surprising that so many businesses do not have an accurate assessment of the physical costs they face in managing property assets. Furthermore, the management of those assets is handled typically at an operational rather than strategic level. The second Lyons report into public sector asset management highlighted the same issue in the public sector for the central government estate (Lyons, 2004).

To summarise, asset management, the term adopted in this chapter, reflects the strategic and operational management of physical assets as a corporate organisational resource through their whole life cycle. It has been noted earlier that there have been modifications to the term asset management, and there are also related disciplines, such as facilities management, property management and corporate real estate management that cover similar facets to asset management. However, asset management is the term adopted here because it is much broader in its remit, is corporate and business focused, deals with the linkages between the organisation's strategic plan and the whole life management of physical assets; the related investment decisions and any related bundle of 'rights' and 'interests' that may be involved in the use of assets to create value for an organisation. These are also integral to the underlying philosophy of value management as a management style. In particular the emphasis on value and whole life thinking reinforces the important role that value management can play within the AM discipline – both are strategic, business and organisational strategy focused.

AM as a strategic business capability and function

The maturing discipline of AM is increasingly seen as one that is undeniably concerned with delivering value to an organisation and helping to achieve its business/organisational strategies, goals and objectives; it is not just about 'doing things' to assets (IAM, 2012). Asset management has moved from just being seen as a tactical and operational discipline, often with a strong emphasis on maintenance (RICS, 2000), to one that encompasses a very strong strategic element. Hence, AM has shifted in its emphasis to become a business level discipline. It is best seen as positioned between an organisation's Management or Executive Board and its operational units. It is an integrating framework to link corporate and business level with operational strategies, and the role that physical assets have within this to enable and achieve organisational/business or corporate value (UoL, 2006).

The substantive cost base associated with physical assets confirms the needs for both to be managed strategically. It also raises issues of corporate governance, to be addressed later in the chapter. CIRIA (2009), adopting the term infrastructure asset management to denote a greater civil engineering emphasis, sets out the business case for asset management as to:

- Demonstrate the economic and efficient use of funds. The authors would also add to this the effective use of funds.
- Optimise expenditure over time.
- Optimise strategies, policies, plans and activities in a context where organisational objectives will often be in conflict.
- Ensure the safety of the asset or assets.
- Delivers the required availability of the asset or assets.
- Meet required levels of service and quality.
- Present a positive impression to stakeholders of the asset owner or asset manager as an organisation.

CIRIA (2009) highlights the fact that infrastructure and for that matter property are assets with a long-life cycle characterised by:

- The planning, design, construction and handover stages being of a very small component of the whole life of the asset. This includes time and cost.
- The renewal, decommissioning stage, and repair and replacement are also a small component of the whole life cycle.
- The eventual disposal stage, to include decommissioning, deconstruction, demolition, and recycling, can be a brief and often difficult stage, and may take place long after the asset has passed out of useful service.

Taking account of these characteristics, it is the operational phase of long-life physical assets that dominate their role within an organisation's resource base.

The successful implementation of AM requires a concerted and co-ordinated effort across any organisation. This could involve substantial organisational change depending on the organisation's starting point and its maturity in AM. Maturity, which has many facets and is not necessarily a straightforward continuum, refers here to the extent to which an organisation has relatively simple and straightforward approaches to managing its physical assets compared to a much more complex and sophisticated approach, where portfolios of different types of asset have to be managed in an integrated way as a corporate resource. One of the key issues to emerge from a report produced for the National Audit Office into the role of property in an organisation, and covering the public and private sectors, is that in situations where major organisational change is required, perhaps through the implementation of a new business model, physical assets can become an enabler and a driver of that change (NAO, 2006). Equally, the implications of changes in an organisation's business model may require the integration of different strands of strategic thinking simultaneously across an organisation, including the consequences for the management of physical assets.

The IAM highlights that an organisation will require the establishment of a management group and/or individual who accepts responsibility for championing, developing and implementing AM; together with considerations of the required resources to drive through and coordinate the necessary activities required (IAM, 2002). Due to the multidisciplinary nature of AM, the IAM recognises the need for, as a minimum, an AM co-ordinator to lead a team of representatives from different operational units across an organisation. That individual has to have sufficient authority, such as a senior manager, to champion the AM process with the support and buy-in of an organisation's Executive Board.

Any proposed structure for AM necessitates consideration of where it is located within the organisational hierarchy. It is best to consider AM as an organisational capability rather than just an organisational function. For example, Figure 8.1 locates the AM capability in a large organisation is brought together at just below Executive Board level (UoL, 2006). In terms of its location within organisational hierarchies, consideration will need to be given to:

- Organisational size, structure and level of physical asset holdings. Large organisations are likely to have a portfolio of physical assets; small organisations may only have a very small number or only one asset.

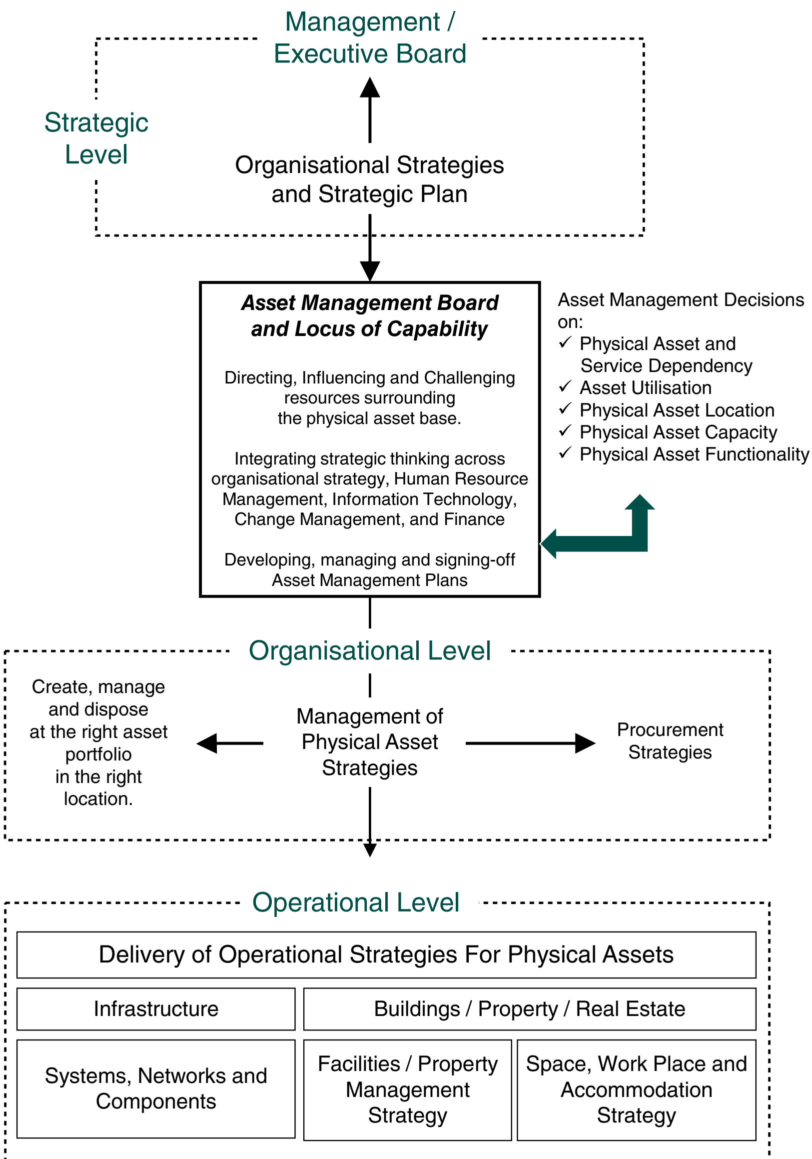

Figure 8.1 The location of a strategic asset management capability. *Source*: Adapted from UoL (2006).

- The requirements placed on the physical asset base are:
  - A distinction can be made between those organisations that have a very close linkage between the physical asset base and the front-line customer service being delivered. Where that relationship is direct, and/or face-to-face, these have been termed 'operational physical assets' (UoL, 2006). For example, roads or buildings accommodating staff dealing with the public on a daily basis.
  - In those organisations where physical assets support the administrative functioning of an organisation only those assets have been termed 'administrative physical

assets'. For example, in the case of a large retail organisation the administrative physical assets might be an office block for headquarters and customer relations staff.

- Some organisations require an organisational structure to deal with geographically dispersed physical assets. For example, an organisation having offices located in different regions, an organisation that has a national distribution network or a national or regional road network.

In sum, account needs to be taken of how the organisational structure interacts with the physical asset portfolio. In some organisations that may well comprise administrative physical assets, operational physical assets or some combination of both and in different geographic locations.

Figure 8.1 highlights three hierarchical organisational layers. The Strategic Level where the Management or Executive Board develops an organisation's medium- and long-term strategies, plans and investment requirements. The Board should also consider the investment implications of the organisation's physical asset base as a strategic resource. Depending on the size of an organisation, the Organisational Level is typically where Heads of Divisions and also Heads of Departments would normally be located, and where for example, a Head of Asset Management or Head of Estates would reside in the organisational hierarchy. The Operational Level is where physical assets are utilised to deliver the organisational services or products. The time horizon at this level is much more immediate taking account of the short and medium-term, and with annual budget cycles operating. Figure 8.1 also identifies the locus of an organisation's asset management capability as being between the Strategic and Organisational levels since it will require Management Board and Heads of Department input from across the organisation into the development of asset management strategies and plans.

From a VM perspective, Figure 8.1 highlights that a VSL would need to take a holistic view of an organisation's asset management capability and physical asset base when involved in this type of value study. This might cover, for example, an understanding of the extent of the physical asset base, its condition, levels of investment and the extent to which service depends upon the physical assets, the asset utilisation, the asset location, the asset capacity, the asset functionality, and the level of organisational resources committed to a physical asset. These types of decisions are noted in Figure 8.1. This might also include an understanding of the positioning or location of one or more physical assets within the organisation's portfolio of assets and how this links to the organisation's strategy; an understanding of the role of procurement, the changes the organisation is facing and the consequences for physical assets would also be required. Furthermore, account should also be taken of asset-related risks, risk management, and any information technology policies that deal with physical assets. The foregoing would then need to be reconciled with their relationship to and the structure and content of the organisation's asset management plan or plans.

In summary, physical assets – land, infrastructure and other built assets – are one of the key strategic resources of an organisation. They have to be managed in terms of whole life costs and value. AM is an organisational and business capability located at or just below Executive Board level, as well as a management function.

8.4 The characteristics of asset management

Key elements of good practice in AM encompass the development of a physical asset strategy, which establishes the portfolio of physical assets that most appropriately, effectively and efficiently meets an organisation's service delivery requirements, and in turn relates and supports directly organisational strategy (Lyons, 2004). This forces an organisation to consider why it needs to invest in certain physical assets, maintain or renew others, and also consider divesting itself of other physical assets that are no longer required or are obsolete. The organisation, having established a physical asset strategy and the associated scope of its asset portfolio, needs to manage this through time on a whole life basis (TAM, 2013). Within an asset strategy, this requires consideration of the following (TAM, 2006):

- Capital investment and procurement costs, which would include the acquisition, renewal and adaptation of physical assets.
- The maintenance costs over the life of the asset(s).
- The operating costs over the life of the asset, including staffing.
- Any disposal costs.

The physical asset strategy leads to a series of interrelated plans:

- Capital Investment Strategic Plan
- Maintenance Strategic Plan
- Asset Disposal Strategic Plan

These plans may comprise individual components of an overall AM plan, including an assessment of trade-offs to provide whole life value.

Thus, AM involves the whole life management of assets from inception to disposal. AM is also an organisational mindset that views physical assets as an important and strategic component of business/organisational functioning. A key principle in AM is the notion of the 'line-of-sight' (Davis, 2012). This is an approach within any organisation that aligns first, its organisational strategy and objectives with the need for and subsequent work undertaken on physical assets, and second, its goals and the risks associated with ownership or other types of 'interests' in assets.

In addition to Figure 8.1 positioning AM in an organisation, Figure 8.2 presents an adaptation of the Institute of Asset Management's conceptual model of AM (IAM, 2012). This essentially covers the line-of-sight from the top of the organisation to its base. It is a very useful concept to apply in a value management study when dealing with asset management to identify how an organisation thinks about and deals with its physical asset base through the various layers of management and any consequent supply chain issues.

Asset management therefore encompasses two interacting aspects, namely, a strategic and a tactical aspect (UoL, 2006). The strategic aspect as noted earlier has a focus on medium to long-term time horizons, typically from 5 to 10 years and beyond depending on the sector. This involves making decisions on an appropriate investment in physical assets to meet customers/end-user needs and service delivery requirements. The strategic

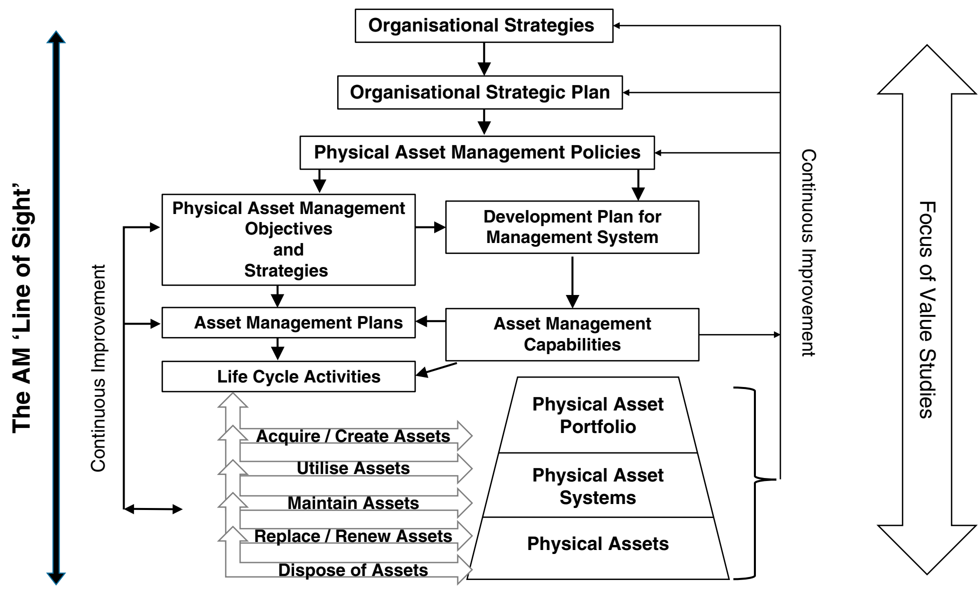

Figure 8.2 A conceptual model of asset and value management. ***Source*****: Adapted and modified from 'The Anatomy of Asset Management' (IAM, 2012).**

aspect is about effectiveness – doing the right things – and hence also addresses the reason for the investment in physical assets – the why – and the need for and use of those physical assets to deliver services through time.

The strategic aspect also has a challenge function, namely, to seek alternatives ways to make an organisation less physical asset dependent whilst maintaining and/or enhancing organisational effectiveness and performance. This could provide greater value-for-money in the long term. The strategic aspect will include making decisions on the location, acquisition, use, exploitation, maintenance, renewal, replacement and disposal of physical assets together with any cross-functional organisational co-ordination required at the Organisational Level to attain service delivery outcomes. Given the substantive investment involved with physical assets, the positioning of the strategic aspect of AM at or just below an organisation's Management Board/Executive Board level, as noted in Figure 8.1, means it has to fall within an organisation's governance framework. Hence, the strategic aspect of AM not only involves aspects of organisational vision and strategy, strategic planning, investment decisions, and managing physical assets through time but also corporate governance.

The operational aspect focuses on the ongoing management of physical assets over a short to medium-term time horizon. Its focus is on maintaining and/or enhancing organisational efficiency. It occurs within an allocated budgetary framework, which is set at the strategic level once investment decisions in physical assets have been made. Typically, the time horizon for the operational aspect is up to 3 years. The organisational locus of the operational aspect would be, for example, below Head of Asset Management, Head of Estates or Head of Property depending on the size of an organisation.

An overview of the context within which AM operates is presented in Figure 8.3 together with the focus of value management, in essence along the AM line-of-sight.

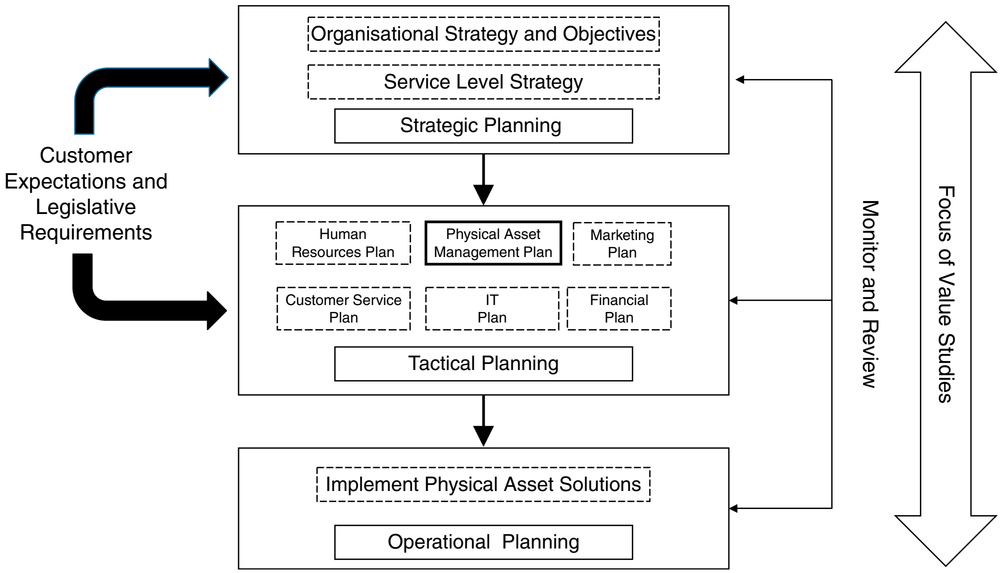

Figure 8.3 The relationships between value studies, strategic, tactical and operational planning for asset management. *Source*: Adapted and modified from IAM (2002) and CIRIA (2009).

In conclusion, this section has presented a number of models of asset management and the consequences for value management. Figures 8.1 to 8.3, when considered holistically, provide the parameters and different facets that would need to be considered as part of a value study addressed asset management in an organisation. Figure 8.1 indicates the need to consider why, where and how an organisation considers its asset management capabilities are located within its organisational hierarchy and the role of assets within it. Figure 8.2 takes this further into the asset life cycle, and the distinct layering of physical asset considerations within an organisation, whilst Figure 8.3 highlights the various plans that might have to be considered within which might be embedded asset implications and consequences.

The next section addresses corporate governance as the organisational decision-making framework impacting asset management.

Asset management models and corporate governance

Land, infrastructure and other built assets, as one of the key strategic resources of an organisation, require significant investment that needs to be invested appropriately, controlled, and also potentially audited in terms of its effective use.

Corporate governance is concerned with the manner in which organisations are directed and controlled (HMT, 2005). It defines the distribution of rights and responsibilities among the different stakeholders and participants in an organisation, determines the rules and procedures for making decisions on corporate affairs, and includes the process through which the organisation's strategies and objectives are set, the means of attaining these and monitoring performance. Corporate governance in the AM arena becomes even more important when an organisation is going through substantive change due to the significant levels of investment and disinvestment that may occur in relation to its physical asset base.

UoL (2006) developed for the central government a model that demonstrated the impact on physical assets resulting from organisational change and development, together with the associated impact on the management of physical assets. This was derived from their earlier work in the retail sector (Male *et al.*, 2003). The model has been informed by work from both the public and private sectors and is therefore relevant to larger organisations in both sectors. It is useful for establishing principles of how value and the management of physical assets and organisational dynamics can be intimately related. For the civil government estate the model was needed to capture the significant levels of organisational flux encountered across central government and the consequent impact on any physical asset base. The model is also useful for simulating, for analytical purposes, guidance on the management of assets in whole life terms.

Figure 8.4 illustrates the more generic organisational development model. It takes account of organisations that are potentially at different stages in their organisational development cycle in relation to their management of their physical assets. As a result of that cycle, the management of physical assets should impact strategic thinking at more senior levels of an organisation depending on where it is in its organisational development cycle.

For example, in the case of the civil government estate, some government organisations were encountered where organisational mergers had taken place. They were clearly in the *growth phase*. Physical asset portfolio rationalisation was taking place along with organisational rationalisation. However, service delivery remained the same. Other organisations were in a more steady state – the *established/maturity phase* – where

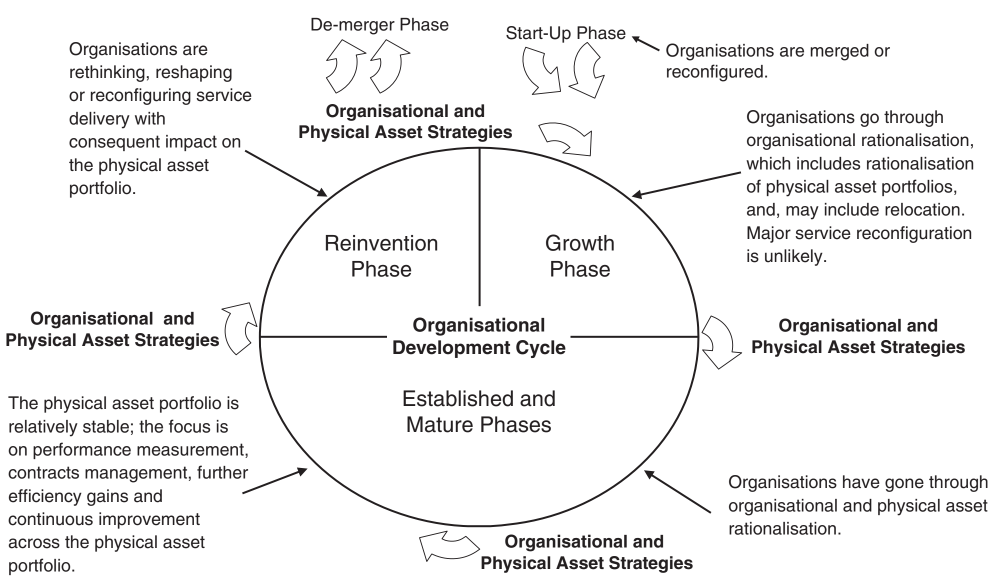

Figure 8.4 The organisational development cycle and asset management. *Source*: Adapted from Male *et al.* (2003).

physical asset portfolios and organisational rationalisation had taken place and the focus was on fine-tuning the physical asset portfolio. It involved a greater emphasis on, for example, contracts management, continuous improvement and performance management processes with external consultants, contractors, facilities management service providers and DBFO/PPP consortia.

Finally, other government organisations were encountered that were going through a total rethinking of their business and service delivery models. Consequently, the direct linkage between organisational strategies and functioning, its further development and the opportunities and constraints posed by the physical asset estate, including its further rationalisation, were clearly in evidence and at the forefront of senior managers' thinking. These organisations were in the stage of late maturity and early transformation. This phase was termed the *organisational reinvention* phase and was typified by simultaneous reconsideration of organisational structures, physical asset portfolios, working practices, work place and information technology strategies, procurement and supply chain relationships. Change was therefore comprehensive and deep within the organisation and across the physical asset portfolio.

Each of the phases presented earlier have different implications for the focus of the strategic facet of AM, and hence corporate governance. In the *growth* and *reinvention phases* there is likely to be a close alignment and integration at the senior level thinking between organisational strategy, human resources, information technology, finance and the AM function. This is multidisciplinary and comprehensive, and in particular with the reinvention phase will involve extensive and deep change within an organisation. Senior managers will need to consider implications and consequences across all levels of the managerial hierarchy. In these phases the strategic facet of AM comes to the fore as an organisational capability. It has an integrating function between organisational strategy, organisational development and physical assets potentially as organisational enablers. It is probable that capabilities in mature levels of AM capability will be required, with integration occurring at, or as a minimum near, Management/Executive Board level. The development of an appropriate physical asset strategy aligned with strategic organisational thinking will be critical. Corporate governance requirements will be extensive. It is likely, however, that whilst corporate governance requirements will be extensive during the growth phase they may be less well developed and embedded. Equally, during the reinvention phase governance requirements may well be extensive. However, they are likely to be better founded and embedded, but will be tested perhaps fundamentally and may need to be refined. The issue becomes one of the extent to which they take account of physical assets and their management at a strategic level.

During the *established/mature phase* when the physical asset portfolio has reached a level of stability and consistency, and organisational rationalisation has become embedded in working practices, the need for an integrated and strategic focus on physical asset related matters will subside to an extent. However, efficient and effective asset management should remain a corporate objective. The focus is more likely to be on the operational facet of AM. Corporate governance requirements are likely to be more mature, and will be operational in orientation but with important reporting and monitoring requirements at the strategic level.

The key element to emerge from an exploration of linkages between organisational change, the organisational development model and AM is that at senior levels there is a clear skill and capability requirement to be able to manage the transition between phases. This requires knowing when a change is likely to happen, may be required, or may be triggered by external events. Again, this is a strategic skill and the information and knowledge about that can only reside at or near Management/Executive Board level. Those changes will normally be organisational strategy and/or policy driven and require an appropriate and timely response subsequently from the physical estate or asset base.

In sum, there is a close alignment between organisational strategies, the requirements for and impact of organisational change, where the organisation is in its life cycle and corporate governance for AM. The implications for value management are clear; any potential value study has to consider the implications of and consequence for corporate governance and its relationship between organisational and physical asset-related value, and the management of the physical asset base.

8.5 Physical assets and value for money

The IAM (2012) notes that physical assets have actual or potential value, and it is AM that achieves the realisation of that value. Value can be reduced, for example, where an organisation sees the physical asset as a liability, for example by posing a risk or being at risk, having an unwanted responsibility for it and/or only seeing the asset in the form of a debt. The realisation of value occurs when use is maximised and liability is reduced or eradicated.

Value and value-for-money must also reflect differing stakeholder expectations. Value involves tangible and intangible benefits. The key concept in value optimisation and realisation in AM becomes one of exploring trade-offs between, or combinations of, those different interests and expectations. For example, a study by Kenley and Heywood (2000) into AM in Australia noted that private sector corporate organisations emphasise the necessity for property to contribute to the organisation's financial outcomes, while the government sector is more concerned with benefit to communities through service delivery. This indicates the need to consider different value and cost drivers, and the trade-offs, that have to be taken account of contextually when considering the role of value management within AM.

Asset management is about deriving value from assets in a structured and predictable way (IAM, 2012). This is also the essence of VM as a way of thinking and as a structured methodology that can assist within the discipline of AM in obtaining organisational value from physical assets. Figure 8.5 sets out a holistic view of asset management. It sets out typically where value management and value engineering are practiced, predominantly in the area of Programmes and projects, the subject of Chapter 9. However, it is argued here that the potential for value management in an asset management context sits within the central circle, namely that of determining, exploring and implementing the relationships across the elements of the diagram for strategic fit.

Section 8.6 sets out three exemplar case studies of the application of value management to AM. The first deals with the use of value management to set up an asset management framework within a large public sector organisation. It is also a policy study. The second uses value management as an underpinning philosophy and methodology to develop a policy for asset management across central government. The third has a private sector

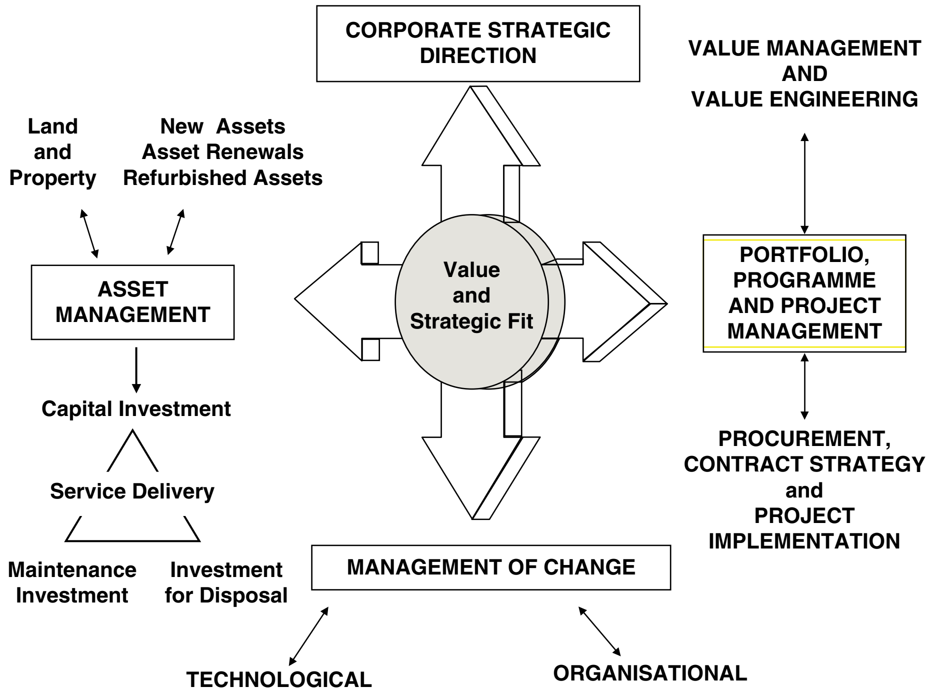

Figure 8.5 A framework for VM and asset management.

focus and concerns the use of value management for plant rationalisation across a manufacturing company.

8.6 Value management and asset management case studies

A government organisation

The value study was conducted on a large public sector 'asset-rich' organisation with a physical asset base having a replacement valuation of between £20–30 bn. The organisation's physical assets were spread across three major divisions and approximately 20 regional operating units. The underlying philosophy of the value study was to combine value and asset management thinking together with organisational development and interorganisational benchmarking. Prior to the study, aspects of AM were being undertaken across the organisation in a fragmented manner, with significant pockets of good practice spread throughout the organisation, nationally, regionally and across divisions.

The organisation had operational assets comprising in the order of 80 000 individual assets of various types and over 24 000 km of linear assets. The administrative estate, which comprised primarily office accommodation, was dealt with separately from other physical asset types, but was not part of the study. For completeness, however, organisational stakeholder representatives were involved. The organisation also relied on, but did not have direct control over, third party physical assets. These affected it 'doing business' on a day-to-day basis. On the one hand, the organisation considered that a significant proportion of its physical asset value was, in fact, liabilities due to the substantive levels of investment in the creation, renewal or maintenance of the infrastructure. However, it also accepted, on the other hand, that its physical assets had a much wider societal value since they supported the functioning of communities, businesses and wider society in general. The physical asset base was comparable with other large-scale and complex asset-rich organisations in the public, private and regulated sectors. This organisation had a multifaceted organisational structure and a unique set of 'value drivers'. At the time of the study the organisation spent approximately £350 m per annum on capital and maintenance expenditure on its physical assets.

Due to reasons of confidentiality, certain aspects of the value study are not presented, and the case study focuses predominantly on value study design and method.

The value management strategy

The purpose of the study was to develop a national asset management framework and strategy for the organisation to take it from where it was currently to a future state. The As-Is and As-Should-Be organisational states in terms of AM were to be defined as part of the evolving study findings and its outcomes. There were two very strong external political drivers for the study, and very strong internal 'time' and 'efficiency' drivers.

Given the purpose of the study, a VM strategy was developed that was multilayered. It was a hybrid study style with a three-phase methodology. The appointment involved the use of a 'shadow team' contracted to the VSLs. This was supported by other specialist inputs as and when required to form an extended shadow team. From the outset, the core shadow team comprised three VSLs, together with a small core client team. The extended shadow team, when fully involved during a major value workshop, involved nine people. The shadow team specialisations were as follows:

- *Three Value Study Leaders*, with experience in AM, VM, RM, and cross-sectoral design and implementation of value studies.
- *Additional expert support, interview and value workshop members*:
  - *Two Programme and Project Management consultants*: With cross-sectoral experience, one of whom worked with a working group dealing with aspects of funding and capital investment, and the other with asset strategy development.
  - *Business Improvement consultant*: Water Utilities, AM, Programme and Project Management, with cross-sectoral experience, who also acted as an assistant VSL (AVSL) for value workshop facilitation.
- Additional specialist main value workshop input:
  - Representative from an AM strategy and service delivery organisation with experience of managing outsourcing of the asset management function, and cross-sectoral experience.
  - Corporate Governance: VM and RM, who also acted as an AVSL for value workshop facilitation.
  - Systems, Process and Procedure: (ISO, 9000), VM, RM, PPP, AM, and cross-sectoral experience, who also acted as an AVSL for value workshop facilitation.

The small core client team comprised two individuals who worked extensively with the core shadow team, a senior policy analyst and a senior manager with significant divisional level AM operational experience and with a business improvement remit for the study. These acted as 'gatekeepers' for the shadow team to provide critical information in the form of documentation, internal policy memoranda, access to senior and middle management client representatives for interviews, external organisational contextual referencing, and an ongoing evaluation of organisational structure, culture and political issues to inform the study as it proceeded.

Value study design and methodology

The Orientation and Diagnostics Phase

This comprised fact finding and the identification of the 'value challenges' facing the client organisation. It involved the following detailed steps:

1. Documentation review in advance of interviews.
2. Initial half-day Initiation workshop for information gathering from a major operational division. This involved some 20 senior personnel. Representatives were familiar with policy and physical asset related information, as well as cultural and organisational structure issues.
3. Interviews with some 40 senior personnel across the organisation. Interviews ranged from Executive Board level, to divisional, regional and functional senior managers. At any one stage a team of between four to six members of the extended shadow team conducted interviews. Interviews were geographically widely spread and were completed within 12 person-days over a 3 week period.
4. Benchmarking interviews with a similar asset-rich organisation in the regulated private sector.
5. A 1-day integration workshop, comprising core shadow team, and the core client team, the member of the extended shadow team with AM and outsourcing experience, together with three additional senior management client representatives. The workshop covered
   ○ Integration of all documentary and fieldwork information.
   ○ Exploration of issues and identifying value challenges.
   ○ Structuring primary AM major value workshop.
6. Value workshop planning, issuing of agenda and briefing note for major AM value workshop.

Orientation and Diagnostics phase duration: This took 39 person-days spread across 2 months.

The rationale for the Orientation and Diagnostics phase, which had multiple objectives, included the following:

- It was important to establish the current situation of the organisation in terms of its maturity in AM – the As-Is situation. The VSLs through the information gathering process needed to understand all aspects of the organisational domain noted in Figure 8.5. This was provided through documentation reviews of corporate reports

and extensive interviews as well as informal benchmarking with a major asset-owning organisation and other asset-rich organisations with whom the VSLs were familiar.
- To explore in-depth the information that had been collated and distil this into a series of value challenges that needed to be addressed at the major AM value workshop.
- To have an in-depth understanding of the culture, functioning and structure of the organisation.
- To scope and identify the objectives, structure, attendees and outcomes anticipated from the major and primary value workshop.

Phase 2: Primary Value Workshop Phase

The aim was to develop an AM framework and strategy for the organisation, and to address the value challenges it faced. It comprised the following aspects:

- Workshop duration: This was 2.5 days and residential. It was conducted 3 weeks after the Orientation and Diagnostics phase 1 day integration workshop. Day 1 of the value workshop commenced at 4 p.m., and Day 3 finished at 4.30 p.m. There were evening working sessions on days 1 and 2.
- Value team: Multifunction, divisional and regional representation of 35 people from across the organisation, including a representative number of their design consultants.
- Workshop design: Due to the significant number of delegates, the workshop structure was primarily focused around small working group sessions from the outset and short plenary sessions for reviews, seeking consensus, progress checking and airing different perspectives. Five working groups were established during workshop planning and confirmed at the commencement of Day 1 of the value workshop phase. These groups were:
  i. Physical asset strategy development: The key focus was on establishing a physical asset strategy across the organisation, including a future organisational state or vision for AM.
  ii. Prioritisation Methodologies for investment funding in physical assets.
  iii. Asset Management Systems: The key focus was on integrating between 8 and 10 information systems that held physical asset related data into one corporate wide database.
  iv. Identifying Organisational Change projects: The key focus was on identifying other change projects with potential impact on the AM initiative. This working group identified and mapped over a hundred potential change initiatives impacting AM, of which 30–40 were critical to its continued development across the organisation.
  v. AM, and Organisational Structure and Governance: Positioning AM at corporate level, and establishing a corporate level AM group, including reporting structures across the organisation.

Each working group was led by a VSL or AVSL, depending on their allocated tasks. Shadow team experts also worked alongside organisational staff in working to challenge assumptions and provide specialist knowledge input. One VSL acted only in the capacity of overall value workshop coordinator, and addressed the scope, progress, momentum and requirements for plenary sessions. That person also intervened in working group sessions where necessary, or requested by the team due to the overview of all working group thinking.

- Use of Function Analysis: A function analysis system technique (FAST) diagram was used to establish the purpose of AM within the organisation. It remained a reference point throughout the value workshop phase.
- Workshop structure:
  1. Day 1: Introductions, aims and objectives of the workshop and outline of agenda by the VSLs. Presentations by key personnel to reflect their views of AM and related value challenges facing the organisation. Presentation on findings from the documentation review, interviews and Orientation and Diagnostics phase integration workshop by the core shadow team and core client team. Commencement of Issues Analysis.
  2. Day 2: In-depth Issues Analysis and prioritisation with full value team. Refinement of issues/challenges for workshop working groups. Working groups operated after approximately 90 min, and using intermittent plenary sessions. Day 2 was primarily an exploration of value challenges. In the early evening, short presentations from working groups were made on emerging and key thoughts, options and expectations for day 3.
  3. Day 3: Development of options by working groups, including enablers and barriers to implementation. In-depth presentation by each working group on options/solutions for peer review by whole value team.
- Deliverables – there were two sets of deliverables:
  1. A substantive value workshop report bringing together solutions focused outcomes from each working group into a coherent assessment of the way forward for asset management in the organisation.
  2. An Action Plan with immediate next steps.

Primary Value Workshop duration: The primary value workshop involved 19 person-days from the extended shadow team, excluding the organisational representatives.

Primary Value Workshop Rationale: The structure of the primary value workshop, and the tasks and composition of working groups were identified at the 1 day Integration workshop in the previous phase, and minor adjustments were made on Day 1 to ensure working groups had a balanced set of skills for their allotted tasks. The value workshop was essentially a key stakeholder event and a significant organisational intervention given the representation of the value team drawn from across the organisation. Due to the number of delegates and the complexity of the challenges, the value workshop necessitated detailed design and management of its structure and process from the outset. The value workshop also acted as the initial impetus for the implementation of AM deeper into the organisation, with each attendee tasked with commencing the dissemination of key messages to their peers back in their own separate Divisional teams.

Implementation Phase

This comprised a series of activities:

- A review workshop: This comprised six organisational staff selected as representatives from working groups and also to reflect cross-functional organisational perspectives;

the core client team; the core shadow team and representatives drawn from the extended shadow team of experts. It was led by two VSLs. This workshop was held 3 weeks after the previous phase to:
  - Address unresolved issues from the primary value workshop.
  - Add further detail to the analysis.
- Subsequently, a Briefing Note and draft value study report was produced for an Executive Management workshop to be held some two months after the Phase 2 primary value workshop.
- A briefing meeting was also held prior to the Executive Management workshop with the organisation's Chief Executive to provide a wider perspective on the implications of findings after the first phase review workshop.
- A 1-day Executive Management workshop comprising 15 senior managers drawn from the Executive Board, Heads of Division and other organisational units. This comprised a series of presentations reflecting each of the findings from the working groups. Presentations were undertaken by the VSLs, extended shadow team experts, and from the core client team on the policy implications of the findings. The outcome of this workshop was:
  - To reaffirm the direction of the study and identify any further work required to complete the value study.
  - To seek feedback to finalise the draft value study report for a wider organisational consultation process.
  - To determine the shape of excellence in AM, and the extent and resource commitment required to move the organisation from the As-Is situation to the As-Should-Be situation, and what those steps might look like.
- Further interviews and a small half-day workshop were conducted in certain regions to refine the study outputs for operational implementation.
- The draft value study report was sent for consultation to primary value workshop attendees and into the wider organisation.
- A small senior management review session was conducted with two VSLs once all comments had been integrated into an updated draft value study report.
- The study was completed with a value study final report sign off meeting between one VSL and the Chief Executive Officer.
- An Executive Management Board paper was produced by the core client team summarising the value study final report, and with recommendations to the Board as to next steps.

The Implementation phase duration: This was spread over 4 months and took 54 person-days to complete.

The Implementation phase rationale: The value study was a significant organisational intervention, and required senior management and organisational buy-in at each successive stage. The review workshop was essential to provide time for reflection on the outcomes of the primary value workshop. Additionally, there were a number of outstanding items that needed further development. Subsequent steps in the Implementation phase focused on testing and seeking feedback on the primary value workshop outcomes with senior management stakeholders drawn from across the organisation. The characteristics of the Implementation phase were adapted as the study proceeded, with this being heavily influenced by each successive step and the ongoing dialogue between the senior organisational decision-makers and the client core team, and subsequently the VSLs. On completion of the final value study report the core client team had the responsibility for implementing the outcomes.

Issues encountered

The underlying philosophy, thinking and methodology of value management was used throughout to provide the scope and shape to the policy study.

- The value study involved collaborative working throughout; using an independent shadow team working alongside a core client team comprising senior in-house managers.
- This was a complex value study. It required extensive planning since it was a significant organisational intervention at senior management level across a large multidivisional organisation with an overlaid regional structure.
- The principal study outcome was the design of an organisational change framework for enhancing AM across a major public sector organisation.
- There was a strong interrelated strategic, tactical and operational focus to the value study linked to capital and operational expenditure requirements for AM.
- The value study approach used interorganisational benchmarking; together with assessments and reflections on a comprehensive set of AM best practice models and principles established from an international documentation review. This was complemented by shadow team consultancy advice and input.
- Most of the pieces of the AM jigsaw across the organisation were either completed, nearing completion or being worked on ready to be put in place. However, at the time of the study they were not integrated and deeply embedded across the organisation and in its collective thinking. The various facets needed to be integrated to achieve maximum benefit and to put AM comprehensively in place within the organisation. The value study provided that focus and momentum.
- A key issue for the value study was the timing, appropriateness and robustness of study outputs, hence an extended Implementation phase to align with a changing external and internal organisational landscape.
- A series of seven detailed implementation plans or work streams were produced as the final output from the study.

A cross-government study[1]

A principal driver for the study was the outcome of the second Lyons report to improve asset management in the central government (Lyons, 2004). The scope of work was to conduct an enabling study to improve asset management across the central government civil estate,

[1] The detailed outcome of this study is set out as a matter of public record in the following document: University of Leeds (2006), Improving **Property Asset Management in the Central Civil Government Estate,** Report for the Office of Government Commerce.

worth some £220 bn. The study was the precursor to the Office of Government Commerce's High Performing Property Initiative. The study objectives were to:

- Determine the current state of AM in Central Government, against which the success of OGC's subsequent embedding programme could be assessed.
- Portray AM excellence through a series of frameworks, models and examples of excellence; and set out a model of maturity in AM against which departments and other central government organisations could judge their own status and progress towards excellence.
- Provide clarity on the effectiveness of options for central intervention and the resulting potential efficiency gains to also guide the development of OGC's Efficiency Programme.

The study had a direct relationship with a parallel and related study to determine the skills framework necessary for AM and the Professional Skills for Government initiative also underway within OGC.

The underpinning philosophy for the study was based on international best practice in AM, the use of the value management philosophy and methodology, and adopting a structure to the value study that aligned with but was a substantive extension to that in the previous case study.

A sense of scale

Table 8.1 defines the limits of the then Central Government Civil Estate (CGCE) at the time of the study. As described in the first part of this chapter, the policy study adopted the term 'property asset management' for a specific reason, namely, to not only capture aspects of AM already identified earlier, but also to include those concepts enshrined in Property Law and the legal concept of 'real property' associated with a bundle of legal rights and obligations. Table 8.1 sets out the strategic context within which enhancements to asset management across the central government were to take place, and covered both administrative and operational assets. It also covered different types of government structures, departments, agencies, nondepartmental public bodies (NDPBs) and other sponsored organisations. This represented a diverse physical asset base, ranging from commercial office space through to power stations, ports and harbours, flood defences, historic and heritage buildings, radio masts, coastguard facilities, laboratories and roads. In the buildings-related area, the central government civil estate protocol (CECP) sets out how Government bodies co-ordinate the acquisition, management, rationalisation and disposal of workspace from the Civil Estate, predominantly the administrative estate. The CECP included workspace, offices and other building-related property used to deliver departments activities that are owned, leased or occupied by a Government body, or outsourced through Design, Build, Finance, Operate (DBFO) arrangements under PPP arrangements.

Consequent to the study (UoL, 2006), there was a refinement of the outcomes to reduce the scope covered under the term property asset management to exclude that which can best be described as civil engineering in focus. The Civil Estate, as currently now defined, is workspace, offices and other property (land and buildings) used to deliver

Table 8.1 The Central Government Civil Estate from ePIMS, Office of Government Commerce. University of Leeds Report, pp. 33 (UoL, 2006).

Central Government Non-specialised Property	Central Government Specialised Property	Wider Public Sector and Other Bodies
Included in the Civil Estate: • Central Departments' owned, leased and occupied property, including PFI procured/managed accommodation • Agencies' owned, leased and occupied property • Executive NDPBs owned, leased and occupied property • Special Health Authorities • DWP Job Centres, Benefits Offices • FCO UK estate • EH administrative estate • Defence administrative accommodation	Included in the Civil Estate: • HMCS Courts • Departmental and sponsored bodies' specialist facilities, e.g. Laboratories, museums, power stations, port facilities • Departmental and sponsored bodies' civil engineering infrastructure, e.g. flood defences, roads, canals, railways • EH heritage estate • Historic Royal Palaces Not included in Civil Estate under this heading: • Defence Military establishments • Prison Estate • NHS Estate, e.g. Hospitals • DEFRA rural estate, e.g. farms • FCO overseas estate	Not included in the Civil Estate: • Doctor's Surgeries and clinics • Schools • HEFCE facilities • Police stations • Fire stations • All local government • Crown Estate • Parliamentary estate

departments' activities that are owned, leased or occupied by a government body, including ministerial and nonministerial departments, executive agencies, executive NDPBs and special health authorities in England. Key facts about the mandated Civil Estate in 2012 are (HMGCO, 2013) the following:

- The overall size of the mandated estate is 9 219 150 m^2.
- The number of holdings is 5582.
- The total cost of running the estate during the financial year 2011/2012 was £3.135 bn, based on reported and estimated costs.

London offices account for 25% of total space and around 41% of total annual costs.

The value management strategy

The VM strategy was multilayered and had a three-phase methodology. The value study adopted a core shadow team approach, supported by specialist expertise when required to form an extended shadow team and a small core client team. The extended shadow team, when fully involved during a major value workshop, had five people, four of whom were involved in interviews. The shadow team specialisation was as follows:

- *Three-person core shadow team*, with experience in AM, VM, RM, Programme and project management, and cross-sectoral design and implementation of value studies.

- *Additional expertise*:
  - *Cost consultant*: with experience in AM, VM, Projects and Procurement, cross-sectoral design and implementation of value studies.
  - *Programme and Project Management consultant*: cross-sectoral experience, and with private sector property development and PPP sponsor experience.

There was a core OGC client team of four senior individuals comprising the senior policy director and three senior asset managers in addition to one private sector consultant asset management advisor. These acted as gatekeepers for the study team.

Study methodology

Phase 1: Orientation and Diagnostics Phase. This involved fact finding and identification of the value challenges in AM facing the central government and this involved the following detailed steps:

- Initial half-day orientation meeting with the client core team and core shadow team.
- Documentation review in advance of interviews covering government reports, and international best practice in AM for central and local governments, and the private sector.
- Core and extended shadow team 1-day integration workshop covering:
  - Integration of all documentary and fieldwork interview information.
  - Exploration of issues and identifying value challenges.
  - Structuring interview schedules.
- Interviews were held with 32 individuals across a range of central government organisations. Thirty interviews were conducted with Heads of Estate (horizontal data collection) and two more detailed interviews within two departments with their directors (vertical data collection).
- A stakeholder workshop comprising senior cross-government and private sector representatives with AM responsibilities.
- A core client integration workshop with the core shadow team to review inferences from all information gathered, plan the primary value workshop, working group composition, issuing of an agenda and briefing note.
- An extended shadow team meeting just prior to the primary value workshop to review the operation of the workshop process and agenda, review tools and techniques, working group composition and expected outcomes from each, and contingency planning.

Orientation and Diagnostics Phase duration: The fact-finding stage took 50 person-days spread across 2.5 months.

Orientation and Diagnostics Phase Rationale: This had multiple objectives:

- It was important to establish the current situation across central government departments and other central government organisations of different sizes, together with their potential maturity in AM. This was provided through documentation reviews of reports and extensive face-to-face and telephone interviews as well as organisational benchmarking using best practice in AM.
- To explore in-depth the information that had been collated and to refine this into a series of value challenges to be addressed at the primary value workshop.

- To have an in-depth understanding of the different departmental cultures operating across government and their other constituent organisations.
- To scope and identify the objectives, structure, attendees and outcomes anticipated from the primary value workshop.

Phase 2: Primary Value Workshop.

The aim was to develop an AM policy, framework and strategy for cross-governmental consideration and address the value challenges identified earlier:

- Workshop duration: 2.5 days and residential, conducted 3 weeks after the core client team 1 day integration workshop. Day 1 commenced at 4 p.m., and Day 3 finished at 4.30 p.m. There were evening working sessions on Day 1 and Day 2.
- Value team: This comprised 17 people drawn from across the client and other central government organisations. Attendance was adjusted to reflect interview fieldwork. There were four VSLs and one shadow team member embedded within a working group dealing with efficiencies across government. Consequent to the value workshop, their role was to develop an estimate of efficiencies that could be gained by implementing AM across the central government. One VSL co-ordinated across working groups and addressed the scope, progress, momentum and requirements for plenary sessions.
- Workshop design: The value workshop was primarily focused around working groups from the outset, and short plenary sessions for reviews, seeking consensus, progress checking and airing different perspectives. Three Working Groups were established:
  - Asset Policy and Strategy: A Vision and Excellence working group. The key focus was on reviewing and subsequently refining a route map for excellence in AM across central government, organisational structures for AM, what AM excellence should look like and a future vision for AM in central government; establishing how efficiencies will be obtained from the preceding once AM is enhanced across the central government.
  - Two Efficiencies and Interventions Working Groups. The identification of current and future efficiencies across the central government; establishing transition strategies to achieve these.
- Use of Function Analysis and FAST: This was used in the workshop with the whole value team to establish the Vision for AM across the central government, and was used and refined subsequently by the asset policy and strategy working group during its sessions, and to identify an organisational focal point for AM capability.
- Value Workshop structure:
  - Day 1: Introductions and presentation of aims, objectives and workshop agenda by the VSL. Presentations from a private sector AM expert that had recently completed an extensive study of property as a key driver for change in organisations in the public and private sectors. Presentation of findings from the core shadow team and also a presentation from the core client team. Commencement of Issues Analysis. The purpose was to establish the nature and scale of the challenge facing the value team.
  - Day 2: In-depth issues analysis and prioritisation with full team. Refinement of issues/challenges for working groups. Working groups set up using intermittent plenary sessions. Day 2 was primarily an exploration of value challenges. In the

early evening, short presentations were made by each working group on emerging themes and key thoughts, options and expectations for day 3 working.
    - Day 3: Development of options by working groups, including enablers and barriers to implementation. In-depth presentation by each working group on options/solutions for peer review by full team.
    - Deliverables – there were a series of deliverables:
        - A substantive workshop report bringing together solutions focused outcomes from each working group into a coherent assessment of the way forward for AM across central government.
        - A provisional route map to AM excellence for central government.
        - An initial AM maturity matrix for use across central government.
        - A series of potential efficiency options that were developed subsequently outside of the value workshop.
        - An Action Plan with immediate next steps.

Primary Value Workshop: The workshop involved 21 person-days from the extended shadow team.

The rationale for primary value workshop: The structure of the primary value workshop and the tasks and composition of working groups were identified at the core shadow and client teams session. The primary value workshop was essentially a highly focused stakeholder policy workshop. The value workshop also acted as the initial impetus for the implementation of AM deeper within central government.

Phase 3: Implementation Phase.

This comprised the following:

- A comprehensive draft value study report bringing together documentation analysis, questionnaire and interview analysis, major value workshop outcomes, including a refined AM route-map to excellence and the initial AM maturity matrix. The matrix was to be used to assess the extent to which central government organisations had different levels of AM embedded within them. Ten substantive policy recommendations and a series of further supporting recommendations were also made in the value study report. The maturity matrix was also circulated to the value team for review and enhancements.
- A half-day Project Board workshop comprising senior AM stakeholders across the central government to present the findings from the primary value workshop and the enhancements made to the AM maturity matrix. The outcome of this workshop was:
    - To reaffirm the direction of the study and to identify any additional work to complete the study.
    - To finalise the draft value study report and consultation process.
- Further interviews were conducted to refine the study outputs, including the production of exemplar case studies in AM from the public and private sectors.
- The draft final value study report was sent for consultation to workshop attendees and to other cross-government key stakeholders for review and comment.
- A senior stakeholder meeting was held with a VSL to sign off the final value study report and discuss next steps.

- A major OGC launch conference, opened by the Chief Secretary of the Treasury, launched the AM initiative across the central government.

Consequent to those listed, further AM maturity matrix development occurred. This was conducted by one of the VSLs and a private sector expert in AM and formed part of the published High Performing Property initiative. This took 25 person-days within a 1 month period and also included a half-day validation workshop with senior AM stakeholders drawn from across central government.

The Chief Secretary of the Treasury launched the High Performing Property initiative formally in July 2008. The first Central Government Head of Profession for Asset Management was appointed in March 2010.

Implementation phase duration: was spread over 4 months and took 46 person-days to complete.

Implementation phase rationale: The focus of this was to consolidate and refine the outcomes from the primary value workshop, together with that from the first phase to produce a policy report for enhancing AM across central government. This required a series of stakeholder feedback and validation workshops. The AM maturity model was seen as an important assessment tool as part of the whole process, including the route-map to excellence.

Issues encountered

- The underlying philosophy, thinking and methodology adopted was that of value management throughout. It was used to provide the rationale, scope, underlying structure and shape to the AM policy study.
- The value study involved collaborative working throughout, using an independent shadow team appointed by the VSL, and a core client team of senior in-house managers.
- This was a complex value study involving substantive stakeholder engagement. As with the previous case study it required extensive planning.
- The principal study outcome was the design of a policy and organisational change framework for enhancing AM across the central government civil estate.
- There was a strong emphasis on using a comprehensive set of AM best practice models and principles established from an international documentation review. This provided a benchmarking datum.
- The study revealed that there were different levels and facets of AM maturity present across central government organisations. This was driven heavily by organisational context in terms of the purpose of a central government organisation, and the reasons for use of and types of different physical assets within its portfolio. For example, some organisations were dominated by a substantive use of operational physical assets, supported by a head office used for government administration purposes; others only functioned with office-based administrative physical assets, whilst others had to deal with an estate that was totally outsourced under DBFO/PPP arrangements. In terms of AM maturity, it was clear from the value study that the important consideration was the profile of asset management maturity linked to a unique organisational context, and where

they were the organisation was in its own organisational development cycle as noted in Figure 8.4.
- A key issue for the value study was the timing, appropriateness and robustness of study outputs given its policy focus. As a result, there was a requirement for considerable interaction between the core shadow team, the client team and key stakeholders throughout.

Lessons learned for value management

The two case studies noted earlier were both policy studies. The tenets, philosophy and methodology of value management were adopted in both studies; however, there were significant elements of adjustment to meet the requirements of each study.

Key issues arising from the studies are the following:

1. The first study was within a single organisation. It had a complex organisational structure through which it managed its asset base, including interacting and relying on third party assets. Stakeholders were primarily internal to the organisation, but with an outfacing perspective on external political drivers. Their orientation was on what was best for the organisation overall and for their own Divisions. Maturity in AM was specific to the organisation. The focus of the value study was both strategic and operational to integrate the AM line of sight across the organisation. The second study was across a diversity of organisations, each with its own structure, level of maturity in AM and with different types of physical asset bases. Stakeholders were diverse and influential, and with an internal and external political orientation. The focus of the study was strategic and cross-organisational with differing organisational sizes.
2. Both studies adopted hybrid value study styles, although the underlying structure of three phases of Orientation and Diagnostics, Value Workshop and Implementation was generic. They involved the appointment of VSLs and a shadow team of experts. The shadow team was more extensive in the first than the second study due to the characteristics and requirements of the value study. The VSLs had the responsibility of selecting and appointing those individuals for the extended shadow team. The use of an independent shadow team is reminiscent of the US public sector approach to value engineering, and in this case was complemented by the use of independent VSLs in a typical UK and Australian style. There was an extensive use of collaborative working throughout; the shadow team also provided an advisory role compared to just a ‘challenge’ role. Both studies involved a small core client team that acted as gatekeeper to the wider organisation(s). Its role was to provide critical information in the form of documentation, internal policy memoranda, access to senior and middle management client representatives for interviews, external organisational and political contextual referencing, and an ongoing evaluation of organisational structure, culture and internal political issues as the study proceeded.
3. Each study was spread across a number of months. The single organisational value study took in the order of 9 months, whilst the second took in the order 7 months. However, the underlying three phases of a value study were adhered to but each phase had its own distinctive operational mix and set of characteristics due to the nature and requirements of the value study.

4. There was considerable stakeholder engagement in both studies across all three phases of the value study Work Plan. Both studies involved a wider organisational consultation process for the draft value study report due to the likely changes that could be brought about due to study recommendations and options.
5. The use of workshops was extensive as problem seeking, problem solving and decision-making events. Importantly, their use was not limited to a one-off event as in the case of the majority of case studies in Chapter 7. However, each study had one primary value workshop where all stakeholders were brought together to work through value challenges, and develop policy and AM solutions. These were to be validated subsequently in an extensive Implementation phase. The Orientation and Diagnostics phase was used to shape each facet of the study and the primary value workshop, but also had an important role to play in the findings presented in the final value report. This is in contrast to a typical first phase to a value study where its function is to help shape the value workshop phase.
6. There was a significant amount of organisational benchmarking involved in both studies. In the first study this involved three aspects. First, using published models of AM as a normative assessment. Second, with a similar asset-rich organisation as a comparative assessment. Third, through the advisory role of the shadow team, where cross-sectoral expertise was also brought to the fore in the value study 'challenge' and advisory functions. The second study also involved four interacting aspects of benchmarking. First, using published models of AM in a similar manner to the first case study. Second, across different government organisations of approximately the same size and similar contextual orientations as a comparative assessment. Third, across government organisations of different sizes and contextual orientations as a scalar assessment. Fourth, the previous aspect, in particular, led to the shaping and validation of the AM maturity matrix; and consequently the identification of the importance of organisational profiling for subsequent organisational benchmarking as a future normative assessment across government organisations.
7. The VM methodology:
    a. The three-phase approach was adopted in both studies but with significant adaptation from that adopted in Chapter 7:
        i. The Orientation and Diagnostics phase. This stage included fact finding by documentation review, interviews and other methods of data collection, such as questionnaires and in particular short intensive stakeholder workshops, which is different compared to how this phase is generally presented in Chapter 7. A key output was to identify value challenges, workshop planning and agenda production.
        ii. The Primary Value Workshop phase. This was extensive and multifaceted in both case studies. It involved a diverse range of stakeholders. The workshop structures were built around a premeditated workshop strategy of working groups throughout, each with their own dedicated VSL or AVSL, and supported by plenary sessions. Full value team working was limited to key points only, typically at the start and end of the workshop and with an interim meeting to agree the next day's working patterns and themes. This is atypical only due to the size of the team, and the need to cover a number of strategic themes comprehensively and simultaneously. In the cases presented in

Chapter 7, the use of working groups were primarily focused around the Development stage of a workshop structure and, not utilised from the outset as with the two case studies presented here.

iii. The Implementation phase. This was again multifaceted in each of the cases presented and typically involved a draft value study report, wide consultation of the report, short intensive stakeholder workshops, and potentially further interviews and extensive refinement of value workshop outputs. Report sign-off was typically through large stakeholder meetings where the VSLs were present to address any outstanding questions and input into the next steps. This is atypical compared to the cases presented in Chapter 7 due to the nature and extent of the studies.

8. Value management was being used in both studies as a short but intensive organisational change initiator or catalyst, as well as for stakeholder engagement and management and as a decision making methodology.

An asset management case study from the private sector

Whilst the two case studies mentioned are complex, large scale, of longer duration than those noted in Chapter 7, and multilayered, the authors have also been involved in much shorter AM value studies. A brief example will demonstrate the point.

The client was a manufacturer who wished to rationalise a number of operational plants using the structure provided by a value management study. The value study was led by two VSLs during the value workshop phase. There were three value drivers behind the rationalisation: (i) to obtain operational efficiencies, (ii) to reduce maintenance requirements, and (iii) to reduce overall business costs. The client had already undertaken a considerable amount of analysis prior to the study, and had developed in the order of six possible options for the plant rationalisation, with some overlap in certain cases.

The *Orientation and Diagnostics phase* was quite short, and covered first, an understanding of the business case, the operational requirements of each of the existing manufacturing plants, and the market demands placed on each. A small number of interviews were conducted.

The *Value Workshop* was of 1 day duration with senior managers drawn from across the business and each of the manufacturing plants. The workshop commenced with a prioritised issues analysis to determine a consensus around the issues and 'value challenges' that might impact on the options from the decision matrix. A Function Analysis was conducted to determine the reasons for the 'rationalisation project'. A Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis of each of the options was conducted, including assessing each against the FAST diagram, and this provided an input into a weighted and scored decision matrix. The outcome was a preferred option, to be subsequently tested outside of the value workshop by the senior management team against the next best two scored options.

The *Implementation phase* comprised the production of a short value study report.

The study duration took 3 weeks in total, from the commencement of the Orientation and Diagnostics phase to completion of the final value study report.

8.7 Conclusions

Asset management as the term adopted in this chapter encompasses the effective and efficient management of physical assets as an organisational resource. AM is an extensive and robust overarching organisational capability and framework that is strategic and operational in nature, acts as an interfacing function between organisational strategy, and the strategic, tactical and operational use of physical assets to enable organisational functioning over time. The physical infrastructure and other built assets enable communities, economies, governments and commerce to function efficiently and effectively for the benefit of society as a whole. Due to the whole life costs and levels of investment associated with different types of physical assets that may have to be managed by an organisation, the organisational capability and function of AM should be located just below Management/Executive Board level. It also involves issues of corporate governance as the whole life organisational decision-making framework for investments in physical assets.

Value management has an important role to play in asset management. Its role is to understand the linkage, requirements and resolution between organisational strategies, the organisation's use of physical assets, and the subsequent prioritisation of investment for the creation, renewal, maintenance, disposal and management of physical assets through time. It also has a focus on decision making interfaces along the AM line-of-sight with respect to prioritising investment in physical assets and their role in an organisation. In short, the role of VM in asset management is to analyse, explore, develop and implement options to improve the strategic fit between an organisation's strategies and its use of physical assets to maintain or enhance organisational value.

The important conclusion to be drawn from the three case studies mentioned is for the VSL to understand the strategic, integrative and operational asset management context within which the value study is to take place, and not to be constrained by the application of a standard approach or Work Plan to a value study. All three VM case studies presented here dealt with AM. It is the design and implementation of the value study that is paramount. Each of the case studies adopted the three standard/generic phases of Orientation and Diagnostics, Value Workshop and Implementation, they were of equal importance to the success of a study but they were also tailored to a given organisational and value study context. The first two case studies had a policy focus and were to move organisations from a more operational to a more strategic orientation for managing physical assets. The first case study had to encompass operational issues within that. The major value workshops for the first two case studies adopted extensive working group activities virtually from the outset of those workshops. The focus of the third value study was around rationalisation of a firm's physical asset portfolio and had a small value team of senior managers working throughout, with no working group activity in the value workshop. The structure and duration of the third case study had a much closer alignment to the majority of case studies presented in Chapter 7.

In conclusion, VM has an important role to play within the discipline of asset management due to its focus on value, value for money and whole life thinking. The disciplines are complementary and self-reinforcing. It is essential that the place of AM in the corporate value system of the client is recognised in the undertaking of any construction VM study.

Chapter 9 deals with Portfolios, Programmes and projects, topics that are closely related to that of asset management.

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9 Managing Value in Portfolios, Programmes and Projects

9.1 Introduction

Value management (VM) in construction is predominantly seen as an intervention within a single project paradigm. However, this chapter explores and argues for the use of VM within single projects, within Programmes and Portfolios, and at different levels in an organisation. In this chapter, the following definitions are adopted:

- Projects are a vehicle to deliver an investment, supported by a business case, and have a set of requirements and objectives, are managed through a life cycle from concept to handover, and deliver a service, product or physical asset.
- Programmes are designed purposefully to create, group, coordinate and manage substantive change-related initiatives to deliver an organisation's strategy, set of capabilities and/or physical assets to attain a strategic goal or objective. Programmes deliver investments through related projects, create value for stakeholders and as a consequence secure a step change in organisational performance.
- Portfolios are groupings of Programmes and projects that may or may not be interdependent or related. Portfolio Management operates at a higher organisational level than Programmes and projects. It forms part of the higher levels of a corporate governance system and provides the linkages between the strategic level, Programmes and projects.

It is crucial for a Value Study Leader (VSL) to have an understanding of the organisational context within which a value study will be deployed in Portfolios, Programmes and Projects (P3) organisational environments, regardless of whether that be within the public or private sectors. A value study may be influenced or impacted by issues that originate from different levels within an organisation. The VSL has to tailor the study, and each of its phases, to address the unique context of that study. This has already been demonstrated in Chapters 7 and 8. A further illustrative case study is presented in this chapter.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

As noted in Chapter 1, in the United Kingdom, reforming the construction industry has focused increasingly on an adoption of collaborative procurement routes and collaboration across the client's supply chain for construction projects. Within these procurement arrangements, construction is viewed in the overall context of the strategic goals of client organisations and is no longer restricted to realizing just a physical asset. It can also involve the overall success of delivering a service to a client from financing to operating, maintaining and managing through a life cycle from inception to disposal.

This has brought to the fore the need to manage value, risk and uncertainty over the whole life cycle of an asset. Equally, the privatisation of industries, such as utilities, power and transportation, has also led to the emergence and consolidation of large, regular-procuring, private sector clients of construction who are willing to pursue innovative approaches to procurement in order to facilitate their business strategies, and occurring typically in multiproject environments. During the 1990s and into the 2000s, it has been contended that the greatest level of project activity now takes place within a multiproject environment (Turner and Speiser, 1992; Kometa *et al.*, 1995; Chinyio *et al.*, 1998b; Blismass *et al.*, 2004a; Blismass *et al.*, 2004b; TSO, 2006). This chapter argues that value management has to develop beyond a single project methodology to embrace fully this trend so that it can be applied effectively within a multiproject environment, and at any level in an organisation. The Project Management Institute (PMI) uses the term 'Organisational Project Management' to describe this type of P3 organisational environment, and it is the term also adopted here (PMI, 2008, 2013a, 2013b, 2013c).

The chapter will present a range of different models and concepts to assist VSLs in designing value studies in a P3 environment. Models are representations of reality and assist in identifying different management challenges and situations (Fellows and Liu, 2003). The chapter commences with an outline of strategic management and organisational strategy to set the context for the remainder of the chapter. A review of published material dealing with Portfolios, Programmes and projects is presented, noting that with the exception of projects, there is a diversity of views surrounding these definitions. The chapter outlines the concept of the Organisational Value Chain (OVC) and the Organisational Project Value Chain (OPVC) and their implications for value management. Subsequently, the chapter presents a value study linking VM with Programme Management thinking in a multiproject environment. A range of managerial models are presented to explore Organisational Project Management.

9.2 Strategic management

The strategic management of an organisation provides the context within which value studies operate. Strategic management aligns the organisation's internal and external environments, achieved through three interlocking components: strategic formulation, strategic choice and strategic implementation (Johnson and Scholes, 2002). It also deals with making strategic decisions about the future direction of an organisation and ensuring that its strategies are put into action (Johnson and Scholes, 2002; Graham and Male, 2003; OGC, 2005).

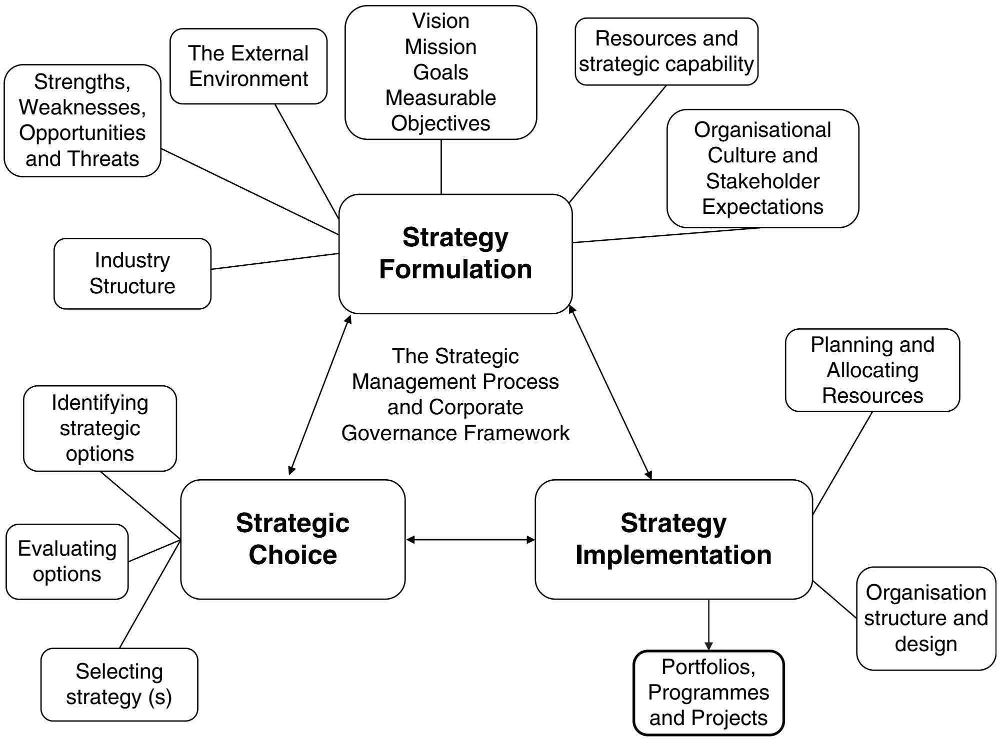

Figure 9.1 A summary model of the components of strategic management. *Source*: Adapted from Johnson and Scholes (2002).

Strategic formulation is about analysing an organisation's current situation and understanding where it wants to be in the future. The outcome of the formulation process is a range of alternative strategies that can be used to move the organisation forward. Strategic choice selects from these alternatives those that will determine most effectively the future strategic position of the organisation in its environment. Strategic implementation occurs through 'organisation' and requires appropriate feedback mechanisms in place to ensure that the strategy as implemented is consistent with the strategy as conceived, evolved and decided upon. Portfolios, Programmes and projects form important aspects of strategic implementation.

The model presented in Figure 9.1 demonstrates the relationship between these three components, and within each the aspects they govern. In combination, they represent the totality of the strategic management process.

The terms mission, vision, goals or objectives, and strategy are often discussed as part of the strategic management process. Vision is about formulating where the organisation is going in the future, and represents an ideal to be aimed for (Naaranoja *et al.*, 2007). Mission is about why the organisation exists, its *raison d'être*, and encapsulates notions of why and what it does (Male and Stocks, 1991; Langford and Male, 2001). Strategic decisions about the long-term directions of an organisation are specified usually in the form of objectives (Langford and Male, 2001). Goals or objectives state what is to be achieved and by when, but not how (Mintzberg, Quinn and Ghoshal, 1999).

Implementation forms part of the tactical response to strategies. It is the domain of P3 structures and environments. It requires three fundamental questions to be asked and answered (Langford and Male, 2001):

1. Who is responsible for strategy implementation?
2. What must be done for successful implementation?
3. How will implementation work?

There are different perspectives on strategy. Johnson and Scholes (2002) define strategy as the direction and scope of an organisation over the long term in a changing environment. It involves configuring resources and competences to fulfil stakeholder expectations. Strategy can also be viewed as a mediating force between an organisation and its external environment (Mintzberg, 1992). Quinn *et al.* (1988) describes corporate strategy as the 'pattern of purposes and policies that define the company and its business, whilst strategy involves setting objectives and planning what is to be achieved and how to do it. Strategy identifies the ways or manner to achieve the vision (Naaranoja *et al.*, 2007). It is also seen as the art of creating value through the intellectual frameworks, conceptual models and governing ideas that managers use to help them identify opportunities for their customers (Normann and Rafael, 1993). Strategy-making is essential to achieve superior performance and effective management of organisational change (Porter, 1985). In sum, vision and mission provide the WHY, objectives provide the WHAT and WHEN, and strategy provides the HOW of directing an organisation from where it is now to where it wants to be.

Mintzberg (1987) attempted to reconcile these diverse perspectives on strategy. He discussed strategy in terms of first, *Plan*, a consciously deliberate course of action to deal with a situation that an organisation faces. Second, *Ploy*, reminiscent of how strategy is used in a military sense, and is a tactic to out-manoeuvre a competitor. It concentrates on the more dynamic and competitive elements of strategy. Third, *Pattern*, a consistent stream of actions over time. This demonstrates constancy and consistency of organisational behaviour. Fourth, *Position*, a means of locating an organisation in its external environment. Fifth, *Perspective*, seen as how an organisation understands its environment and is a deep-rooted consensus amongst the members of an organisation's or managers' intentions over time. Perspective involves intention and behaviour in a collective sense (Langford and Male, 2001; Moussa, 1999; Woodhead, 1999).

Levels of strategy

Strategies exist at different levels in an organisation. Typically, three levels of strategy are identified, namely, corporate, business and functional strategies (Hofer *et al.*, 1984; Langford and Male, 2001; Kelly, Male and Graham, 2004; Ghobadian *et al.*, 2007). A fourth level has also been identified that can be termed collective, interinstitutional or, as preferred in this chapter, strategic alliances (Hofer *et al.*, 1984; Mitrovic, 1999; Moussa, 1999; Ghobadian *et al.*, 2007).

Corporate strategy involves the comprehensive management of strategic business units and their associated objectives (Langford and Male, 2001). Business level strategy is concerned with improving the competitive position of a firm's product or service in a certain industry or market segment (Wheelan and Hunger, 1984). Functional strategies operate at organisational departmental level and support business strategy.

Strategy and policy

Policy has two distinct meanings in relation to strategy. In the *Political domain*, it refers to the basic principles that guide government, and are the declared objectives it seeks to achieve. Policy-making is defined as 'the process by which governments translate their political vision into programmes and actions to deliver "outcomes" – desired changes in the real world' (Mintzberg *et al.*, 1999). Typically, in the public sector, policy-making, strategy and delivery (or implementation) are split with very clear implications for how organisational decisions are made across these important interfaces and at what organisational level. For example, the Nicholls report highlighted the complex interfaces between the Department for Transport and the Highways Agency that required careful consideration and management (UoL, 2006; Nichols, 2007; Male *et al.*, 2008).

In the *Management domain*, and typically in the private sector, policies are the rules or guidelines that set limits within which managerial action should occur, and are often contingent to resolve conflicts between specific organisational objectives. Strategic policies are those major policies that guide the organisation's overall direction, its posture or viability (Mintzberg *et al.*, 1999). Policies are laid down by an organisation as a response to known or knowable situations and are an endeavour to control risk.

The two public sector case studies presented in Chapter 8 used a value study as the basis for asset management policy development and implementation. The private sector value study also presented in Chapter 8 dealt with manufacturing plant rationalisation and is an example of a business strategy study. A corporate strategy level value study is required where subsidiary organisations of a parent company have autonomous business units, with their own Management Boards, and with each operating as a separate product focused profit and loss centre.

Organisational structure and roles

In addition to the foregoing, organisations comprise three basic components of organisational structure (Robbins, 1983). *Complexity* relates to structural differentiation within an organisation. It has three dimensions. First, *horizontal differentiation* is the extent to which tasks are subdivided among organisational members such that they can be allocated to specialists or nonspecialists. This also relates to the degree of specialisation within an organisation. The second dimension is *vertical differentiation* and relates to the number of levels in the organisational hierarchy – its depth. The third dimension is *spatial dispersion*. This relates to either vertical or horizontal differentiation and refers to the extent to which activities or personnel are dispersed spatially by separating power centres or tasks, that may or may not be geographically located.

Formalisation, the second component, is concerned with the extent to which codes of conduct or the norms of an organisation are known explicitly amongst its members. Formalisation goes beyond the written rules and procedures operating within an organisation since unwritten norms and standards are as potent for controlling human behaviour. The ideas behind the different facets of formalisation affect an organisation's culture and will have an influence on its value system(s). Mintzberg (1979) views formalisation and training (in order to standardise skills) as substitutes for codes and norms since both are methods of co-ordination.

Centralisation is the third component and refers to the degree to which power is centralised or concentrated within the hands of a few people, units of departments within an organisation. The degree of centralisation can also be viewed as a measure of trust within an organisation and the extent to which individuals have a wide degree of discretion in making decisions. Power exists along a continuum from highly centralised to highly decentralised. Decentralisation also has a vertical and horizontal component. Those organisations that are vertically decentralised have power formally distributed down the managerial line hierarchy. Organisations that are horizontal decentralised, commonly referred to as a silo structure, have decision-making power resting predominantly outside the managerial line hierarchy.

Finally, organisations not only have structural components but a network or system of organisational roles. An organisational role perspective is based on the principle that an individual in an organisation holds expectations, perceptions or beliefs about how they behave in social situations. Not only does the individual hold these views about themselves but also how other people behave in social situations. A role analysis of an organisation proposes that these two perspectives come together within an individual to create a situational view of an organisation as a 'social' and 'business' entity and that individual's part within in it (Male and Stocks, 1991). Understanding a person's role within an organisation or project, and how that role is shaped, is vital for the VSL in a value study, especially if they are a representative that is involved in one or more stages of the study.

Levels of managerial decision-making

Within the strategy framework discussed, an associated layering of management decision-making can be identified. The *institutional* or *strategic level* focuses on adapting the organisation holistically to the external environment. Strategic decisions are taken at this level and have a long-term policy and strategy focus. Depending on organisational size, strategic decisions have impacts and a timescale that can span decades, for example, for large organisations this is often 5, 10, 15 or 20 years or more. Another strategic decision with a long-term time horizon is that of outsourcing activities under a private finance procurement arrangement in the public sector. The consequences will span decades, typically often two or three decades. The creation of an output specification and contractual arrangements under such a procurement system is a strategic and not tactical decision with significant consequences for strategic briefing. For smaller organisations, that timescale is more imminent, with strategic decision time horizons of three years or less.

As Langford and Male (2001) note, strategic decisions are often non-programmed, that is, decisions are made in situations that have high degrees of uncertainty, are ambiguous, unstructured, novel and/or complex and where there are no guidelines from policies, procedures or routines to assist the decision-maker. This requires a response from the decision-maker that is problem-solving or problem-seeking. It will require a high degree of insight and typifies decisions at the institutional or strategic level. Strategic decisions set the parameters and context for organisational decisions at lower levels in the managerial hierarchy.

The locus of managers' decision-making at the *organisational level* is one of integrating lateral and vertical relationships; the focus is much more on resource allocation, stakeholder management and budgets. The time frame is more towards the medium term, again organisational size has a mediating effect, but this is often between one to three years for large organisations. This is less than the horizon of a typical construction project from gestation to commissioning and handover into use.

Finally, the *technical, production or operational core level* on an organisation transforms inputs from the external environment into outputs, hence the use of the term operational decisions. Their time frame is much shorter, often less than one year. Operational decisions tend to be recurrent, that is, programmed decisions. They are the routine, repetitive and frequently occurring situations within organisations. These types of decisions assist in developing standard procedures. Figure 9.2 sets out the levels of strategy and management decision making.

In Chapter 7, case study 9 illustrates a value study team that comprises individuals spanning all three levels of decision making illustrated in Figure 9.2. First, it involved those at the strategic level, the university senior management. Second, it involved those at the organisational level – the Head of Estates and his managerial peers from his executive team. Finally, it involved operational level managers who understood the implications of making changes to the way the Estates Division interacted with its internal clients, the university departments, on a day-to-day basis.

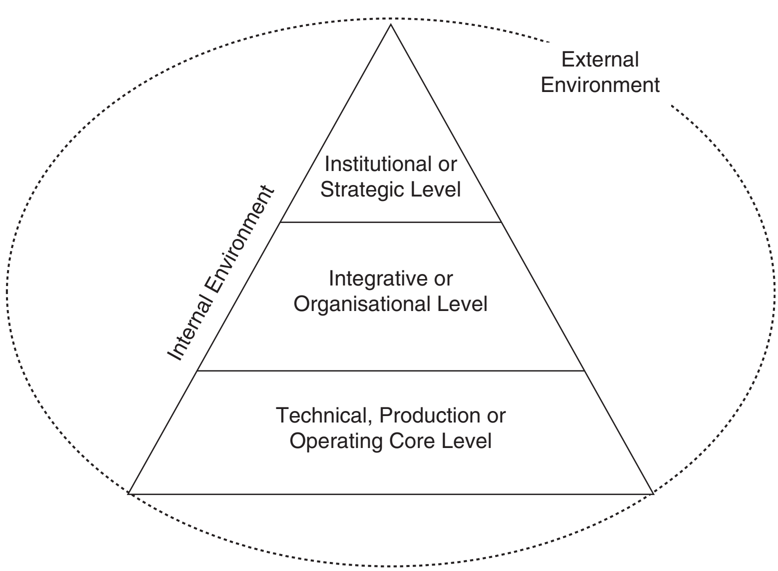

Figure 9.2 The hierarchical structure in a simple organisation. *Source*: Adapted from Langford and Male (2001).

Levels of managerial decisions, programmes and projects

Projects and Programmes are outcomes of strategic decisions, and may well involve the construction industry. However, projects may also be outcomes of integrative or operational level decisions. Construction projects are often characterised by a high degree of uncertainty subjecting organisations to many pressures and influences (Loftus, 1999). The organisation's strategic decisions are therefore complicated by this high degree of uncertainty in often relatively unpredictable and dynamic environments (Smith, 2003a). These influences will certainly affect single projects. The multiproject environment is even more complicated because it has to take account of both individual project risks and uncertainties, and balance these against the accumulated strategic level/corporate risks across a Programme (Merna and Al-Thani, 2005). Furthermore, managing in a multiproject environment must also take account of the cumulative effect of the various projects within Programmes, which at times will be in geographically dispersed locations, and at different stages of their own project life cycles (Blismass *et al.*, 2004a).

Section 9.3 explores these ideas in more detail.

9.3 Portfolios, programmes and projects

Section overview

During the 1950s and 1960s, the United States Department of Defence (DoD) developed the modern concepts and core techniques of project management (Kerzner, 2006). This also coincided with the DoD developing its approach to Value Engineering. The emphasis for successful project delivery was seen as being on time, within budget and to specification. This traditional way of thinking about projects has shaped perspectives on project management exclusively as a means of planning, scheduling and controlling of activities and resources. The surfeit of tools and techniques resulted in the view during the 1970s that project management was a middle management, tools and techniques methodology (Maylor, 2005), commonly based solely on computerised critical path analysis (Turner, 1993). However, people related issues, teamwork and leadership came to the fore as project management developed, and the concept of the matrix organisation emerged (Turner, 1993). This view of project management has persisted, as did a single project focus (Van der Merwe, 1998; Blismass *et al.*, 2004a, 2004b).

During the 1980s and 1990s, the European perspective of project management emerged as a more holistic service with concepts, such as 'Management by Projects', going beyond traditional intraproject issues and addressing process and people-oriented approaches, with almost no reference to tools and techniques (Morris and Hough, 1987; Van der Merwe, 1998). This type of thinking proposes all activities and ongoing operations are considered projects and therefore project management principles may be applied (Hamilton, 1997; Taher and Sharad, 1998).

This also engendered an environment of managing multiple simultaneous projects that make up the strategic objectives of an organisation – the multiproject environment (Van der Merwe, 1998). It brings project management clearly into the realms of strategic management, organisational strategy and behaviour (Platje *et al.*, 1994). During the early part of this millennium the Engineering and Physical Sciences Research Council (EPSRC) network on Rethinking Project Management identified simultaneous management as one of the future challenges for project management Maylor (2006). The Project Management Institute in the United States recognised this with its concept of Organisational Project Management, the term also adopted in this chapter as the overarching managerial framework for Portfolios, Programmes and projects (PMI, 2008, 2013a, 2013b, 2013c). Within this P3 framework, Thiry (2010) proposes that:

- Projects deliver a single product or service, and have a tactical and operational focus. They are relatively well defined, and can be complicated but not complex.
- Programmes are business focused, have multiple deliverables, are complex, and need realigning frequently with organisational strategies. The implication here is that Programmes are focused at Strategic Business Unit (SBU) level, in the organisation; although a different perspective will also be presented in this chapter.
- Portfolios are mission and corporate strategy focused with ongoing and/or recurrent projects, which are relatively predictable in terms of outcomes. They can cover an organisation's projects, or its whole investment portfolio, and will need to be realigned with corporate strategy. The implication here is that Portfolios operate at corporate level.

The clear inference from this is that P3 occurs at different levels in an organisation and have a different focus. However, the reality is less clear cut as will be presented later in this section and the chapter. Whilst Thiry (2010) argues projects are tactical, it is also argued in this chapter that this is correct in relation to P3 structures generally, but there are also factors of organisational size, criticality and, the nature of the project to consider. For example, in fieldwork conducted by the authors and reported in Male *et al.* (2008), one organisation, in comparisons to others in the sample, procured projects on an ad hoc basis. However, due to the distinct nature of that organisation and its organisational size each project was mission critical, and therefore considered strategic for that organisation. Figure 9.3 sets out the relationship between the strategic management process and P3.

The P3 framework is a vehicle for delivering investments that will decide the shape of an organisation's future position and help achieve its vision, regardless of whether it is located in the private or public sectors. Figure 9.3 indicates schematically the relationship between the strategic management process, Portfolios, Programmes and projects, including mission critical projects as noted earlier, together with the link with procurement strategies.

Semantics have also plagued the discipline of managing 'projects' through the use and meaning of different terms such as project management, project organisation and project team (Lock, 1987; Pinto, 2007). Further developments in the project domain have also seen the emergence of terms such as Programmes of projects (Rayner, 2007; OGC, 2010a; APM, 2012; PMI, 2013b) and Portfolios of projects (OGC, 2010b; APM, 2012; PMI, 2013c). The further emergence of terms such as: multiproject, Portfolio, Programme, macro-project, mega-project, super-project, meta-project, also add to this confusion. Furthermore, situations occur in different organisations where these terms are also used in combination, interchangeably and also at times synonymously. This has contributed to the idea that these terms have similar meanings, making definitions inconsistent and ambiguous. This is

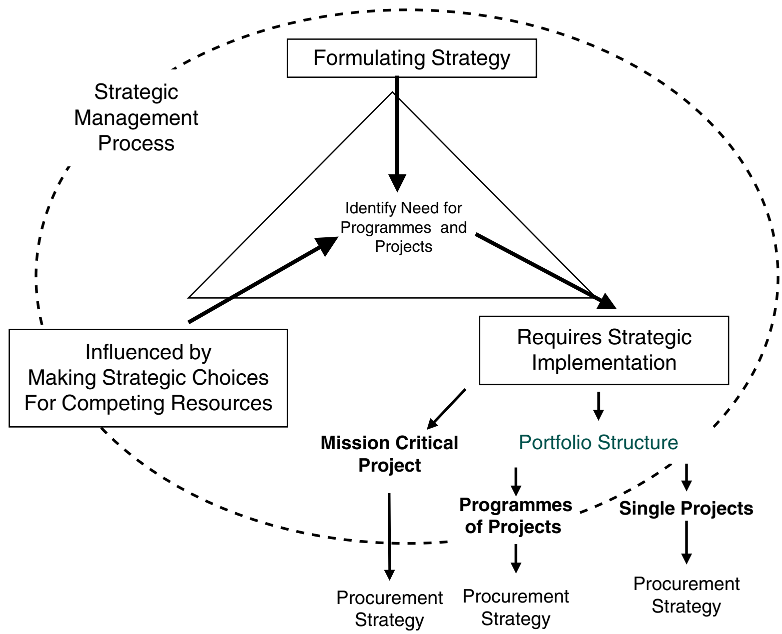

Figure 9.3 The strategic management process, Portfolios, Programmes and Projects.

due, in part, to the influence of professional bodies (Ferns, 1991; Gray, 1997; Pellegrinelli, 1997; Cooke-Davies, 2002). Additionally, with the emergence of managing simultaneous projects, case study based research has demonstrated that traditional single project management strategies are usually adopted for simultaneous or multiproject environments, but with limited success (Blismass *et al.*, 2004a, 2004b).

Whilst there remains some vagueness around these terms, given the importance of these concepts and practice to organisations, and their impact on value studies conducted in larger organisations, it is imperative that a clear and consistent definition is adopted in this chapter for each term prior to any detailed discussion on the implications for value management. Portfolios, Programmes and projects are discussed later in more detail under the term 'Organisational Project Management'.

Organisational project management

This section introduces and discusses the concepts behind P3 and proposes they occur in some form of a continuum within organisational environments. The discussion and exploration addresses projects and Major Projects initially, and then addresses Programmes and finally Portfolios, primarily due to the fact that in comparisons to project management, these are more recent concepts in the discipline.

Projects

From an analysis of definitions (Borjeson, 1976; Morris and Hough, 1987; CIOB, 1988; Archibald, 1992; Turner and Speiser, 1992; Platje *et al.*, 1994; BSI, 1996; McElroy, 1996; Hamilton, 1997; Pellegrinelli, 1997; Archer and Ghasemzadeh, 2000; BSI, 2002;

Meredith and Mantel, 2002; Lock, 2003; Kelly, Male and Graham, 2004), Merna and Al-Thani, 2005; Kerzner, 2006; OGC, 2007; PMI, 2008; Smith and Bower, 2008; APM, 2012), the most important elements of defining projects are:

1. They have objectives that conform to and engender specific requirements.
2. They are unique undertakings with each project different from another.
3. They are a temporary or transient undertakings with a defined or finite lifespan, typically encompassing phases in a lifecycle.
4. They are constrained by: scope and quality – normally expressed in the form of a specification, time and cost. A change in one parameter affects the others therefore implying a trade-off between these parameters.
5. They involve an organised effort of coordinated activities, actions or tasks.
6. They consume or use resources, which are often limited.
7. They are an overall system involving processes that will create and deliver a product, service, or result. More fundamentally, projects deliver an investment creating and adding value to an organisation.
8. They will deliver one or more of these outputs in accordance with a specific business case.
9. A particular project may or may not be part of a Programme or Portfolio, the subject of subsequent sections.

These characteristics of projects have, however, been contested from within lean construction thinking (Koskela and Howell, 2002). It is argued that project management in construction should be perceived as a process of production and flows of information similar to a manufacturing philosophy. The proponents of this viewpoint argue that the theoretical base implied by the PMI Project Management Body of Knowledge (PMBoK) is based on an economics approach. It is further argued that this has contributed to the mismatch between project management theory and practice. However, the counter argument is that lean construction theory also has its limitations, making it inapplicable to project management (Winch, 2006).

The concept of 'Managing by Projects' is useful when considering the wider application of project management within an organisational context. The defining characteristics of the term would include the following (Kelly, Male and Graham, 2004):

- Managing value, risk and uncertainty, and functionality throughout the project life cycle.
- Managing a project as a life cycle comprising discrete phases linked as a value chain, to include, for strategic phase analytical purposes only, the additional phases of Use and Operation, and Decommissioning. Each successive phase of the life cycle has to transmit and add value, or as a minimum ensure that there is no risk to that value being delivered.
- Delivering a product, process, service or asset that is fit-for-purpose as defined by the statement of requirements.

The EPSRC sponsored research Rethinking Project Management, from a study of major private and public sector clients and a number of other types of organisations, has challenged the widely held characteristics of projects. This research suggests that PM should be addressed from a range of different viewpoints to encompass the full range of practice encountered (Maylor *et al.*, 2006). The EPSRC study specifically recommends that due to changes in the procurement and delivery of infrastructure, the definition of projects should be extended to encompass operation and decommissioning. In this chapter, however, the authors contend that this causes conceptual difficulties. The operational phase can be extensive, and whilst that may well encompass decommissioning and disposal, more fundamentally the operational phase is the disciplinary domain of asset management. Consequently, it is only useful to consider operation, decommissioning and even disposal at the strategic phase of a project and as the design stage develops, even under Finance, Design, Build, Operate, Transfer (FDBOT) structures, but not as separate project phases. It is the implications and consequences for asset management and any necessary relationship between a project, or a Programme and asset management that need to be considered. In this context, therefore, Programmes and projects are a direct result and outcome of the close alignment between organisational strategy and asset management. In a value study on a project or on a Programme the relationship between P3 and any asset management requirements has to be considered.

Major projects

A 'Major Project' as defined by the Major Projects Association (Morris and Hough, 1987) is one that is high risk and/or mission critical. The Major Projects Association has also stated that major projects have long gestation periods, are challenging and are impacted by scope change, political interests and external influences. They will have substantive management, corporate and governance structures to deal with investor and Project Board requirements (MPA, 2008).

In this context, multiproject environments can include numerous low value projects, perhaps in the order of £200 000 to £500 000, which when aggregated into an annual spend can accumulate into significant sums of investment money, and they can be mission critical to an organisation. An example in a retail context could be a national roll-out investment programme for refurbishing retail outlets within very tight time schedules to gain a competitive edge. Also in this context, Turner (1993, 2009) states that by their definition, small to medium-sized projects occur in a special environment where there are many projects competing for resources from a common, limited resource pool. Hence, the term 'major' can also be viewed as a relative one and may be influenced by the size of the organisation, the size of project or the size of an aggregate Programme of small projects typified by multiple and diverse stakeholder management requirements that add substantial layers of complexity (Male *et al.*, 2008). As a consequence, the OGC research from which this principle was adopted modified the Morris and Hough (1987) definition of Major Projects to include (Male *et al.*, 2008) the following:

- They are of high cost/value. This will include significant capital programmes, single projects alone, or smaller projects that are aggregated into annual major spending activities within an organisation that are mission critical.
- They have time urgency or speed requirements.

- They have high levels of complexity comprising one of more of the following aspects: technological, organisational/managerial, multiple stakeholders, organisational hierarchical levels, and numbers of people involved, together with numerous interfaces to be managed or linkages with construction supply chains.
- They have high levels of technical and/or organisational innovation and/or are at the forefront of knowledge.
- They are mission-critical to an organisation.

Bell (1994) conducted empirical work on project development and delivery within a large, volume-procuring, owner-occupier client involved in managing Major Projects. She adopted the term ‘value thread’ to signify the potentially fragile links between each successive stages of a project that could be easily broken. As an example, in a central government context, HM Treasury experience is that government projects often go off track after Full Business Case stage (HMT and CO, 2011). This is still within the Project Initiation phase of a Major Project (MPA, 2011). Put in a different way, the ‘value thread’ is placed under greater pressure beyond the Full Business Case stage when a wider construction supply chain is engaged.

In this context, the Cabinet Office and HM Treasury, having jointly established the Government’s Major Projects Authority in 2011, defines a Major Project as ‘a central Government funded project or Programme that requires HM Treasury approval during its life’. This definition aligns projects and Programmes under the Major Project umbrella. Projects exhibiting any of the following characteristics are considered Major Projects (HMT and CO, 2011):

- Could create pressures leading to a breach in Departmental Expenditure Limits, Administration costs limits, or Estimates provision.
- Would entail contractual commitments to significant levels of spending in future years for which plans have not been set.
- Could set a potentially expensive precedent.
- Are novel and contentious, or could cause significant repercussions for others.
- Require primary legislation.
- Where Treasury consent is a statutory requirement.

The Major Projects Review Group (MPRG), an HM Treasury pool of experts that comprise Major Project review panels, scrutinise the largest and most complex major government projects. Their remit is to challenge Major Projects on deliverability, affordability and value for money at key points in the HM Treasury approvals process, most notably at Strategic Outline Case, Outline Business Case and Full Business Case. The parameters for project selection for review by a Major Projects panel provide further evidence of what comprises a Major Project in central government terms:

- Projects with a whole life cost over £1 billion.
- Projects that are high risk and complex in their procurement and delivery of benefits.
- Projects that set a precedent or are highly innovative.
- Other projects ‘of concern’.

The NAO (2011) noted that in its preceding three years of examining in the order of forty government Major Projects, comparable also to previous years in terms of numbers investigated, a clear lesson emerged, namely, that the quality of project initiation is highly predictive of Major Project success. As a consequence, the NAO identified the following key elements as leading to central government Major Project success:

1. Purpose: The requirement to have clarity on the overall priorities and desired outcomes.
2. Affordability: Understanding what delivery will cost and not being over-optimistic.
3. Pre-commitment: Having robust internal assessment and challenge to establish if the project is feasible.
4. Project set-up: The detailed specification, procurement, contract and incentive design.
5. Delivery and variation management: Maintaining pressure on delivery throughout the life of the contract and having the flexibility to recover the integrity of the project in light of unanticipated events or significant variations from the original plan.

In terms of a sense of scale, there are 205 projects in the Government's Major Project Portfolio, with a combined whole life cost of £376 billion, annual costs of £14.6 billion, and with 92% of whole life costs originating from major projects in five departments (NAO, 2012).

The next section considers the project life cycle (PLC).

The project life cycle

The project life cycle (PLC) breaks a project into different phases to produce better management control. These phases can overlap, typically as a result of the procurement strategy, with each having a purpose and scope of work and typically a major decision point or 'gateway' at the end of each phase to determine progress and future actions (APM, 2012). There are different views on how many phases form the PLC and what should comprise the content of each (Graham, 2001).

The 'project process protocol' is probably the most detailed and extensive exploration of the project life cycle for construction, however, it uses experiences of manufacturing as a datum. The process protocol life cycle comprises 10 phases, from Phase 0 (demonstrating the Need) to Phase 9 (Operation and Maintenance). These are classified into four broad stages of preproject, preconstruction, construction and post-construction stages (Kagioglou *et al.*, 2000). The RIBA project life cycle also informed the development of the generic process protocol for the construction industry and maps the whole project process from the emergence of client's need through to operations and maintenance (Kagioglou *et al.*, 2000).

In a VM context, and for continuity with the first edition of this book, the RIBA project life cycle is adopted in this book. It is well known and represents the most detailed life cycle provided by a professional institute for construction (Smith *et al.*, 2006). As a consequence, Kelly and Male, 1993, Male *et al.* (1998a, 1998b), and Kelly, Male and Graham (2004) have linked it to common VM intervention points.

Summary: Projects

The perspective adopted in this chapter is that projects are:

> A vehicle to deliver an investment, supported by a business case, and have a set of requirements and objectives, are managed through a life cycle from concept to handover, and deliver a service, product or physical asset. Projects can be strategic or tactical. This depends on their purpose, criticality, their origins within an organisation, and/or the size of an organisation.

A Major Project is one that has a set of important characteristics that distinguish it from other types of projects. Projects can also exist in an organisational environment that is characterised by any number being managed simultaneously to deliver an organisation's strategy. Construction projects have their origins in an organisation's asset management function. The authors contend that the project life cycle starts at the concept phase, once need, scope and the investment requirement have been identified, and finishes at the commissioning and handover stage. At this point, the operational phase of a physical asset commences and the asset management function will assume responsibility for it. During the operational phase the requirements for other projects, Programmes, and decommissioning and disposal (as discrete projects in their own right) will occur.

In a similar manner to the project management discipline historically, VM is seen in construction as a single project intervention methodology. The value study has to be grounded within the client organisational setting that has initiated a project. Whilst the single project paradigm dominates organisational thinking, the VM methodology requires adaption and development to take account of multiproject environments, the subject of the next section.

Multiproject environments

Overview

Until the late 1980s and early 1990s there was a scarcity of material written on multiprojects or their environments. Consequently and in general, project management literature reflected the single project paradigm. However, in practice up to ninety percent of all projects by value, including many in the construction industry, are undertaken in a multiproject environment (Payne, 1995; Van derMerwe, 1997, Van der Merwe, 1998; Evaristo and van Fenema, 1999; Blismass *et al.,* 2004a; Blismass *et al.*, 2004b; Blichfeldt and Eskerod, 2008). Prioritisation of projects within the context of resourcing and the impact of political agendas, information requirements and interdependencies of multiprojects was noted (Kopperlman, 1992; Turner and Speiser, 1992). Multiprojects have also been discussed in the context of a number of projects having to be managed in different geographical locations (Evaristo and van Fenema, 1999). This is an aspect of the 'complexity' dimension of organisational structure noted earlier, suggesting a recategorisation of multiprojects to focus on the impacts of organisational complexity, and potentially with a multisite perspective that is concerned with the organisational structural dimension of decentralisation.

It is clear that the challenges of managing multiprojects make it difficult to apply traditional techniques and thinking associated with single projects without adaptation or modification. Therefore, the term *multiproject environment* is adopted in this chapter to denote an organisational environment whose characteristics are that a number of projects are created and managed simultaneously, that they can be delivered independently, or they can be grouped together in some meaningful way and managed as a package. However, their collective management does not fit easily within that of the single project paradigm. Stemming from this, a multiproject environment does not signify, but equally does not exclude, the existence of an overarching management structure, approach or framework that is implied by concepts such as Programme Management or Portfolio Management. This aligns with evidence presented by Pellegrinelli (1997), Blismass *et al.* (2004a, 2004b), Maylor *et al.* (2006), Patanakul and Milosevic (2009) who all use the term *multiple project* management to make a distinction with single project management.

The management implications that stem from the existence of projects operating in a multiproject environment is the need to consider the management structures and approaches of *Programmes* and *Portfolios*. However, there are conflicting views around the characteristics of these concepts. For example, Murray-Webster and Thiry (2000) (cited in Turner and Simister, 2000) describe 'Programmes of Projects' as the missing link between projects and organisational strategy. The concept of Programmes has also been argued to be a bigger version of projects but remains at a tactical level. Others have introduced the term 'Portfolios of projects' as the missing link between projects and organisations (Merna and Al-Thani, 2005; PMI, 2013b). Additionally other researchers use the term Programme Management to mean the same as Portfolio Management (Lycett, Rassau and Danson, 2004). This confusion is exacerbated further when these terms are used synonymously, as used by for example by Kerzner (2006), or used in combination such as Portfolios of Programmes, Programmes of Portfolios (Ferns, 1991; Lycett, Rassau and Danson, 2004). The more detailed arguments around terminology and concepts have been addressed elsewhere (Aritua, 2009; Mlybari, 2011). However, as a baseline for this chapter, the standards set out by OGC, PMI and the APM will be used to articulate and differentiate clearly between these important concepts.

Programmes and portfolios

Programmes

The OGC (2008) defines a Programme as:

> A temporary, flexible organisation created to co-ordinate, direct and oversee a set of related projects and activities in order to deliver outcomes and benefits related to the organisation's strategic objectives (p.5).

OGC (2010) adds that Programmes exist to manage the complexities involved in beneficial change.

Rayner (2007) defines a Programme as:

> Temporary management structures designed to help organisations achieve specific objectives (p. 1),
>
> and,
>
> A co-ordinated set of projects that together achieve a beneficial change of a strategic nature for an organisation (p. 2)

The Project Management Institute (PMI, 2013b) defines a Programme as:

> A group of related projects, sub-programs and program activities managed in a co-ordinated way to obtain benefits not available from managing them individually. Programs execute and deliver corporate strategies and achieve organisational goals (p. 2, 5).

PMI (2013b) adds that a common strategic goal relates all projects within Programs. However, if projects have different goals and have no connection through the delivery of synergistic benefits but through common stakeholders, funding or technology then they are better managed through a Portfolio, the subject of the next section.

Pellegrinelli (1997) also provides a useful definition of a Programme:

> A Programme is a framework for grouping existing projects or defining new projects, and focusing all activities required to achieve a set of major benefits. These projects are managed in a co-ordinated way, either to achieve a common goal or to extract benefits which would otherwise not be realised if they were managed independently.

This definition concurs with the conclusion that Programme Management is predominantly about 'choosing the right projects' whereas Project Management is about 'doing the projects right' (Cooke-Davies, 2002). The definition of Pellegrinelli (1997) also implies a top–down as well as bottom–up approach to either defining projects, or grouping them in some meaningful way. However, as noted by Morris and Hough (1987), it is possible to successfully manage the wrong project, and a top–down approach to Programme Management should be about ensuring this does not occur.

Finally, a useful elaboration provided by Thiry (2010) adds to the concepts set out in the standards, he defines a Programme as:

> A collection of change actions (projects and operational activities) purposefully grouped together to realise benefits (p. 15)
>
> and,
>
> The governance and harmonised management of a number of projects and other actions to achieve stated business benefits and create value for stakeholders (p. 16).

Programmes have been suggested as varying according to their origin, objectives, project composition and execution (Ferns, 1991; Reiss, 1996; Pellegrinelli, 1997). The APM Body of Knowledge (APM, 2012) refines the definition to include:

> A Programme is a group of related projects and change management activities that together achieve a beneficial change for an organisation (p. 241).

The APM adds further that whilst there might be different definitions, Programmes all have these characteristics:

- Programmes deliver the capability for organisations to make significant or step changes in performance, typically delivered as benefits.
- Programmes are the mechanism to deliver elements of and are consistent with the organisations' strategy.
- Benefits will only be delivered through the co-ordination and successful completion of a number of constituent projects.
- The impact of the Programme will be felt either by different parts of the organisation, or by different organisations.
- Projects deliver specific one-off deliverables. Programmes deliver capabilities and physical assets and their success is measured by the delivery of the expected benefits, and their use in an ongoing Business-as-Usual manner. Business-as-Usual (BAU) is defined as (OGC, 2008) as '*The things done to keep the business operating day to day' (p 5).*

The OGC (2008) also adds that by understanding the demands of BAU, which will have its own life cycles and key events, it is possible to time the impact of projects and Programmes so as to ensure least disruption. Projects and Programmes are by their nature change oriented. Hence, it is vital to see them as such and anticipate their consequences throughout an organisation.

In a critical review of Programme Management, Lycett, Rassau and Danson (2004) conclude that the difficulties of Programme Management practice stem from the erroneous assumption that it is a scaled up version of project management and that a standard approach to Programme Management is applicable to all circumstances. As a consequence, Programmes should not just be perceived as the 'missing link' between projects and corporate strategy.

In summary, Programmes are:

> Designed purposefully to create, group, coordinate and manage substantive change-related initiatives to deliver an organisation's strategy, set of capabilities and/or physical assets to attain a strategic goal or objective. Programmes deliver investments through related projects, create value for stakeholders and as a consequence secure a step change in organisational performance.

A Programme is also a temporary and flexible part of the corporate governance structure that harmonises, co-ordinates and manages a group of related projects and operational activities to deliver benefits that cannot be delivered by managing projects singly.

Categorising programmes

Categorisation of projects and Programmes into types assists with developing specific management approaches, and for resources analysis and allocation (Blismass *et al.*, 2004a, 2004b). Categorisation of Programmes can also assist with the planning and delivery of value studies.

The most comprehensive reviews of Programme types and developments in Programme Management may be traced to Ferns (1991), Reiss (1996), Pellegrinelli (1997), and Blismass *et al.* (2004). Two very broad types of Programmes emerge from the project literature. The first focuses on achieving corporate objectives through co-ordinated management (CCTA, 1994; Gray, 1997; Pellegrinelli, 1997). The second implies the simultaneous management of a number of projects, usually dealing with resource conflict (Morris and Hough, 1987; Kopperlman, 1992; Payne, 1995; Reiss, 1996; PMI, 2013a). It has also been argued that an organisation may have a variety of different kinds of Programmes (Payne, 1995). Consequently, variations on categorisation have occurred within this. For example, Ferns (1991) and Pellegrinelli (1997) propose three types each, and Reiss (1996) proposes four. The obvious assumption made in developing these typologies is that they are relatively generic and applicable across sectors. However, Blismass *et al.* (2004a, 2004b) have argued for a more specific categorisation to construction. Initially, Blismass *et al.* (2004a) identify three common themes in their research specifically on Programmes in construction multiproject environments, namely, *Objective, Strategic and Ongoing Programmes*:

- *Objective* Programmes are those where projects make-up a single objective. They can be well defined, focussed and with a definitive outcome marking the Programme.
- *Ongoing* Programmes are those that share resources, and are typified by co-ordination and continuity. They impact directly on organisational functioning.
- *Strategic* Programmes are those through which changing strategic goals and initiatives are planned and completed. The goals of these projects change as the strategies of the organisation are modified to meet new challenges from the external environment.

Subsequently, a construction-specific Programme typology has been developed further and a continuum established (Blismass *et al.*, 2004a). These are named Bounded, Target and Rolling Programmes, with Target Programmes as a hybrid of the other two. The typology describes the degree of certainty associated with a Programme. Four characteristics related to Programme definition and certainty are used as the main identifying features of each type: Time horizon, Programme definition, Programme objectives and project sites. Table 9.1 is a summary of the construction Programme typology, with additional consequences for procurement, supply chains and value management added.

In addition to the foregoing three major types of Programmes, the empirical data analysed by Blismass *et al.* (2004a) also revealed two other possible types of Programmes, namely *Maintenance Programmes* that were quite distinct, had repeatable features and are closely related to strategic and operational asset management, and *monolithic projects* that have the characteristics of large, perhaps one-off and unusual projects. This aligns more closely with Major Projects. However, the three most consistent types of Programmes are those noted in Table 9.1 and are described further later.

Table 9.1 Summary of construction programme types. adapted from Blismass *et al*. (2004a) Tables 5–8, Male *et al*. (2008).

Feature	Bounded Programmes	Target Programmes	Rolling Programmes
Time horizon	Defined or limited – fixed Programme time horizons.	Variable goal. Typically 3 to 5 year time frame for the Programme.	Continuous – no fixed time frame.
Programme definition	Closed; rigidly and well defined Programmes (and projects). Clearly defined aims.	Variable definition, usually moderate. Programme likely to have better definition than the other two types due to some known parameters over its time scale.	Open, vague and ill-defined Programmes. Programme certainty is low and subject to constant change. Projects may arrive into the Programme in an unplanned manner but those projects may be well-defined.
Programme objectives	Specific outcome based and well defined.	Moderately well-defined corporate level objectives that have given rise to the Programmes and related targets.	Programme objectives evolve. Gradual/ incremental development of project network that is subject to change over time.
Project sites	Existing or secure project network related properties – typically owned or contractually secure.	Properties or land to be acquired. There may be some need to acquire sites from third parties, which will increase levels of uncertainty.	Properties or land to be acquired from third parties and increases levels of uncertainty.
Sources of funding	Dedicated funds to achieve completion of the programme.	Yearly variable budget. Funding may also be allocated through yearly budgets based on targets.	Funding through annual budget cycle – bids and approvals based on annual basis.
Project similarity	High degree of similarity.	Moderate to high similarity. There is likely to be a degree of similarity across projects, which is encapsulated within the use of targets.	Variable with projects likely to be dissimilar although corporate branding may have an influence.
Project interaction – interdependency	High – production-based roll-out to programme.	Moderate. There may be a moderate degree of relationship between projects, normally in the resource area. Target completion important.	Low. Projects are independently instigated and typically procured as such.
Influence of economic environment	Low.	Moderate to High. Targets may be influenced by economic circumstances, which can result in an acceleration or de-acceleration of projects in a Programme.	High. The state of the economy at any given time may effect projects initiated and coming on stream.

Table 9.1 (*Continued*)

Feature	Bounded Programmes	Target Programmes	Rolling Programmes
Workload certainty and continuity	High short term certainty and continuity with production focus to Programme. Low long term continuity once programme complete.	Variable Medium term. Targets provide a degree of certainty; however, Programme scope and content may be impacted by external environment and necessitate adapting the project mix.	Low short-term continuity. Workloads are likely to fluctuate in the short to medium term but some degree of stability in the longer term.
Susceptibility to schedule and other changes	Low over life but possibly high in the short term.	Constant change may be made on targets due to changes in the external environment. However, corporate objectives may influence the degree inflexibility around targets.	High long-term flexibility. Client organisations will wish to retain flexibility to changes in the environment and economy.
Strategic procurement focus	Requirements can be well defined at Programme level and at project level.	Programme requirements need some degree of flexibility.	Greatest flexibility required. Individual project requirements likely to be known.
Potential use of supply chain partnering	High potential, but limited to single programme only.	Variable but able to establish long-term alliances on targeted work. Suppliers likely to have good ideas of workloads but clients will wish to retain flexibility. Long-term relationships and repeat work probable.	High long-term working relationships can be established with strategic supply chain partners. However, client commitment may be variable in the short to medium term.
Ability to use bulk procurement	High due to similarity of projects.	Moderate to High. Potential is high, especially around target project numbers. As variability increases this benefit is reduced.	Variable. Volume purchase at component level may be possible with projects initiate, leading to component standardisation.
Supply chain consequences	Defined packages of work or projects can be specified and tendered either as a whole or in tranches.	Packages of work and projects benefit from early involvement of key supply chain members around target driven projects.	Early involvement of strategic supply chain members with client for long-term relationships. Strategic supply chain partners accept likelihood of short to medium-term variability for more sustainable longer-term workloads.
Learning and knowledge retention	Low – once programme completed supply, chain knowledge disperses. Likely client knowledge retained only at Programme Sponsor and Senior Project Manager levels once Programme complete.	Variable. Depends on the extent of supplier repeat work and the extent of outsourcing of internal knowledge areas by the client to the supply chain, i.e. that which is retained in-house versus that outsourced.	High. In house client knowledge is likely to be high due to ongoing nature of Programme. However, supply chain knowledge may be lost if workloads are too variable in short to medium-term.

(*continued*)

Table 9.1 (*Continued*)

Feature	Bounded Programmes	Target Programmes	Rolling Programmes
Creativity and innovation	Variable – high levels of advanced planning and design at Programme level, low in delivery unless innovative production approaches determined.	Moderate. Depends on the extent and nature of Programme definition and scope.	High. New innovations and solutions can be tested within the ongoing Programme as projects are initiated. High potential for savings possible as a result.
Collaborative working to capture wide range of expertise and knowledge	Beneficial but not a necessity.	Very Beneficial. A 3 to 5 year target driven Programme with a degree of certainty around the known workloads within the targeted projects.	Highly relevant at Programme level with strategic partners on innovative developments for project level inclusion.
Likely cost, time and risk certainty	Due to need for extensive advanced planning and production style execution: Cost certainty – High Time certainty – High Risk certainty – High, high levels of control possible.	Need for advanced planning around known target driven projects. Degree of uncertainty around other projects with some possible inclusion of slippage. Cost certainty – Moderate, Time certainty – Moderate. Risk certainty – Moderate.	Programme level is likely to be characterised by: Cost certainty – Low to moderate; Time certainty – Low to moderate; Risk certainty – Variable over time. However, at project level depending on the client's value system, the client is likely to be looking for consequent high levels of probity surrounding cost, time and quality.
VM strategic focus	Programme level.	Programme and project levels.	Project level.
VM focus at programme level	Strategic aims and objectives of Programme. Scope, Design and Execution of roll-out; possible innovations in production level activity. Decisions in choice of exemplar projects for value studies at project level.	Advanced scoping, planning and forward management of known target driven projects. Contingency thinking around remainder of projects in Programme. Identification of Projects for Value Studies.	Bringing innovation and cross-project learning across project network with strategic supply chain partners.
VM focus at project level	Exemplar typical and atypical projects.	VM in early stages of targeted projects and VE at later stages to ensure requirements and client value system are clear to project team members, value thread is clear across supply chain, and value studies optimise all aspects of project. Value Studies on new projects.	VM in early stages of projects and VE at later stages to ensure project requirements and client value system are clear to project team members, value thread is clear across supply chain, and value studies optimise all aspects of project.

Bounded Programmes for example, might be typical of those encountered where a retail organisation is upgrading its fast food outlets. With bounded programmes, value drivers are focused around certainty of delivery and cost. They have high certainty, where the client's objectives are very clear and the Programme is well-defined. They can be characterised by volume procurement and substantial elements of supply chain involvement. They provide stability for planning project sequences, ordering products within acceptable lead times and permitting project details to be fixed at very early stages. These programmes permit a high degree of efficiency and associated benefits, with limited change impacts during the Programme life cycle – value drivers are efficiency focused.

Rolling Programmes are diametrically opposite bounded programmes and can be viewed as comprising the other pole of a Programme continuum in construction. For example, this type might be typical of a large developer who focuses on particular types of development and needs to secure land and funding on a regular basis for particular project developments. Programmes are characterised by dynamism and a loose and ongoing nature that stems from the client organisation wanting to develop their project network in alignment with environmental factors and limiting the extent of fixed capital commitment. Organisational objectives and project definitions may be well defined for those selected at a particular point in time; however, the composition, rate, number, and mix of projects will be highly variable and generally unknown across the Programme. The client relies on external environmental conditions to shape the Programme for the next period. The resultant Programme stream is highly variable and unpredictable, but continuous over the long term. Uncertainty is high within the Programme workload and clients will usually form long-term relationships with strategic suppliers to accommodate this but will not commit to any specified workload numbers or volumes. With rolling programmes, value drivers are focused around flexibility, adapting to change and maximising each investment opportunity – they are effectiveness driven.

Target Programmes are a hybrid of the previous two Programmes. For example, this could be typical of a railway infrastructure operator who has a substantive Rolling Programme of known commitments over a number of years that form the basis of targets in published business plans, but also has to adjust this based on asset condition surveys from a renewals and maintenance regime identified through the asset management function. They exhibit the more dynamic characteristics of Rolling Programmes but have aspects of definition and direction characterising Bounded Programmes. Target Programmes are a consequence of forecasting long term needs in an organisation's strategies but there is uncertainty around critical resources and/or demand. This imposes the need to adapt production rates or target numbers of projects to continue operating at optimum profitability. With Target Programmes, value drivers are focused around certainty of delivery and cost but retaining some flexibility – they will be effectiveness and efficiency driven.

In this context, Programmes provide a particular challenge for VM as the focus of value studies moves away from single projects to one focused on the relationship between organisational strategies, Programmes, and projects within Programmes. Value studies will investigate the consequences of impacts between Programmes, and of creating and managing multiprojects that may be competing for resources within a Programme.

The next section addresses Portfolio structures.

Portfolios

The OGC (2008) defines a Portfolio as:

> The totality of an organisation's investment (or segment thereof) in the changes required to achieve its strategic objectives (p. 5).

The OGC adds that Portfolio Management coordinates the collection of strategic processes and decisions that when combined permit the most effective balance of organisational change and Business-as-Usual.

The APM (2012) defines a Portfolio as:

> A grouping of an organisation's projects and Programmes that can be managed at an organisational or functional level (p. 240).
> and,
> Portfolio management is the selection, prioritisation, and control of an organisation's projects and Programmes in line with its strategic objectives and capacity to deliver (p. 240).

The PMI (2013c) defines a Portfolio as:

> . . . a collection of Programs, projects or operations managed as a group to achieve strategic objectives. Portfolio components may not necessarily be interdependent, or have related objectives but the components are quantifiable, can be measured, ranked and prioritised. An organisation can have more than one Portfolio to address a unique organisational strategy or objective (p. 3).

In this chapter, the authors argue that Portfolio Management:

> Operates at a higher organisational level than Programmes and projects. It forms part of the higher levels of a corporate governance system and provides the direct linkage between the strategic level and projects that may or may not be interdependent or related and Programmes of projects.

The PMI (2013c) adds further that Portfolio Management balances the conflicting demands between Programmes and projects, allocates resources based on organisational priorities and capacity to achieve identified benefits.

A reinterpretation of the rail infrastructure project – Chapter 7

The rail project in Chapter 7, case study 3, is a Major Project. It comprises a series of six projects, substantive in their own right, and whose own operational objectives were to help achieve the overarching higher level objective. It was being managed as a Programme of projects, and appears to have a close similarity to that of the *monolithic project* type described by Blismass *et al.* (2004a) and that described by HMT and CO (2011). The focus of each of the value studies was:

- To confirm the vision, mission and Programme objective of the Major Project as a Programme across client and design teams. This was achieved principally through the technique of function analysis.
- To confirm each of the single but interrelated project objectives, and how they would contribute to achieving the Programme level strategic objective. This was achieved through a project-level analysis of function, and subsequently, option level function analysis within each project. Reference was also made in each of the project-level value studies to the FAST diagram operating at Programme level to tie each one back to the Programme strategic objective.
- To reappraise progress and the contribution that options were making to achieve the overall Programme objective through the Implementation workshop.

As noted, the VSLs maintained close contact throughout the design and implementation of each of the project level value studies to ensure a consistency of approach and cross-project learning. The VSLs were managing the VM programme as a network of value studies, linked by the achievement of the overall Programme objective within the network of projects.

The next section explores the relationship between the P3 environment and organisational change.

The impact of organisational change on P3

Strategic management encompasses the management of change. Some organisational changes are *incremental* while others are *transformational*. Incremental change involves an organisation in continuous improvement, adaptation and modification, and is relatively easy to implement. Transformational change involves an organisation doing things completely differently or doing different things. Transformational change is more difficult to handle and implement since it involves shifts in the interests of people and power bases within and outside the organisation (Graham and Male, 2003). Organisational change is not an event but a process.

Graham and Male (2003) classified change into two major and three contingent types. *Recurrent change* is incremental, routine and expected. It requires no major realignment of the organisation with its external environment. An organisation will have developed routines to handle this type of change and decision-making will function within the parameters of programmed decisions, and established policies and guidelines. Recurrent change is likely to operate at the organisational and operational core levels in the management hierarchy. Hence, operational change occurs at the lower levels of an organisation through its day-to-day activities. It will typify Business-as-Usual activities. The consequence is likely to be the initiation of operational projects to adjust the Operating Core incrementally to those recurrent changes.

Transformational change creates a fundamental shift between the organisation and its external environment. Transformational change can comprise strategic or competitive change. *Strategic change* is immediate, fundamental, radical and discontinuous. It is unpredictable and unanticipated by most managers in an organisation, and it affects the whole organisation from top to bottom. The impact of the global financial crisis on firms, Government and other organisations is an example of strategic change. Existing organisational models and ways of thinking are disrupted in a sudden, dramatic and discontinuous manner. An organisation's routines will be ineffective in handling this type of change but it requires response from managers at all levels. Decision-making will function within the parameters of non-programmed decisions and operate outside of policy guidelines. Transformational change is likely to have a major impact on existing Programmes and projects, and generate its own Programmes and projects to realign an organisation to those changes. The consequence for P3 structures is likely to be substantive and profound.

Competitive change creates a fundamental shift between the organisation and its environment in the medium to longer term. This will be felt as a sustained and continuous pressure on the organisation to readjust its activities. This type of change will operate within established policies and strategies, but may require these to be adjusted and adapted over time. Programmes and projects are implementation mechanisms to typically introduce competitive change into an organisation at different levels over time.

The preceding highlights the important relationship between organisational change and the need to consider this within P3 thinking. Also, against this background a value study implemented in the context of P3 structures has to take account of the impact of organisational change on those structures and also how those P3 structures will also contribute to that change.

The organisational and project value chain

The concept of the 'value chain' originates with the thinking of Michael Porter (1985) on business strategy and competitive advantage. He argues that a business organisation gains competitive advantage from the way it structures, links and manages strategically important internal and external activities. Porter termed this the 'value chain', which provides the organisational infrastructure from which it is able to create value for its customers from products or services. The concept of the value chain applied to business entities has been extended to include projects and Programmes (Male and Kelly, 1992; Bell, 1994; Standing, 1999; Alajmi, 2009). This chapter also adds Portfolios to this structure. In construction terms, the OVC stems from activities deep within a client's strategic management process and links organisational strategy to P3 activities. Using the PMI's notion of Organisational Project Management, the consequent OPVC connects together conceptually and delivers organisational value through Portfolios, Programmes and projects. The Organisational Project Value Chain influences and is, in turn, influenced by the Organisational Value Chain.

The organisational value chain: Corporate, and business and P3 value

Depending on the organisational structure of a client, there will be a requirement to align Portfolios, Programmes and projects with corporate and/or business unit missions and objectives to achieve value for money. Bell (1994) using the notion of the 'value thread', argues that value must be transmitted, transformed and maintained either through a

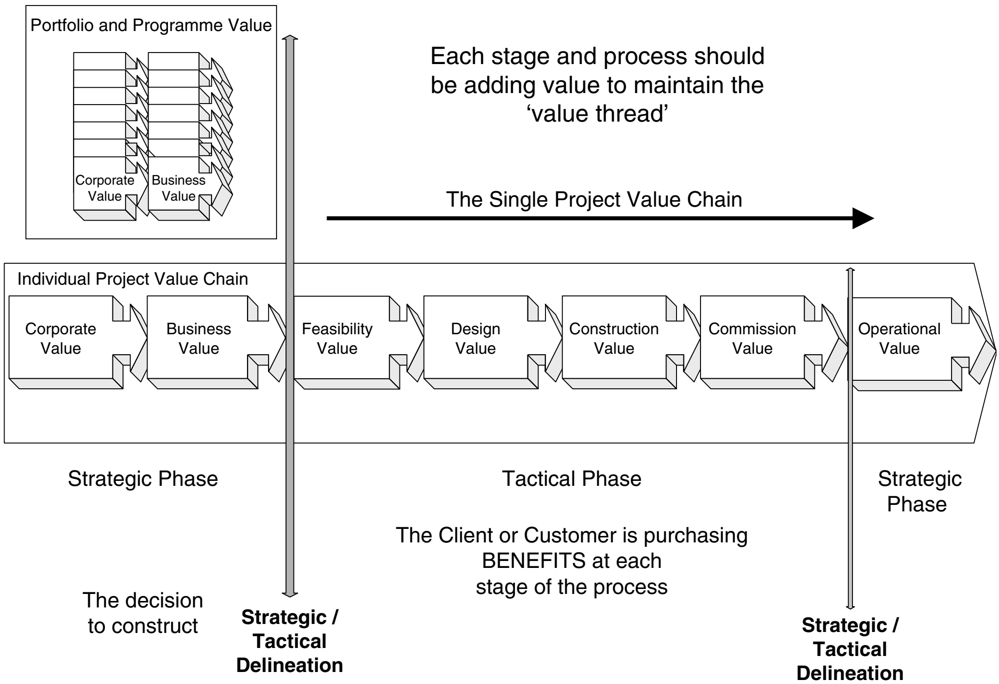

Figure 9.4 The organisational and single project value chain. *Source*: Adapted from Figure 2.4 in Standing (2001).

project network, at Programme or Portfolio level or a single project, to ensure that value for money is obtained.

The Organisational Value Chain is a multilayered system of strategically connected activities that commences with the decision to invest, then through P3 structures, and subsequently into a constructed physical asset (Standing, 1999; Woodhead, 1999). As an extension of corporate and business value it is also useful to think in terms of Organisational Project Value comprising *Portfolio*, *Programme* and *Project Value*. The Organisational Project Value Chain schema is set out in Figure 9.4.

Table 9.2 builds on this and adds the structure of the Organisational Value Chain to the 3P framework.

The 'strategic' phase of the Organisational Project Value Chain operates at the interface between the strategic management process, Portfolios, Programmes and projects. The start and finish of the strategic phase is often difficult to identify for Projects (Graham, 2001). There is a difference between the start of the strategic phase of a Project and the start date of the project when it is perceived as such by an organisation. For example, the gestation of large infrastructure projects during the strategic phase can take many years. However, the start date for the project occurs when it becomes legal or sanctioned and has a customer or end user for supply. Hillebrandt (1984) reported a wide range of time periods for projects to emerge into the construction industry, some over decades, and Woodhead (1999) indicated that time spans for the projects that he studied varied between 6 months and 3 years. Often projects will have gone through a variety of changes within the client organisation before they emerge as defined projects with a clear

Table 9.2 The organisational and single project value chain.

Strategic Phase	• Corporate value • Business value • Portfolio value • Programme value	Creates multiproject value system. Defines and creates Portfolio, Programme and subsequently creates project level value systems
Strategic/Tactical Phase interface – the 'Grey Zone'	• Single project 'gestation'	Single project requirements, scope, goals and objectives established, including establishing and prioritising the client value system criteria.
Tactical Phase	• Project Value, comprising ○ Feasibility ○ Design ○ Construction ○ Commissioning	Delivers project level value. This is typically where VM interventions are located currently in construction.
Operational Phase	• Operational value ○ Business-as-Usual ○ Physical Asset Decommissioning ○ Physical asset portfolio rationalisation ○ Physical Asset Disposal ○ Physical Asset Renewal ○ Physical Asset reconfiguration	The Asset Management function creates the need for Programmes and projects throughout the operational phase.

scope, objectives, budget and momentum ready for the construction industry to commence its work. The strategic phase of the Project development process is therefore often 'messy', 'fuzzy' or 'ill defined' and can be difficult to identify in terms of a clear start – it is termed here the 'Grey Zone' to reflect these characteristics. The 'tactical phase' is concerned with implementation of projects.

Figure 9.5a and b set out the very early stages of the P3 organisational environment, deep within the Strategic Definition phase using RIBA Plan of Work 2013 nomenclature, and how this relates to organisational strategy and policy. This early phase of Programmes and projects was investigated as part of OGC funded research into significant construction related Programme and project investment across central government (Male *et al.*, 2008).

Figure 9.5a and b highlight that there is an organisational phase prior to the scoping of Programmes or projects, termed here Strategic Definition (−1). Figure 9.5a and b set out this gestation phase, and the creation of Programmes and projects, the close linkages with asset management, and the subsequent interaction with Organisational Project Management processes and the construction industry. Figure 9.5a highlights the need for a Corporate Portfolio Board to take a holistic view of the relationships between organisational strategy, policy, asset management investment requirements, P3 investment and corporate governance responsibilities. These will all intersect when investments are made for the construction of physical assets.

The Strategic Definition (−1) domain is that of policy, strategy development and P3 creation. This may well involve policy initiatives resulting in service or organisational

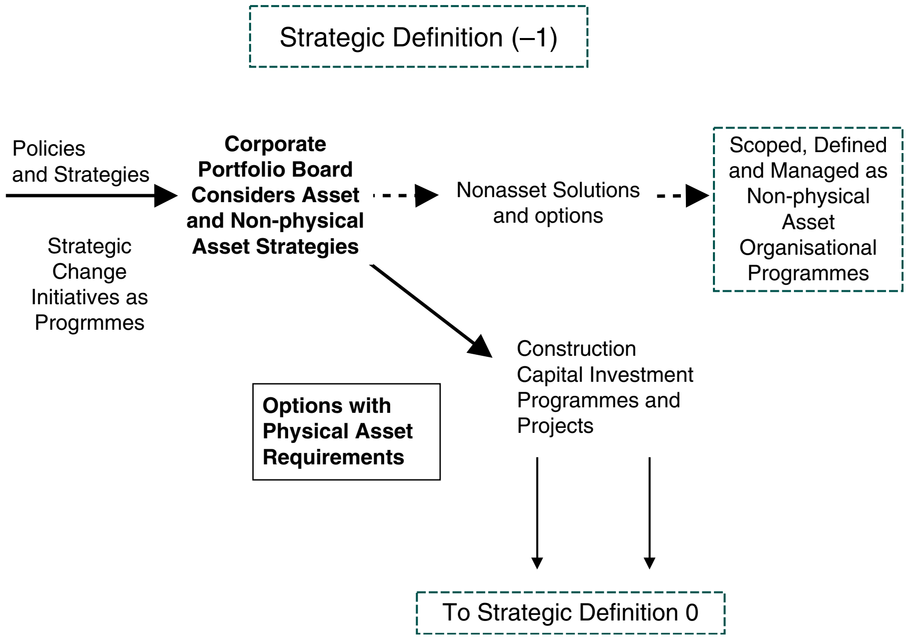

Figure 9.5a Strategic Definition 1 to Strategic Definition 0. *Source*: Adapted from Male *et al*. (2008).

changes, and associated investment requirements and their own non-physical asset related Programmes. Empirical evidence indicates some form of impartial review or sense checking is required prior to a major construction capital investment being launched (UoL, 2006; Male *et al.*, 2008). Nonasset solutions would result in 'organisational soft

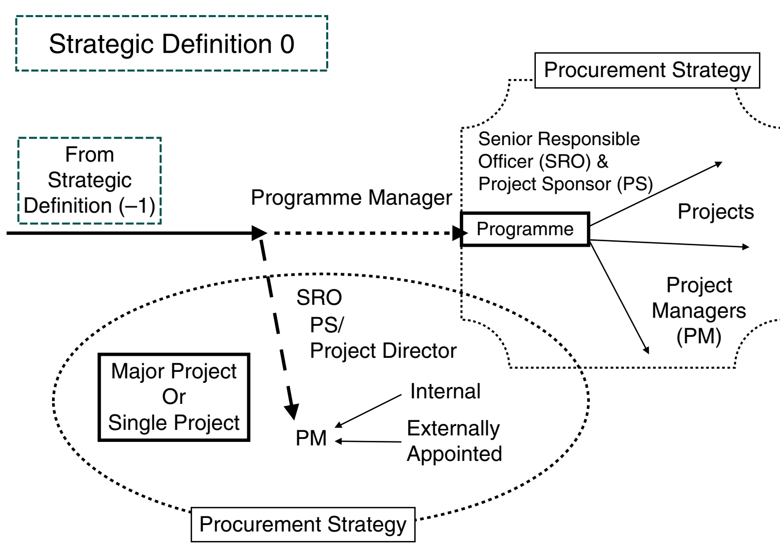

Figure 9.5b Strategic Definition 0 for construction. *Source*: Adapted from Male *et al*. (2008).

Programmes and projects' focusing on services, process, procedures, and organisational structure reconfigurations. Physical asset solutions are also probable. The sense check during Strategic Definition (−1) occurs due to the interaction between organisational strategies, policies, physical asset and nonphysical asset solutions, organisational change initiatives, and the consequential impact on Portfolios, Programmes and projects that needs to be analysed and investigated as part of that review. The remit of Strategic Definition (−1) is also the confirmation of the Client Value System and the commencement of the Organisational Value Chain.

Subsequently, as investment decisions to meet associated organisational needs move through Strategic Definition (−1) to Strategic Definition 0, the Organisational Project Value Chain will take shape along with its related value criteria. A strategic value study at this point would be central to development of a value philosophy for subsequent P3 implementation. HMT and Cabinet Office (2011) argue that a Starting Gate Review should occur in the early stages of Major Projects. This is a similar concept to that advocated with a Strategic Definition (−1) review study (UoL, 2008). However, the authors would argue in the context of this chapter that a strategic value study should be conducted prior to a Starting Gate Review to ensure the Organisational Value Chain, Organisational Project Value Chain, Asset Management, and P3 structures and subsequent delivery thinking are all fully in alignment.

The Strategic Definition 0 domain operates at Programme level and concerns: scoping and justifying the Programme based on its fit with organisational strategies, strategic policies and/or organisational objectives; stakeholder analysis, and an assessment of the financial costs of the Programme, its resource requirements, risks, timeframes, benefits and governance structures. The broad strategy for change will have been scoped, and the need for the Programme identified. It might also encompass an exploration of interdependencies between projects making up the Programme. The need and changes could entail one or more of the following:

- Making and delivering new physical assets.
- Changing the way the organisation works.
- Policy of strategy changes that address public concerns, or society driven by desired outcomes.
- A Major Project that can be broken down into a series of related projects and managed as a Programme. The rail infrastructure project in Chapter 7 (case study 3) is an example of this.
- Some combination of those listed.

A proposal will be developed in the form of a Programme Brief and Business Case for senior management sign off to provide executive authority. The alignment with organisational vision, strategies and objectives should also be articulated clearly as part the Programme Business case. Account will also need to be taken of any interdependency with other Programmes or Portfolios. Important work streams will have been identified and articulated as projects within the Programme; each with their own business cases. Consequently, the Programme may also need to address procurement strategies.

Robust linkages with asset management structures should have been established with the front end requirements for Programmes, Major Projects and significant capital programmes of work that result in construction project activity (UoL, 2006; Male *et al.*, 2008). Empirical research has indicated that there also needs to be a sense check review at Strategic Definition 0 when Programme, Major Projects, or projects have been scoped and are ready for launch. It was clear from the empirical research that Strategic Definition 0 alone is insufficient to take account of the organisational complexities surrounding the creation of Portfolios, Programmes and, in particular, Major Projects, their relation to asset strategies and as the outcomes of strategy and policy decisions (Male *et al.*, 2008).

Also, as noted earlier, depending on the client's core 'business' activities, client organisations will experience change over time. At one end of a continuum, change may be quite radical, as in rapid growth, downsizing or restructuring, and require asset rationalisation as noted in Chapter 8 Figure 8.4. At the other end of the continuum, change may only deal with day-to-day activities within the organisation – Business-as-Usual/operational change. Change may be externally driven, organisationally driven or technologically driven, or a mixture of all three. Consequently, projects and Programmes may have to adapt to technological and/or organisational change as part of their development process. This sets the context for the strategic and, subsequently, the tactical management process for single project development and will become particularly important the longer the duration of the project.

Of equal importance is the 'capability' or maturity of an organisation in managing a P3 environment. This is based on whether the organisation has:

- A top–down corporate/business strategy driven approach to creating, defining and managing its Programmes and Projects – a strategic orientation.
- A bottom–up driven approach to defining and managing its Programmes and projects – a tactical orientation.
- A combination of both – a hybrid orientation – that aligns, prioritises and groups projects that originate and are generated from a bottom–up perspective coupled with corporate/business strategies and objectives to align or realign the bottom–up approach.
- An ongoing organisational multiproject environment or an organisational environment dominated by ad hoc projects (this is often linked to an issue of organisational size). If it is the former a key question is whether the organisation manages the projects within its multiproject environment as single projects, or does it group them in some manner logically and manage them in a holistic and structured manner using Portfolio and/or Programme structures.

The P3 capability has clear implications for the articulation and delineation of the client value system and the way in manifests and is communicated within the Organisational Value Chain and throughout the Organisational Project Value Chain. This will also have an implication for procurement strategies.

Bell (1994) proposed that a value hierarchy exists at Portfolio/Programme level since each will comprise projects at different stages of their own life cycles. This is set out in Figure 9.6.

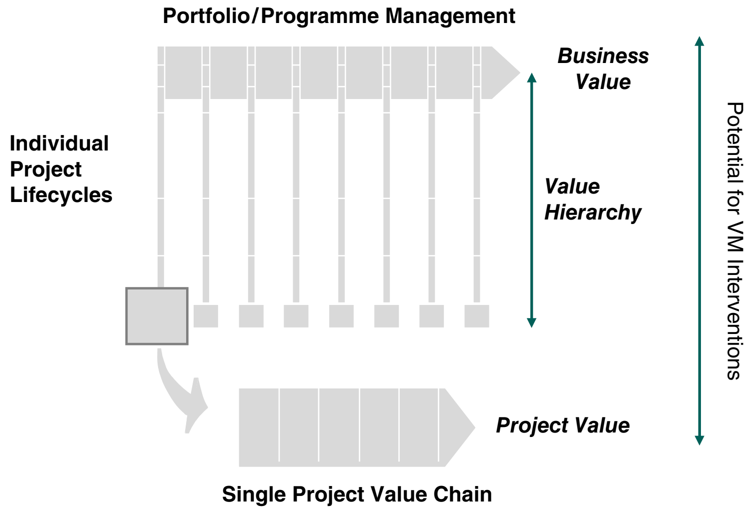

Figure 9.6 The organisational project value hierarchy. ***Source*****: Adapted from Bell (1994).**

For VM at the Portfolio level or Programme level, this may address competition between Programmes and projects for investment or how best to manage them holistically. It may also need to address issues surrounding the capability of the organisation in managing P3 structures.

Male and Kelly (1992), building on the idea of Porter's value chain, proposed using the concept of the 'project as a value chain' within a VM framework. This sees single projects as a series of linked, value adding activities and assists in understanding a client's requirements at the strategic and tactical stages of a project. The Reading Construction Forum (1996) document 'Value for Money' utilised the concept of value chains to prescribe the notion of adding value through each stage of the chain into a project but without describing how it is managed as a project value chain. The concept of the project value chain helps to inform the constituency of those who should be attending a value study by way of deciding those who represent different value interfaces:

- Those to be consulted as part of the Orientation and Diagnostics phase.
- Those required to present during the Value Workshop phase.
- Those who need to be considered when planning for the Implementation phase.

In terms of the 'value thread', there are two primary transition points in a single Project Value Chain. The first is the decision to construct, the point at which the client effectively outsources the 'business project' to a project team within the construction industry – the 'technical project' – to meet and deliver the client's identified needs and requirements. For example, a client can outsource the whole of the Organisational Project Value Chain through a DBFO arrangement, procure this in and subsequently outsource construction, or chose other procurement options. The decision to construct represents an organisational commitment that an investment has resulted in the need for a physical asset as the right approach and capital funding is available for further investigation and delivery. Corporate sanctioning of the 'business project' becomes a key demarcation point for the subsequent successful functioning of the Organisational Project Value Chain.

The second important transition point is the commissioning and handover of the completed physical asset into the operational domain. There are potentially additional supporting transitional points as different project team members become involved. Discontinuities can occur resulting from the influence of individuals, the functioning and working practices of the project team, the chosen procurement strategy, or external and internal events to the project.

Standing (1999) argues that the Organisational Project Value Chain encompasses three distinct but interacting major value systems, namely the client value system, the multivalue system and the user value system. These three interacting value systems reflect major value transition points within the Organisational Value Chain and also the Organisational Project Value Chain. At a single project level, the Organisational Project Value Chain is represented in the linked value-adding activities throughout its life cycle. Using the nomenclature of Standing (1999) for a single project the following emerges (this is summarised in Figure 9.7):

- The client value system is the source for and has primary influence over the Organisational Value Chain and impacts the strategic phase of Portfolios, Programmes and projects. The client's value system helps define the demand statement for the construction industry, is 'business' focused and is concerned with achieving corporate or business value from Portfolios, Programmes and projects.
- The multivalue system – or project value system - is most evident in the tactical phase of projects. It forms part of the Organisational Project Value Chain. The Project Value System comprises the client's value system and any necessary modifications to this by external agencies, such as planning departments and heritage interests, and the construction industry supply chain tasked with delivering the client's requirements through a technical response to the business project. It also ensures that various interested parties have an opportunity to input into the process. Although in the context of the construction industry supply chain, the client organisation should retain control over the degree of influence exerted by them. Different foci will be involved, such as the following:
    - The designer's value chain is design focussed. It comprises numerous organisations working together to create design value.
    - The contractor's value chain is task focussed. It, however, comprises a myriad of suppliers and subcontractors, some of which also have a specialist design focus.
- The operational value chain reverts to meeting the client's original business need through users. The hope is that the construction supply chain has worked effectively to deliver what the client, as customer, requires, that is, the delivered physical asset is fit-for-purpose. Also, depending on the method of procurement adopted, the operational value chain may include third party operators contracted in to operate the physical asset on behalf of the client.

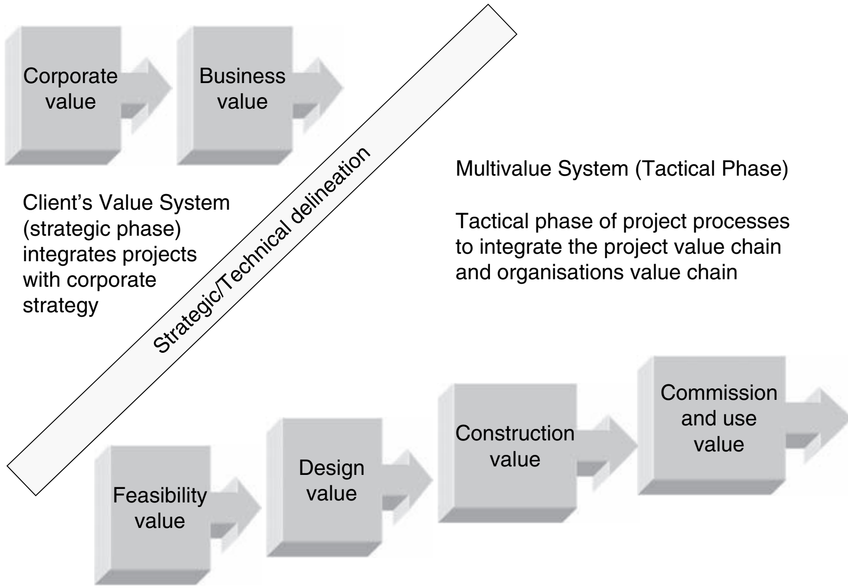

Figure 9.7 Strategic and tactical phases of projects *Source*: Adapted from Standing (2001).

- The user value system is evident in the operational phase. It is forms part of the Organisational Value Chain and Organisational Project Value Chain. The user value system comes into play throughout the operational life of the physical asset.

Bell (1994) argues that it is too simplistic that the client value system hands over control to the multivalue system of the project. In reality, strong client communication and leadership is required for the client value system to be clear for all to see during the progress of the project. The value thread, representing the tenuous link of the client value system, has to be managed throughout the whole process. The value thread can be placed under severe strain, or even broken. The choice of procurement route to be adopted on a project, or within a Programme, is a strategic value choice that has a direct influence on whether the value thread is stressed or where it could be potentially broken by the tendering process. That pressure point can be viewed as the locus of where, first, the formal transmission of the value thread takes place through adequate tender documentation. It also influences choices on where effective communication strategies are required to ensure the value thread is understood by those that have the responsibility to infuse its implications into the project team thinking. As a consequence, the adequacy of the tender documents becomes a key communication mechanism for the client value system. The concept of the value thread flowing from the client organisation and describing time, cost, quality, risk and functionality in the context of core business is answered by the supply chain through its project value chain activity. The supply chain does not contribute to the client value system but to the project multivalue system. It in turn should be influenced by the former.

The foregoing also sets the context within which Value Management has to function and operate. Hence, one role of VM is to codify and maintain the value thread. It also has to align, perhaps reassemble, or realign the value thread depending on what pressures have been placed on it and when. For example, in Chapter 7, case study 5 deals with the use of VM on a college library. It sets out three value studies that were undertaken and involved a detailed investigation of value thread implications for a mission critical flagship project. The first value study – value engineering – occurred as a result of the value thread being placed under considerable strain. The second value study occurred when the value thread was close to almost breaking point. The eventual outcome was a breaking of the value thread on the project. The third value study involved a recreation of the value thread to ensure that in the early stages of a 'new project' it stood the best chance of being transmitted appropriately through other stages of the project life cycle, which occurred in reality.

Figure 9.8 illustrates where the client value system extends through the project. It has the most influence in the early stages but is supplemented, influences and is also influenced by the multivalue system of the participants until handover and commissioning. At that point the client value system becomes re-established into the user value system during operation.

As a consequence, the diagram informs a series of possible VM project intervention points to align from the outset or, as more frequently found in reality, realign a project as a value chain. This depends on whether VM was a used proactively to forward think a project, or reactively as a review process prior to looking forward into the next stages of a project (Kelly and Male, 1993; Male *et al.*, 1998a, 1998b; Kelly, Male and

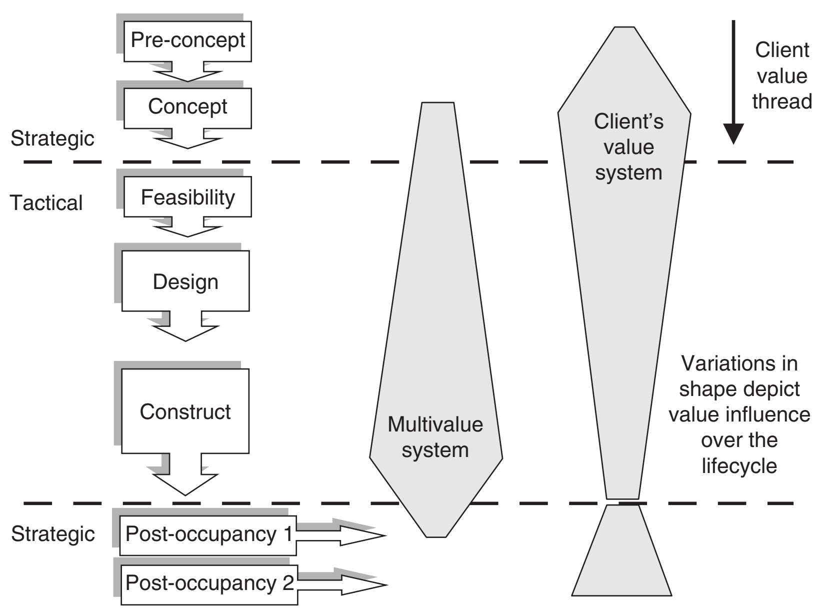

Figure 9.8 The client value system. *Source*: Bell (1994).

Graham, 2004). These interventions points at project level have been presented in detail in Chapter 3 and examples have been explored at project level in case studies 1 to 8 in Chapter 7.

Summary: Portfolios, programmes and projects

Due to the hierarchical structure of large corporate organisations, a project or projects may start their life at the corporate strategic level and then be managed at individual business unit level. Equally, in larger organisations with more autonomous separate businesses, a project or projects may start life at the business level and with minimal if any input from the corporate strategic level. Much will depend on the size, complexity, strategic criticality and importance of the project(s) to the organisation, the level of investment required, the policy and operating procedures for handling such projects, and whether they operate Portfolio and/or Programme structures. Figure 9.9 is adapted from the APM (2012) to set the parameters for considering the interacting value chains operating within a multiproject environment.

As argued in this section, the role of value management in this context is one of ensuring that not only is the client's value system made explicit but remains intact and is also transmitted via the 'value thread' in such a way that it is fully understood through all P3 structures. The next section explores empirical research on value-based methodologies used in a P3 environment.

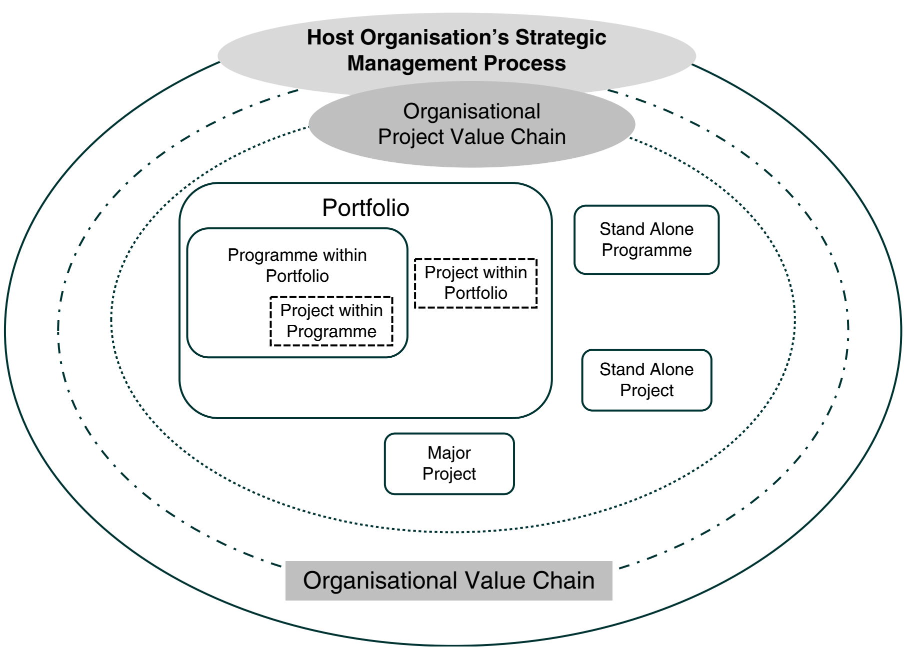

Figure 9.9 The context of the organisational project value chain. *Source*: Adapted from APMBoK (2012).

9.4 Value-based methodologies in the P3 environment

Overview

This section presents empirical research into the relationship between P3 and the related value-based methodologies of value management, risk management (RM) and requirements management (RegM). An organisational schematic model is subsequently presented to integrate the previous concepts from this and the previous chapter to establish the consequences for value management in a P3 environment. The subsequent section describes a value case study conducted at Programme levels.

Empirical research into value-based methodologies

The findings are presented from empirical research into the relationships between policy, strategy, Portfolio, Programme and project levels, and the applications of value, requirements and risk management at different levels of an organisation to develop an integration approach (Mlybari, 2011). The object of the research was to seek depth rather than breadth and to understand fully the use of value, requirements and risk management at different levels in an organisation. The empirical findings were derived from three in-depth client organisation case studies, in-depth interviews with consultants ($N = 8$, with an average of 30 years of experience in construction), and two focus groups comprising value management practitioners ($N = 10$).

The client organisational case studies were drawn from amongst the regulated private sector industries, and therefore provide elements of the private and public sector. These clients have large numbers of employees, ranging from 3000 to 35 000. Information about their businesses was obtained from websites, a diversity of documents from within and external to these organisations and interviews with senior managers. They have adopted to varying degrees asset management, corporate governance, portfolio management, programme management, construction management, project management, value management, risk management, and finally, requirements management. Consultants' organisations provide consultancy services covering the spectrum of activities adopted by these client organisations. They were interviewed predominantly about their views on client organisations' investment processes in the public, regulated private and private sectors; the different organisation levels encountered in P3 environments and clients' understanding, application and integration of ReqM, VM and RM methodologies within different organisation levels.

The clients and all consultants confirmed that for all sectors covered in the research there is a level above the organisational strategy level, which they termed the policy formation level, which they saw as comprising vision, mission and values.

In terms of the creation of Programmes and projects, the consultants indicated two approaches to this. The first is a *top-down approach* where an organisation forms its policy, this drives organisational strategy and objectives and these, in turn, drive the investment portfolio to allocate resources across capabilities. Subsequently, this drives Programmes which, in turn drive projects. The second approach is from the *bottom–up*. Board members, as the strategic management team, set the business strategy and planning aspects for an organisation, which produces consequently the capital investment process and requirements. However, managers at the project level will generate projects to satisfy these requirements and to solve problems that exist at their level. In some organisations, these projects may be grouped at the Programme level depending on how these organisations decide to group them. For example, their only linkage could be between technical requirements. Finally, some organisations will group their Programmes under a Portfolio. However, it was also noted by the consultants that some regulated private sector organisations commence the investment process using a bottom–up approach to create Programmes and projects but subsequently manage them using a top–down management structure. Two of the case studies organisations that were investigated adopted this approach. This is a hybrid form.

At one level, the research also identified that there appears to be very close conceptual linkages between approaches to value and risk management; the ideas and concepts from within the emerging field of Uncertainty Management (UM) and also ReqM (Standing, 2005). Uncertainty Management focuses on making decisions under significant uncertainty (Cooper and Chapman, 1987; Chapman, 1997; Chapman and Ward, 2002; Hetland, 2003); where uncertainty is defined as a lack of certainty due to high levels of variability and ambiguity (Chapman and Ward, 2002). Chapman and Ward include risk within the definition of UM, as does Hetland (2003). They view two aspects to it: upside risk (opportunity) and downside risk (threat). Smith (2003) argues that uncertainty exists when there is more than one possible outcome of a course of action but the probability of each outcome is not known. He also states that risk exists when a decision is expressed in terms of a range of possible outcomes and when known probabilities can be attached to the outcomes. He further argues that drawing a distinction between uncertainty and risk is of little significance and the two terms are used interchangeably in construction projects. It is argued here by the authors, however, that it is useful to distinguish between uncertainty and risk for analytical purposes in value management. In terms of the value-based methodologies, Male and Mitrovic (2005) linked project uncertainty, risk, value and supply chain strategies together with a client typology. Smith and Male (2007) linked conceptually VM, RM, Uncertainty and ReqM in construction projects. Smith and Afila (2007) have investigated the links between value and risk management; whilst Weatherhead *et al.* (2005), Dallas (2006) and Walker and Greenwood (2002) have explored the linkages between managing risk and value through the use of concepts, ideas, methods and toolboxes of techniques in a similar manner to Male *et al.* (1998a, 1998b).

Finally, Requirements Management, having originated from the Information Technology field, focuses on eliciting, documenting, organising, and tracking requirements. These are seen as a 'capability' that is needed by a user to solve a problem or objective (OGC, 2007b). In a similar vein to VM and RM, ReqM nomenclature includes stakeholders and project teams, the 'voice of the customer', goals, functions and constraints to product and service specifications, including related systems behaviour. These terms also appear in the VM paradigm. The value and traditional risk paradigms also address the management of complexity, uncertainty and ambiguity through their respective methodologies; and implicitly also opportunity. In sum, there is a considerable degree of overlap between the concepts and ideas of the four themes noted.

The empirical research conducted by Mlybari (2011) identified that in a P3 environment the application of ReqM, VM and RM, and associated tools and techniques, increase and become more formalised downwards through an organisation from policy and strategy through Portfolio and Programme into projects and their distinct phases. These methodologies are:

- Typically adopted in projects
- Intermittently in Programmes
- Occasionally in Portfolios
- Rarely in organisational policy and strategy

In conclusion, the empirical study identified three approaches to defining Programmes and projects: top-down, bottom-up and a hybrid. In terms of the use of ReqM, VM and RM, a diversity of views were encountered. It also identified that formal ReqM, perhaps using tracking software, is rarely used. If it is to be used it would be on substantive projects. Furthermore, requirements elicitation was also seen as an important component of VM studies. VM is understood, but it is applied more as an audit process, a cost cutting exercise, or when considered appropriate. RM was adopted generally but in an unstructured manner and as an ongoing process. The evidence indicates that the three methodologies are used at project level but rarely at higher levels in an organisation. There is a preferred sequence of use identified empirically by Mlybari (2011) and this is set out in Figure 9.10.

The next section draws together the various elements of the chapter to integrate strategic management and P3 thinking in the context of value-based thinking. It also draws together aspects of the previous chapter into asset management to locate it within the P3 environment.

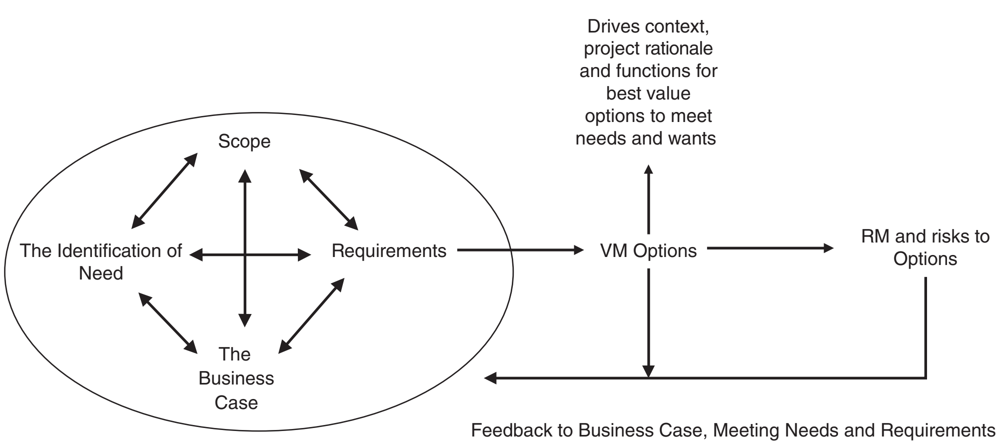

Figure 9.10 Sequencing requirements, value and risk management. *Source*: Adapted from Mlybari (2011).

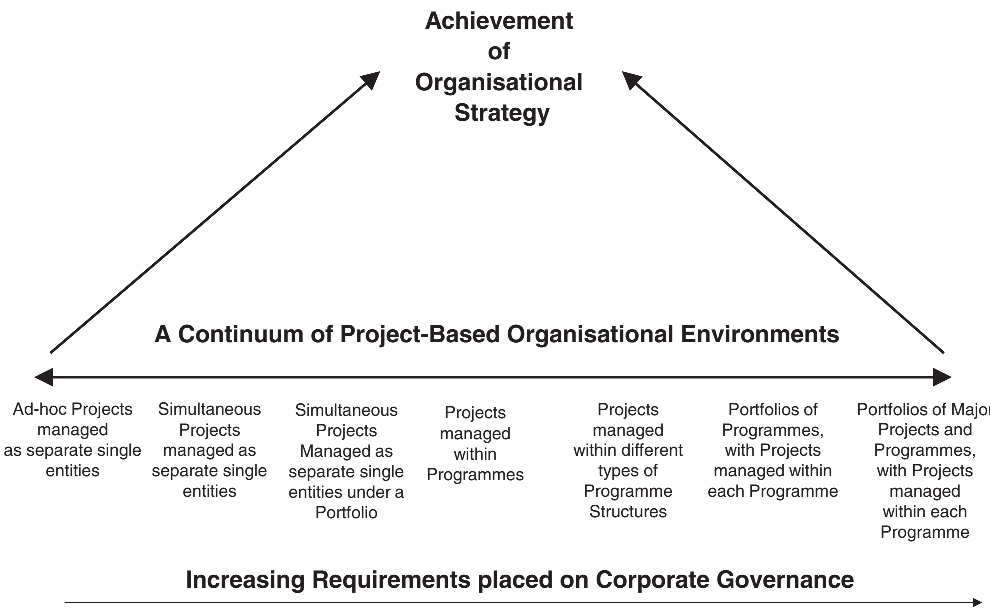

Figure 9.11 P3: The organisational project management environment – A continuum of project-based structures. *Source*: Adapted from Male *et al*. (2008).

An organisational model of P3 and value-based methodologies

The chapter discussion has explored the development of project-based thinking and its subsequent development into Programme and Portfolio structures. Organisations that operate in project-based environments can be seen as being categorised along a continuum, from those that operate and manage projects as single project entities through to those that have overarching management structures to group Programmes and projects. As an organisation matures by continuously developing more effective and efficient approaches to the management of projects it will tend to evolve into an increasingly more complex P3 environment. Such an organisation will progress along a project-based continuum as noted in Figure 9.11. There will also be increasing requirements on the corporate governance system.

Within Figure 9.11 there is also a correlation between organisational size and the continuum. Organisational environments on the left tending to be found in smaller organisations and those to the right found in increasingly larger organisations, regardless of whether they are in the public or private sectors. The chapter has also explored and presented empirical findings on how value-based methodologies – VM, RM and ReqM – have been used in organisations that operate Programme and Portfolio structures. Figure 9.12 brings together the earlier discussions into a model of Portfolios, Programmes, projects and value-based thinking and related methodologies.

The arrows in Figure 9.12 denote the general context of influencing relationships among elements. At the top of the triangle in Figure 9.12 the Policy and Strategy Domain involves organisational vision, or the creation of a blueprint of the

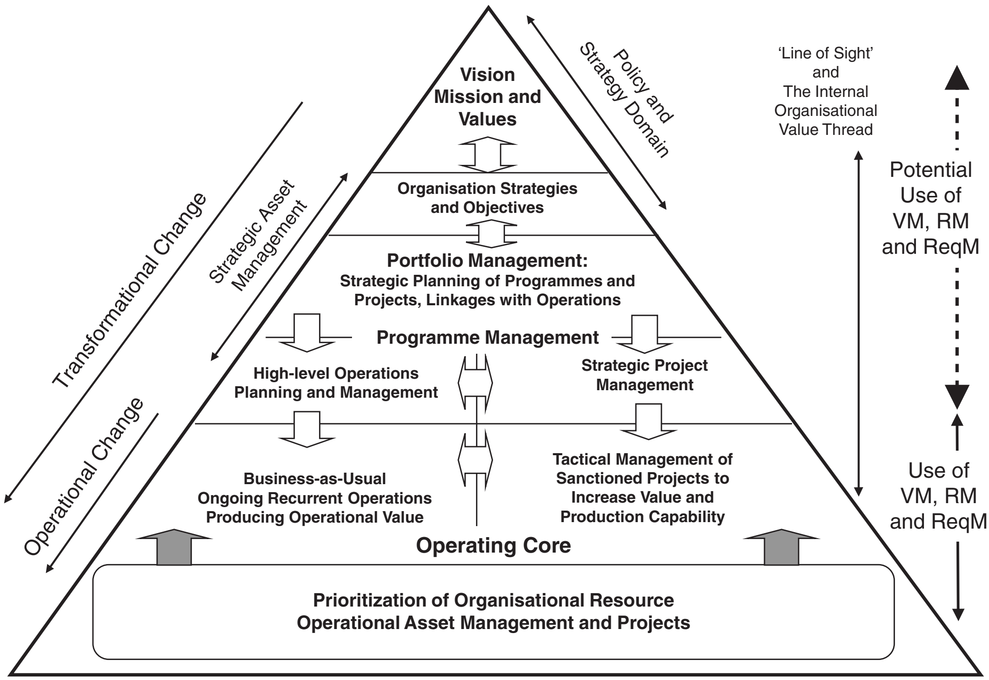

Figure 9.12 P3: The organisational structural context. ***Source*: Adapted from Male *et al*. (2008), PMI (2013b).**

organisational future; organisational mission; organisational values; the organisation strategies and objectives that set the strategic direction for the organisation. Portfolio Management represent the objectives, structures and processes that establish appropriate actions required to meet the strategies, goals and strategic objectives developed in the Policy and Strategy Domain. Portfolio Management, seen in Figure 9.12 as the overarching corporate management framework for Programmes and projects, must consider strategic and tactical change, ongoing Business-as-Usual activities and new investments and activities in the form of projects and Programmes. Figure 9.12 also highlights where the different types of change will impact the organisation, the line-of-sight and organisational value thread. The figure also denotes where value-based methodologies predominate and where they have an opportunity to be more fully utilised.

Programmes and projects are used by organisations to achieve their strategic intent as expressed in the vision, mission and strategies. These higher structures and processes impact and interact with those at the lower levels of the triangle, where operational and production activities create ongoing value along and new value through ongoing Business-as-Usual activities and more operationally focused projects. Typically, tactically focused projects will occur within the operating core, and these projects will have their origins higher within the organisational hierarchy.

Major Projects are highly likely to operate outside of the mentioned structures and will have their origins in the Policy and Strategy Domain.

The next section presents a case study on the use of VM in a P3 environment, from an action research consultancy undertaken with a major infrastructure owner-operator.

9.5 A value case study: Prioritising a capital investment programme for an asset owner-user

Value study description

The value study was conducted for a large infrastructure asset owner-operator, operating within the regulated industries, who had significant assets located on four Strategic Business Unit (SBU) campus sites. The asset owner prioritised their capital programme into 5 year spends, and also covered a 10 year spending horizon to encompasses the current and next 5 year period. Each SBU Director is responsible for identifying a list of projects for consideration to go into the 5 year capital programme. The consequence is that each 5 year capital programme deals with prioritising in the order of 300–400 projects of various sizes. The list is relatively dynamic as new projects emerge from within each campus SBU annually for future consideration. The central corporate office prioritises these projects using a scaling methodology linked to strategic purpose, measures of cost, complexity, urgency, and criticality. This produced an output that identified projects into a prioritised list of Must Dos, Needed, and Residual (subject to capital availability). The list is truncated when the 5 year capital allocation had been achieved.

The result is that the Must Dos, and a proportion of the Needed projects would go forward as a commitment to fund, subject to Board confirmation. Major Projects would tend to operate outside of this regime and would be controlled either at corporate or SBU level. For each 5 year period, those that are unfunded would be put into a new round of subsequent prioritisation. The organisation could be characterised as having a bottom–up approach to projects predominantly but overlaid by a top–down approach as a consequence of the corporate prioritisation process and the imposition of the capital programme 5-year budget cut off.

The value study had to provide an independent validation for the initial current 5-year prioritisation, and subsequently review the following initial 5-year projected prioritisation. A reprioritisation of the projects was undertaken based on a methodology derived from integrating Value Management and Programme Management approaches. The rationale behind this was that investments within a Programme are about building organisational capabilities and that each individual project within a Programme has to contribute to and deliver that capability, and add value or as a minimum not detract from value.

Study design

The study comprised an Orientation and Diagnostics phase, a Value Workshop phase comprising two validation workshops, and the Implementation phase of a debriefing meeting. There were two Value Study Leaders, both very familiar with the asset owner-operator's business and with the concepts and methodologies of Value and Programme Management. The study took in total 4 months from start to finish.

The Orientation and Diagnostics phase

- A review of strategic documents and the current prioritisation of projects produced by the asset owner-user.
- A review of the descriptions for each project in terms of its purpose, technical scope and cost. This included:
  - An assessment of the business drivers for each project.
  - An assessment of the functional requirements, project objectives, scope, technical requirements, timescales, geographical location issues for projects, and investment costs associated with each project.
  - An assessment of whether a project was concerned with the future development of the organisation and asset group, that is, to build future capabilities. In the study, these were termed 'Development Projects'. Projects to maintain existing operational capabilities of an existing asset group were termed in the study 'Operational Projects'.
  - An assessment of how and why each project contributed to achieving the organisation's business strategy and the strategic objectives for an asset group, regardless of whether they were Development or Operational Projects.
- A briefing session with the senior asset development manager.
- The development of an investment–cost matrix that prioritised each project against whether its focus was on:
  - Building future or maintaining existing capabilities, and
  - Whether it contributed to the organisation's strategy and asset group strategic objectives, using information derived from the business drivers, function analysis, capability and strategic objectives analyses.
- An orientation meeting with the senior asset management team to agree the final methodology and approach.

The Value Workshop phase

- Workshop 1: This was a 1-day workshop. The focus of this workshop was on the validation of the current 5 year capital spend prioritisation. The following was undertaken as part of this workshop:
  - A presentation by the VSLs on the results of their own prioritisation.
  - A review of a value–cost matrix as a result of reprioritisation using the value-based methodology.
  - A debate around the prioritisation of the current 5 year capital programme by the asset owner-user. The VSLs debated their own approach to prioritised projects with that of the asset development team.
  - A consequent comparison and rationale of why projects may or may not appear within either the VSLs or asset development team's lists for funding.
  - Any potential gaps of oversupply or undersupply of investment into projects assessed against strategic objectives and business drivers.
  - Any reprioritisation of projects.
  - The risks associated with the investment-value profile of a possible reprioritised capital programme.

- Workshop 2: This was a 1-day workshop. The focus was on the review of a large sample of selected projects from the total population of projects for inclusion in the subsequent 5 year capital programme. These projects were selected by the asset development team. The following was undertaken as part of this workshop:
  - The reprioritisation of the projects by the asset management team using the value-based methodology developed by the VSLs. The role of the VSLs was to facilitate this prioritisation.
  - An assessment of the organisational and asset group capabilities required over a 15 year period comprising the previous, the current and the subsequent 5 year period capital allocation. The assessment also included any impact on individual SBU campus development and operations.
  - An analysis to determine if the capability analysis changed the priorities for the current 5 year capital programme under review, and if it might influence the shape and content of the future 5 year capital investment programme.

The Implementation phase

- A reconsideration by the asset owner-user of the Implementation requirements of the independent review of their current 5 year capital programme. Their review was a more formal assessment of the results of the workshops when compared to their first-pass prioritisation of projects using their own methodology. It also provided them with an additional complementary methodology to support their existing prioritisation approach.
- A debrief meeting with two of the senior managers from the asset team, who confirmed that the VSLs approach had provided them with a new perspective on how to approach their capital programme prioritisation and had given some unexpected results, which they had taken account in their subsequent thinking.

Tools and techniques adopted

- The use of a truncated Issues Analysis in the orientation meeting with the senior asset development and management team. This permitted the VSLs to obtain a greater understanding of the organisation's strategic thinking around its diverse asset base.
- The use of a business drivers analysis for projects to help shape where they should fit strategically within the organisation's strategy and objectives.
- The assessment of projects in terms of their contribution to the creation of future or maintaining existing organisational capabilities. This included the allocation of projects to SBU objectives and business drivers. Programme Management thinking is about capability building and aligning projects in Programmes around organisational strategies and objectives to deliver capabilities. The method presented here combined both top-down and bottom-up approaches.
- The creation of a value-cost matrix whose axes were project type versus strategic objectives, business drivers and capability. This permitted an assessment of the value that each project was providing to the organisation and not just its cost.

- The analysis of backward looking, current and forward looking strategic organisational capability analysis for a capital programme. This ensured the asset team were not just focusing on a single 5 year period but a 15 year investment cycle around capability building and enhancement and the value they were seeking from this. Again this is central to Programme Management thinking.

Use of function analysis

A truncated function analysis was adopted to assess each project. Individual project statements were analysed for high-level function-type statements that helped clarify the purpose of each project. These function statements were subsequently interrogated against the organisation's stated purpose for that project, and used consequently to allocate it to an organisational capability and a strategic objective. This was a very efficient technique to assess each project fundamentally; and in terms of why it existed as an investment regardless of its technical specification.

Team dynamics and stakeholder management during the study

There was a very positive team dynamic from the outset. The value study team comprised five senior asset managers (Workshop 1) and seven senior asset managers (Workshop 2). The orientation meeting helped considerably. The VSLs had two roles, first, to independently challenge and validate the organisation's prioritised capital programme by designing and using a bespoke value methodology. This role was explicit in the first workshop. The second role was of a more typical challenge approach within the second workshop.

Outcomes of the study

The outcome of the study was three fold. First, the validation of a first pass prioritisation of a current 5 year capital programme for an asset owner-user. The second was the development of a bespoke value methodology that was underpinned by Programme Management and Value Management thinking. Third, the asset owner-user organisation had used and was exposed to a complementary approach to their existing prioritisation methodology.

Lessons learnt

The case study is of an asset owner-user that has a decentralised organisational structure for generating its capital programme. It then centralises that process for prioritisation within a 5 year capital investment programme, and its consequent authorisation at Management Board level. It has a very structured and formalised investment process. The organisation at the strategic level has to create Stakeholder and Regulator value, as well as its own business value for its customers. It has deep knowledge of its asset base and operates in a strong multiproject environment and culture. The study moved the client into thinking about Programme and Portfolio thinking.

The case study demonstrates a series of Value Management principles. The critical element of the study was to understand the financial and organisational environment –

its Organisational Value Chain – within which the delivery of the 5 year capital programme added and contributed to managing value within the asset owner-user's organisation. Not only did the analysis require an assessment of corporate and business level value and value drivers but also SBU campus level value and value drivers; they were distinctly different due to the customer bases being served. The Orientation and Diagnostics phase of the value study was crucial for this aspect.

The two external VSLs had expertise in VM and Programme Management. The study demonstrated the importance of the VSLs being able to design an appropriate VM study in addition to just facilitating workshops. These are two different but essential and complementary skill sets within VM.

In the Value Workshop phase, the two workshops combined presentations by the VSLs of their analysis and then joint exploration of that analysis with the senior asset managers of the organisation. There was a considerable challenge element as a consequence of the preparatory work undertaken by the VSLs.

Finally, whilst each project within the capital programme had a defined technical scope, the focus of the value study was primarily and substantively investment focused and technical requirements only came to the fore if this helped to inform investment decisions.

The case study also demonstrates a series of principles within strategic management, project and Programme Management. The organisation had a well-developed and formalised corporate and business strategy approach and extensive experience of operational asset management and project management, especially in the Major Projects area. The organisation is a substantive user of physical assets, their core business depends on them, and it has a highly developed formalised capital and operational expenditure investment approach for its physical asset base. At the time the value study was conducted the organisation's strategic orientation was one of: a bottom–up approach to aligning groupings of projects from distinct campus-based SBUs around a series of corporate level strategic themes, and within overarching top-down SBU business and corporate level strategies. However, the value study adopted a top–down strategic approach from the outset as a capability building and enhancing vehicle. The value study provided, at times, a different grouping and mix of projects than the existing prioritisation methodology.

9.6 Conclusions

This chapter has provided a theoretical and practical baseline for how value management can be applied at different hierarchical levels in an organisation that has a P3 environment, together with the context of what needs to be taken account of when designing a value study or studies. VM in construction is seen predominantly as a single project intervention methodology. However, many organisations, due to their size and reliance on physical assets to support their underlying organisational infrastructure, operate in a multiproject environment where projects are in competition with each other for investment funding. In addition, many organisations provide overarching governance arrangements typified by Programme Management and

Portfolio Management structures. These are used to manage significant change initiatives that result in projects or to group projects together in some meaningful way in the case of Programmes, or as disparate entities in the case of Portfolios.

It is argued in this chapter, and in Chapter 8 that asset management provides the overarching governance, management structure and linkage between organisational strategies and the P3 Organisational Project Management environment. The Organisational Value Chain, via the asset management function, interacts with the Organisational Project Value Chain to set up the cascading value thread that should link all projects together within an organisation. The adequacy of this will also depend on the nature and configuration of the governance system that is in place to control the creation, development and implementation of the P3 environment.

Value Management, if it continues to develop within the Organisational Project Management domain, has to move beyond being seen as single project intervention methodology to one that is able to operate at different levels in an organisation. This was set out in Figure 9.12. Figure 9.13 sets out a line-of-sight diagram that links the various concepts together. Figure 9.13 also illustrates the organisational framework within which the impact of Vision, Policy, Strategy, Portfolios, Programmes and projects also impact on and are impacted by other ongoing changes within an organisation. The ideas behind the Client Value System and Project Value System will be elaborated further in subsequent chapters.

The result is a series of value studies that can be undertaken at differing levels in an organisation. These are set out in Table 9.3.

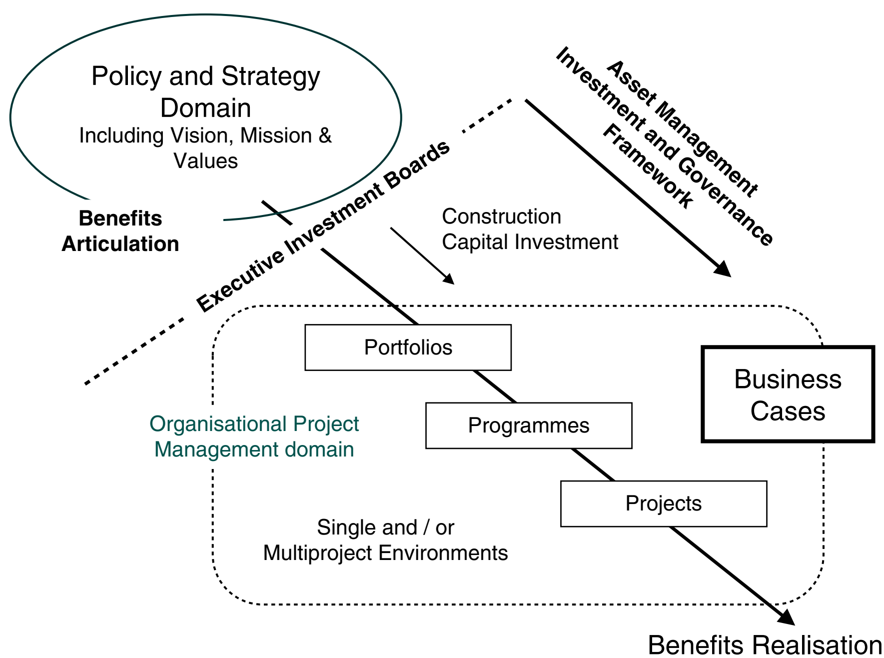

Figure 9.13 The P3 line-of-sight: strategic and asset management, Portfolios, Programmes and Project structures.

Table 9.3 Study Types and Focus (Adapted from Mlybari (2011)).

Study Types and Features	Organisational Policy Level	Organisational Strategy Level	Portfolio Level	Programme Level	Project Level
Degree of importance	←				Importance of using VM, RM and ReqM
Direction of benefits	Direction of benefits from using VM, RM and ReqM cascade downwards →				
Focus and issues addressed	Establish core vision, mission, and values. Establish requirements for investment needs. Establish investment priorities in outline terms. Establish fit with external agencies or third parties.	Test individual business plans back against vision, mission and values. Strategic thinking to formulate or confirm strategies.	Clarify core vision, mission, and values against particular Portfolio investment vision as a strategic intent, and capability building via Programmes. Establish or clarify Portfolio organisation. Establish fit and linkage of Portfolio with organisation strategy.	Clarify vision, mission, values against particular Portfolio investment vision and Programme level vision. Establish or clarify Programme Scope, Business Case, Brief and organisation. Establish fit and linkage of Programme with Portfolio strategy. Establish or clarify priorities and dependencies across Projects within Programme. Establish or confirm need for each project within network.	Clarify need. Establish or clarify Project vision. Establish or clarify Project Scope, Business Case, Brief, project organisation. Establish fit and linkage Linking project fit with programme strategy.
VM focus and activities	Policy formulated according to external environment appraisal, third party or regulators/ funders' stakeholder requirements.	Identifying and evaluating strategic options.	Portfolio definition: Ensuring Programmes and projects within portfolio conform to its overall objectives.	Programme definition: Ensuring projects within programme conform to its overall objectives.	Project definition: Develop the Strategic Project Brief.

Table 9.3 (*Continued*)

Study Types and Features	Organisational Policy Level	Organisational Strategy Level	Portfolio Level	Programme Level	Project Level
RM focus and activities	Assessing global risks and risk of not meeting external environmental opportunities and threats, stakeholder influences, regulators or funders' requirements.	Assessing the strategic risk that could influence business organisational survival, continuity and growth in the long term.	Identifying and managing Portfolio risks.	Identifying and managing Programme risks.	Identifying and managing Project risks.
ReqM focus and activities	Identify and manage broad external stakeholder performance, regulators or funders' requirements.	Identify and manage strategic requirements.	Identify and manage Portfolio requirements.	Identify and manage Programme requirements.	Identifying and manage project requirements.
Accountability	The Executive Board.	The Executive Board.	Portfolio manager.	Programme Manager if appointed, or Programme Sponsor	Project Manager or Project Sponsor.
Key value study participants	Board, all at senior level in the client organisation, others as needed. Typical team size is 10–15 senior managers.	Board, all at senior level in the client organisation, others as needed. Typical team size is 10–15 senior managers.	Board (unlikely), Nominated Board representative (likely) Portfolio manager, Programmes and Projects sponsors, others as needed. Typical team size 10–20 senior managers.	Board (unlikely), Nominated Board representative (likely) or probably Portfolio manager, Programme Manager {if appointed} and Programme and Projects sponsors, others as needed. Typical team size 10–20 senior managers.	Programme Manager, Project Manager (if appointed) and Project Sponsor, others as needed within project supply chain depending on Value Intervention Point. Typical team size 10–20 senior, middle managers and technical experts depending on Value Intervention Point.
Inputs	Macro issues from external environment. Assess impact of key external stakeholders, and third parties such as regulators/funders'	Organisation policy, culture, environment, resources and strategic capability with list of requirements and risks. Series of strategic	Confirm strategic business plan against need and investment priorities to confirm strategic fit.	Series of Programme level business plans. Portfolio brief. Value and risk profiles across Programmes and projects.	Programme need. Capability identification. Confirm Programme level business case. Programme brief. Value and risk profiles across

(*continued*)

Table 9.3 (*Continued*)

Study Types and Features	Organisational Policy Level	Organisational Strategy Level	Portfolio Level	Programme Level	Project Level
	objectives, requirements and associated risks.	business plans by portfolio need.	Organisation strategies and objectives with list of strategic risk and requirements.	Risk allocation and management plan.	projects. Risk allocation and management plan.
Outputs	Organisation policy with list of requirements and risks. Series of strategic business plans by portfolio need.	Confirm strategic business plan against need and investment priorities to confirm strategic fit. Organisation strategies and objectives with list of Strategic risk and requirements.	Series of Programme level business plans. Portfolio brief and requirements. Value and risk profiles across programmes and projects. Risk allocation and management plan.	Programme need. Capability identification. Confirm programme level business case. Programme brief and requirements. Value and risk profiles across projects. Risk allocation and management plan.	Project strategic brief. Project level business case. Project requirements. Value and risk profiles. Risk allocation and management plan.
Typical techniques	Issues Analysis. Strategic Function Analysis. Needs Analysis. Value System Analysis. Risk Analysis.	Issues Analysis, Strategic Function Analysis. Needs Analysis. Value System Analysis. Risk Analysis.	Issues Analysis. Strategic Function Analysis. Needs Analysis. Value System Analysis. Time Cost, Quality Trade-offs. Strategic time line. Programme requirements: needs and investment requirements outlined. Capability building.	Issues Analysis. Strategic Function Analysis. Needs Analysis. Value System Analysis. Time Cost, Quality Trade-offs. Strategic timeline. Project requirements: needs and investment requirements outlined. Capability building. Consider procurement strategy (strategies).	Same as Programme Level and typical techniques noted in VM texts and publications.

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10 Option Appraisal, Risk Management and Whole Life Costing

10.1 Introduction

Maximum whole life asset value can only be attained if all valid business options are considered and evaluated. This is true irrespective of whether the business of the organisation is commercially motivated, socially motivated or a combination of the two. The succeeding sections in this chapter are as follows:

- Section 10.2 describes the fundamental principles of option appraisal. The main reference for this section is the HM Treasury Green Book, Appraisal and Evaluation in Central Government (TGB). Although focused on the public sector, the guidance is equally applicable to the private sector (HM Treasury, 2003 – updated 2011).
- Section 10.3 outlines an approach to risk management and discusses the extent to which value and risk are complementary approaches within business case development and option appraisal.
- Section 10.4 summaries the primary rules for undertaking a whole life costing (WLC) exercise as part of an option appraisal conducted in a manner that allows direct comparison.
- Section 10.5 is a case study illustrating the use of option appraisal, risk management and whole life costing techniques to inform proper cost–benefit decisions, and underpinned by a value management (VM) methodology.

Although the methods outlined in this chapter are described in other texts, including TGB, as free-standing techniques in support of option appraisal, their use is enhanced significantly when used in conjunction with a planned series of value management studies as described in this book.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

10.2 Objectives of TGB and option appraisal

The purpose of option appraisal, as defined by TGB, is to facilitate the development of a value for money solution that meets the objectives of the organisation's strategy, Programme and/or project. HM Treasury (2006) states that:

> Value for money is defined as the optimum combination of whole of life costs and quality (or fitness for purpose) of the good or service to meet the users requirement. Value for money is not the choice of goods and services based on the lowest cost bid. To undertake a well-managed procurement, it is necessary to consider upfront, and at the earliest stage of procurement, what the key drivers of value for money in the procurement process will be.

The recommended approach is to create options and values, including those for a base case situation that may be adjusted to take account of non-monetary impacts and uncertainty about the future using sensitivity and scenario analysis. Creating options requires a logical approach to the analysis of all information including stakeholder opinion to accurately identify the functional objectives of the potential project. The list of options will always contain the Do Minimum option – the base case. The Do Minimum option includes doing nothing at all. The authors' experience of option appraisals is that in situations where a project or Programme is proposed, it is observed that the base case is rarely a zero-cost option, is often not the least-cost option, and frequently is not providing best value for money. The Do Minimum option, most commonly the base case, should therefore always be included in any option appraisal. The options are best generated using the logical method of value management described in this book.

Option appraisal takes account of the wider social costs and benefits of Programme and/or project proposals to satisfy organisational strategies/policies, and ensure the proper use of resources by identifying and analysing a number of potential approaches that achieve similar outcomes. The focus of TGB on the option appraisal of Programmes and projects assumes that the evaluation of strategies and policies has already been undertaken at a higher level. The stated objective of TGB is to provide guidance on methods for:

- Appraising Programmes or projects by assessing measurable benefits and/or cost at inception before significant funds are committed, and
- Evaluating the performance of past and present activities to enable learning from experience.

In appraisal it is intended that no Programme or project is adopted without first having the answer to two key questions: (i) are there better ways to achieve this objective, and (ii) are there better uses for these resources.

The business case

The TGB recommended methodology for the analysis of Programme or project costs and benefits is a *cost–benefit analysis*, described as an:

> Analysis which quantifies in monetary terms as many of the costs and benefits of a proposal as feasible including items for which the market does not provide a satisfactory measure of economic value.

This is contrasted with *cost effectiveness analysis* defined as an analysis of the costs of different ways of satisfying the objective. In undertaking either cost–benefit analysis or cost effectiveness analysis, it is necessary to regularly assess and reduce the impact of risks, uncertainties and bias, thereby ensuring that the developing Programme or project remains value for money.

Whether to proceed with a Programme or project is a decision based upon a business case appropriate to the particular stage in the Programme or project's development. Each business case should be supported by a clear, logical, well-founded and transparent report of the appraisal process with sufficient evidence, particularly in terms of costs, benefits and values to support conclusions and recommendations. An audit trail of decision-making will be supported by calculations, supporting evidence and assumptions. Flanagan and Nicholls (2007) describe the business case in terms of a five-case model:

1. Strategic case
2. Economic case (for option appraisal)
3. Financial case (or affordability)
4. Commercial case
5. Project management case (or achievability)

The five-case model provides useful headings under which to structure the business case at the three stages of the Programme or project's development:

1. Strategic Outline case
2. Outline Business case
3. Full Business case

In this context, Programmes comprise a number of related projects and are the means for implementing the business strategies and investment decisions of strategic and operational importance to the organisation. Each Programme will require a strategic outline case and each project nested within the Programme will require a strategic outline case, an outline business case and a full business case.

Strategic outline case – Programme

The purpose of the strategic outline case is to demonstrate that the Programme is a necessary requirement and has a strategic fit with the furtherance of the vision, mission and long term goals of an organisation. The strategic outline case for a Programme will contain:

- A clear, succinct statement of the Programme's strategic mission including:
  - The underlying reason for an intervention or change supported by a description of all relevant issues.

  - A timeline for the Programme's execution including a judgement of whether the mission is likely to change in scope or magnitude over time.
  - An assessment of the constituency of potential stakeholders and/or customers who will benefit from the Programme and conversely, a description of those who may be disadvantaged by the change.
  - The reasons for this Programme at this time, including an explanation of why the market has hitherto failed to provide the product or service.
- The factors used to measure the Programme's evolution and successful completion to be included in the benefits realisation plan.
- The change management plan.
- The Programme Management plan including a statement of commitment from top management, the identity of the senior responsible person for the implementation of the plan and the governance structure.
- An option appraisal exercise and a recommendation of the way forward including an initial assessment of the Programme's constituent projects and activity work-streams. The option appraisal will include:
  - A whole life budget for each option considered for the Programme.
  - The risks associated with each Programme option.
  - The benefits potentially delivered by each Programme option.
  - The projected timeline for each Programme option.
  - An assessment of the whole life value of each Programme option.

Strategic outline case – Project

For a project that is one of a number of projects contained within a Programme, that is, a project nested within a Programme, the strategic outline case for the project will summarise the strategic outline case for the Programme. The strategic outline case for a project, whether it is a part of a Programme or freestanding and independent of any Programme will address the following:

- The mission of the project describing succinctly and explicitly the purpose of the project in functional terms. This will include:
  - The reason for the project at this time.
  - The reason why the product or service delivered by the project is not available in a satisfactory form in the open market.
  - The extent to which the project is mission-critical or high risk.
- The output specification that amplifies the project mission in terms of subfunctions and outputs required of the project supported as necessary by reference to guidelines and standards.
- The linkages between this project and other projects and the extent to which they are interdependent.
- Any assumptions regarding the continuation of production of an existing product, or the continuation of an existing service, the curtailment of which would compromise the proposed project.
- The benefits realisation plan, including the factors that will be used to measure the project's success, and form the feedback and benchmarking data for use in future projects.

- The constituency of potential stakeholders and/or customers who will benefit from the project and conversely, a description of those who may be disadvantaged by the project.
- The change management plan for the project.
- The project management plan including the identity of the senior responsible person for the implementation of the project management plan, the anticipated project management structure and the governance procedures for the project.
- An option appraisal exercise for the project and a recommendation of the option to adopt. The option appraisal exercise will include:
  - The whole life cost of each option.
  - The risks associated with each option.
  - The benefits potentially delivered by each option.
  - The extent to which the market can deliver each option.
  - A projected timeline for each option.
  - An assessment of the whole life value of each project option. Whole life value is discussed in Chapter 12.
  - A recommendation of the option to adopt.

The structure for the preparation of a strategic brief, which provides the foundation for the strategic outline case, is described in Chapter 3. The strategic briefing study will address options to meet the business needs and will confirm that the project is required. The options will always include the 'do minimum' option and could involve developing and investigating non-physical asset alternatives. The strategic briefing mission statement will always define the project by function and never describe a built solution. The conclusion of the strategic outline case will make a recommendation of whether or not to proceed and crucially whether the selected project option requires the construction of a new, a renewal or a refurbished built asset.

Outline business case – Project

The outline business case concludes the technical development of the option(s) selected by the option appraisal process described in the strategic outline case, and confirms that the selected option(s) meets the business need, is affordable, is achievable and is likely to deliver value for money. In the context of a construction project the outline business case will include the project brief and (dependent upon the procurement strategy) a concept design. The outline business case should be completed and approved prior to the project proceeding to the first stage of planning permission.

The following tasks precede the preparation of the Outline Business Case:

1. Stage 1 – Briefing:
   a. In the context of construction, appointing a technically expert team of design and construction consultants and specialists.
   b. Selecting representative stakeholders familiar with the strategic and operational aims of the project. The composition of the stakeholder team will change as the project progresses from the consideration of strategic matters to those of operational efficiency.

  c. Compiling the project brief (see Toolbox in the Appendix). The brief is the written performance specification of the option selected through the strategic outline case process. The brief is met by the concept design.
  d. Defining the procurement strategy.
  e. Updating the project execution plan (see Toolbox)
2. Stage 2 – Concept design
  a. Designers prepare two or more optional concepts designed to meet the project's functional requirements as defined in the brief. The optional concept designs for the project are subject to detailed option appraisal.
  b. Some procurement strategies for example, pure forms of design and build, assume that the competitive bids will be based upon meeting the brief alone, although many design and build derivatives do rely on exemplar designs to amplify the written requirements of the brief. Where design and build procurement strategies are used the option appraisal will be based on the designs submitted by bidders in a similar manner to the preceding item a.
  c. The factors to be considered in option appraisal of concept design alternatives are as follows:
    i. The whole life cost of each option.
    ii. The risks associated with each option.
    iii. The benefits potentially delivered by each option.
    iv. The extent to which the market can deliver each option.
    v. The impact of alternative procurement strategies on each option.
    vi. A projected timeline for each option.
    vii. An assessment of the whole life value of each project option.
    viii. A recommendation of the option to adopt.
3. Stage 3 – Outline Business Case

   The outline business case will restate the mission of the project and the factors used to measure the project success. It will also include the following:
   - The project brief as developed in stage one.
   - The option appraisal of concept design alternatives as developed in stage two.
   - The concept design for the preferred option as developed in stage two.
   - The outline Whole Life Cost Plan for the preferred option.
   - An updated benefits realisation plan, change management plan, project management plan and project execution plan.

Full business case – Project

The full business case summarises the development process from the initial strategic mission to the final validated scheme including the project design and the bid document. The full business case reflects the highest level of certainty of all factors pertinent to the project design and nothing should prevent an accurate assessment of the whole life cost, the whole life value, the risk profile and the project management plan. The documents comprising the full business case include the following:

1. *Strategic Case*
  a. The background to the project including details of client policy and where applicable a description of the Programme in which the project is nested.

   b. The strategic mission of the project including all those factors described in the strategic outline case updated as necessary.
   c. The scope of the project in terms of the parameters to the product and or service delivery.
   d. The key design features and procurement strategy of the option selected following the outline business case.
   e. The assessment of future demand for the product and/or service.
   f. The place of the project in the asset management plan.
2. *The Economic Case*
   a. A review of the options considered and described in the strategic outline case and the outline business case, and the economic argument for the option chosen.
3. *The Financial Case*
   a. The preferred contractor's and/or supplier's bid.
   b. The updated whole life cost plan.
   c. The calculations in support of the capital cost risk plan and operating cost risk plan as it affects the client and a breakdown of the contingency allowance included in the contract.
   d. The achievement of financially relevant non-measurable benefits, for example, carbon reduction and waste minimisation.
   e. The client's anticipated investment funding requirements and income overlaid by the anticipated project cash-flow.
4. *The Commercial Case*
   a. In the context of the private sector, the commercial case is the anticipated profitability of the proposed project, the return on the investment.
   b. In the context of the public sector, the commercial case is:
      i. The savings in public expenditure brought about by the investment in the project.
      ii. The anticipated asset value of the project in the market place, assuming that the project can be sold.
      iii. The achievement of any commercially relevant non-quantifiable benefits, for example, esteem, goodwill, advertising and increase in staff morale.
5. *The Project Management Case*
   a. The client's core project steering group including stakeholder management arrangements.
   b. The client's business change management plan (to seamlessly integrate the project into the client's core business).
   c. The benefits assessment and benefits realisation plan.
   d. The post-project evaluation plan.
   e. The project management arrangements.
   f. The project execution plan (see Toolbox but specifically including the following):
      i. Risk management strategy
      ii. The project change management plan
      iii. The whole life value plan
      iv. The project governance arrangements
      v. The project schedule
      vi. The design management plan including building information management (BIM)

The full business case approval precedes the confident signing of the construction/supply contract by giving the client executive the maximum information with the highest level of certainty possible regarding all factors relating to the project. The client approaches the full business case with the knowledge that the project mission has been carefully compiled and that many options to satisfy the mission have been considered. Option appraisal is a key component of project development and is given credibility by TGB. The following section summaries the key points from TGB.

The HM Treasury Green Book option appraisal method

The TGB requires that the description of a worthwhile intervention or change will include a statement of the proposed Programme or project objective in terms conducive to the identification of the full range of alternative options to satisfy the objective. This implies that the mission of the proposed Programme or project, and its supporting objectives, should be expressed as a functional statement rather than a statement of solution. A functional statement is for example 'make available health care, diagnostic and treatment services in Anytown'. A technical solution is to 'construct a community hospital in Anytown'. Objectives supporting the project mission will have a hierarchical structure leading to a hierarchy of outcomes, outputs and targets that should be clearly set out in an appraisal. Outcomes are benefits to society that the proposals are intended to achieve and the targeted outcomes should be SMART.

- Specific
- Measurable
- Achievable
- Relevant
- Time bound

Appraising the options

The purpose of option appraisal as defined by TGB is to facilitate the development of a value for money solution that meets the objectives of the Programme or project. The recommended approach is to describe a base case situation, commonly the status quo or do minimum option, and then create a list of optional solutions to achieve the identified functional objectives and evaluate these adjusting for non-monetary impacts and uncertainty about the future using sensitivity and scenario analysis.

Creating options necessitates an information gathering stage to assemble and compile the set of data and information relevant to the objectives and the scope of the problem. Activities associated with information gathering include for example, the research of existing reports, analysis of similar completed Programmes and projects (across the public sector), consulting widely with practitioners and experts, stakeholder workshops and public consultations. The data should be analysed to understand significant dependencies, priorities, incentives and other drivers. The data will identify the full range of issues that are the bedrock of the correct identification of the Programme or project mission and functional objectives. It must be assumed that all information is made available to all parties in the venture. Imperfect information or information asymmetry may result in 'market failure' and can lead to increased prices and restricted quality.

Once the project mission and functional objectives have been established, a well-run brainstorming session can help to generate a range of ideas including radical options. The radical options may not become part of the formal appraisal but are helpful in testing the parameters of feasible solutions.

Valuing the costs and benefits of options

Relevant costs, benefits and disadvantages are defined as those required to support a decision resulting from the analysis of options. Included are the impact of the options under consideration on other public sector facilities and services. Costs and benefits will cover the period of the useful life of the assets envisaged by the options under consideration, although if the appraisal concerns the contractual purchase of facilities/services for example in any form of Design, Build, Finance, Operate (DBFO) arrangement, the appraisal period might be different.

The decision-maker will compare the results between options to help select the best. It is important to avoid being spuriously accurate when concluding from and presenting the results of data generated by the appraisal. The confidence in the data provided by the analysis will need to increase depending on the importance or scale of the decision at hand implying increased resource to support the decision making process.

Costs (including cash flow and resource costs) and net benefits are normally based on market prices, which usually reflect the best substitute use for those goods and services (the opportunity cost). Wider social and environmental costs and benefits for which there is no market price are included in any assessment. As costs are expressed in terms of relevant opportunity costs, other opportunities for the expenditure of capital must be explored. For example, expenditure on another deserving project may give greater benefits.

Costs can be classified as sunk, fixed, variable, semivariable or step costs:

- Sunk costs are the costs of goods and services that have already been incurred or are irrevocably committed. These are ignored in any option appraisal.
- Fixed costs are time related costs that remain constant regardless of activity or occupancy, for example rental costs of a specific sized warehouse or office.
- Variable costs are proportional to the volume of activity, for example, energy costs and office consumables.
- Semivariable costs include both a fixed and variable component, for example, maintenance contracts that exclude the cost of replacement parts.
- Step costs are fixed for a given level of activity but they eventually increase by a set amount at some critical point; for example, the number of buses required in transporting varying numbers of people.

Categorising costs in this way allows sensitivity analysis to be undertaken on the full economic cost (including direct costs, indirect costs and associated overheads but excluding income).

In any option appraisal, capital expenditure is included in full. Depreciation is ignored over the study period, as are capital charges (the opportunity cost tied up in the capital asset once purchased). However, residual values (the estimated value of the asset at the end of the study period) should be included and tested for sensitivity. projects that expose the public sector organisation to contingent liabilities (future expenditure if certain events occur) should be appraised based on the likelihood of the event occurring.

In option appraisal there will always be a base case to facilitate an understanding of the net impact of the benefits of different options. The benefits of all options are calculated with consideration of 'leakage', 'dead weight', 'displacement' and 'substitution' described as follows:

- Leakages are those benefits accrued outside of the spatial area or group that the intervention is intended to benefit.
- Dead weight refers to outcomes that would have occurred without the intervention.
- Displacement and substitution measure the extent to which the benefits of a project are offset elsewhere by causing unemployment or reducing output.

The net benefit of an intervention therefore equals the gross benefits less the benefits that would have occurred in the absence of the intervention (the dead weight) less the negative impacts elsewhere (including displacement activity) plus any multiplier effects.

Asset management

Asset Management has been dealt with in detail in Chapter 8. However, for completeness within option appraisal, in the situation where assets exist whether or not directly associated with the project, consideration needs to be given as to whether these can be surrendered, merged or modified to release value. With newly built assets, consideration has to be given to design, whole life cost, fitness for purpose, operational efficiency and the end-of-life costs as well as the initial impact of the capital payment. If a proposal involves the acquisition, management or disposal of legal rights in land and buildings, the value of those property rights needs to be taken into account, whether these are interests of freehold, leasehold, a licence or interests subsumed within any form of DBFO contract.

With new construction, the initial cost, the lifetime cost and residual value will need to be considered. Appraisals will be carried out by bringing the cash flows to a net present value or net present cost. The valuation of the site should include an assessment of the social costs and the benefits of any alternative use of the site, not just the market value.

Estimating the value of benefits and sacrifices

The purpose of valuing the benefits and sacrifices of options is to determine whether the benefits less the sacrifices are worth the costs. Most option appraisals will identify some sacrifices and benefits for which there is no readily available market data. In this situation revealed preference technique or stated preference technique can be applied to elicit values even though in some cases they may be subjective.

The revealed preference technique involves inferring a price revealed indirectly by examining consumers' behaviour in similar or related markets. The technique involves estimating 'willingness to pay' for a project's outcomes or service where 'willingness to pay' is based on the value placed by consumers on the additional element of the service. The level of additional payment is related to the consumer's income level and for this reason valuations are made based upon average income. For example, in a given community of 1000 households, 50% of households are willing to drive an average of 5 miles once per week to dispose of recyclable waste at a recycling centre. A kerbside collection available to all 1000 households once per 2 weeks will cost £750 per week. The 'willingness to pay' by the community is 500 households × 5 miles × £0.40 per mile = £1000 per week. The carbon saving is calculated at 0.1 tonne at £20 per tonne = £2 per week. The cost is therefore £750 per week and the benefit based on 'willingness to pay' is £1002 per week. Therefore, the project is beneficial.

Stated preference techniques are obtained by questionnaire and/or interview designed to elicit estimates of the 'willingness to pay' for a particular outcome. A typical question is 'what is the maximum amount you would be prepared to pay to receive a particular attribute or service?'

A variation of the 'willingness to pay' aspect of the stated preference technique is 'willingness to accept', which is based on the level of compensation a person or community is willing to accept for the imposition of a particular situation. A typical question is 'what level of compensation would a community consider equitable to accept wind turbines on neighbouring council owned land?' Willingness to accept is likely to refer to a sacrifice, which is added to the cost of the project in an option appraisal.

Unvalued costs and benefits

In the situation where data for an option appraisal is a mix of monetary values, quantified data and qualified data, weighting and scoring (sometimes called multicriteria analysis) can be used to bring data expressed in different units into the appraisal process. The approach involves an explicit relative weighting system to account for the differences in the expression of data relevant to the option appraisal decision. Research may be necessary to determine the best unit of measurement for application in a weighting and scoring system. Weighted scores are used to rank options according to factors that are thought important. While the factors can be listed by experts, the selection of appropriate factors and the scoring process will inevitably incorporate the judgment of stakeholders and decision makers. Weighting and scoring techniques are illustrated in the Toolbox.

Economic efficiency

Economic efficiency is achieved when:

- Additional output cannot be achieved without additional input.
- Production is at the lowest possible cost.
- No one can be made better off without someone else being made worse off; that is, there is just sufficient resource available to satisfy demand, if someone takes more than their fair share then there is insufficient to meet the demand of someone else.

Inefficiency occurs when somebody can be made better off without someone else being made worse off; that is, there is more than enough resources to satisfy demand. In the context of public services, 'non-rival' services are those where demand from one person does not affect use of the service by another person.

Similarly, inefficiency can occur in the provision of 'non-excludable' services, that is, those services that, when made available to one person, effectively become available to everyone. Many public services are undervalued in this situation because of a condition known as 'free-riding'. A new non-excludable service for which those that previously paid (or were willing to pay) that is subsequently made freely available to everyone effectively cause a subsidy (from a valuation perspective) to those that previously did not take advantage of the service. For example, in the collection of recyclable waste described earlier, it is stated that the cost of kerbside collection is £750 per week and the benefit based on 'willingness to pay' (by only 500 households) is £1002 per week. The project is beneficial even though 500 households are 'free-riding', that is, would be unwilling to pay. It could be argued that that the true value of the service to the 1000 households is £2004 per week and that the £750 per week figure should be compared to the £2004 per week figure.

Externalities

Externalities occur when a particular activity produces benefits or costs for activities that are not directly included in the cost of the project. For example, the requirement for gas heating a new school may tip the demand for gas beyond the gas infrastructure's ability to supply. A new gas main is installed by the gas company but the cost to the new school is only that of the standard gas connection charge. From the perspective of the school project the new gas main is an externality.

Adjustments to values of costs and benefits – Distributional analysis

For all Programmes and projects, a statement will be included (quantified if possible) describing the fairness of options and their social impacts on individuals according to their income, marital and family status, gender, ethnic group, age, geographical location, disability, and so on. It is presumed that the public sector will act in an environment of equality and any action that appears unequal will be redressed or the reasons for accepting the inequality are made explicit. As a minimum this requires appraisers to identify how the costs and benefits accrue to different groups in society. For example, investment in a nursery school will only benefit those with young children.

Additionality

A measure of the success of a public sector intervention is in producing a benefit in addition to the new or improved service provided. For example, a new service may result in increased employment opportunities. Furthermore, a note should be made in the option appraisal where public sector intervention results in a downturn in private or voluntary investment, for example, in a case where the new service to the whole community was previously provided by a private company or the voluntary sector, although not necessarily to the whole community.

Design quality

The design quality of all public sector building projects will be assessed during option appraisal by considering the costs and benefits of the design investment. Optional design solutions will be assessed on a whole life value basis.

Adjusting for relative price changes

The valuation of costs, sacrifices and benefits will be expressed in 'real' terms or 'constant prices', that is, at the current general price level as opposed to 'nominal prices' (those existing at the time of the future expenditure). In calculating the present value of future costs, all future costs will be discounted to today's value (present value) using the HM Treasury discount rate (3.5% as of January 2014). The effect of expected future inflation in the general price level is ignored.

Discounting is a technique used to compare costs and benefits that occur in different time periods. Society generally is assumed to prefer the receipt of goods and services sooner rather than later and to defer cost to future generations, a phenomenon known as social time preference. The social time preference rate is therefore the rate at which society values the present compared to the future (3.5% as of January 2014). The discount rate is valid for study periods of up to 30 years. Beyond 30 years the declining schedule of discount rates illustrated in TGB should be used. Unless taxation is known to affect the Programme or project options differently, taxation is assumed to affect all options in the same manner and is therefore ignored. VAT is always assumed to apply to all options in the same manner and therefore ignored.

Where particular prices for different options are expected to increase or decrease at significantly higher or lower rates than the general inflation rate, then this relative price change should be included in the calculation, such as the following:

- High-technology manufactured goods of equivalent performance tend to fall in real price terms.
- Fuel prices tend to react to the adequacy of supply against demand.
- Wages generally increase above general inflation due to productivity and efficiency gains.

Therefore, for example, in the comparison of the status quo and the cost of an installation of a high-technology heating control system to save fuel, changes in fuel price above inflation would be taken into account. It is helpful to consider whether the option benefit or sacrifice will change as income increases as this will affect calculations based on stated preference or revealed preference techniques. Assessments based on weighting and scoring techniques are less likely to be affected.

Developing and implementing the solution

Once an option has been selected, TGB states that it will need to be refined into a solution. If costs, sacrifices, benefits and risks have been robustly valued (using the methods described earlier including weighting and scoring methods) the option presenting best value for money will be the one offering the optimal combination of benefit, sacrifice and risk adjusted net present value. Weighting and scoring techniques are useful in comparing different options in terms of the same criteria. However, as scores are not expressed in monetary terms, judgment is required to compare the results of weighting and scoring with a cost–benefit or cost effectiveness analysis. The two analyses should complement each other and may indicate that a further analysis is required before a decision can be reached. Fully involving stakeholders is very important in making judgments between monetary to nonmonetary criteria. The logic supporting a decision to proceed with a particular option should be clear and explicitly recorded. The authors agree with this approach and promote value management as the appropriate methodology.

In selecting the best option, TGB suggests that 'payback period' should not be used as a decision criterion as it ignores the differences in values over time and periodic high-value maintenance. Similarly, the internal rate of return should be avoided as a decision criterion since it can rank options that are mutually exclusive. The authors do not agree with this point of view, which is discussed in the Section 10.4 on 'whole life costing'.

In support of the best option, a budget statement should be based on resource accounting and budgeting principles and show the resource costs over the lifetime of the proposal. A cash flow statement will demonstrate the additional cash required by the lead option if it goes ahead. A funding statement will show which internal department, partner or external organisation will provide the required resources. A statement of the contingency arrangements will ensure there is sufficient financial cover for risks and uncertainties.

Conclusion of HM Treasury Green Book review

Authors of VM/value engineering texts tend to major on the generation of options to satisfy the functional requirement and then pay scant attention to the deeper financial implications of option appraisal. The guidance incorporated into the HM Treasury Green Book is well respected and replicated in other public sector guidance documentation. However, TGB whilst offering a logical approach to option appraisal does not include a methodology for the logical development of options. The use of the techniques described in TGB within a value management methodology is clearly advantageous and, in the United Kingdom at least, results in an option appraisal method that is compliant with HM Treasury guidance. A principle of TGB is the use of a risk management approach to the evaluation of options, which is discussed in detail in Section 10.3.

10.3 Risk management

Definitions

Risk is commonly defined as being a hazard, the chance of an adverse event, bad consequence or loss, or the exposure to mischance. A risk event is defined as a situation in which:

- The nature of the risk can be identified,

- The probability of the risk event occurring can be established, and
- The cost consequences of the risk event occurring can be estimated.

Uncertainty is defined as the situation in which:

- The nature of the event can be established, but
- The probability of the event occurring cannot be established, and/or
- The cost consequences of the event cannot be estimated.

Risk and uncertainty therefore lie at either end of a continuum line that represents the accuracy of the estimates of probability and the cost consequences of the risky or uncertain event. Smith (1999) states that although it is accepted that risk and uncertainty have these different meanings, in terms of construction projects the distinction between the two terms is of little significance and the terms are used interchangeably.

Risk management

Risk management is the planned and systematic process of identifying, analysing and controlling the outcome of a particular event to achieve the planned objective and thereby maximise value in the project process. It is about proactively consulting with project stakeholders to understand the financial, physical, cultural and social dimensions and developing backup strategies in the case of the risk event occurring (Loosemore *et al.*, 2006). TGB includes risk management as a part of option appraisal to support better decision-making through a good understanding of the risks inherent in each option considered. The management of risk involves:

- Designing out risk
- Minimizing risk
- Accepting the risk of an event occurring in a form in which its occurrence is immediately recognized and responded to

The management of risk incorporates three distinct stages:

1. Risk identification
2. Risk analysis
3. Risk response

During option appraisal the choice of minimizing or accepting risk will require contingency to be added to the cost and/or time side of the time, cost and quality equation thereby recognizing the cost and time impact of maintaining quality. Time risks have a cost consequence and therefore it is this cost that is usually added to the contingency sum although time contingency can additionally be incorporated into the project programme/schedule. The three distinct stages of risk management are discussed next.

Risk identification

Risk identification can be undertaken by a facilitated team brainstorming risks associated with a particular solution evolved during the evaluation stage of a value study. Generally, these risks will fall under four headings, and are largely generic (HM Treasury, 2011) as illustrated in Table 10.1:

1. *Changes in project focus or scope:* This will result in a change to the project mission and could result from, for example, a future reorientation of the client's core business.
2. *Client changes:* These are brought about by unforeseen changes in the client organisation. However, client changes commonly result from poor communication structures leading to incorrect briefing of the project in the first place. The client change is generally not so much a genuine change as an unnecessarily expensive correction to the project's course to take account of factors that were known at the inception of the project, but, not communicated to the project team.
3. *Design changes:* These result from incomplete or an incorrect analysis of briefing data or the exposure to some unforeseen circumstance due to insufficient project/site investigation. For example, forming a doorway in a wall in a refurbishment project that was assumed to be plasterboard on a timber stud frame, but which when the plasterboard is removed reveals itself as plasterboard dry lining to a reinforced concrete structural wall.
4. *Changes in the project environment:* These changes are brought about by bad weather, non-delivery of materials, unavailability of labour, new legislation, planning restrictions, and so on.

Table 10.1 Generic risks.

Change in Project Focus and Scope	Changes in Project Environment
Availability risk Business risk Budget risk Demand risk Project data/intelligence risk Volume risk	Economic risk Environment/weather risk Legislative risk Residual value risk Standards/Code of Practice risk New pressure group risk Resource availability risk
Client Changes	**Design Changes**
Occupancy risk Operational risk Policy risk Decant risk Funding risk Affordability risk Reputational risk Personnel change risk	Project objectives risk Design and design coordination risk Planning risk Procurement risk Construction risk Maintenance risk Technology risk

Upon completion of risk brainstorming, some form of ranking exercise is undertaken to highlight, based upon the opinion of the team, those risks that have a high probability and a serious consequence. The consequence can be determined at five levels:

1. Insignificant irritating background interference that can easily be recognized and accommodated.
2. Minor disruption that can be anticipated, is plain to see and can be dealt with if it arises.
3. Moderate disruption or, turbulence in the project's progress (the project can continue but is severely disrupted).
4. Major disruption that could temporarily halt some operations.
5. Severe or a blocking force that is capable of halting the project until contained.

Probability can also be ranked in five steps from almost certain to very unlikely as illustrated in Table 10.2. A score attributed to consequence and probability can assist the decision-maker on whether to take the potential risk to the next stage of analysis. A traffic light system (red, amber, green) can further aid evaluation. Green being no action required other than being sensitized to the risk, amber may require action and red has to be fully evaluated.

Dallas (2006) concurs with the preceding points but makes the additional point that those risks identified through brainstorming that have a probability of 100%, that is, they are certain to happen, are issues and should be addressed in a similar way to risks. The authors agree that risks with a probability of 100% are issues, but they should be dealt as issues occurring in the issues analysis of a value management study and inform function analysis. Using the value management approach ensures all issues are addressed in the performance specification of the project. The management of issues is addressed in detail in Chapter 4.

Table 10.2 Risk ranking matrix.

Consequence	Weight (W)	Probability	Value (V)
Severe	10	Almost certain	10
Major	8	High	8
Moderate	5	As likely as not	5
Minor	2	Low	2
Insignificant	1	Very Unlikely	1
Consequence × Probability	**Score W × V**	**Traffic Lights Colour**	**Action**
	>6	Green	Note
	6–25	Amber	Take appropriate action
	<25	Red	Take extensive action to avoid

Risk analysis

The first stage in a risk analysis is normally qualitative. The following are analysed:

- A brief description of the risk event, the stage of the project when it could occur and the ownership of the associated risk.
- The factors that could cause it and the probability of those occurring.
- The extent to which the project will be affected.

The qualitative risk analysis may be considered sufficient and the action of undertaking it will sensitise the team towards the recognition of the risk and prompt an appropriate risk response in the event that it occurs. The team, however, may decide that a qualitative risk assessment is insufficient and require a quantitative risk assessment. This is an activity normally not carried out within a value workshop and it may be necessary to take this within the Action Plan, or adjourn the workshop at this point if the workshop cannot proceed having identified and made an attempt at qualitative assessment initially.

Quantitative risk analysis seeks to mathematically model the probability of the risk event occurring in two ways: objective risk analysis and subjective risk analysis. An objective risk is when the probability of the event occurring is known exactly, for example the loss of £10 relies on the flip of a coin landing tails up. The probability of this is 50%. A subjective risk is when the probability is not known exactly but can be estimated, for example, a loss of £10 relies on more than one hour of continuous rain next Thursday. While reference to weather data records will allow an assessment of the probability of continuous rain next Thursday, this cannot be relied on exactly. Quantitative risk analysis becomes mathematically complex when a number of risks are combined. Computer software is available for this situation to undertake Monte Carlo analysis, which is used to simulate many possible values of the input variables with weighted probabilities derived from data from prior projects or from properly structured opinion surveys. A distribution of values for total cost is calculated for each simulation with the generally accepted output being minimum, most likely, and maximum values. It should be emphasized that the results presented by the computer software are merely an aid to decision-making.

Risk response

At the end of the risk analysis exercise, the team will undertake a risk response by reducing the cause of risk in one of four ways:

1. To avoid the risk by undertaking that part of the project in a different manner.
2. To reduce the risk by taking action to lower the probability of the risk event occurring.
3. To transfer the risk to a third party, commonly an insurance company.
4. To accept the risk event will happen and manage its consequences. This is a valid course of action. If the risk event were to arise the team is sensitised to its recognition and mentally prepared for some form of action. This stage is characterised by continual reference back to the function analysis and particularly the client's project

value system. All decisions must accord with the functional requirements and fulfil the requirements of the client.

Risks register and action planning

The output of a risk management workshop is a risk register that summarises the deliberations of the team. A risk register or risk log is a necessary tool for the identification and quantification of risks pertaining to a proposed option. A risk register is a dynamic document, continually updated, that lists all the identified risks and the results of their analysis and evaluation at a particular point in time during project development. The risks register records the following:

- Risk reference number;
- Risk event type;
- Originator of the risk (if proposed outside of a formal risk management workshop);
- Date identified;
- Date last updated;
- Description of the risk;
- Expected impact and identity of the party suffering the consequence of the risk event,;
- The probability of the risk event occurrence;
- Interdependencies with other risks (concurrent, sequential or asynchronous);
- The person responsible for action to the next stage and date by which action is to be taken;
- The nature of the solution agreed to by the team including the time and/or cost contingency that is to be built into the project at this stage;
- Reversible or irreversible action. Irreversible action occurs where the implementation of a proposed solution to a potential risk rules out later investment opportunities or alternative uses of resources. Irreversible risk should be detailed in the option appraisal report; and
- Risk status and risk action status.

Summary of risk management

In summary, risk management involves the following:

- The support of effective decision making.
- Identifying possible risks in advance and putting mechanisms in place to minimise the likelihood of their materialising with adverse effects.
- Having processes in place to monitor risks and collating reliable up-to-date information about risks.
- Ensuring that the right balance of control is in place to mitigate the adverse consequences of identified risks should they materialise.
- Ensuring that all decision making processes are supported by a framework of risk analysis and evaluation.

Effective risk management is enhanced by the following:

- Consulting early.
- Avoiding irreversible decisions.
- Carrying out pilot studies and/or modelling.
- Building in flexibility from the start.
- Taking precautionary actions.
- Transferring risks through contract arrangements e.g. through insurance.
- Developing less risky options by, for example, making less use of leading edge technology.
- Reinstating or developing different options that are less risky.
- Abandoning the project because it is too risky.

The risk management approaches described in this section accords with the requirements of the TGB and reflects the description in the literature for example, Smith (1999), Flanagan and Norman (1993), Raftery (1994), and OGC (2007). The subject of contingency is similarly dealt with by all authors who refer to a risk allowance to cover the potential financial impact of the client's retained risk as detailed in the risk register. This is differentiated from the base estimate for the project. TGB introduces a further dimension to the financial contingency or risk allowance, which is termed optimism bias and discussed in the next section.

Optimism bias

The TGB states that there is a demonstrated, systematic tendency for those managing public sector projects to be overly optimistic in overstating project benefits, underestimating capital and operational costs, and understating the anticipated time required for the Programme or project. This can arise from such factors as the following:

- Poor definition of the scope and objectives of Programmes or projects in the business case.
- Poor identification of stakeholder requirements during strategic briefing and resulting in the omission of important elements during project costing.
- Poor management of Programmes or projects during initial stages resulting in nonadherence to time schedules and failure to mitigate identified risks.

To redress these perceived tendencies, business cases for public sector projects are to include a specified cost and time contingency uplift based on TGB optimism bias tables. The optimism bias (2014) for construction work is shown in Table 10.3.

In the opinion of the authors, this tendency for time overruns and difficulties in cost prediction in public sector projects is due to a characteristic complexity in the public sector stakeholder community and in many cases the acceptance of a long 'wish list' of requirements, which are often politically motivated. The authors were commissioned as

Table 10.3 TGB optimism bias table (HM Treasury, 2013).

Project Type	Optimism Bias (%)			
	Works Duration		Capital Expenditure	
	Upper	Lower	Upper	Lower
Standard buildings	4%	1%	24%	2%
Nonstandard buildings	39%	2%	51%	4%
Standard Civil Engineering	20%	1%	44%	3%
Nonstandard Civil Engineering	25%	3%	66%	6%

VSLs on a strategic briefing value management study for a project involving a number of public sector organisations and members of the voluntary sector. The study was commissioned because the project had stalled. Initial interviews of stakeholders revealed that each participant had a lever arch file full of identical memos and meeting minutes circulated amongst the project group during the previous 12 months. The comment made after the study by the project sponsor was:

> In one day we have completely understood the project, agreed its strategic mission and moved a huge distance in establishing the budgetary contribution of each stakeholder department, something we have not been able to do over the past 12 months.

It is the proper use of value and risk management that is important and not the allowance based on past time and cost performance of public sector projects.

In the opinion of the authors, optimism bias has another major disadvantage. The advantage of an optimism bias addition to the public sector treasury is the certainty that the projected out-turn cost will not be exceeded. The disadvantage is that the projected cost contains so much contingency that there is little incentive to aggressively manage value and risk to ensure value for money.

The second Forth Road Bridge in Scotland (Forth Replacement Crossing) is a project with potentially high risk and subject to the optimism bias addition. Transport Scotland (2009) reported the cost estimate at Q4 2006 prices (excluding inflation to out-turn prices and the cost of capital) in the scheme definition report of March 2009 as in Table 10.4. The estimate for inflation and finance to 2016 is stated as between £525 million and £1145 million.

News items widely reported the cost of the crossing at between £1.8 billion and £2.2 billion. The BBC (2013) reported ‘The Scottish Parliament passed, by majority, new legislation needed to build the £2 billion crossing, due for completion by 2016’. The expectation generally is that the crossing will cost £2 billion. However, the project has been subject to strict financial controls and value engineering by the project sponsor resulting in contracts, signed in 2011, for the main crossing, approach viaducts, connecting roads and intelligent transport system in the sum of £828.5 million. It could be argued that proper value and risk management is far preferable to an addition for optimism bias.

Table 10.4 Cost estimate of the Forth replacement crossing.

Element	£m
Main crossing, approach viaducts, all connecting roads and intelligent transport system.	777
Risk allowance	95
Optimism bias	178
Non-recoverable VAT	145
Total	£1195m
Inflation and finance to 2016 range	£525m to £1145m

Value and risk as a combined service

Weatherhead, Owen and Hall (2005) present a method of combining value and risk management as an iterative process of first considering the objectives of the project, seeking innovative solutions to the objectives and subsequently considering associated risks following a high-level judgment phase. In their opinion the method ensures that improvements brought about by value and risk management are simultaneously addressed. Focusing on the project objectives and achieving a balance between identified values and risks ensures an optimal design solution.

Dallas (2006) makes a strong case for integrating value and risk management using a common team, workshop structures and techniques. Dallas states that the processes:

- Are complementary, enabling each to augment the other.
- Require a deep understanding of the project, which is common to both value and risk management methods.
- Ensure good communication and embed knowledge in the design team and external stakeholders.
- Are characterized by good reporting methods, which aid management and audit procedures, and provide the basis for project learning and continuous improvement.

Dallas (2006) proposes that a risk review accompany every value management workshop, addressing and reminding the team of the key value drivers behind the project. The point is made that there is little point in spending time maximising value if risks are left unmanaged.

Whilst respecting this intertwining of value and risk it is noted that the risk management actions follow the value management actions. This is logical since although it is possible to build a risk profile of the corporate client in the context of attitudes towards risk, it is impossible to conduct risk management until a design or at least a concept exists. The design option or concept flows from the value management exercise. The authors recommend that value and risk are not so intertwined that the team is constantly flipping from value to risk to value but rather that a value study is completed to the evaluation stage before addressing the risks associated with each of the evaluated options. Risk management therefore slots in between evaluation and development. This approach means that risk management is not an intervention into the smooth running of a value management workshop but occurs after, perhaps days or weeks after, and not necessarily involving all the stakeholders who have participated in the value study.

Conclusion of risk management

Risk management is a fundamental part of Programme and project management, which begins when an idea is translated into a conceptual or technical solution. As soon as a particular event is definable, the planned and systematic process of identifying, analysing and controlling the risks to achieve the planned objective becomes practical. TGB includes risk management as a part of option appraisal. The risk management solutions will involve eliminating the risk by changing the design or methodology and minimizing the risk or accepting the risk in a manageable form. During option appraisal the choice of minimizing or accepting risk will require contingency to be added to the cost and/or time side of the time, cost and quality equation thereby recognizing the cost and time impact of maintaining quality. HM Treasury requires an optimism bias addition to projects to be added to cover the cost and time overrun. While this reflects the inadequacies of proper value and risk management of projects in the past, the authors argue that optimism bias could be eliminated if proper value and risk management procedures are adhered to.

That proper value and risk management procedures aid effective and efficient project management is indisputable. However, notwithstanding the commonality of value and risk in the issues analysis and functional performance specification stages the authors are of the opinion that risk analysis should follow the completion of a value management evaluation and not be incorporated into a common value and risk study that expects workshop attendees to flip/flop between thinking first positively of value then negatively of risk.

10.4 Whole life cost

Throughout this section extensive reference will be made to the BCIS/BSI (2008) publication PD156865 *Standardized Method of Life Cycle Costing for Construction Procurement: a supplement to BS ISO 15686-5 Buildings & constructed assets – Service Life Planning – Part 5: Life cycle costing.* The document will be referred to in this section as SMLCC.

Clause 1.7 of SMLCC defines life cycle costing (LCC) as ‘an economic evaluation method that takes account of all relevant costs over the defined time horizon (period of study), including adjusting for the time value of money’. This definition could equally apply to whole life costing or WLC. The difference between LCC and WLC is that LCC is focused only on the construction, maintenance, operation and disposal of the asset, whereas WLC will additionally include client and user costs such as project financing and occupancy costs. In this section the term WLC will be used but the same rules and procedures apply equally to LCC.

Whole life costing is comprised of three basic steps: analysis of the problem to be examined, structuring and undertaking the mathematics, and interpreting the results.

The most difficult parts are the first and last stages. There are two primary reasons for undertaking a WLC study:

- A study to predict a cash flow(s) over a fixed period of time for budgeting, cost planning, cost reconciliation and audit purposes.
- A study as part of an option appraisal exercise or tender appraisal exercise conducted in a manner that allows direct comparison. This is the approach envisaged in HM TGB.

Whole life costing cash flow predictions facilitate the analysis of an expenditure profile over the study period using nominal costs, that is, those that have been adjusted for inflation, deflation and estimated efficiency or technological change. WLC option appraisal exercises require that all future costs are discounted to a comparable time base thus ensuring that comparisons are made on a like-for-like basis. This section will discuss the relevant costs, the notion of time, data gathering and the principles of discounting.

The base case

In option appraisal, TGB recommends the use of a base case against which comparisons can be made. The base case arises in two situations:

- The project under investigation involves a study of optional improvements to an existing situation that is performing adequately. A common example is the retro-fitting of insulation to save energy. The existing building is performing adequately but a project has been instigated to determine whether it is economically viable to install insulation to improve performance. In this case the existing situation is the base case.
- The project under investigation has a number of identified options one of which (usually the lowest capital cost option) is chosen as a base case against which other options may be compared.

The levels of study

A WLC study can take place at a number of levels and described in SMLCC (clause 2.9) as follows:

- Multiple assets or portfolio/estate level.
- Single asset or whole building level.
- Cluster level. A cluster is a number of elements combined on the basis of a common function or combined on the basis of a work package for contracting purposes, for example, the total weather-shield of a building (walls, roof, windows and doors).
- Element level. An element is defined as a part of construction that performs the same function irrespective of the components from which it is made, for example, internal walls.

- System level. A system is a number of identified discrete components combined to form a mechanism to perform a single function or a number of functions of a similar nature, for example, a central heating system.
- Component level. A component is defined as a single manufactured product installed in a single operation, which can be described by its manufactured part number or by its physical characteristics and function, for example, a pump in a central heating system.

Whole life cost studies can be undertaken at any level. Higher level studies may contain studies undertaken at a lower level, for example, a whole building study may be a summation of elemental whole life costs.

Relevant costs

SMLCC defines the costs relevant to a WLC study as follows:

- Capital Costs including construction works costs, fees and statutory charges, site costs, finance charges and development grants.
- Through-Life Costs comprising the following:
  - Maintenance and redecoration
  - Cleaning
  - Energy
  - Property management
  - Waste Management
  - Occupancy costs (security, switchboard, ICT, laundry, car parking, etc.)
  - End of life costs (disposal, dilapidations, demolition, etc.)
  - Non-construction costs (financing charges, leases, rents, taxes, etc.).
  - Income (rent and service charge payments)
  - Externalities (costs associated with the asset but not born by the client and therefore not part of the construction or facilities management transaction costs – see discussion under TGB)

Some costs are not relevant and are not accounted for in the calculation. These costs are either trivial in amount or do not affect the decision. The latter are those that are 'sunk', that is, the client has already expended money or is irrevocably committed, or the cost is 'unchanged', for example, if carrying out a project comparing double glazing with single glazing then it is not necessary to take account of window cleaning costs. Similarly, if rates or insurance are assessed on a per square meter basis then they can be excluded from decisions unless undertaking an option appraisal of solutions of differing areas.

Period of study

Rules relate to the period of study and must be observed in the undertaking of any form of whole life cost study:

- The time interval used for the study. This may be any unit of time measurement (day, week, month, year). However, in the calculations the time period and interest rate per time period must be synchronised. Commonly, the period of study is defined in terms of years although exceptionally it may be months.

- In option appraisal a base date year is established. This is the date from which all future spend is discounted (adjusted for the time value of money) and is the same date for all options being considered.
- The period of study is the period over which the cost of the component, system, element, cluster, building or asset portfolio is being operationally assessed. It should be noted that capital spend, although obviously included in the WLC assessment, commonly occurs during the time period preceding the defined period of study; that is, capital spend generally occurs before the base date year and operational spend occurs after the base date year. The period of study commences at the base date year. Therefore, if the base date year were 2014 then the capital spend will be generally assumed to have been incurred prior to 2014 and a 25 year period of study would end in 2039. In option appraisal studies the period of study is the same for all options being considered notwithstanding that some components for some options will fail and be replaced during the period.

Discussions of WLC are characterised by the debate over what is an appropriate maximum period to undertake the calculations. There has been no resolution to the debate, although some have advocated 30 years as a realistic limit on the basis that the future is difficult to predict at 30 years out without going beyond this. For illustration, it is useful to reflect on what was not invented, in common use, or part of the social culture; 30 years ago (1984) for example, the Internet, Social Media and other IT systems, the common use of microsurgery, concern for the environment, effective insulation of buildings, style of supermarkets and globalisation of commodities. All of these have an impact on modern commercial and public buildings. In the public sector the use of the standard HM Treasury discount rate (discussed in the previous section) is restricted to calculations for up to 30 years. Clearly, buildings and building components commonly last longer than 30 years and the way to deal with this is described later.

Cluster, element, system and component studies

Option appraisal at the cluster, element, system and component levels are commonly of alternatives that satisfy the functional requirement under consideration. For example, the heat source for a central heating system may be powered by gas, oil, electricity, solid fuel or alternative energy. An option appraisal will consider the whole life cost of the capital installation, maintenance and energy costs over a period of time. As stated earlier, the base date year and the period of study will be the same for each option being considered.

Clearly, various components of the alternative systems will fail at different points in time. This means that at the end of the study there will be differing residual values remaining in the options under consideration and is discussed later.

Whole building and asset management studies

The period of the study for the option appraisal of a whole building(s) will be determined by the client. The time interest of a client may be judged in a variety of ways including the length of a DBFO concession, the length of a lease, the anticipated functional life of a whole building, and time to first refurbishment. In 1986, the Quantity Surveyors Division of the Royal Institution of Chartered Surveyors (RICS) produced a guide (RICS, 1986) that defines the length of time during which the building satisfies specific requirements described as follows:

- Economic life – A period of occupation that is considered to be the least-cost option to satisfy a required functional objective.
- Functional life – The period until a building ceases to function for the same purpose as that for which it was built.
- Legal life – The life of a building, or an element of a building until the time when it no longer satisfies legal or statutory requirements.
- Physical life – Life of a building or an element of a building to the time when physical collapse or failure is possible.
- Social life – Life of a building until the time when human desire dictates replacement for reasons other than economic considerations.
- Technological life – Life of a building or an element until it is no longer technically superior to alternatives.

However, in the majority of studies the study period will be less than any of the periods just described.

The base date year, as defined earlier, simplistically sets the date when all capital expenditure is complete and revenue expenditure commences. For example, consider the comparison between a traditionally procured project and one procured under a DBFO arrangement. In a traditionally procured project the investor will be expending money on fees and construction long before the project is ready for use and provides service. In a project procured under a DBFO arrangement there is no capital spend by the client and revenue expenditure starts when service is provided. Therefore, in the option appraisal of the procurement of a project under these two systems it is logical to assume a base date of 'ready for use' in both instances. It is recommended that for all comparative calculations of entire buildings the base date is the point where service is provided. Therefore, all expenditure on fees, construction, financing, and all overhead charges from the commencement of the project until service is provided are added together and treated as capital expenditure. Revenue expenditure commences when service is provided. This treatment of the base date year for comparative costing will permit like-for-like comparisons to be made (Figure 10.1).

This simplistic explanation of the base date year for whole building option appraisal is valid for the situation where options for the delivery of the project take approximately the same time and therefore all options have the same ready for use date. In the situation where options for the delivery of the project take differing periods of time and therefore have differing ready for use dates, then the option having the earliest ready for use date, defined by TGB as the base case, sets the base date year. This means that some options

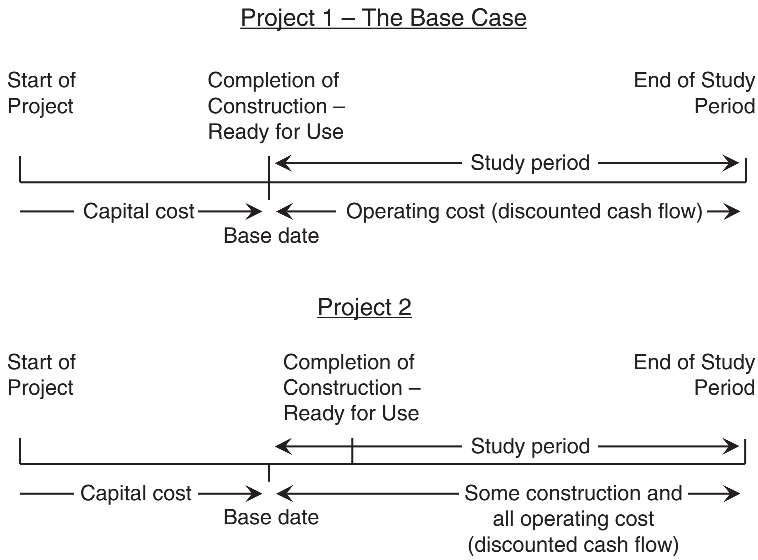

Figure 10.1 Common base date and study period for projects with different 'ready for use' dates.

will have the base date year set during the construction period and well before their ready for use date meaning, that some capital spend will be treated as part of the discounted cash flow. This concept is illustrated in Fig. 10.1.

Real and nominal costs

There are two primary reasons for undertaking a WLC study: cash flow prediction or option appraisal. A cash flow prediction requires an estimate of the relevant costs over the length of the study period adjusted for inflation, deflation and the estimated efficiency or technological change that may occur during the study period. Clearly, as the study period lengthens these predictions become more difficult to make. However, the establishment of a cash flow forecast with costs adjusted allows the forecast to be revisited and fine-tuned on a regular basis such that the forecast is always the most accurate prediction. Such forecasts are slightly easier if it is established that technological and organisational change can be ignored as is the case in most DBFO contractual arrangements that include hard and soft facilities management. This approach assumes the facility provided on the base date will be maintained and operated in the same manner throughout the concession period. The adjustment of cash flow costs for inflation, deflation and estimated efficiency or technological change results in a cash flow of amounts that are expected to be paid in the future. These future costs are referred to as nominal costs as they are the best estimate of what will be incurred when paid.

Real costs are those costs current at the base date. These costs can be considered in two parts, the capital costs being all relevant costs incurred before the base date, and through-life costs being all relevant costs incurred after the base date and during the study period. Discounting is the process used to bring all future costs to a value at the base date and can be undertaken in two ways, annual equivalent and present value. Bringing the capital costs and through-life costs to a value at the base date allows options that have differing capital costs and through-life cost spend profiles to be directly compared.

Annual equivalent and present value

Annual equivalent

Annual equivalent is easiest thought of as the loss suffered by investing a sum of money in a building rather than a bank. The annual cost of investing in a building is the interest that would have been gained and expended per annum were the money to have been put on deposit in a bank. Therefore, if the spend on a building is £300 000 and interest is at 4% then there is a theoretical loss of £12 000 per annum.

The problem with investing in a building rather than investing with a bank is that at the end of the building's life all that is left is a crumbling ruin whereas if the money was invested in the bank the money is still there. Therefore, the loss is greater than £12 000 per annum. It is £12 000 per annum plus the amount that would need to be invested each year to replace the £300 000 at the end of the life of the building. This accumulating amount is termed a sinking fund.

The advantage of using the annual equivalent method is that once the relevant capital costs have been reverted to an annual equivalent, then the real value (i.e. present day value) of annual through-life cost spend for a single year can be added to the annual equivalent without adjustment to realise a real annual equivalent spend for a single year. The annual equivalent method is useful for comparing options with a consistent annual through-life cost spend. However, this method does not deal simply with expenditure that is not on an annual basis, for example, repainting every 5 years, and therefore the use of the annual equivalent method in construction option appraisal is rare.

Present value

Present Value represents the relevant capital costs accrued at the base date plus the theoretical amount of the investment required to be made into a bank on the base date, at a given rate of interest, to pay for all future revenue costs. The sum to be theoretically invested will be less than the total of all relevant future costs because the sum will attract interest until the time when it is spent. This assumes that when the final payment is made at the end of the study period the bank account stands at zero. This discounting exercise to bring all future spends to a total real value at the base date is termed the Present Value method. The present value method manages irregular future spend in a straightforward manner and therefore is the method most suitable for construction option appraisal and tender comparison exercises. The present value method is the method used in the remainder of this section.

The discount rate

The discount rate is the interest rate used in a present value calculation to bring future costs to their real value on the base date. This answers the theoretical question 'how much do I need to deposit in the bank today at a given interest rate to accumulate a sum that equates to the amount I need to spend on a future date?' The illustration of the bank, whilst theoretically correct, is simplistic as it is highly unlikely that an actual amount will be put on deposit. Furthermore, the question ignores the impact of inflation.

For public sector projects, option appraisal is based on the HM Treasury prescribed discount rate, which at the time of writing (January 2014) is 3.5%. Whilst it would be incorrect to say that this rate is net of inflation, it does not need to be adjusted for inflation. The prescribed discount rate is suitable for all study periods up to 30 years.

For private sector projects, option appraisal is based on one of two approaches to determine the discount rate:

1. The adjustment of a bank interest rate or bond rate by the anticipated inflation rate, or
2. Determining from the client the real opportunity cost of capital.

With respect to the first approach it is worth noting that at the time of writing (January 2014) the Bank of England Bank Rate is 0.5% and the inflation rate target is 2%. If a discount rate were to be based on these rates then the discount rate would be negative implying that the present value needs to be higher than a future cost. In the current financial climate it is better to use a bond rate or a bank loan rate to adjust for inflation. If the future reflects the recent past then discount rates based upon bonds or bank loan rate adjusted for the inflation rate are likely to stabilise between 2 and 4.5%.

In the second approach, the real opportunity cost of capital is the real rate of return available on the best investment available to the client. Therefore, if £1000 would earn £300 in 1 year if invested in a particular manner then the opportunity cost of that £1000 is 30%. The real opportunity cost of capital can only be determined by reference to the client and if it is significant may result in this rate being used as the discount rate. The question that should be asked of the client is 'if you were to invest £1 in your organisational activity rather than, say, in increased insulation then what would that £1 earn?' If the answer is that the £1 would earn £0.16 then 16% may be the discount rate for judging whether increased insulation is worthwhile when measured against energy savings. This of course ignores the client's project value system with regard to, say, the client's 'green' agenda.

In summary, if undertaking option appraisal on a public sector project then the HM Treasury prescribed discount rate applies. If undertaking option appraisal for a private sector client then the client or the client's financial advisers should be involved in the selection of an appropriate discount rate. Private sector option appraisal studies should be tested for the sensitivity of the result to variances in the discount rate. In the evaluation of tenders on a WLC basis the method of evaluation and the discount rate to be used must be advertised to the tenderers in the tender invitation.

Residual and terminal values

An option appraisal study over a given period of time will include elements and components that will need to be replaced during the study period and include elements and components that have remaining utility at the end of the study period.

Components replaced during the option appraisal study period may have recycling or scrap value, which is termed the terminal value and is included as a credit in the WLC calculation. However, if the element or component is replaced then it is probable that the total cost of replacement will include the terminal credit for the replaced item and therefore the terminal credit will not appear as a separate item in the calculation.

Components that have remaining life or utility at the end of the option appraisal study period should be credited with that value. This is termed the residual value. It should be noted that credits for residual values only apply to option appraisal exercises where the aim is to compare options on a like-for-like basis. A prediction of a cash flow will rarely require the expression of residual values since the focus of the cash flow is on spend on a single option.

In considering an entire building option appraisal only those components that have a life less than the prescribed building life should be subject to a residual value calculation. Simplistically, these are the elements and components that wear out, for example, floor, wall and ceiling finishings, doors and windows, fittings and fixtures, heating and ventilation equipment. Those elements and components that have a life equal to the prescribed building life should be ignored, for example, foundations, frame, external wall, roofs, stairs and internal walls. Clearly, some elements such as the external wall and roof will require maintenance and this will be accounted for in the option appraisal calculation. However, they will not be replaced in their entirety in the same way as a failed heating pump.

There are different financial accounting methods for dealing with the residual values; however, in option appraisal the straight line method of depreciation is most commonly used.

The calculation

An illustration of the method for undertaking a whole life cost calculation is beyond the scope of this book and readers are referred to Flanagan and Norman (1983), Flanagan *et al.* (1989), Flanagan and Jewel (2005), Boussabaine and Kirkham (2004), Kelly and Hunter (2009), Kishk *et al.* (2003), OGC (2003,) and RICS (1986). For those seeking further practical help, the Society of Construction and Quantity Surveyors in the Public Sector (SCQS, 2013) has an online training course. For an encyclopaedic work see Ruegg and Marshall (1990).

Presentation of whole life costs results

The least useful presentation to a client is pages of spreadsheet output. The challenge is to correctly interpret the results from the calculations and give the client a summary of the key outputs. For an option appraisal these may include the capital cost and the net present value of the whole life cost. If there is an identified base case (recommended) then further information can be given with reference to the base case, for example, net savings, savings to investment ratio, internal rate of return, payback and discounted payback. Ruegg and Marshall (1990) discuss various decision techniques including the use of risk adjusted discount rates. A certain amount of care needs to be taken in reporting any of the figures. TGB suggests that 'payback period' should not be used as a decision criterion as it ignores the differences in values over time and periodic high value maintenance. Certainly for example, reporting a payback in year 7 ignoring a massive investment required in year 8 is unhelpful, but to rule out a technique on the basis that it may be improperly applied is not useful. Similarly, the comment with regard to avoiding the use of internal rate of return on the basis that it can rank options that are mutually exclusive is unhelpful. Clearly, options to different problems will not be reported simultaneously.

All results from a WLC exercise will be reported with an adequate amount of explanatory text that is interpretive of the calculations.

Summary of whole life costing

There are two primary reasons for undertaking a WLC study:

- A study to predict a cash flow(s) over a fixed period of time for budgeting, cost planning, cost reconciliation and audit purposes.
- A study as part of an option appraisal exercise or tender appraisal exercise conducted in a manner that allows direct comparison. This is the approach envisaged by TGB.

Whole life cost cash flow predictions facilitate the analysis of an expenditure profile over the study period using nominal costs, that is, those that have been adjusted for inflation, deflation and estimated efficiency or technological change. WLC option appraisal exercises require that all future costs are discounted to a comparable time base thus ensuring that comparisons are made on a like-for-like basis. This section has described a logical method to achieve the two approaches.

Until SMLCC was published in 2008 the rules for comparative exercises, such as option appraisal, were included in each WLC report. Now, it is simple to refer to SMLCC. Provided SMLCC and the guidance contained in this section are followed, reliable and repeatable option appraisal evaluations can be undertaken. WLC is an invaluable and indispensable tool in every VSL's toolbox. As in the case of risk management, WLC exercises on options generated in value studies can be time consuming and best undertaken following a value workshop. This approach is illustrated in the following case study.

10.5 Case study: Forming a new academic department from the amalgamation of identical departments of two academic institutions

The study was undertaken by the authors as an option appraisal for two educational institutions to amalgamate their complimentary departments. The purpose of the proposal was for one of the institutions to take over the overall operation of the amalgamated department and thus generate a larger single department with associated overall savings in operational costs to deliver a combined academic vision to secure its future in a very competitive market. The educational funding body was supportive of the proposal.

The study took place over a 5 month period. The primary project value driver was the need to save in operational costs while securing and building upon a leading position in the academic field for the department concerned, and its faculty. The key issues for the study were as follows:

- The delivery of the future vision for the combined department by creating and raising synergies and raise the position of the department to meet international competition.
- Other aspects of the vision for the project were to improve cultural outreach and deliver interinstitutional co-operation.
- The integration of both departments into the one institution.
- The relative size of the student cohorts in both institutions and the future increasing student profile to meet the vision of the department.
- The available built space within both Institutions.
- The need to rationalise space within both Institutions and the desire not to increase the size of the estate.

The purpose of the study was to explore the available estate options that could satisfy the academic vision for the project.

Study design

The objectives of the study were as follows:

- Establish and reconcile the strategic requirements of the departmental amalgamation, some of which were conflicting, and the implications for the tactical delivery for both institutions and departments.
- Establish the transition strategies, work flow patterns and user requirements to ensure that existing and future operational disruptions were kept to a minimum.
- Generate options for co-locating the departments, undertake full option appraisal to highlight options that deliver the best value in terms of benefit and cost for the new department and for both institutions.
- Develop a strategy for the tactical aspects associated with transition including the ideal user workflows and patterns, logistics management of the move from the various existing sites/buildings into a single new location or locations in a planned and logical manner.

The study addressed key issues before, during and after the co-location from each existing location and the new location(s) in order to meet the requirements of the departments to avoid or reduce any disruption to an absolute minimum. In addition the comparative strategic and tactical risks associated with each location option were identified and utilised in the option appraisal. The study included a financial capital and whole life cost model for each option with a discounted cash flow identifying which option delivers the best value through a net present value comparison. Various sensitivities were applied to these models to test their robustness.

Orientation and Diagnostics phase

Before the structured workshops an information gathering process was carried out as follows:

- Meetings with the steering group including key stakeholders were held to discuss the scope of work and identify primary objectives and identify other stakeholders for interview.
- Existing accommodation was visited, its condition noted and an assessment made of possible options.
- Interviews were undertaken with identified stakeholders.
- All available relevant documents were studied.
- The information gained was analysed and an agenda prepared for the two structured workshops.

Workshop planning

The first of two value workshops concentrated on the academic vision, stakeholder issues, transition strategy, workflows and work pattern analysis. This was followed by option appraisal work notably risk management and whole life costs of the options generated during workshop 1. The second workshop focused on the option appraisal work. A value and risk management framework was applied using a tailored workshop process, complemented by analytical tools and techniques.

Value workshop 1

The first workshop focused on the strategic requirement making explicit the Business Project and Vision using Function Analysis and Function Analysis System Technique (FAST), the establishment of new working patterns and strategic opportunities through greater potential for multidisciplinary collaboration, ensuring both Institutions remain at the forefront of their subject. This included fully understanding the following:

- The strategy of both Institutions and departments and how these strategies are integrated and translated into organisational and technological changes during different time periods.
- The extent to which strategic needs and their consequent requirements are firm or uncertain.
- The demands for space made by each strategy.
- The current and future developments in research and teaching, how these will change over time and the consequent impact on the management and administration of the combined department.

- The establishment with stakeholders of the client's project value system and weighting for option appraisal activity.
- The opportunities for potential for growth and accommodation of future collaborative partners.
- Any risks including constraints and opportunities.
- A number of site options were generated each with a number of suboptions following the function analysis of the issues arising from all those just listed.

Post workshop 1 development work

The period of development work included the following:

- Analysis of floor areas required together with consideration of growth and future collaborative partners.
- Analysis of potential floor areas of each site option and preparation of a draft floor area comparison of the options including estate efficiency opportunities.
- Analysis and financial assessments based on existing condition surveys, construction and whole life costs and disposal values where appropriate.
- Investigation of land ownership and planning restrictions.
- Analysis of the whole life cost models.
- Analysis of the logistics and Programme implications for each option.
- Analysis of the information generated in workshop 1 and preparation of the agenda for the second structured workshop.

Value workshop 2

The second workshop focused on considering how each option fitted strategically with the requirements identified by the departments in the first workshop and also the technical aspects and information prepared and analysed between the workshops in relation to the options available. The second workshop addressed the following:

- The consideration of the various options set against the strategic and future requirements of the departments.
- A critical analysis of the development work done between workshops to generate the option appraisal models.
- Accommodation and organisational synergies and potential efficiencies engendered through the co-location options.
- Confirmation of the key criteria for judging the options to be considered.
- Agreeing the short list of options by relating them to strategic requirements, whole life costs and benefits identified in the first workshop.
- Exploring the technical aspects and analysis associated with the options.
- Confirming the key risks associated with each option.
- Identification of the preferred option.

The study was conducted and the workshops managed and facilitated by two VSLs who possessed complementary skills in business management, the academic environment and in construction capital and whole life cost management.

Implementation phase

Following the workshops a report was prepared that detailed the various options considered and identified the preferred option with key recommendations. A review meeting was held with the steering group to present the findings of the report, and outline the various options and their consequence including the preferred option.

The tools and techniques adopted in the study

The value study used the following tools and techniques:

- Interviews. Used to gather information from key stakeholders in both departments in both Institutions. The information spanned views on key strategic direction to detailed information on student and staff numbers and information regarding the condition of parts of the estate.
- Issues generation and analysis.
- Presentation techniques were used to impart information gained before the first workshop and at the second workshop to present the analysis of material made between the two workshops.
- Function analysis to confirm and structure the academic vision.
- Ideas generation on options; consolidated into 12 estate options.
- The use of weighted criterion scoring matrices to determine the relative merits of each option.
- The use of Strengths, Weaknesses, Opportunities and Threats technique to analyse the relative criteria of each estate's option.
- The use of consultancy analysis of the information gained to establish the physical size of the combined department and how this could be applied to each option location. This information also was used in identifying the estate efficiency that could be gained.
- The use of whole life cost models to determine the comparative operational and maintenance cost associated with each option.
- Standard option appraisal techniques to determine an NPV of each estate option.
- The use of comparative risk analysis to compare the relative risks across all options, and also linked to the FAST diagram.

The use of function analysis

Function analysis was used with the workshop team during the first workshop to analyse the academic vision of the combined department. The restructuring of the academic vision using function analysis was an important and useful tool in enabling a discussion on the needs and wants. This ensured that the estate options concentrated on academic needs. Functions from the function analysis were used in the weighted criterion scoring matrix later in the study to provide an input in the evaluation of options.

Teams, dynamics and stakeholder management during the study

The study attracted a large number of stakeholders within both educational institutions. The stakeholders most involved included the senior management in each institution, the heads of departments and their senior academic staff, together with the academic administration of both departments and the estates and buildings department in both institutions.

The VSLs identified initially the stakeholders to be interviewed, after which the workshop value teams were identified. Establishing a schedule of dates for the study was a challenge as the workshops involved senior people with full diaries. Due to the number of academic stakeholders a meeting was held with all academics from both departments. This had the advantage of generating a discussion on key issues, which was very useful. It was recognised that this approach worked with a group of academics used to making their views heard in a public forum but still had the disadvantage that some confidential material that may be gained in interview was probably withheld.

In addition to the VSLs, the consultancy team also included the services of an experienced architect who had detailed knowledge of the high-level project briefing process. The architect's spatial analysis and expertise applied to the study was an essential part of its success.

Other consultancy advice was taken from an expert in data analysis and the use of NPV calculations and associated Savings to Investment Ratios and Internal Rate of Return analysis.

The workshop team dynamic worked well even though the workshops were attended by varying grades of management. The workshop attendees were chosen for their expertise to discuss the key issues explored at each workshop. In some cases the same people attended both value workshops and this helped to give the study continuity.

The outcomes and benefits of the study

The outcome of the study was a report on the various estate options available to address the whole academic vision and other estate, cost and Programme drivers from the proposed department amalgamation. The options were fully analysed and ranked against the academic vision criteria, business fit, area fit, estate efficiencies gained, the comparative risks of each option and the cost criteria. The result was a preferred option that was recommended for adoption.

The benefits of the study were as follows:

- A rigorous value approach was adopted that kept the academic vision at the forefront in the study. The use of functional analysis was a key tool in delivering this benefit.
- The stakeholders were fully involved in the process. This was perhaps the greatest advantage of adopting a value study methodology where implementation of study outcomes can best be assured.

- Transition strategies were established for each option and this was essential in identifying how business continuity would be maintained in both institutions during the change process.
- The choice of study value team including the consultants involved was crucial to its success.
- The study delivered a preferred option that delivered the value criteria identified by the institutions in academic, estate and cost efficiency terms.
- An embryo risk register was generated.

Lessons learnt

The main lessons learnt for this study were as follows:

- Careful consideration and planning of the study at the value study bid stage established a methodology that was thorough and rigorous. This was recognised by the commissioning client.
- The application of the right skills required by the study was essential.
- The value study approach based on the value management Work Plan involved the client body closely and helped in the ongoing implementation of the study result.
- The value study framework and methodology can be used to great advantage in complex business change and asset management projects.
- The client required an option appraisal compliant with HM Treasury Green Book and this was delivered through a comprehensive value study.

10.6 Conclusion

This chapter has relied heavily on the requirements of the HM Treasury 'Green Book', Appraisal and Evaluation in Central Government. The chapter could therefore be criticised from the perspective that the option appraisal methodology is heavily public sector orientated. This criticism is countered by reiterating that the TGB presents a generically sound approach to option appraisal and is equally applicable to the public and private sectors. However, the TGB whilst offering a coherent approach to option appraisal does not include a methodology for the development of options. A value study using the logic described in TGB is clearly advantageous and, in the United Kingdom at least, results in an option appraisal method that is compliant with HM Treasury guidance and related best practice.

The business case development and option appraisal process mirrors exactly the logic of value management described in this book. Option appraisal requires the identification and evaluation of alternative technical solutions that meet the functional requirement. The focus of the current TGB is on the quantification of the costs and benefits to determine a measure of value as described in Section 10.2 of this chapter.

Section 10.3 describes risk management and discusses the place of risk management within a value study. Risk management is the planned and systematic process of identifying, analysing and controlling the outcome of a particular event to achieve the planned objective and thereby maximise value in the project process. TGB includes risk management as a part of option appraisal to support better decision-making through a good understanding of the risks inherent in each option considered. Risk management incorporates three distinct stages; risk identification, risk analysis and risk response. Risks are not able to be identified until a concept or design is available, and it is this indisputable fact that puts risk management as an activity that follows the evaluation stage of a value study. However, as argued at length in Section 10.3, the proper management of value and risk is a far preferable approach to the added contingency required of an optimism bias approach.

Section 10.4 discusses the reason for, and processes involved in, undertaking a WLC study. There are two reasons for undertaking a WLC study: to predict a cash flow for budgeting, cost planning, cost reconciliation and audit purposes, or as part of an option appraisal exercise or tender appraisal exercise conducted in a manner that allows direct comparison. There are three activities involved in WLC: analysis of the problem to be examined, structuring and undertaking the mathematics, and interpreting the results. Risk management also has a three-step approach: identification of the risk, structuring the evaluation and making a management response to the results of the evaluation. In both, it is the first and last stages that are most difficult. In both, the difficult part is understanding and structuring the problem and responding to the results of a qualitative or quantitative assessment. In both, the mathematics are generally straightforward.

Section 10.5 illustrates the previous three sections with a case study. The lessons learned from this study included the benefit of submitting a value study bid to a client who was knowledgeable and able to recognise a value methodology that was thorough and rigorous. Needless to say this was not the cheapest bid. The client required an option appraisal compliant with HM Treasury Green Book and this was delivered through a comprehensive value study. It is unfortunate that this approach to complex business restructuring is not recognised more universally.

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Part IV
Developments in Value Thinking

The early value analysis studies undertaken by an in-house team on a manufactured product in production regarded value as being achieved when the necessary functions in the production of the product were provided at the least cost without compromising quality. This definition carried forward into the majority of value engineering and early value management texts, which regarded value as a relationship between function and cost. Later value management texts increasingly regarded value as a relationship between function, cost, time and quality where quality was as much to do with the culture and excellence of organisations as it was to do with the performance and 'defects free' aspects of a product. During the past decade these factors have led to research into 'what exactly is of value?' Additionally, influential public sector and industry reports have testified to the necessity to provide whole-life value defining the concept but not the methodology.

Chapter 11 critiques the existing representations of project value as part of the theoretical discourse on the subjects of value and quality. Chapter 11 continues the dialogue began in Chapter 9 on organisational values to explore the relationships between the value systems of the client organisation (which stems from within the Organisational Value Chain) and the value system of a construction project specified by the client organisation (which stems from within the Organisational Project Value System). This has led to an understanding of organisational values, and the client's value system that governs the client's core business both from the perspective of the core business supply chain and the core business product. The commissioning client of a construction project establishes a special temporary supply chain and a value system reliant on, but different to the client's value system. This realisation led to the development of a technique, the client's project value system matrix, to uniquely identify the value system of the project enterprise. It is further recognised that the client's project value system may be impacted by the design and construction team and its specialist supply chain resulting ultimately in a project value system. The degree of impact is a choice made by the client either knowingly or unknowingly. This unique value

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structuring of construction projects is illustrated by two case studies and further discussion, with conclusions drawn.

In Chapter 12 whole-life value is defined as a systems approach to the discovery, representation, measurement and audit of the lifetime value of an asset to an organisation. This is a helpful definition in the analysis of the literature on whole-life value and the derivation and testing of a method of measurement resulting in a whole-life value factor conducive for use in option appraisal and benefits realisation. The barriers facing the adoption of whole-life value by government departments, as outlined by the NAO (2005), set the context for the development of the whole-life value factor. The chapter concludes that the primary barrier to the adoption of a whole-life value approach to construction projects is the client's will to do it. Chapter 12 introduces a new, comprehensive, whole life value methodology.

Chapter 13 draws together the issues addressed in this book to explore the developmental challenges facing value management in 2014 and beyond as seen by the authors. An analytical reinterpretation of aspects of research and practice over the previous decade permits conclusions to be drawn on the theoretical knowledge base of value management, the nature of professions and the institutional structuring and positioning of value management within institutional organisations, the role of stakeholders in a value study and the current and potential market place for value management services. Primary among the conclusions are first, that value management has to go beyond being seen as a single project paradigm. Second, the necessity for Value Management to aspire to being an indispensable, professional, and value adding service well known amongst construction clients contemplating any change activity from a single project to the restructuring of their entire physical asset portfolio.

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11 Discerning Value

11.1 Introduction

This chapter is a theoretical discourse on the subjects of value and quality and a review of those facets that combine to best describe value in the context of the delivery of a physical asset through a construction project. Value is delivered by the asset in use. There are no fundamental laws of value in the same way as there are fundamental laws of physics, indeed it was not until the early part of the twentieth century that philosophers began to analyse the concept of value.

The chapter is in six parts:

- Part 1 presents the basic tenets of value as discussed in the literature and makes the case for a value systems approach to understanding what value is.
- Part 2 considers the social and psychological aspects underpinning the individual's approach to deciding what is 'of value'.
- Part 3 considers the theories of quality and concludes that quality can be assessed based on a degree of excellence; determined as the provision of all basic functions at the required level and all performance functions at the highest level.
- Part 4 distils the theories discussed in the previous three parts to deduce the principles for the determination of a value system.
- Part 5 discusses value systems in a construction environment by considering the following:
  - The client's value system and the client's project value system
  - Corporate and business values
  - The project value system
  - The practitioners' value system
  - The consumers' (users'/customers') value system
  - The stakeholders' value system
- Part 6 considers the practical considerations and ethical issues in the use of a value system by reflecting on two case studies.

This chapter argues that whilst there are a number of varied value systems relevant to projects, at a high enough level, the basic facets of each value system are the same. These facets are time, cost and quality subdivided into capital cost and operating cost, time,

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esteem, flexibility, comfort, community, environment and exchange (financial return). The chapter presents a typology of clients to introduce the idea of different client value systems, each of which must be made overt and understood in order to tailor a value study. The client's value system, that is, the corporate value system operating at the level of the core business, is translated to form the client's project value system at the inception of a project at the strategic briefing stage. It is the client's project value system that should be the major input into the project value system, which evolves during the project briefing, design and construction process. The logical progression from the client's value system to the client's project value system and finally the project value system is described and the implications discussed. The chapter concludes by raising some ethical issues within value management (VM) as a process of resolving and reconciling different and diverse value systems.

11.2 Part 1 – Background to the value debate

The contemporary argument at the end of the nineteenth century was that value cannot be defined in an analytical manner; value as a concept being used as an adjective rather than analysed in a substantive manner. Perry (1914) argues that the case for non-definition of value is only sound if value was incapable of analysis. This is clearly not the case since a diamond set in a gold ring is likely to have more value (not just monetary value) than the diamond alone. Therefore, there must be some attribute of the setting and indeed the ring as a whole, which is capable of description in the context of value.

Perry (1914) and Moore (1903) agree that something that is good has value and that the assessment of goodness is discussed in the context of pleasure or hedonism; the greatest of which, Moore argues, are personal affection and aesthetic enjoyment. Perry considers this definition of goodness to be too narrow and discusses value from the perspective of harmony and fitness asserting that value exists when something can be described as 'good for' a purpose. This perspective takes the concept of 'goodness' as relative to interest, that is, something becomes of value when interest is taken in it. It should be noted that this debate does not imply ownership or necessarily the desire for ownership; it is argued that it is simply required for interest in and/or pleasure to be derived from, for something to be of value.

The debate in the literature Moore (1903), Perry (1914), Rice (1943), Hartman (2011), Holbrook (1999), Kahneman and Tversky (2000) Zimmerman (2001), is reasonably consistent in its approach to the different perspectives of value. This consistency is helpful in allowing a reasonably robust definition of the perspectives as:

- Intrinsic value
- Extrinsic value
- Instrumental value
- Contributory value

Of these terms intrinsic value and extrinsic value are the most commonly discussed. Instrumental value and contributory value are discussed by Rice (1943), Holbrook (1999) and Audi (1999) amongst others.

Intrinsic value and extrinsic value

Perry (1914) defines intrinsic value as being possessed by the object-interest complex, whereas extrinsic value is possessed by the object itself. This is a tidy definition and generally accepted. The implication as discussed by Hartman (2011) and Zimmerman (2001) is that intrinsic value is comprised of a number of different facets, which in combination lead to the definition of an object as being good. The important point here is that the object, or experience (Wagner, 1999), is judged based upon the totality of the predetermined facets. Therefore, intrinsic value can be anticipated. Intrinsic value can be defined before an object is chosen or a design commenced. The facets of intrinsic value, discussed later in this chapter in respect of construction, can be incorporated into a specification. The study of value theory is termed axiology, which is concerned *inter alia* with a deeper understanding of the facets of value.

Extrinsic value does not come into play until the object exists. Extrinsic value is possessed by the object itself most commonly expressed in terms of pleasure and related to, for instance, aesthetics, for example, a smart suit and a beautiful landscape. While neither intrinsic nor extrinsic value imply ownership, it is more likely that the facets of intrinsic value are those of importance to 'the owner', whereas extrinsic value is more likely to be of importance to 'the observer'. Therefore, while the owner of a beautiful yacht derives pleasure from all those facets that are associated with intrinsic value, the owner's neighbour, or indeed a casual observer, can derive pleasure and therefore extrinsic value from observing the yacht sailing peacefully on a blue sea. Wagner (1999) states that the pleasure derived from the object itself defines extrinsic value.

In summary, intrinsic value can be anticipated before the object or experience exists, or before the object or experience is chosen, whereas extrinsic value is possessed by the object or experience itself.

Instrumental value

Instrumental value comes from the object or service by which the intrinsic value facets are satisfied. Therefore, if a sensation of speed is a facet of intrinsic value, then a sports car, speed boat or roller coaster has instrumental value. This is important as it confirms that intrinsic value can be anticipated in the absence of the means by which intrinsic value is delivered. The facets of intrinsic value can be explicitly stated as a specification of requirements delivered by that which gives instrumental value, which could be through a wide range of options.

Contributory value

Audi (1999) introduced the concept of contributory value where the setting enhances the value of the object. For example, a research laboratory on a green field site will have a given value. The same research laboratory sited amongst other research laboratories on the science park of a prestigious university may have the same given value plus additional value conferred by the prestige and reputation of the university. This additional value is termed contributory value. Contributory value, in a monetary context, is well understood by valuation surveyors and asset managers. However, there is more to contributory value than just money, for example in the context of the research laboratory, esteem and the working environment of researchers comfortable in the presence of other academics adds contributory value.

The measurement of intrinsic value

Zimmerman (2001: p.160) consolidated and developed the theory of intrinsic value, distinguishing between basic and non-basic intrinsic value. Non-basic intrinsic value is described as the situation in which goodness is inherited, that is, it inherits contributory value. Basic intrinsic value is where the value exists within the variables that make up intrinsic value, excluding contributory value. Zimmerman defines the rules for basic intrinsic value as follows:

For any state S that has basic intrinsic value,

If $S_1 \ldots S_n$ are proper facets of S and
$S_1 \ldots S_n$ have no facets in common and
$S_1 \ldots S_n$ have actual intrinsic value and
there is no part of S that has actual intrinsic value that
is not a part of $S_1 \ldots S_n$,

Then the basic intrinsic value of S is the same as the sum of the intrinsic values of $S_1 \ldots S_n$.

In the context of the theoretical value model applicable to construction projects

- S represents the value system.
- $S_1 \ldots S_n$ are the proper, inclusive, intrinsic facets that make up the value system.
- No parts of the facets are correlated.
- All facets should have intrinsic value. This does not prevent the variables from having intrinsic and extrinsic value; but from Zimmerman's work the extrinsic element is ignored when undertaking the summation of the facets S_1 to S_n.

The rules set down by Zimmerman are helpful in the search for those 'higher-order' facets of a value model for construction. It is emphasised that in the development of the model the search is for the highest-order facets, accepting that some of the facets are capable of being broken down into subfacets.

Value expressed in the VE/VM literature

Taking the definitions of intrinsic value, extrinsic value, instrumental value and contributory value and taking the value proposition expounded by Zimmerman (2001), then the search for a value equation representing a value system in the context of construction will involve the search for those facets of intrinsic value that lead to a satisfactory explanation of value that can be used in the construction of a specification of requirements. The specification of value will be satisfied by a technical solution, itself conferring instrumental value and attracting both extrinsic value and contributory value.

Simply stated, the earlier theoretical discussion confirms that a specification of requirements should include a statement of intrinsic value facets that represents the client's corporate value system, and which, as applied to the project, becomes the client's project value system. Extrinsic value results from the skill of the designer or provider of an object or service in the provision of something that is good. Instrumental value is the means by which the intrinsic value facets are provided. The following is a description and debate of the extent to which the value models represented in the value engineering (VE)/VM literature satisfy these identified requirements.

Value models in the VE/VM literature

The VE/VM literature describes a generally operationalised view of value and demonstrates a fairly consistent approach to the definition of value. The most common expression (Crum, 1971: p.14; O'Brien, 1976: p.16; EUR 14394, 1993; ICE, 1996: p.3; Hayden and Parsloe, 1996: p.5; RJ Park, 1999: p.96) is that value has a relationship with function and cost, most usually expressed in mathematical terms as follows:

$$\text{value} = \frac{\text{function}}{\text{cost}}$$

The expression represents value in the context of the units of function, which can be obtained for a unit of cost.

Adam (1993: p.176) defines value as the lowest cost to reliably perform a function where the definition of function is that which the product, process or system delivers to make it work and sell. The definition of basic function is the specific reason why the device was designed and made.

Norton and McElligott (1995: p.13) define value as a relationship between cost, time and function. They state that in a value engineering study the objective is to improve value through the balancing of cost, time and function, which can be achieved in three ways:

1. To provide for all the required project functions but at a reduced cost
2. To provide additional desirable project functions without adding to the cost
3. To provide additional desirable project functions while at same time reducing costs

This assumes a technical solution to a functional requirement and at a given cost. Kaufman (1990: pp.1–5) defines value as

$$v = \frac{\text{want} + \text{worth} + \text{need}}{\text{cost}}$$

where want is equivalent to esteem value, worth is equivalent to exchange value and need is equivalent to utility value.

Parker (1994: p.40) concurs with Kaufman by describing want as relating to esteem value, worth as relating to exchange value and need as relating to use value, but describes a value index as being represented by function cost divided by function worth. This is an interesting concept particularly as the worth of a project in anticipation of its delivery may be different to that once delivered.

$$\text{value index} = \frac{\text{function cost}}{\text{function worth}}$$

Crum (1971: p.14) and Mudge (1996: p.13) define enhanced value as the lowest cost to reliably provide the required functions or service at the desired time and place and with the essential quality. Value is a measure of the consumer satisfaction with the goods or services purchased in terms of their quality, reliability and price. Crum and Mudge also concur in their definitions of 'use value' as those properties of an object or service that accomplish the desired task, that is, meet the requirements and are fit for the purpose; 'esteem value' as those properties that make ownership of an object desirable; 'cost value' as the sum of labour, material, overhead and other costs; and finally 'exchange value' as the properties of an object that make it possible to procure other items by trading. Crum also refers to a value opportunity as represented by use value plus esteem value divided by price.

$$\text{value opportunity} = \frac{\text{use value} \pm \text{esteem value}}{\text{price}}$$

Thiry (1997: p.9) defines 'use value' as the amount of resources expended to realise a finished product that performs as it was intended; 'esteem value' as the amount of resources a user is willing to expend for functions attributable to pleasing rather than performing; 'exchange value' as the amount of current resources for which a product can be traded; 'cost value' as the amount of resources expended to achieve a function measured monetarily; and 'function value' as the relationship of function worth to function cost.

Zimmerman and Hart (1982: pp. 61 and 62) similarly recognise four types of value: use value, esteem value, exchange value and cost value using the same definitions as Thiry.

Customer value is defined by Thiry (1997) as the needs, plus objectives, plus targets, divided by the maximum overall resources expended. In this case it is presumed that Thiry is referring to objectives as being other than needs.

$$\text{customer value} = \frac{\text{needs} \pm \text{objectives} \pm \text{targets}}{\text{resources}}$$

Thiry also illustrates a value fulcrum with offered quality divided by expected quality balanced by available resources divided by required resources. The European Value Management Handbook (European Commission, 1995) presents a similar relationship of needs and resources.

Fallon (1980: pp.19–34) defines value to the producer as function divided by cost but value to the buyer as perceived benefits divided by price.

$$\text{value producer} = \frac{\text{function}}{\text{cost}} \quad \text{value buyer} = \frac{\text{benefits}}{\text{price}}$$

Fallon quotes Adam Smith's paradox of value, namely, that extremely useful goods such as water have little or no exchange value whereas certain other goods such as diamonds have great exchange value although, as jewellery, of little use or utility value. Fallon also describes the four most significant aspects of product value as being use value, esteem value, market value and exchange value.

The texts reviewed earlier focus on value being a relationship between function and cost and simplistically consider that value can be enhanced by decreasing cost or increasing function. The following authors introduce perspective into the equation by considering value from the perspective of the user as opposed to the perspective of the producer. The texts reviewed next introduce the concept of worth and specifically the worth to an individual.

Fallon (1980) and Shillito and De Marle (1992) debate the difference between 'value' and 'worth'. Both refer to the source of 'worth' as being from the Anglo-Saxon word 'weorth' relating to an expression of individual importance. Fallon describes the value of products as being determined by a relationship of worth to cost, which conforms to the customer's wants and resources in a given situation. Describing value, Fallon and Shillito and De Marle refer to the French 'valoir' and its relationship with exchange in the market place. In value management terms worth is commonly interpreted to represent the cost of providing only the utilitarian function, that is, without consideration of aesthetics, which can be useful when considering an element that has a measure of decorative purpose, for example, a door.

Shillito and De Marle (1992: p.9) define value as:

$$\text{value} = \frac{\text{need} \times \text{ability to satisfy}}{\text{cost}}$$

This is an equation for individual value, which relates to an individual's rating of the importance of the need and the ability to satisfy. A customer's perception of value uses the same equation but the denominator is price. As this value equation is related to individual perception of value it is more closely associated with 'worth'. In an enterprise involving a number of individuals the value equation for the enterprise becomes:

$$\text{value} = \frac{\sum \text{worth } 1 + \text{worth } 2 + \text{worth } 3 + \text{worth } n}{n}$$

Thomson *et al.* (2006) define value from the individual stakeholder's perspective as the perceived sum of the benefits (attributes that the stakeholders seek from the project) less the sacrifices (things that stakeholders are willing to surrender to get the benefits they seek) related to the resources (the effort expended by stakeholders by being involved with the project). The observation is made that stakeholders *affected by*, rather than *participating in* the project would not expend any resources

$$\text{value} = \frac{\text{benefits - sacrifices}}{\text{resources}} \text{ (related to)}$$

The assumptions made in this equation are discussed further in a review of the VALiD (Value in Design) methodology in Section 11.8.9.

Miles (1989: p.4) defines value by stating a product or service is generally considered to have good value if that product or service has appropriate performance and cost. Value is always increased by decreasing costs and maintaining performance, and by increasing performance if the customer needs and also wants increased performance, and is willing to pay for more performance.

McGeorge and Palmer (1997: p.23) state that good value is achieved when all functions are accomplished at the lowest achievable cost. There is little or no value when no function is achieved, unwanted functions are provided or where function is achieved at too great a cost.

BS EN 1325:2014 (2014) defines value as the measure of how well an organisation, project, or product satisfies stakeholders' needs in relation to the resources consumed. There are the following seven notes:

- Notes 1 and 2 – Value facilitates the audit of solutions by assessing the benefits and disadvantages by reference to an index of relevance applied to any product, service, process or organisation.
- Notes 3 and 4 – The satisfaction of need can only be assessed by reference to the required functions. Approaches of cost reduction that involve optimisation of design and specification reduction do not improve value when they entail a reduction in the required function of a product, process or service.
- Notes 5, 6 and 7 – Satisfaction should include the satisfaction of society generally in addition to the client and/or user stakeholders and take account of risk, uncertainty and potential opportunities. Satisfaction of society generally includes those positive social, economic and ecological impacts brought by the solution to the required functions. This implies that a wider perspective of value should be considered by the project stakeholders.

BS EN 12973 (2000) refers to the definition of value in the BS EN 1325 - 1 (1997) as the relationship between the satisfaction of need and the resources used in achieving that satisfaction. The standard also states value is not absolute but relative, and may be viewed differently by different parties in different situations. Generally, achieving good value requires balancing a series of conflicting parameters to arrive at an optimum position.

Although Crum (1971) and Mudge (1996) mention quality, Burt (1975) and Best and De Valence (1999) introduce quality into the equation. Burt states that maximum value is obtained from a required level of quality at least cost, the highest level of quality for a given cost or from an optimum compromise between the two. Best and De Valence state that value is a relationship between time, cost and quality, and illustrate the time, cost, quality triangle (see toolbox). The technique is commonly used in project management and illustrated on numerous commercial websites, and although accredited to Dr Martin Barnes, academic debate on the technique is thin. Quality as a concept is discussed later in this chapter.

This brief review of the literature demonstrates a reasonably consistent approach to value being a relationship between function (including the ability to satisfy) and cost (or resources). Differences in the equations generally, result from the different perspectives from which value is viewed, that is, from the producer, customer, consumer or user. This aspect is discussed later in this chapter. Risk as a factor of value is little discussed by any of the authors. In the context of value, risk has two dimensions, namely, those risks that can be evaluated in monetary terms as discussed in Chapter 10. Second, there are those risks to the achievement of a value objective that is more subjective and related to the confidence that a stakeholder has that a particular designed option will meet the specified value criteria.

Producer, consumer, customer

The VE/VM literature introduces three perspectives from which value can be judged, namely, from the producer's perspective, from the consumer's perspective and from the customer's perspective, defined as follows:

- A producer provides at a price a physical object or service for consumption.
- The consumer is a user that utilises the product or service for a purpose. The consumer may not pay for the product or service directly. For example, a householder consumes waste disposal services from a local authority paid for through general taxation.
- A customer is a consumer that buys the physical object or service at a price from the producer, as part of an exchange transaction, in order to use it.

It should be noted that these generic roles overlap when individuals buy products or services for household use. However, with organisations of varying levels of complexity, these roles may become disaggregated and diffused throughout a single organisation as part of its structure. Conversely, the roles may be combined through such value adding structures as co-creation described in Chapter 3.

Satisfaction plays an important role in each of the perspectives of value. Satisfaction occurs when each party to a transaction gives up one thing of value for something of greater value (Holbrook, 1999). Satisfaction as a psychological dimension relates to decisions made by an individual or group. The moment more than one individual is involved in decisions about value and satisfaction, complexity of decision-making comes into play, particularly if individuals or groups of individuals sit in different departments, organisational unit, organisations or firms with different ownership characteristics. Value decisions then become very dependent on the following:

- The complexity of perceptions involved.
- The context within which judgements about value and satisfaction are made.

- The number of interfaces that exist between individuals, groups of individuals, organisational units, organisations and firms that decide on value and benefits and satisfaction derived therefrom.
- Power of different individuals and organisational units.

The conclusion from this short debate is that value as a concept must be viewed through the lens of the context within which that value is decided. This leads to a discussion of individual and group perceptions of value in Section 11.3.

11.3 Part 2 – Social and psychological dimensions of value

In understanding the social and psychological dimension to value, it is important to distinguish between 'values' and 'value'; one is not the plural of the other (Mills, 2013). Values are normative, comprising that part of the cognitive structure of an individual that governs attitudes and behaviour (Thomson *et al.*, 2003). Rokeach (1973) states that the term 'values' is used to incorporate interests, pleasure, likes, preference, duties, moral obligations, desires, wants, goals, needs, aversions and attractions. Schwartz (1994) states that values determine the manner in which individuals see, perceive and think about the world, structure information, take action and behave.

Assessments about objects and experiences relate to judgements of value and can be subjective if they remain internalised within an individual or an organisation or can be objective if they are overtly expressed. In the latter case objective value assessment and measurement by an organisation can inform management action.

The social and psychological dimension to values has an important part to play in making choices and managing projects and organisations. Values, attitudes and beliefs have emerged from social psychology and provide a framework for explaining the way people behave in social situations, perceive others and change and adapt their behaviour over time. Gross (1996) views attitudes as an important integration of beliefs and values, defining beliefs as the knowledge and information we have about the world. Attitudes provide shortcuts for relating to and interpreting events, situations and objectives. In a review of research evidence, Gross (1996) concludes that individuals will have thousands of beliefs, and hundreds of attitudes but only a few dozen values. Values operate at a much deeper level of cognitive functioning than either attitudes or beliefs.

Attitudes, beliefs and values are notoriously difficult to change because they are so deeply held. Social psychologists agree that individuals seek consistency between their thoughts, beliefs, values and attitudes, and attempt to appear rational to others as well as to themselves. They feel psychologically scarred when these are inconsistent. This often occurs when an individual has made a difficult choice or a decision or is experiencing hardship, making sacrifices that turn out to be pointless or becoming involved in behaviour that is inconsistent with internal attitudes and beliefs. When a person feels strong internal inconsistencies this will lead to an attitude change (Gross, 1996). This is often termed dissonance.

Classification of values in terms of type and orientation have been undertaken by Allport, Vernon and Lindsey (1960), Rokeach (1973) and Schwartz (1992, 1994).

The classification of Allport, Vernon and Lindsey (1960) describes six distinct types of individual:

1. The Theoretical individual is rational, focused on discovering the truth and determining the underlying principles of how things work. The theoretical individual will reject notions of beauty and utility.
2. The Economic individual elevates worth and utility to the highest positions of value being driven by the pursuit of money. Knowledge exists to be applied. Their focus is on money and finance.
3. The Aesthetic individual views beauty as the highest value and is quite individualistic.
4. The Social individual is kind and sympathetic and concerned for the welfare of others.
5. The Political individual pursues power and wishes to be an influential leader.
6. The Religious individual is concerned with unity and morality, seeking to understand and experience the world as a unified whole.

Research by Schwartz (1992, 1994) concluded that there are 10 distinct types of human values. The Schwartz Value Survey found that these are the following:

- Self-direction – the need for control and management.
- Stimulation – the need for variety and excitement.
- Hedonism – related to pleasure or sensuous indulgence.
- Achievement – personal success according to social standards.
- Power – the need for control, status and authority.
- Security – safety and stability.
- Conformity – matching and achieving social norms and standards.
- Tradition – respect and commitment to customs.
- Benevolence – the need for attachment, relationships, connections and membership.
- Universalism – associated with an understanding and respect for the world and those in it.

Rokeach (1973) lists (see Table 11.1) terminal values (personal and social values) and instrumental values (moral and competence or self-actualization values), and suggests that a number of assumptions can be made concerning the nature of human values:

- Individuals possess a relatively small number of core values.
- All individuals possess the same characteristic values but they vary in degree.
- Culture, society, experience and personality are the building blocks of values.
- Values are apparent in every aspect of human life.

To summarise, opinions operate at the surface of awareness, can represent attitudes that are at a much deeper level and usually tapped through verbal statements. Beliefs, representing an individual knowledge of the world, cluster around attitudes and values providing that judgemental component to attitudes. Attitudes, beliefs and values lie at the core of personality and are deeply held convictions and orientations about who and

Table 11.1 Terminal and instrumental values (Adapted from Rokeach (1973: p.28)).

Terminal Values	Instrumental Values
A comfortable life	Ambitious
An exciting life	Capable
A sense of accomplishment	Cheerful
A world at peace	Clean
A world of beauty	Courageous
Equity	Forgiving
Family security	Hardworking
Freedom	Helpful
Happiness	Honest
Inner harmony	Imaginative
Mature love	Independent
National security	Intellectual
Pleasure	Logical
Salvation	Loving
Self-respect	Obedient
Social recognition	Polite
True friendship	Responsible
Wisdom	Self-controlled

what an individual is, their place in the world and how they interact with others. They influence choices. A useful social and psychological framework for values is shown in Figure 11.1; the boundaries are deliberately indicated as dotted to demonstrate a permeable boundary between psychological layers that interact and overlap and are conceptually different. The stress on exploring the social and psychological dimensions of values provides a framework for thinking about the processes going on within a value study. The understanding and representation of quality as a construct of comparability by groups and individuals is discussed in Section 11.4.

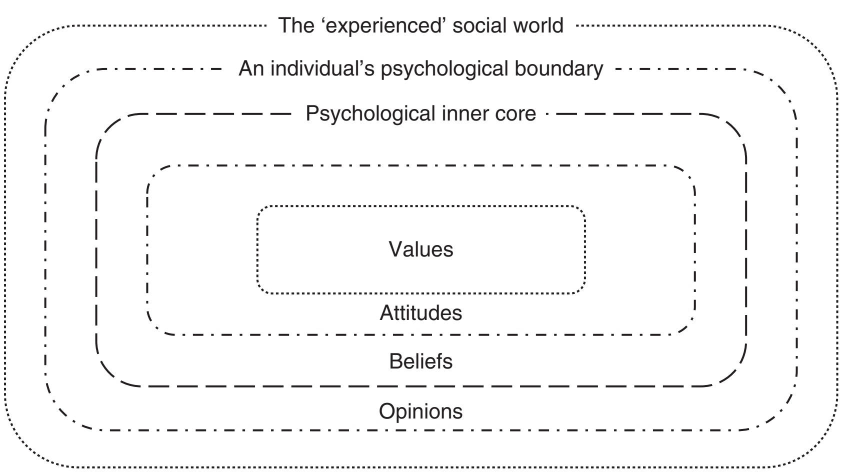

Figure 11.1 A social and psychological framework for values.

11.4 Part 3 – Quality debated

Rice (1943) commences the debate on quality and value by focusing on the reluctance of philosophers to define quality. Rice states 'The difficulty arises partly from the fact that the term "quality" as applied to values has a multiplicity of meanings'. He gives the example of a piece of cloth being better quality than another because it is warmer and more durable. However, an alternative piece of cloth may be better quality because of its exquisite sensation of sight and touch even though it is flimsy. Rice concludes with the observation that value in this context is intrinsic and relies solely on the specified requirement of the user.

Definitions of quality are few in number. Bicheno (2002) quotes Deming, who states that quality can only be defined in terms of customer satisfaction. There is no absolute measure – two customers may perceive a product or service differently. Juran and Gryna (1988) defines quality as the totality of features and characteristics of a product or service that bear on its ability to satisfy stated needs or implied needs. Quality consists of freedom from defects. This definition of quality is repeated in standards, for example, ISO 9000: 2005. Vorley (1998) quotes Juran's definition of quality and comments that quality needs to cover more than utilitarian function, for example, a quality definition will include aesthetics.

In 'Zen and the Art of Motorcycle Maintenance', Pirsig (1991: p.252) states

> why does everybody see Quality differently? . . . Quality is shapeless, formless, indescribable. To see shapes and forms is to intellectualise. Quality is independent of any such shapes and forms. The names, the shapes and forms we give Quality depend only partly on the Quality. They also depend partly on the *a priori* images we have accumulated in our memory. We constantly seek to find, in the Quality event, analogies to our previous experiences . . . The reason people see quality differently is because they come to it with different sets of analogies.

If this is true then it is logical to assume that individuals setting targets for attributes of quality must have sufficient experience or knowledge of an analogous event and have the tools and measures to assess that event. For example, someone working with polyester resins might be in a good position to be able to define adequate ventilation in a workshop where polyester resins are being used. However, without appropriate tools and measures, that person may be unable to specify a quality ventilation system.

To take this one step further, two hotels are considered. The first hotel is sited on a busy arterial road leading from a major city. There is no air-conditioning and many rooms have a tendency to overheat. Rooms are basically furnished; each has an en-suite bathroom in reasonable condition but with some mould growth and evidence that the room has not been too well cleaned. The dining room and bar areas are reasonably comfortable and the quality of the food is good. The second hotel is also sited on a busy road but is fully air-conditioned and the rooms are soundproof. Rooms are large, well furnished with modern furniture in good condition. The en-suite bathroom is finished in marble, has a shower in addition to a bath and is immaculately clean. There is a choice of dining room and bar areas, which are all interesting and comfortable, and the food is very good.

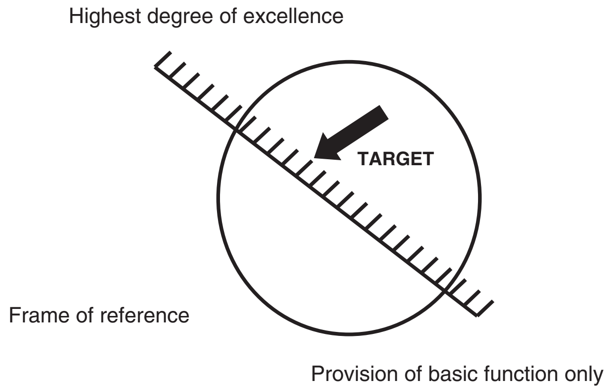

Figure 11.2 The quality continuum.

The question arising from the logic of Pirsig is: could the specification writer who had only ever stayed in a hotel of the first type envisage the second type? The answer is probably no unless other knowledge and experiences can be brought to bear, for example, illustrations or descriptions in books, television programmes, standards of cleanliness in other situations, experience of air-conditioned offices in similar locations. Pirsig therefore implies that quality is relative and is based primarily on experience, but in the absence of relevant experience substitute knowledge or some form of simulation will be employed.

This dilemma is illustrated in Figure 11.2. On a continuum from the highest degree of excellence achievable to the lowest provision of the basic function, every individual will create a frame of reference based upon experience and knowledge, represented by the circle on the scale. The individual's target level of quality will be within the frame of reference. There is a high probability that because every individual's knowledge and experience is different the frames of reference for all individuals will not be in the same place on the continuum.

The next logical question is what happens in the situation where the product/service receiver has more experience than the product/service specifier and/or supplier. The rational answer to this question is that because of the greater experience of the consumer there is a high probability of the provision of a poorer quality product or a poorer quality service as perceived by the consumer. A way around this dilemma is to ensure that the appropriate experience is brought to the writing of the specification and suitable models are available for the interrogation of the experience of the receiver of the service.

Bicheno (2000) describes the Kano model developed by the Japanese quality guru Dr Noriaki Kano who states that maximum quality is attained when targeted characteristics are achieved and the customer is delighted. There are three variables within the model. These are 'basic factors', 'performance factors' and 'delighters', which have a relationship to the presence of quality characteristics and customer satisfaction. These variables are included in the Kano model, illustrated in Figure 11.3.

In the Kano model a basic characteristic is expected to be present, the customer will be dissatisfied if it is absent and only neutral if the characteristic is completely fulfilled. The performance characteristic relates to the essential function. The customer will be more satisfied if higher levels of performance are achieved. The delighter is the extra characteristic that was not expected by the customer. There is however a time dimension

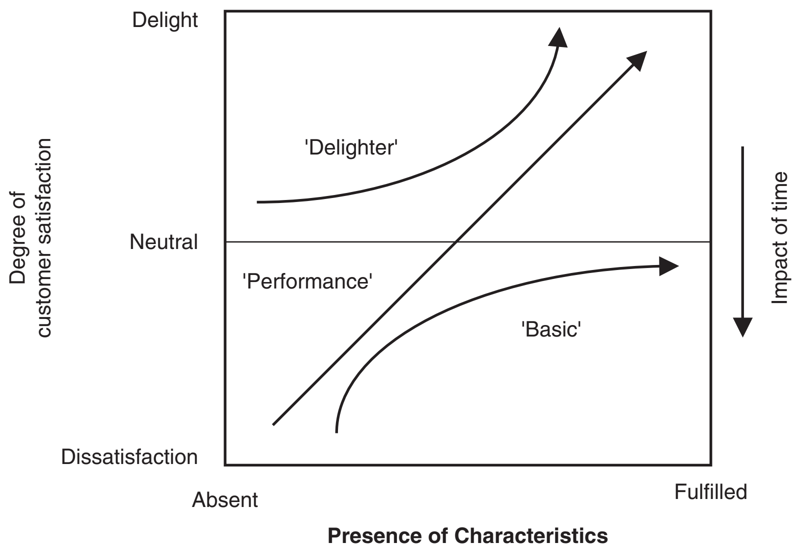

Figure 11.3 The Kano model. *Source*: Adapted from Bicheno (2000).

to the model such that the three variables will tend to sink over time, that is, what once delighted is now expected and higher levels of performance are always sought. For example, power steering on small cars as a standard feature once delighted customers but now power steering is expected as a basic characteristic and its absence would lead to dissatisfaction.

Pirsig (1991) quotes Kant's 'Critique of Pure Reason' in describing quality as being determined by means of the senses. The five senses of touch or feel, see, smell, hearing sound and taste lead to an individual perception of personal awareness relating to safety, security, comfort, relaxation, performance/excitement and delight. It is these that enable each individual to judge quality.

Quality is therefore a construct of comparability where the degree to which stated objectives, characteristics and/or attributes have been met. It is assessed based on a degree of excellence determined as the provision of all basic functions at the required level and all performance functions at the highest level. Delight functions provide the added value. The next section considers how quality can be incorporated into a formalised system.

Quality systems and value systems

There are two categories of quality systems: Total Quality Management and Quality Assurance. Total Quality Management is described as the synthesis of the organisational, technical and cultural elements of an organisation expressed in the attitudes that pervade the management culture in the provision of the highest level of excellence in products and/or services. Quality Assurance is the management of defined, consistent, standards of products and/or services (Vorley, 1998). Quality Assurance necessarily requires an understanding of the performance capability in the production of products or

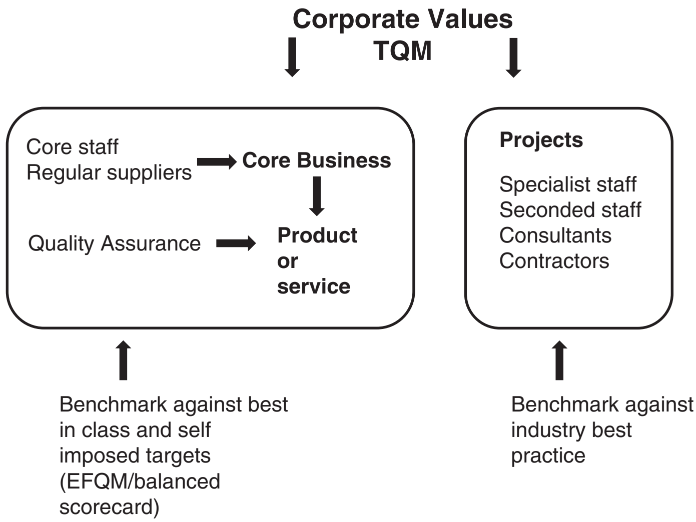

Figure 11.4 Corporate values permeate core business and projects.

delivery of services, the setting of standards, the measurement of performance and the means of remedial action. The relationship between total quality management and quality assurance is shown in Figure 11.4. In the context of a construction project the design and construction team should be aware of the client issues of Total Quality Management. However, the design and construction team may be less aware of the client's Quality Assurance measures in the context of the client's delivery of products or services.

Corporate total quality management criteria, as illustrated in the EFQM model, Figure 11.5, will influence the client's corporate value system which, in turn, influences the client's project value system applied to projects. The projects themselves will be influenced by corporate TQM and indeed, since projects can be instigated by a quality failing, may have come about through a weakness discovered through the application of TQM. The weakness is most likely to be discovered through a failure to meet a key performance indicator.

By abstraction from the quality criteria, the raw data for a value system could incorporate the following:

- Culture in terms of leadership, human resource organisation and policy.
- Organisational processes incorporating flexibility, agility, stability, and so on.
- A focus on the consumer.
- The organisational attitudes to society.

As reviewed earlier the most popular expression for value in VE/VM texts is, as a relationship between function and cost. Other texts reviewed refer to value as an algorithm with the variables of time, cost and quality. It is the latter that is the more useful. In the development of a value system the variables of value are required to obey a number of rules. As determined by Zimmerman (2001) the basic intrinsic variables

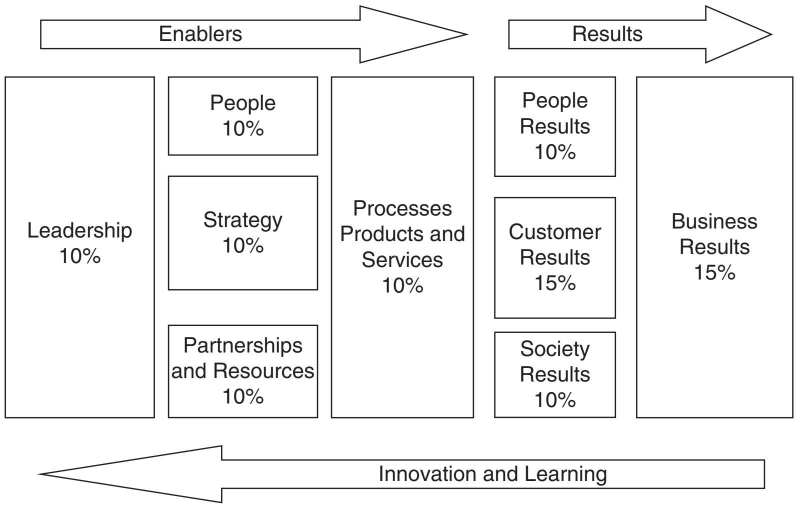

Figure 11.5 The EFQM model (EFQM® and the model are registered trademarks of the European Foundation for Quality Management).

comprising a value system should have no correlated parts, have actual intrinsic value and contain all the intrinsic parts of the value system.

Additionally, to comply with the requirements of the quality definition, value is maximised when basic functions achieve their required level, performance functions are at the highest level and delight functions add to the goodness of the product or service. In the context of a value system delight functions are a bonus and are therefore logically not specified.

Basic functions are those requirements that carry a precise specification. Failing to meet that specification even by a small amount will lead to dissatisfaction. Basic functions also include legislative requirements, such as Health and Safety. Basic functions therefore fall outside of the area of discretion and will be included as a specification requirement and cannot be a part of a value system.

Performance functions are those requirements that are perceived as having discretion and can give client satisfaction or delight at less than 100% fulfilment. Delighters are not specified and can delight even at low percentages of their potential. This is illustrated in Figure 11.6.

11.5 Part 4 – Principles for eliciting a value system

Some important principles have been laid down in the earlier sections in the search for a client's project value system:

- Intrinsic value can be anticipated before the object or experience exists, or before the object or experience is chosen, whereas extrinsic value is possessed by the object or experience itself.
- The object or experience is the instrument that satisfies the intrinsic value specification, that is, the object or experience has instrumental value.

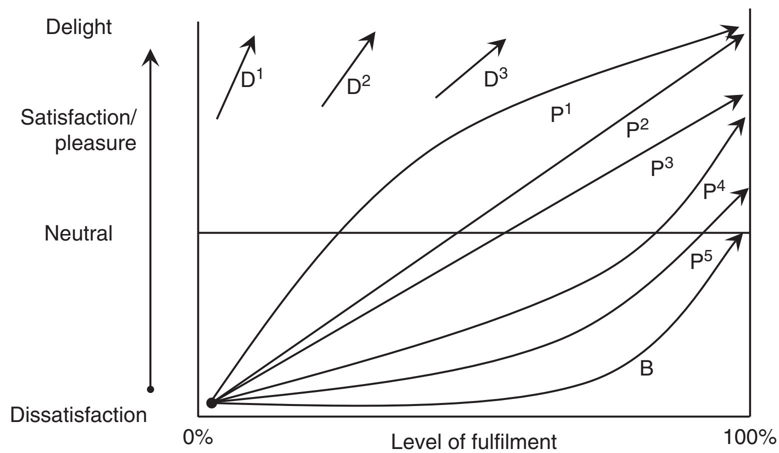

Figure 11.6 Basic (B) Performance (P^n) and Delighters (D^n).

- Zimmerman's value proposition gives the basic structure of a value system comprised of those facets that properly describe intrinsic value, are inclusive and are not correlated.
- The discovery of a value system requires the interrogation of people who possess deeply held values that are unlikely to change.
- The VE/VM texts concur that value has a relationship with function and cost. Some authors refer to function, cost and time and others to time, cost and quality.
- Quality is a construct of comparability where all basic functions are satisfied at the required level, all performance functions are satisfied at the highest level and delight functions correctly mirror the wants of the customer/consumer.
- Quality is comprised of a number of facets that contribute to a total quality management structure. These facets can be anticipated prior to the creation of the product or service that is designed to satisfy them.
- Quality Assurance is focused on the freedom of defects in the product or service that delivers instrumental value.

The principles described are used in the following section to examine the facets proposed by the authors seeking to evolve a value system method conducive for use in a value study.

The facets of a value system

In the analysis of architectural design, Vitruvius (100 BC, translated by Morgan, 1960) stated that the value system for architecture depends on order, arrangement, eurythmy, symmetry, propriety and economy. Kirk and Spreckelmeyer (1993) describe typical design objectives as follows:

- The aesthetic, esteem or image, the concept of the building and the way in which the building attracts attention to itself.

- Functional efficiency and flexibility, being the degree to which the building is able to respond to the work process and flow of people, equipment and materials, be rearranged or expanded by the client to conform to revised processes and personnel changes with minimal disruption to existing building functions.
- Human performance is impacted by the physical and psychological comfort of the building as a place for working and living.
- Technical performance, how the building operates in terms of mechanical systems, electrical systems and industrial processes.
- Through-life costs are described as the economic sequence of building expressed as long-term operating costs.
- Good neighbour issues cover the impact on the community, energy conservation and security addressing the degree to which the building can segregate sensitive functions from one another and prevent the entry of people to restricted areas.

Kirk demonstrates the use of weighted design objectives as a methodology for highlighting the relative degrees of importance, or value priorities, of the various design objectives.

Thiry (1997) cites a paper by Kirk presented to the 1994 conference of SAVE International (at that time the Society of American Value Engineers). Thiry illustrates Kirk's quality model as a radar diagram comprising the following performance measures:

- Capital Cost
- O and M Cost
- Schedule
- Operational effectiveness
- Flexibility/expandability
- User comfort
- Site Planning image
- Architecture image
- Community values
- Engineering performance
- Security/Safety in operation
- Environmental

Best and De Valence (1999) emphasize the complexity of quality by listing for illustrative purposes 15 factors that may be subjected to a quality continuum. Davies, Gray and Sinclair (1993) describe sets of scales, published in a volume of over 300 pages, for setting occupant requirements and rating scales for office buildings.

In July 2002, the Construction Industry Council (2004) launched the Design Quality Indicator which, although related by Whyte and Gann to Vitruvius directly (Whyte and Gann, 2003; Gann, Slater and Whyte, 2003), has significant similarities to Kirk. The indicators are grouped under three headings as follows:

- Functionality
  - Use
  - Access
  - Space

- Build Quality
  - Performance
  - Engineering Systems
  - Construction
- Impact
  - Form and materials
  - Internal environment
  - Urban and social integration
  - Character and innovation

Additionally, the topics of finance, time, environment and resources are dealt with separately.

The Construction Industry Council (2009) 'All Construction KPIs' are as follows:

- Client satisfaction product
- Client satisfaction service
- Client satisfaction value for money
- Construction cost
- Construction time
- Predictability cost
- Predictability time
- Defects
- Profitability
- Productivity
- Safety

The various key performance indicators and design issues indicated in the lists are compared in Table 11.2. Whether each performance indicator and design issue meets the criteria required of a valid contender for inclusion as a facet of a client's project value system is based upon the following:

1. A distinction is made between basic and performance variables. A basic variable is one in which there is a requirement to meet a specification at 100%, there is no element of discretion. KPIs, such as safety, security and other matters determined by legislation, are basic variables. To not meet the specified requirement at 100% invites failure but conversely, there is little to be gained in exceeding the specified requirement. A performance variable is one where the client has discretion and the designer has the opportunity to delight.
2. KPIs and design issues that address performance are those with elements of discretion. For example, the client has discretion (within limits) on the amount to be spent on the capital cost of the project. If the design and construction team bring the project in under budget the client will be delighted. Similarly, the client has discretion on whether the project will meet a particular 'green' agenda. If the design and construction team present a building that exceeds the client's environmental aspirations and meets other client requirements then the client is likely to be delighted. Facets that allow discretion on the part of the client and

Table 11.2 Analysis of contender variables for the project value system.

Vitruvius	Kirk	Best and De Valence	DQI	CIC KPI's	Comments	Selected for inclusion in a value System
Economy	Capital cost		Finance	Cost and Cost predictability	Meets criteria	Capital Cost
	Operating cost	Minimum OPEX			Meets criteria	Operating Cost
	Schedule		Time	Time and Time predictability	Meets criteria	Time
Order					Design task	
Arrangement					Design task	
Eurythmy	Esteem	Uniqueness	Character		Meets criteria	Esteem
Symmetry	Efficiency				Design task	
	Flexibility	Flexibility			Meets criteria	Flexibility
	Comfort	Comfort			Meets criteria	Comfort
	Internal Environment	Engineering services	Internal environment		Correlated with comfort	
Propriety	Community		Community		Meets criteria	Community
	Security	Security			Specified basic requirement	
	Safety			Safety	Specified basic requirement	
	Environment	Environment	Environment		Meets criteria	Environment
		Fit for purpose	Fit for purpose		Specified requirement	
		Site			Specified location	
		Durable			Correlated with OPEX	

(*continued*)

Table 11.2 (*Continued*)

Vitruvius	Kirk	Best and De Valence	DQI	CIC KPI's	Comments	Selected for inclusion in a value System
		Financial return			Meets criteria	Financial return/exchange
		Weatherproof			Specified requirement	
			Quality		Too inclusive	
				Defects	Workmanship issue	
				Satisfaction product	Too inclusive	
				Satisfaction service	Too inclusive	
				Satisfaction value for money	Too inclusive	
				Profitability	Not relevant to value/ quality	
				Productivity	Not relevant to value/ quality	

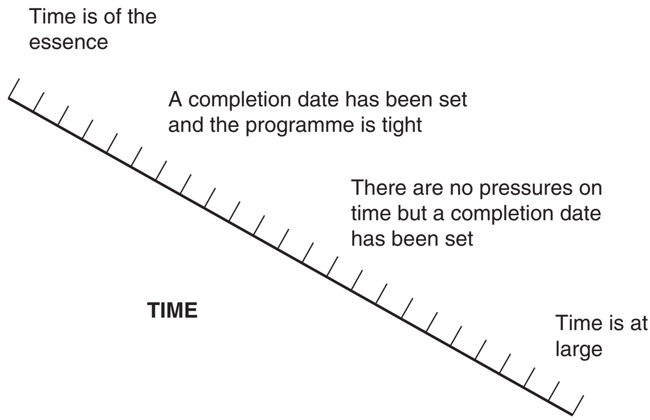

Figure 11.7 The time continuum.

the opportunity for the design and construction team to delight indicate contenders for inclusion as facets of a value system.

3. A value system must be comprised of facets that are not correlated (Zimmerman's rules), which tends to rule out large inclusive variables, for example, KPI's, such as client satisfaction.
4. A value system must be solely comprised of facets that are judged intrinsic and can be included in a specification. The application of the designer's skill will delight the client if the designer is able to interpret the specification and undertake the design task in accordance with or exceeding the value system.
5. The facets of a value system must be at the same hierarchical level, that is, one facet should not be subservient to another, nor should one facet be junior to another (indicating a missing high level facet).
6. The final test of variables to be included in a value system is the extent to which they can be the subject of a continuum against which the client can indicate the satisfaction point. This is illustrated in Figure 11.7 with reference to the variable 'time' commonly included in a value system. Time in this context would be defined as the time from the current stage in the project until the receipt of service or handover of the building/service. The continuum would extend from, 'time is of the essence', that is, one day late would be the cause of dissatisfaction, to 'time is at large', that is, the project is expected to be completed within reasonable time.

Definitions of facets and client's project value system representation

From the discussion in the previous sections of this chapter and the analysis of Table 11.2 the facets of a client's project value system that meet the six criteria listed are:

- Capital cost
- Operating cost
- Time

- Esteem
- Flexibility
- Comfort
- Community
- Environment
- Exchange/Financial return

These potential facets are defined as:

- Capital cost (CAPEX) refers to all costs incurred from inception of the project until operability, occupation or service delivery as a part of core business. This is measured on a continuum, which reflects choice, that is, the continuum is between the budget not being exceeded (lump sum contract), to complete flexibility in budgeting (cost plus contract). In some situations, the capital investment is subsumed within the operating cost and therefore the capital cost facet is omitted. This can occur for example where the cost of a building is rentalised within a total lease package, such as a Design, Build, Finance, Operate (DBFO) or PFI contract.

  In many public sector building projects and indeed private sector projects where there is an absolute budget that cannot be exceeded, flexibility or discretion under the capital cost facet heading may be considered in terms of the sacrifice of specified space, that is, to reduce the overall size and therefore cost to afford another required facet. The question is not, for example, 'Is the client willing to spend more now to reduce future OPEX?' but 'Is the client willing to sacrifice space to reduce future OPEX?' A reduction in the size of the proposed building for the same budget will permit spending on initiatives, which will reduce operating costs or increase comfort or promote esteem, and so on.
- Operating cost (OPEX) refers to all costs associated with the operations and maintenance of the completed project as it moves to an operational asset within the client's core business. In the context of a building this includes facilities management, which may be limited to maintenance, repairs, utilities, cleaning, insurance, caretaker and security, but may be expanded to include the full operational backup such as catering, IT provision, photocopying, mail handling and other office services. The continuum is between OPEX that must be at a controlled absolute minimum, to there is flexibility in operating cost. Flexibility in operating cost is common when issues of exchange or income generation are considered, for example, a more comfortable or 'green environment' office may command a higher rent and/or have a higher capitalised value.
- Time is the time from the present until the project is absorbed back into the client's core business. Time is assessed on a continuum between 'time is of the essence', that is, 'one day late and the project is worthless', to 'time is at large', that is, the project only has to be completed within a reasonable time.
- Politics/Popularity/Community is an external dimension that refers to the extent to which community, popularity and good neighbour issues are important to the client. It is the case that tensions between stakeholders have to be understood and subject to negotiation. The continuum ranges from, must be popular with the local community or electorate, to we have no concerns towards our neighbours.

- Environment/Sustainability refers to the extent to which the project results in a sympathetic approach to the environment, measured by its local and global impact, its embodied energy, the energy consumed through use, and other 'green' issues. The continuum is between maximum observance of Kyoto and Agenda 21 issues, to indiscriminate sourcing policies and solving every problem by adding more power.
- Exchange/Income/Financial return is the monetary value of the project. This represents the earning potential of the project as represented by, for example, capitalised rental or income, assets on the balance sheet, the increase in share value, or how much the project would realise were it to be sold. The continuum is between maximum return required to, return is of no consequence.
- Flexibility represents the extent to which project parameters have to reflect a continually changing environment. This value criterion is generally associated with changing technology or organisational processes or both. For example, medical practice is changing so rapidly that spaces in a hospital may need to accommodate a number of differing functions during the life of the building. The flexibility may be considered in terms of the reuse of space as designed (alteration) or in terms of the total reconfiguration of the spaces (demolition and alteration). The continuum is between highly flexible to accommodate changing functions to unlikely, to change to any extent.
- Esteem is the extent to which the client wishes to commit resources for an aesthetic statement or portray the esteem of the organisation, internally and externally. The continuum is between we need to attract the admiration of the world, to esteem is of no significance.
- Comfort is the physical and psychological comfort of the building as a place for working and living. Comfort is measured on a continuum from the support of the business in purely utilitarian terms, to the highest degree of opulence.

Measurement of facets of a value system

It was argued earlier that the facets of a value system should be measured in terms of their relative importance. In practice, at a value study workshop, the discussion that accompanies the measurement debate is as important as the measurement itself provided that it is accurately summarised. There are two techniques that could be used to determine the relative importance of the facets of a value system, simple paired comparison and the analytic hierarchy process:

1. Simple Paired Comparison is a means of organising a number of variables into an order by asking the question of each pair of variables 'which is more important to you, A or B?' This has the advantage that the process can be run in a workshop environment where knowledge is generated through the discussion that accompanies each question. The result is a hierarchy of importance on an ordinal scale. (Scaling is described in Chapter 12).
2. The Analytic Hierarchy Process (AHP) as described by Saaty (1980) is at first sight an attractive method of measurement because of its robust methodology and its striving towards a ratio scale. Saaty defines a hierarchy as 'a particular type of

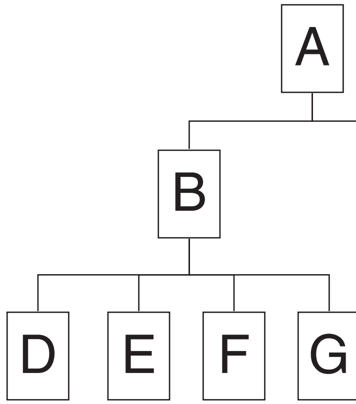

Figure 11.8 Hierarchy Process. *Source*: Adapted from Saaty (1980).

system, which is based on the assumption that the entities, which we have identified, can be grouped into disjoint sets, with the entities of one group . . . influenced by the entities of only one other group'. This is illustrated in Figure 11.8 where A is influenced by B and C but B is not influenced by C. Similarly, B is influenced by D, E, F and G but D is not influenced by E, F or G. Saaty describes the hierarchical composition of priorities in which a number of criteria are used to decide between options. It is this and the focus on choice between alternatives that made Saaty's work attractive.

However, as Saaty admits (1980), the operation of the method within a workshop environment can be difficult with 'wear and tear' setting in early. The method has more validity at the stage when solution options are available rather than at the stage when criteria are selected. However, the comments made (Saaty, 1980) on the structuring of the criteria and specifically the extent to which the criteria are influenced by the participants concerned and the fact that criteria preferences may change over time are all relevant to the representation of a value system in a value study.

For the reasons of the disadvantages of using AHP in a workshop environment, the authors consider that Simple Paired Comparison is the preferred technique to rank the facets of a value system. A model used in value study workshops is illustrated in Figure 11.9.

11.6 Part 5 – Value systems in a construction environment

This section introduces the concept of the value systems relevant to organisations and organisational structures associated with a construction activity, such as the following:

- Client types and values
- Corporate and business values
- The project value chain
- The practitioners' value system
- The consumers' (users'/customers') value system
- The stakeholders' value system

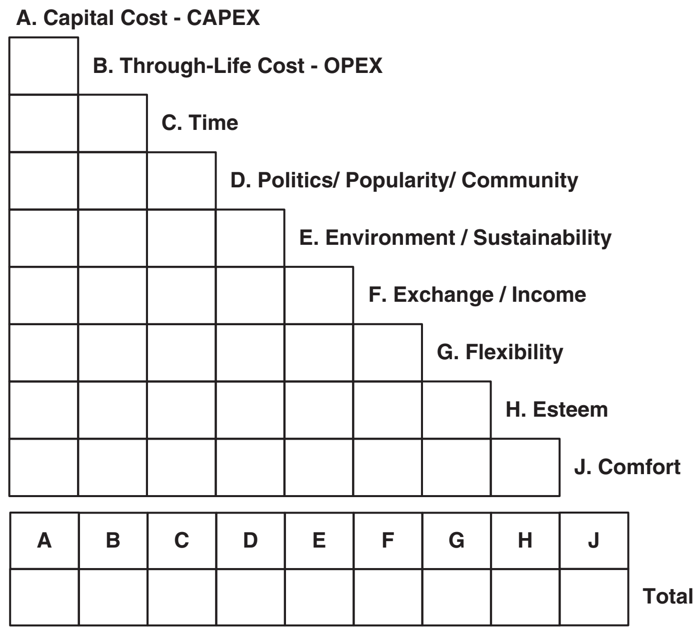

Figure 11.9 Client's project value system matrix.

Whilst aspects of strategic management have been presented in Chapter 9, it is considered useful here to recap and also extend a number of these points in the context of exploring value.

Public and private clients to construction are a heterogeneous group of organisations facing different environments and with a diversity of reasons for existing, with different objectives, cultures and value systems. Organisations are social constructs. They have formal and informal structures whose primary purpose is to reduce the variability in human behaviour and help managers achieve a common purpose for the organisation and co-ordinate tasks across different types of labour. Power is also exercised within an organisation's structure and information flows take place between the organisation's different constituents. Within the organisation people develop their expectations around their roles, which are affected by the formal and informal technical and technological structures of the organisation. The technical system and technology probably have the most pervasive impact on an organisation (Male, 1991). Organisations also have strategies that can be considered an outcome of a strategic management process. As noted in Chapter 9, Johnson and Scholes (2002) separate the process into three distinct areas:

1. Strategy formulation
2. Strategic choice
3. Strategic implementation

Strategy, as an outcome of this process, can be defined in terms of a means–ends relationship. The means are a set of rules to guide organisational decision-makers; ends are measurable objectives against which organisational performance can be quantified. Strategy is also seen as a cultural web, a set of collective beliefs shared by an organisation about the direction in which it is going. Hence, strategy is explicit and stated in documents or implicitly understood as consensus throughout the organisation.

The literature on strategic management also distinguishes a hierarchy of strategies (Langford and Male, 2001):

- Corporate strategy is holistic and concerned with the activities of the whole company across its organisational configuration of different business units.
- Business strategy is concerned with competing in different markets or industries.
- Operational or functional strategy is concerned with the production process or functional departments within an organisation.

Other terms allied to the strategic management process are *core business, core competencies* and *distinctive capabilities*. The core business of a firm is derived from its distinctive capabilities, the latter being created from three primary sources (Kay, 2000):

1. *Organisational architecture.* This is derived from the social and commercial relationships that the firm has and comprises the internal relationships between employees, external relationships with suppliers and customers, and networks of firms involved in related activities with the firm. Crucial elements of organisational architecture are the relational contracts founded on trust and expectations that define the moral and psychological contracts possessed by an organisation. These may or may not be underpinned by a legal contract.
2. *Reputation.* Reputation, as a strategic asset, has to convey meaningful information to customers. It is built through a process of continued success. It decays easily through poor performance. Reputation embodies the long-term experience of an organisation and creates the likelihood of repeat business. Reputation is worthy of investment as part of the firm's value creation process provided the cost of maintaining and upgrading reputation is less than the premium that can be charged on goods and services as a result.
3. *Innovation.* As a strategic asset on its own it is difficult to secure rewards and a profit from innovation. However, when combined with organisational architecture, in particular, it can implant a process of continuous innovation in a firm.

Organisations are also said to have core competencies that represent the collective learning of an organisation across its skill, production and technology bases (Prahalad and Hamel, 1991). They provide value to the customer. Core competencies are likely to be implicit and can be identified through three tests:

1. They provide potential access to a diversity of markets;
2. They should contribute significantly to perceived customer benefits; and
3. They should be difficult for competitors to imitate and are likely to be rare, complex and embedded in organisational knowledge and practice.

Strategy lies at the heart of developing and delivering value. In a value management context the concepts of strategy, core business, core competencies and value are inextricably linked within the client organisation, be it public or private, large or small. They are also of major concern when a client brings together firms to deliver a physical asset through a network of suppliers of services and products – the construction supply chain. They find their expression in the conception and delivery of projects as outcomes of the client's strategic management process.

Client types and values

One of the important considerations for value management in construction is the impact that the client (or customer) of the construction industry has on the project process. Each client has distinct requirements and value systems, driven by their own organisational configurations, business and/or social needs for a project. The client commences the process of project procurement by bringing together the necessary skills and expertise (not generally available in-house) to deliver a completed product – a physical asset of some type – to meet a business or social need, or both.

A number of distinguishing characteristics can be applied to public and private sector clients (Male, 2002), and can also provide clues about their different value systems. Public accountability at local, national and European Community level is a primary driver determining public sector client's value system. Private sector clients are much more heterogeneous. Influences can range from the impact of shareholder value, to time-to-market considerations and ownership considerations due to business status, that is, public or private limited company or perhaps family business.

Clients differ in their level of knowledge of the industry. They may be:

- *Knowledgeable.* These clients will normally have a very structured approach in dealing with the industry and project delivery. Often this will be set out and summarised in a project manual, a set of procedures or guidelines. They will treat the construction supply chain and its members as 'technicians' to deliver a project or projects to meet their business and/or social need. Internal or external project managers will act on their behalf as the interface with the construction industry. They will tend to be innovative with procurement methods and will generally be the volume procurers of construction services. They will place considerable demands on members of the construction industry and expect it to respond accordingly.
- *Less knowledgeable.* These clients will often have limited or minimal in-house expertise and knowledge of the operations of the construction industry. They will have partial or no appreciation at all of the complexities of construction. Evidence suggests that, depending on their initial contact point within the industry, they will tend to be directed into a traditional procurement path. However, this type of client may consult more knowledgeable clients depending on its business network.

Kelly, MacPherson and Male (1992), influenced principally by Newman *et al.* (1981), classified clients within a typological framework for the purpose of understanding further the briefing structure most appropriate for a particular client type. This framework is summarised as follows:

Large Owner/Occupier. Property companies and large organisations building for their own occupation are knowledgeable clients and tend to commission design only after completing a detailed identification of need rooted in a strategic plan for the organisation.

Public Sector. The public sector are generally knowledgeable clients and are similar to large owner/occupiers in respect of the approach to project management and the commissioning of design. The primary difference between the private and public sector client is that the driver for the project will be social rather than commercial and be governed by legislative requirements. The public sector operates within a culture of user consultation, public accountability, audit and financial annuality. The commissioning of developments is strictly governed by available finance.

Developer. Developers (as opposed to property companies) are knowledgeable clients and differentiated from large owner/occupiers only in that they are opportunity driven, are dependent upon available sites and require a quantifiable return. The equity holding in the project is released at an early stage often before the end of construction. The type of building will reflect the requirements of the market/location and users are often not consulted before floor plans and elevations are fixed.

Refurbishing Retailers. Refurbishing retailers were not included in the original Kelly, MacPherson and Male (1992) paper but revealed in subsequent research (Male *et al.*, 2003) as a distinct client type with a significant construction spend. They are characterised by a detailed identification of need resulting from an intensive study of markets in which the project development forms part of an organisational strategic plan but where opportunity is driven by available new sites or existing premises. Similar to large owner/occupiers, this client group will develop project briefs, employ project managers, develop in-house design guides and treat the design team as 'technicians' necessary for the mechanical development of the design. However, dissimilar from the other groups these clients tend to commission large numbers of low value projects, often as little as £50 000, and often employ smaller, local, contractors/consultants. Projects are carried out quickly and often whilst trading.

Small and/or infrequent owner/occupier. This client group is less knowledgeable and tend to react rapidly often because existing premises are inadequate for immediate needs. They have limited in-house expertise and therefore rely on design team for briefing. A poor appreciation of the complexities of planning, design and construction lead to unrealistic expectations of time and what can be bought for the finance available. This client group tend to be directed on a traditional procurement path.

A further dimension to client characteristics is the economic demand placed into the industry in terms of volume, its frequency and regularity, coupled with the extent to which standardisation may exist from project to project in terms of parts, processes and design (Croner, 1999):

- *Unique* construction embodies distinctiveness of technical content, the level of innovation required or the extent to which the client requirement is for leading-edge projects that push the industry's skills and knowledge to the limit. With this type of project, value studies give a significant benefit to the client through the accurate definition of function and the value system employed; however, once production is committed there is limited, if any scope, for efficiencies in process or standardisation through repetition.

- *Off-the-peg* construction, tends towards the preceding *Unique* type but the possibility exists for standardisation with economic benefits, perhaps through repeat designs and value studies. The term *customised* reflects a better description since a design for a particular client is likely to have some foundation in previous designs undertaken for other clients but with some adaptation (Male, 2002). Some commercial offices and warehousing fall into this category.
- *Process* construction, which can occur when a client has repeat demands for projects and a high degree of standardisation is possible due to the volume placed into the industry. Efficiencies are probable from value studies leading to standardisation of design, components and processes. Similarities are obvious with the manufacturing sector assembly lines. Process construction could also include client types where there is a relative balance between 'new build', maintenance, refurbishment or retrofit of existing assets. They may place large volumes of business into the industry, are ad hoc procurers of new build work, but deliver volume in the maintenance and refurbishment of existing assets.
- *Portfolio* construction, where clients have large, regular and ongoing investment programmes across a range of different project types. Portfolio construction will, however, involve a diverse range of needs in terms of technical requirements, degree of uniqueness or customisation as well as content. Regular spends will permit long-term relationships with some suppliers. This group could also include those client types where there is a significant volume of 'new build' to the asset base as well as the maintenance, refurbishment or retrofit of existing assets. Clients in this category are most likely to undertake value studies. The case studies presented in Chapter 9 are from Portfolio construction clients.

In summary, clients to construction are heterogeneous. A client's value system at corporate level comprises a number of interacting parts derived from the client's structure, cultural web, ownership characteristics and strategic management processes. Each client will have its own value system and drivers derived from its sector, organisational structure and functioning and the manner in which it approaches the industry, as identified earlier.

The discussion on the client value system will be extended further in the next section to differentiate between corporate and business value.

Corporate and business value

A project or projects are an outcome of an organisation's strategic management process and are the result of a series of business decisions made by senior managers within an organisation. Depending on the type of project and the client, business decisions may result in projects requiring the creation of a physical asset where profit, financial benefits to the country, or social need (or any combination thereof) may be a driver.

The forward direction of a client organisation will be worked out normally as part of a strategic plan for larger organisations made up of many businesses, or as a business plan for smaller, single entity businesses. It is often possible that due to the hierarchical structure of large corporate organisations a project or projects may start their life at the corporate strategic level and then be managed at individual business unit level. Equally, in larger organisations with more autonomous separate businesses, a project or projects may start life at the business level with minimal, if any, input from the corporate strategic level. Much will depend on the size, complexity and strategic importance of the project(s) to the organisation, the level of investment required and the policy and operating procedures for handling such projects. This sets the parameters for the project development process and has been discussed at length in Chapter 9.

The project value chain

As noted in Chapter 9, Porter (1985) developed the concept of the value chain as a tool for diagnosing commercial competitive advantage. He argued that in a manufacturing firm, activities within the firm are supported by the firm's infrastructure and described as: inbound logistics, operations, outbound logistics, marketing and sales, and service. A number of firms contribute to the process from the mining of the raw material, to the sale of the finished product to the customer. Each contributing firm is a member of the supply chain and adds a discreet amount of effort, termed by Porter – value. Therefore, Porter's value chain can be established by reference to the added value by each member of the supply chain. Porter argues that as each activity within each firm has the potential for differentiation, competitive advantage can be made explicit through the analysis of each activity within the value chain. A customer of the firm bases their desire for the firm's product upon specific criteria. Porter proposes that if the product desired by the customer can be produced at least cost, through the focus on the value chain, then a competitive advantage can be achieved for the product. Standing (2001) interprets Porter's value chain in the context of construction focusing on the construction project in place of the manufactured product and the different value systems that are present therein. In earlier work, Bell (1994), as explored in detail in Chapter 9, concludes that for a client's project value system to be clear for all to see during the progress of the project calls for strong communication and leadership by the client throughout. This is also reinforced by Atkinson (1999). Bell uses the term 'value thread' to represent and exemplify the fragility of the client's project value system that permeates through the (robust) value chain arguing persuasively that the thread can be easily broken. The value thread is particularly under threat where the value chain links between elements of the project are missing or tenuous. The work of Standing, Bell and others in the context of the project value chain is discussed in detail in Chapter 9 and restated briefly here, for completeness, as part of a more extensive treatise on the expression of value in construction projects. The next section debates the influence of the individual's value system on the organisation and the client's value system.

The relationship between personal and corporate values

The primary question answered by this section is 'do individual stakeholders influence the client's value system by overlaying their culture and beliefs onto the project?'

Thomson *et al.* (2003) concludes that the common values influencing the development of the project emerge from a process of negotiation between stakeholders who often have markedly different backgrounds and objectives and in this negotiation an individual may need to subordinate their personal values to those of the client's value system. Thomson quotes Najder (1975) that an individual might operate within several different value systems, for example religious, political and economic, which may not be precisely correlated with the client's value criteria for the project. Thomson further states (2013) that the notion that a stakeholder would give up deeply held values is hard to reconcile and suggests that potential conflict between stakeholders' personal values should be recognised and resolved through a satisficing process (D. S. Thomson, personal communication).

Flint and Woodruff (2001) describe research into customer values, stating that customer values are different from personal values, which are abstract, centrally held, implicit beliefs that guide behaviour and tend to remain fairly stable over time. Customer value on the other hand is constantly developing through the influence of knowledge and experience. Flint uses the example of the motor car industry of the United States in which customers were strongly influenced by the apparent quality and reliability of Japanese imports. Manufacturers are influenced by what Flint describes as tension drivers, defined as changing external customer demands, changing internal organisational demands, competitor repositioning, changing supplier demands and macro-environmental change. Therefore, whilst personal values remain stable over time customer and organisational values will respond to the commercial or social world displayed at a given point in time.

Dumond (2000) largely supports Flint by stating that customers will be satisfied if the product or service provides them with value. Dumond defines customer value as those matters linked to the use of a product or service, thereby differentiating between customer values and personal values. Furthermore, value is not determined by the seller but determined by the customer and typically involves a trade-off between what the customer receives, for example, benefits, quality, worth and what is given up to acquire and use the product or service, that is, payment or other sacrifice. Dumond states that in the management of value it is necessary to distinguish between price and worth where price is assigned to goods and services by the seller to attract the customer whereas worth reflects the customer's view of the perceived benefits of the product or service. The question then arises as to how the value criteria of the customer are explained.

Fischhoff (2000) concludes that an explicit statement of well-differentiated values is likely only for the most familiar of evaluation questions about which an individual or organisation has had an opportunity by trial and error or reflection to develop a fixed opinion. This would be the case for example, for the corporate mission statement included in a company's annual report, but unlikely in the case of an individual asked on the street for their value system. Therefore, unless an individual or an organisation has previously been in the situation where it has been necessary to articulate a value system then the formulation of such a system will be problematic; although Fischhoff states that an explicit value system may be derived by inference from an analogy. The formulation of a value system is conducive where there is the time and motivation to think, to hear and share views, where the consequences of its expression are clear, the need to justify oneself and the likelihood of consequent conflict is minimal, where the form of expression is familiar and meaningful, and where its expression is directly related to an action. These rules are useful in the context of formulating a value system for a construction project.

Woodhead (1999a), referred to in Chapter 9, defines paradigms and perspectives in the context of influences on client's value systems in projects. A paradigm is defined as rules, codes of practice and peer expectations identified as belonging to a particular organisation, social institution or profession, central to which is a collective belief system based on concepts of value. Within paradigms, perspectives or alternative views of individuals, or identified groups, fight for dominance. This internal conflict takes place as the paradigms themselves fight for dominance against other paradigms. Woodhead concludes a study of large construction projects in the United Kingdom by stating that a capital investment paradigm and cost–benefit analysis paradigm influence the process by which decisions were shaped and evaluated. The capital investment paradigm is described as being dominated by shareholder expectations, the return on investment and investment finance. Other paradigms, such as the marketing and planning permission paradigms, compete for dominance and play an important role in influencing the decision to build process. The paradigms and perspectives fight for overall dominance of the group decision-making agenda through the values and expectations of people.

Individuals operate within their own culture, beliefs, attitudes and opinions, and these permeate thinking, guide behaviour and tend, as noted, to remain fairly stable over time. However, the public face of the individual and the value system used in the selection of goods and services is constantly developing through the influence of knowledge and experience, linked to the use of a product or service, and focused on the trade-off between what the customer receives, for example, benefits, quality, worth and what is given up to acquire and use the product or service, that is, payment or other sacrifice. Simplistically, a clear match between the product required and the value system will result in a buy decision and a mismatch will result in a not to buy decision. In the selection of a product or service, the views of Woodhead (1999b), Flint and Woodruff (2001), and Dumond (2000) on the position of the individual purchasing a product is summarised in Figure 11.10.

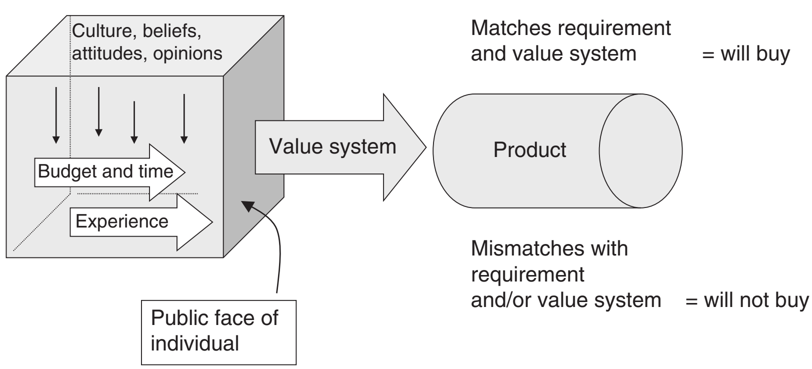

Figure 11.10 Individuals decision to purchase.

Practitioner value system

The practitioner is an individual professional or a professional organisation that contracts with a client to provide those services generally unavailable within the client organisation. Construction practitioners are characteristically those individuals or organisations that provide architectural and engineering design, cost and project management services. The value system of the individual professional or professional organisation will be no different in concept to the value systems of individuals and organisations discussed earlier. However, construction professionals will exert significant project influence and therefore a wise client will ensure that the value system of the construction professionals appointed match those the client wishes embodied into the project. Alternatively, the client should be assured that those appointed are sufficiently professional to set aside their own value criteria in order to achieve those values the client considers important for the success of the project. For example, an architects' practice, which has a value system explicitly dominated by environmental considerations, may not be a suitable match for a project where environmental considerations are secondary to many other facets of the client's project value system.

The debate on the power of influential stakeholders and their persuasive capacity to modify the client's value system related to the project is discussed later. The preceding discussion highlights an apparent contradiction in that those consultant members of the team with the greatest power to influence the client's project value system (by implementation) are those whose professionalism should prevent them so doing. In practice, the client's project value system is rarely overtly expressed or understood and therefore in these instances consultant members of the team do tend to influence and shape the project value system to a significant degree.

Consumers' value system

The nature of the producer, consumer and customer has been discussed earlier. An individual's decision to purchase is illustrated in Figure 11.10. In a construction project the consumer's perspective will be governed by the instrumental value that the building or civil engineering facility provides in use. It is through the visualisation of the facility in use that the consumer is able to specify that which would give intrinsic value. Holbrook (1999) identifies eight facets of consumer value:

1. Efficiency, defined by output/input ratio and convenience
2. Excellence, defined by quality
3. Aesthetic
4. Enjoyment, for example, play, fun and entertainment
5. Status, for example, success, impression and achievement
6. Esteem, for example, reputation, materialism and professionalism
7. Ethics, for example, virtue, justice and morality
8. Spirituality, for example, faith, ecstasy and sacredness

In the examination of Holbrook's consumer values to those construction values previously discussed, only the esteem and comfort values directly correlate. It could be argued therefore that consumer stakeholders have a mandate only in these areas.

Finally, it is important to reiterate the statement by Flint and Woodruff (2001), that customer values are different from individual personal values. Individual values are deeply held and tend to remain stable over time whereas the same individual as a customer constantly develops customer values through the influence of knowledge and experience. The impact of advertising and persuasion on that knowledge and experience should not be underestimated and it is the case that consumer values can be manipulated and sold. The next section concludes the debate on the value system of consumers as stakeholders.

Stakeholder values

Stakeholder is a term used to define those individuals and groups that are directly affected by the actions of an organisation. In this context, examples of stakeholders are investors, employees, members of project teams, consumers, suppliers, members of the local community, and so on. In a construction project, stakeholders are generally defined as those individuals who influence the development of the project and/or those who are impacted by the project (APM, 2006). At a corporate or project level the term stakeholder defines a wide constituency of individuals varying from those who have a fundamental responsibility for the development of the organisation or the project to those whose interest is based on a minor benefit or inconvenience.

Thiry (2010) states that the classification of stakeholders results from an understanding of their power and interest, the objective being to understand how much and what type of effort should be invested in each individual stakeholder or stakeholder group. Thiry recommends the level of interest and level of influence of stakeholders be expressed in four categories: keep informed, keep interested, keep consulting and keep involved. This is useful from the perspective of stakeholder management but less useful in understanding stakeholder values.

The authors consider that the term stakeholder as defined earlier, represents such a large group of individuals that it is impossible to consider a meaningful way of determining representative stakeholder values. Furthermore, the definition makes it impossible to administer the contribution of stakeholder values to the resultant value system of the project. There is however a benefit to be gained from identifying those influential stakeholders with real power and influence over the project.

The distinction has been made earlier between the consumer as user and the consumer as customer, who may or may not be the user. The consumer as customer is defined as the person that buys the physical object or service from the producer as part of an exchange transaction but may or may not be the user. The consumer as user selects a product or service on the basis that appropriate functional aspects are provided to give utility, satisfaction and benefits. It is proposed that the consumer as user and the consumer as customer are influential stakeholders but have influence only over selected facets of the client's project value system. The selected facets will depend on the role of the influential stakeholder. Not all stakeholders will attend a value management workshop so methods, such as interviews or questionnaire, should be used to determine stakeholders' values using appropriate questions.

A value system model for construction

This section is a synthesis of the earlier debate, which states that value decisions are dependent on the following:

- The complexity of perceptions of the client and the influential stakeholders in considering the construction, refurbishment and maintenance of a constructed asset (building, process plant, utility service or civil engineering facility).
- The context within which judgements about value and satisfaction are made.
- The number of interfaces that exist between individuals, groups of individuals, organisational units, organisations and firms that decide on value and benefits and the satisfaction derived therefrom.
- The relative power differential of different individuals, groups and organisational units, and organisations.

Considering complexity, if the desire is to make a cup of tea, then boiling water gives intrinsic value and a kettle gives instrumental value. The facets of value are simple and applied to the choice of kettle by the consumer. If the desire is to administer justice then the facets of value are more complicated and influenced by the organisation responsible for administering justice and those stakeholders who have a real stake in the process. A courtroom is not necessary to meet the functional requirement of administering justice, but the value system of the organisation (the client) and the influential stakeholders will demand a facility that reflects their functional and value system requirements.

A value system model for a construction project therefore has two inputs, the client organisation and the influential stakeholders. These inputs combine at strategic briefing stage to form the client's project value system as illustrated in Figure 11.11. At a later stage in the project's development the client's project value system may be influenced and modified by the design and construction team to form the project value system incorporated into the project. The extent and nature of that influence is a choice made by the client. This is illustrated in Figure 11.11 as a dotted line. The issues of design and construction team involvement are discussed next.

From the debate of client values three aspects of client value are deduced:

- The value system of the client as a customer of goods and/or services.
- The value system of the client as a supplier of goods and/or services to others.
- The value system of the client in relation to the commissioning of a project.

The value systems of the client in the three situations just mentioned reflect the corporate culture in part comprised of the rules by which the client organisation runs, the paradigms and the perspectives of the individual or groups of members within the organisation. The corporate culture permeates the client's business.

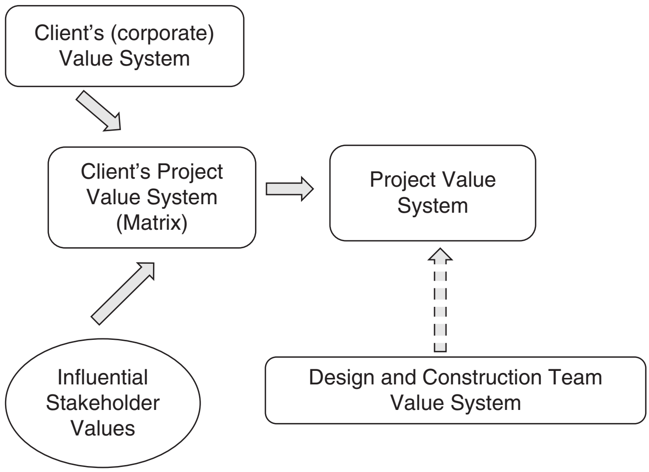

Figure 11.11 Inputs to the client's project value system matrix and components of the project value system.

The value system of the client is illustrated in Figure 11.12. This illustrates (to the left of the diagram) that the client as a customer of goods and/or services communicates a value system to the core business supply chain (the value thread). This supply chain, responsible for the supply of goods and services to the client's core business, will act as a value chain as described by Porter (1985) and input into the Client's Value System. To the right of the diagram are the corporate and business values reflecting the public face of the organisation.

The effectiveness of the client in displaying corporate values to potential customers will determine the extent to which customers are attracted and satisfied by the goods and

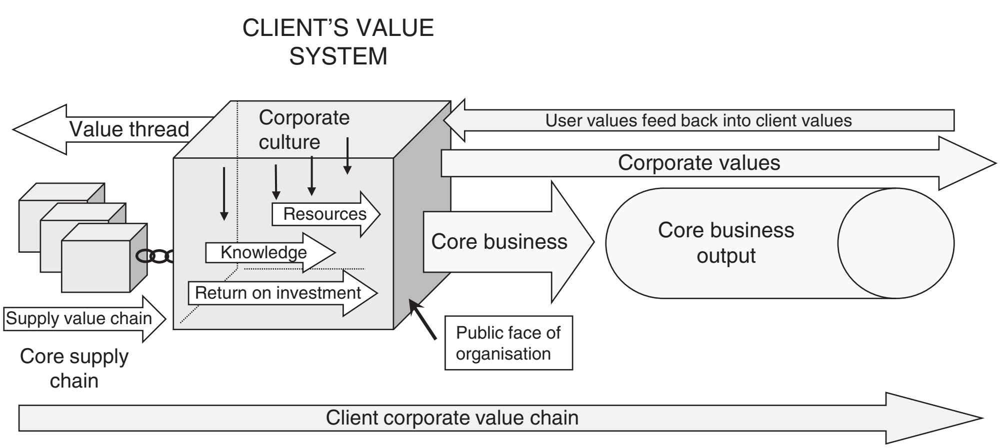

Figure 11.12 The client organisation and the client's value system.

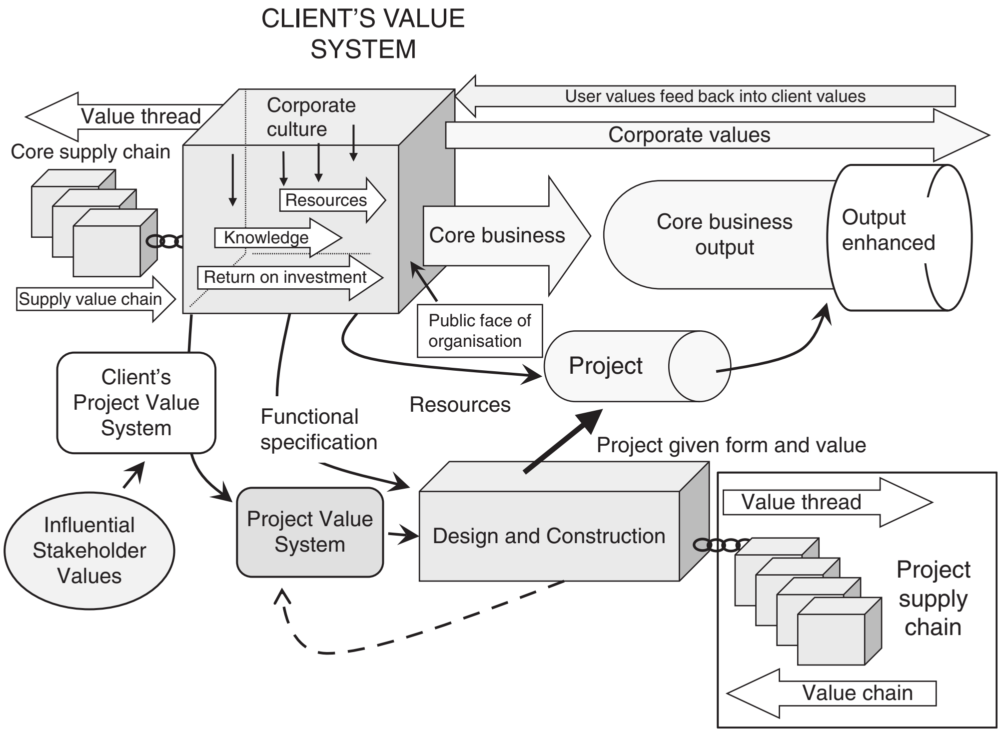

Figure 11.13 The client's value system influences the client's project value system.

services supplied by the client. Customers will also feed back to the client organisation those values they expect to see and thereby influence the Client's Value System. The process by which products and services from the supply chain are transposed into the core business output of the client consumes resources, reflects knowledge, and gives the return on investment sought by the client organisation. All these feed into the Client's Value System.

Figure 11.13 illustrates the impact on the client organisation shown in Figure 11.12 of the commissioning of a construction project to deliver an asset that provides value and enhances core business. A construction project requires three types of input from the client organisation:

- Resources in the form of seconded personnel to input into, for example, strategic briefing, project briefing, facilities management briefing and business cases.
- A functional specification in the form of a detailed project brief.
- The client's value system as discussed earlier translated into the client's project value system.

The client's (corporate) value system in the context of a project is influenced by the values of influential project stakeholders, the results of which becomes the client's project value system, which is evolved at strategic briefing and feeds into the design and construction process. It was consistently and strongly argued earlier that it is the members of the client's stakeholder team (client representatives and possibly users and customers of the project) who determine the client's project value system as represented in the Client's Project Value System Matrix. However, in reality, because the client rarely expresses the client's project value system and the construction professionals do not overtly seek it, a project value system is formed that can be strongly influenced by the design and construction team's interpretations and assumptions based upon the project brief. This situation is illustrated in Figures 11.11 and 11.13 by a dotted line. Even where the Client's Project Value System is clearly expressed, the client may be willing to relax elements of the value system in the light of representations made by the design and construction team including specialist designers and suppliers involved possibly subsequent to the signing of a construction contract. The Project Value System, which therefore drives the construction project, may depart from the Client's Project Value System as illustrated in the matrix; however, this change should be carried out overtly, with the full knowledge of the client, and the consequences approved through the benefits realisation or other governance process.

The design and construction process will be reliant on goods and services from the project supply chain. The value thread that feeds into the project supply chain will be the project value system. The supply chain will answer specification requirements and respond to the value thread by adding value to the goods and services provided. The design and construction process will feed information, goods and services into the project. At its completion the project will feed into the client's core business and will enhance the output of the core business.

This part of the chapter has discussed a framework for the application of a value system designed to ensure that a construction project undertaken by a client will maximise value to the client's core business. The facets of the value system and the method for determining what is of importance to the client in the context of value are reflected in the client project value system matrix. The issues concerning the practical application of the matrix in the context of the determination of the project value system is discussed later. The discussion in this chapter reflects the research and consultancy undertaken by the authors. In parallel to the authors' research, other work has been pursued in various academic institutions. Notable amongst this research is the Value in Design work at Loughborough University briefly reviewed later.

A review of VALiD (value in design)

Value in Design (2013) was a research programme at Loughborough University, completed in 2005, which sought a methodology for understanding project stakeholder values, relating the values to the project itself and finally monitoring the evolving design to ensure that the design maximised the identified values. The research spawned other research activity at Loughborough University into the subject of value.

Value in Design uses an adaptation of the Schwartz Value Survey (discussed in Part 2 of this chapter) to identify stakeholders' individual values through a sorting exercise involving printed cards with indicative value statements. The individual values contain no more than 30 criteria (facets). Stakeholder groups negotiate an agreed value position for the project, which is represented by a dashboard displaying value criteria and targets. In later work, Mills (2013) describes the use of content analysis in extracting corporate values from policy documents and guidance material as an input into the negotiation process. Mills states that the benefit of this process lies in the reassurance of stakeholders that they were informed of statutory and regulatory guidelines and best practice for delivery.

Having understood individual and negotiated project values the design team respond with a design solution. The design solution is assessed by the stakeholders by determining how well the design answers the demands of the value criteria and targets recorded on the dashboard.

During the research it was observed that not all stakeholders define value in the same way but are prepared to conform to set patterns when required to do so. When stakeholders were asked to select criteria on the basis of interest, they tended to select more criteria than those that they had an individual responsibility or had influence over. Restricting the boundaries of criteria selection was seen as important.

Stakeholders were categorised using a process almost identical to the ACID test (see toolbox):

- Approve – stakeholders with the authority to sign off.
- Consult – stakeholders with operational knowledge.
- Inform – stakeholders provided with information as the project developed.
- Decide – upper and middle management stakeholders authorised to make operational decisions.

The approach is said to be useful in identifying broad stakeholder representatives, allowing stakeholders to select relevant value criteria, set stakeholder targets and capture stakeholder design judgements during the delivery process.

Mills (2013) describes stakeholders as being 'quick to express values' whereas designers were less enthusiastic. Designers used values to justify the design. This view is confirmed in a survey of designers by Thomson (2013). This is an important point in recognising that designers should be professionally bound to accept the value systems of the client organisation and influential stakeholders.

VALiD takes a slightly different approach to the exposition of values in construction projects to that described in this chapter because of its method of making individual and thereby group stakeholders value systems overt. It is included because it is contemporary research and at a general level reaches similar conclusions to those of the authors.

11.7 Part 6 – Practical considerations and ethical issues in the use of a value system in a construction value study

The understanding of the Client's Value System at corporate level and the making explicit of the Client's Project Value System at project level is central to the development of the Project Value System. In expressing the Client's Project Value System the client stakeholders and those influential project stakeholders external to the client organisation will be sensitised to the extent to which others, involved perhaps later in the project, will seek to modify (or corrupt) the Client's Project Value System. Making explicit the Client's

Project Value System by reference to the facets described in Part 4 will also clarify those facets over which those stakeholders external to the client organisation are entitled to have influence.

Therefore, the practical considerations in the compilation of the client's project value system matrix and subsequently an understanding of the development of the project value system importantly involves the method used by the Value Study Leader (VSL) to understand the former through engaging with the value team in a value study. The ethical issues relate to whom within the value team has a stake in the client's project value system, over what facets are they entitled to have influence and therefore who should contribute to its compilation.

As discussed in Part 4 a simple paired comparison exercise is the most satisfactory method for the compilation by a team of a client's project value system matrix in a value study. Figure 11.9 illustrates a robust paired comparison matrix that has been used successfully in a number of value studies. Two case studies have been selected to illustrate the use of the paired comparison matrix by a team in a value study.

Case study 1 – New A and E department

The value study was held shortly after a fire seriously damaged the accident and emergency (A and E) unit at a district general hospital. Within days of the event, a contractor was appointed under a contractual framework to assess whether the structure remaining could be repaired or whether total reconstruction was required. Following tests by consultant structural engineers (members of the contractor's supply chain) the decision was made to reconstruct the accident and emergency department. The disaster recovery plan put into operation within hours of the fire was performing adequately and therefore it was decided not to hurriedly replace the previous unit but to consider carefully the best accident and emergency unit required by a contemporary district general hospital. A half-day workshop was held to consolidate the stage of the project, that is, for the team to agree the stage that the project had reached, the information collated to date and information required. The workshop was also tasked with understanding some of the project issues, and determining spatial adjacency and the linkages required with the rest of the hospital. A strategic brief statement was agreed as:

> To redefine and redesign the service provision for accidents and emergencies at The Hospital in keeping with the recommendations arising from the NHS Plan in particular the requirements outlined in the document 'Reforming Emergency Care'.

The value team comprised the following:

- Client – Medical consultants (6)
- Client – Service managers (7)
- Client – Nursing (1)
- Client – Financial Planning (1)
- Client – Capital Projects Manager (1)
- Client – Project sponsor, project managers (3)

- Contractor – Senior Project Manager, Project managers (2)
- Contractor's supply chain – architect, cost consultant, hospital planner (3)
- VSL and assistant VSL

With such a large and diverse client body the VSL invited the project sponsor to lead the completion of the client's project value system matrix but she deferred to the medical consultants present. The medical consultants, all from different medical specialities, were of one mind in the completion of the matrix, which confirmed the theories relating to corporate and individual values described earlier. However, the medical consultants were less concerned about finance and there was some perceived discomfort amongst the service managers and financial planners who, when invited to comment by the VSL, declined. This illustrated the problem in a situation where the client group can be viewed as a number of discrete disciplines and specialities and with differing responsibilities in a perceived or real hierarchy.

The client's project value system matrix is illustrated in Figure 11.14. It was completed by a paired comparison exercise that gave a weight to each facet and demonstrates that the three most important aspects to the medical consultants were, in order, Flexibility, Comfort and Community/Accessibility. This indicated that the built facility must be adaptable both internally and externally, for instance, in terms of expansion and linkages with the other hospital buildings. The project must take into account the internal comfort of patients and staff, and it must be considered accessible to the direct community and wider public. A comment made by a member of the client group about the completed client project value system matrix was that it reflects an 'inside building', meaning that the focus is on how the building functions rather than its external form or aesthetic appeal.

A. Capital Cost – CAPEX							
B	B. Operating Cost – OPEX						
C	B	C. Time					
A	B	D	D. Environment				
A	B	C	D	E. Esteem			
F	F	F	F	F	F. Flexibility		
G	G	G	G	G	F	G. Comfort	
H	H	H	H	H	F	G	H. Community / Accessibility

A	B	C	D	E	F	G	H	
2	4	2	2	0	7	6	5	Total

Figure 11.14 Client project value system for A and E project.

Case study 2 – Local authority/health service partnership centre

The partnership centre, the subject of the value study, was one project in a Programme of projects to regenerate a run-down area (approximately 100 ha) of a large UK city. The mission statement for the programme was as follows:

> Regenerate the area as a desirable place to live, improve the feeling of the community, strengthen the local economy and facilitate the provision of good quality shops.

Within the Programme the mission statement for the partnership centre was as follows:

> The Partnership Centre is a platform for integrated services to improve the health and wellbeing of the local community by providing better services and appropriate additional services.

The value team comprised representatives from the local authority and from the health board together with representatives of the framework contractor engaged for the partnership centre project. The VSL interacted with the team as a whole to get a consensus on values. In this instance a two-stage process was adopted:

- Stage 1 required consensus on the relative importance of each of the facets in the matrix by asking the question 'which is more important A or B'. Alternatively, the question was considered in terms of whether A could be sacrificed for B.
- Stage 2 refined the choice by indicating how much one facet was more important than another based on a split of 5 points.

The value study team comprised the following:

- Client – Senior managers (local authority and health board) (2)
- Client – Service managers local authority (4)
- Client – Service managers health board (2)
- Client – Financial Planning local authority (2)
- Client – Capital Projects Manager health board (1)
- Client – Project sponsor, project managers (4)
- Other stakeholders (3)
- Contractor – Programme Manager, Senior Project Manager (2)
- VSL and assistant VSL

Although the client's project value matrix exercise ran very smoothly and the team was receptive, a lead was taken by the senior managers present with the VSL obtaining cues of agreement or disagreement from the body language of the other members of the team.

The team appreciated the opportunity of awarding points as illustrated in Figure 11.15, indicating a measure of importance of one facet over another, and this facility tended to speed the process rather than delaying it. The disadvantage of the two-stage process was

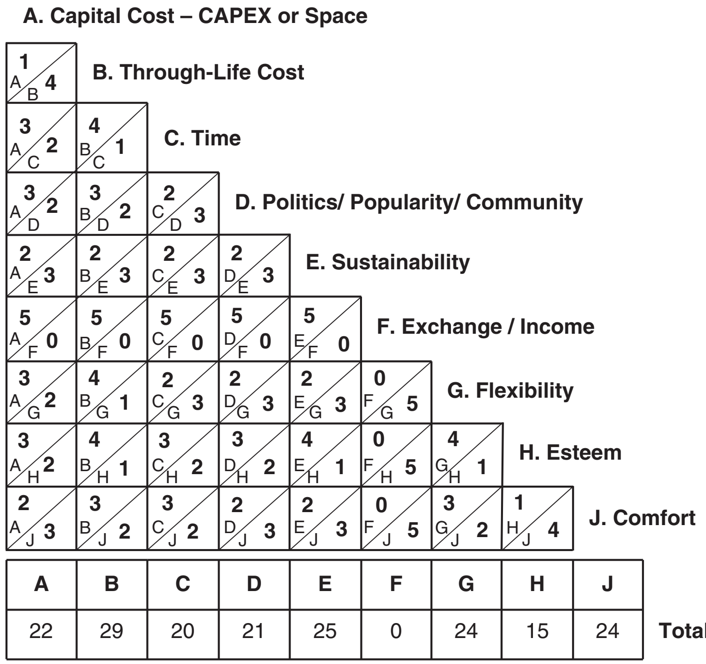

Figure 11.15 **Client's project value system matrix with importance weighting.**

that the numeric difference was smoothed although the hierarchy of facets was preserved. The team agreed with the conclusion that the minimisation of revenue costs was the most important facet with sustainability, flexibility and comfort almost equally important thereafter.

Ethical issues in the completion of the client value system

The client's project value system determined through a facet matrix is a powerful tool and undoubtedly influenced the thinking of the design and construction team in the projects in which the authors were involved. There are, however, some ethical issues that are worthy of debate:

- The VSL as workshop manager is always in a position of power. There is a danger in completing the client's project value matrix, with the VSL acting as a quasi-arbiter amongst competing interest groups represented in the value study team. This is clearly unacceptable in obtaining consensus. There is no straightforward answer to this problem and it is a problem that affects the role of the VSL using other techniques. However, the client's project value system matrix is a powerful and influential technique and should be based on consensus.
- The role of attendees to a value study must be understood by the VSL prior to undertaking the value matrix technique. The client body is not a unitary organisation and within that body will be those who have a clear responsibility for some of the

facets and those that do not. For example, the finance director has a clear responsibility for CAPEX and OPEX whereas the logistics director may be less concerned with finance and more concerned with time and supply chain issues. Additionally, some stakeholders will only have influence over minimal numbers of facets. The authors consider that the design and construction team have no jurisdiction over client project values, and if they are in attendance at the value study they are there to understand the client's project value system so that it can be reflected in the design and construction process. In reality however, the design and construction team are influential and may wish to subsequently 'sell' a value position to the client. Where this occurs it should happen after the completion of the client's project value system matrix.

- Thiry (2000) raises the issue that as the pressure for shorter and more focused value management studies intensifies, and the complexity of projects subject to value management increases, then consideration has to be given to the communication and data structures that exist within the value workshop. This is a useful comment in the context of the value systems. The question is whether given more time to think through the value system, rather than being required to give an 'on the spot' performance, would the answer be different? Some people react well to immediate demands whereas others require time to consider. It is the nature of a value study that those who are familiar with the technique because they have used it before and those who excel in on the spot performances will tend to lead a value matrix exercise. However, it is the role of the VSL to ensure that others present within the workshop have the opportunity to contribute.
- During the value study workshops led by the authors, apparent logic errors were perceived during the completion of the client's project value matrix. These were not noticed by the team and were not drawn to their attention as the apparent errors were few in number and would not have impacted the result. The logic errors were, if A is more important than B and B is more important than C, then can C be more important than A. The reason for not drawing this to the attention of the team although it was noticed at the time was the uncertainty of the result. It is logical to say if A is taller than B and B is taller than C then A is certainly taller than C but this relies on a simple interval scale. The value system matrix is not based on an interval scale; the ranking was only ever used to state a general conclusion. However, if the value system is to be relied upon to produce a Whole Life Value factor (discussed in Chapter 12) then logic errors should be raised and discussed, although this may give rise to 'wear and tear' on the team as indicated by Saaty (1980).
- The overriding presumption in this chapter is that the client's project value system matrix is completed at strategic briefing as a part of a proactive value study on a project moving forward. Whether the design and construction team are appointed at this stage will depend upon the procurement route. If the client's project value system matrix is used at, for example, a Charette then it is being used as part of an audit process to confirm the client's project value system following concept design. It is still the authors' opinion that the client stakeholder team alone should complete the client's project value system matrix. This may expose tensions between the client's project value system and the evolving project value system, which will require careful management by the VSL.

There are a number of issues in the previous discussion. The primary constraint for a value study is always time. Time in a workshop is precious and therefore any method that can be employed to make a process more efficient should be explored. Furthermore, there is more that can be done prior to a workshop to obtain the views of stakeholders through questionnaire and Delphi techniques.

11.8 Conclusion

The purpose of this chapter is to explain the derivation of a methodology for determining those facets that combine to best describe the context of a value system for a construction project. In undertaking this task it is important to review the philosophical background to value to ensure that the debate and subsequent methodology is correctly founded and keyed into contemporary value thinking. In the analysis, a number of conclusions were reached:

In the definition of value

- Intrinsic value is that which is contained within the object or indeed within the concept of the object and can be anticipated before the object exists. Intrinsic value can be described or specified by means of a number of facets.
- Extrinsic value is that which is given by the object, once it exists, in terms of pleasure, aesthetic, appreciation, and so on.
- Instrumental value is that provided by the object itself in meeting specified intrinsic value requirements.

Value models in the VE/VM literature:

- There are many models of value discussed in the literature, the majority of which describe a relationship between either function and cost, or cost, time and quality.
- The models are described in terms of their relevance to the producer, customer, consumer or user.

Individual values:

- There is considerable literature that discusses individual values and a number of models developed for the understanding of individual values.
- There is reasonable consistency in the description of individual values comprising an inner core of key beliefs, which tend to remain unchanged over time and an outer layer of opinions that are influenced by the inner core but which can be moulded by information gained through, for example, advertising.

Quality:

- Quality can be viewed in two parts:
  - Total Quality Management, which is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated needs or implied needs.
  - Quality Assurance, which focuses on freedom from defects.

- Quality is a construct of comparability where individuals or groups assess the degree to which stated objectives, characteristics and/or attributes have been met. This is assessed based on a degree of excellence determined as the provision of all basic functions at the required level and all performance functions at the highest level. Delight functions provide the added value.
- Quality is a variable of value in that value is a relationship between cost, time and quality. There are therefore facets of quality that are common with facets of value.

Facets of a value system:

- Value can be described by a number of facets, namely, time, cost and quality subdivided into capital cost and operating cost, time, esteem, flexibility, comfort, community, environment and exchange (financial return).
- The facets can be ordered by simple paired comparison into a hierarchy of importance. This gives form to the value system and is used in a value study in a matrix to determine the client's project value system.

Value systems of organisations, businesses, projects, practitioner's, consumers and stakeholders:

- The approach to value is determined by the individual or group configuration and relationships.
- The value thread is communicated by the corporate client to the core business supply chain and indicates the client's value system.
- The value chain notes the benefits given by the supplier in response to an understanding of the client's value system.
- Individual's inner core of beliefs tend not to influence the value system of the organisation for whom the individual is working (There are some exceptions based upon authority and power of the individual).
- Practitioners are not generally classed as influential stakeholders and should not impact the resultant client's project value system. However, there are caveats, which are discussed in this chapter.

The project value system:

- The project value system is the resultant of the client's project value system and is formed after the completion of the strategic brief during the project briefing, design and construction process.
- The client's project value system will be assumed by the design and construction team if it is not made explicit by the client.
- The interlinking of influences that give the project form and value are given in Figure 11.13.
- For the client to obtain maximum value from the project, the client's project value system has to be a part of a structured project briefing and design process notwithstanding that it will be refined and adapted to become the project value system. These refinements will be clear for all to see and for the client to approve.

In summary therefore, a client wishing to invest in a construction project to enhance core business is required to produce a comprehensive set of information different in type and scale to those where the client is to purchase a product from a catalogue. The project brief will be required by the design and construction team who will develop, using their own professional and technical expertise a technical solution to the project requirements. The project will thereby be given form and value. In the absence of a client's project value system the design and construction team will be influenced by their interpretation of the client's corporate values. The design and construction team will also be influenced by extrinsic values such as those relating to esteem and environmental issues. The project will attract these values whether or not an explicit client's project value system has informed them. It is argued here that it is better if an explicit value system does inform those values by which the project will be developed and assessed.

The client's project value system must be made explicit before design commences and should be expressed in a form that can be used as a part of a benefits realisation structure that monitors the design through its evolving stages. The use of the client's project value system in this context is discussed in Chapter 12, whole life value.

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12 Whole Life Value

12.1 Introduction

Whole Life Value (WLV) is a systems approach to the discovery, representation, measurement and audit of the lifetime value of an asset to an organisation. Whereas value management (VM) and value engineering (VE) can be (and most commonly are) conducted as interventions in a project development process, WLV is a methodology relying on a systems approach to the delivery of the most appropriate facility and the evaluation of the facility over its defined lifespan. A system in this context refers to a number of individual processes working synergistically to deliver the whole life value assessment. Within the systems approach the whole and the component parts of the project are functionally defined, assessed by reference to a value system and subject to a whole life cost and time factor assessment. Therefore, while VM and VE are indispensable contributors to the project management process, WLV is an integral part of project management and asset management. The concept of WLV is not new; the Office of Government Commerce (OGC), Achieving Excellence guidance (OGC, 2003) states:

> The main success criterion of a construction project is the value of the facility to the organisation over time. Successful delivery requires an integrated process in which design, construction, operation and maintenance are considered as a whole – together with an understanding of how the project will affect business efficiency and service delivery over the lifetime of the project. It also requires effective use of project management techniques such as risk and value management.

The OGC quote highlights the confusion that surrounds the term 'the lifetime of the project'. The options for the definition of the end of the life of a project are as follows:

- When the project is absorbed into the core business of the client and is 'ready for use'.
- When the client's strategic need for the functionality provided by the project ends.
- When the asset of which the project has become a part is disposed of.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

For the avoidance of confusion, the position adopted in this book is reiterated as follows:

- A project is defined as a vehicle to deliver an investment to enhance an asset and/or a business activity.
- The life of a project begins at the inception of the project and ends when the project is absorbed into the core business of the client. The end of the project is the 'ready for use' date.
- Value for money (VfM) is defined as the optimum combination of whole-life costs and quality (or fitness for purpose) of the good or service to meet the users' requirement. VfM is achieved when the highest level of benefit is received from the enhanced asset in exchange for the least consumption of resources.
- A WLC study is entirely capital and through-life cost focused.
- WLV study in addition to whole life cost includes subjective measures of functional benefit, value and a time factor. At the earliest stage of the project's development when conceptual options are first considered it is only those characteristic risks to cost and time that can be considered. Cost risks can be covered in the WLC and time risks considered separately as a time factor.
- A WLV study will treat WLC as the capital investment, that is, relevant investment costs accrued until the project is absorbed into the client's core business and is 'ready for use' (the base date), plus the Net Present Value (NPV) of the estimated through-life costs over the study period, that is, the estimated total operating cost of the enhanced asset from the ready for use date until the end of the study period. For example, in a project to insulate the roof of a factory to save energy, the capital costs are those of the installation of the insulation until the work is complete. The asset is therefore enhanced once the project is complete. The total operating costs of the enhanced asset are calculated as the estimated Net Present Value over the study period, the time horizon, which commences at the completion of the project (the base date) and ends at the end of the stated study period. The project therefore ends when the project is absorbed into the client's core business but its impact on the latter in estimated Net Present Value terms, over the study period, is accounted for in the WLC.
- A WLV study is based on the change resultant from a project. Once a project is complete and absorbed into the client's core business then any subsequent requirement for change indicates the requirement for a new project.
- A WLV Factor is calculated to facilitate option appraisal at strategic briefing and to establish a benchmark, a key performance indicator (KPI), against which subsequent choices in the developing project can be assessed. The WLV Factor is a number on a scale measuring value for money.

This chapter is in two parts. The first is the debate of the concept of WLV with a discussion of the methodological approaches proposed in the literature. The second part is a case study demonstration, based on the case study used in Chapter 3, of a heuristic approach to the discovery and monitoring of WLV. The heuristic approach promotes team learning through a step-by-step methodology that relies on a series of logic statements.

12.2 A discussion of the methodological approaches to WLV

In 2005, there was a useful debate on the subject of WLV, which defined the concept, its relationship with the design and construction process, and outlined the challenges and barriers to its introduction (Saxon, 2005; NAO, 2005; Mootanah, 2005; Bourke *et al.*, 2005). Bourke *et al.* (2005) defines the WLV of an asset as representing the optimum balance of costs over the life of the asset with the stakeholders' aspirations, needs and requirements over the same period of time. Mootanah (2005) states:

> Whole Life Value (WLV) encompasses economic, social and environmental aspects associated with the design, construction, operation, decommissioning, and where appropriate, the reuse of the asset or its constituent materials at the end of its useful life. WLV takes account of the costs and benefits associated with the different stages of the whole life of the asset.

The National Audit Office (NAO, 2005), in a critical review of government departments' procurement strategies, stated that departments needed to improve their construction delivery performance by introducing independent challenge to their conceptual thinking and business cases. Furthermore, departments must overcome the practical difficulties in procuring construction on the basis of sustainable WLV, which can be achieved by the following:

- Investing more time and resources in the early planning phase of construction.
- Ensuring that the running costs of the proposed built asset is affordable over its whole life and reflecting this in the business case for the project.
- Assessing the wider economic, social and environmental impact of the proposed built asset and being overt in its representation.
- Being clear from the outset of procurement about the departments' WLV criteria for awarding a contract and the performance expected of suppliers.

The barriers facing the adoption of WLV by government departments were seen to be:

- The lack of clarity in, and understanding of, the WLV process (although this is not defined in the report beyond the preceding bullet points).
- The absence of suitable tools to assist clients in understanding and evaluating the interrelationships between whole life costs, time and quality, and the wider social, environmental and economic impacts (positive and negative).
- The lack of whole life cost data.
- The scarcity of quantifiable evidence of the benefits of adopting a WLV approach.

Bourke *et al.* (2005) lists the challenges facing the implementation of WLV:

- The consistent application of WLV principles in the development and management of assets.
- Ensuring the data used at the various stages of development are available and reliable.

- Involving stakeholders at various points within the development process and ensuring their different values and objectives are efficiently coalesced to deliver the required outcomes. This implies a system of measurement and integration.
- Managing initiative fatigue.
- Determining who pays for and who benefits from a WLV exercise.
- Overcoming the current perceived conflict between budgets and the WLV process.

Bourke *et al.* (2005) states that WLV requires a multistage process of progressive improvement in the level of detail and accuracy of a project as it progresses through its development life cycle. The multistage process involves a framework that:

- Identifies competing value drivers and develops value measures for prioritisation purposes.
- Uses whole life cost, risk and value management tools and techniques at each stage of the project life cycle.
- Provides the mechanism for evaluating alternative investment options at each key decision-making stage.
- Supports benchmarking.
- Enhances effective and efficient decision-making during the project development process by referring to the stakeholders' value drivers.
- Identifies the best value solution.

Mootanah (2005) states that the key methodologies supporting WLV are whole life costing, life cycle assessment, value management, risk management and multicriteria assessment.

Saxon (2005) argues for a two-stage approach to maximising WLV through the following:

- Enhancing the front-end inputs into project definition, brief making, design and delivery planning through building information management systems.
- By putting effort into understanding how value is created for the occupying organisation and how costs are created in use.

Referring to the second approach, Saxon describes a concept of pulling value through the construction and development process from the facility management end of the supply chain. The assertion is that value pulling is a reversal of the traditional model and would focus the team on owner-occupier performance. This process is enhanced if members of the project design team were to occupy the new facility, gathering feedback as well as easing occupiers into their new workplace – a process termed 'soft landings'. This approach is being promoted by the UK Cabinet Office through its 2013 guidance on Government Soft Landings (GSL) (Cabinet Office, 2013). Although GSL is focused on handover, the process should be described and recorded in the project brief. There could be an implication that by focusing on the output, the potential points at which the client's value thread through the project can be broken is realised and therefore the value thread is reinforced at these points. This logic could emphasise the importance of a proper transfer of the value thinking that drove the project to the asset management stage once the project is complete and incorporated into the core business.

It can be concluded from the preceding debate that WLV:

- Utilises whole life costing, life cycle assessment, value management, risk management and multicriteria assessment.
- Relies on the development of value measures for prioritisation purposes.
- Defines the outcome requirements or functional benefits.
- Is methodological, employing tools and techniques to
  - Provide a basis for the option appraisal process;
  - To act as the benchmark against which developing designs and procedures can be assessed; and
  - Be used at key design development stages.

The burst of activity in 2005 summarised, with a reasonable degree of consensus, the need for and nature and form of WLV but with little practical guidance on its use during the lifecycle of a constructed asset. The following sections present a conceptual WLV model conducive to practical application. The practical application is illustrated by reference to a case study.

The development of a conceptual WLV model

The development of a conceptual WLV model requires the answer to three primary questions:

1. What is a WLV evaluation process?
2. What are the component parts of a WLV model?
3. How is the model used at different stages in the process and subsequently through the life of the asset?

The WLV process

From the debate earlier, a WLV process comprises a number of distinct events/interventions that take place during the strategic brief, option appraisal, design development, construction, integration with core business and operational stages. The WLV model developed at the strategic brief stage will be required to evolve into a form capable of application at each of the other stages therefore implying a two-step process of model creation and model use.

The two-step development approach is discussed by Takim (2005) in her investigation of performance in construction procurement. The study differentiates between critical success factors (CSFs) and KPIs, stating that CSFs are the input factors determined at strategic briefing for the purpose of strategic option appraisal. The CSFs transform into KPIs, which are the efficiency and effectiveness measures used during the development stages of the project and against which the success or failure of the project will be judged.

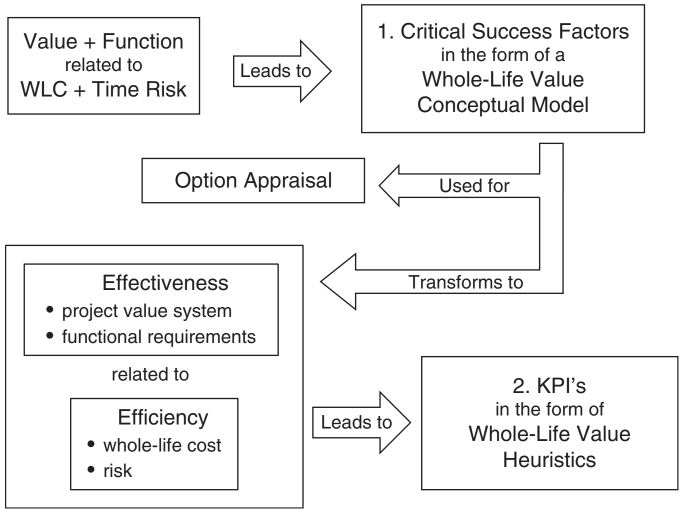


Figure 12.1 The two-step WLV process.

Efficiency is associated with the 'process orientated' measures, embracing strategic planning and the management and utilisation of resources. The effectiveness element is associated with 'result orientated' measures and relates to the project outcomes, such as the accomplishment of the core business objectives and asset improvements described in the project objectives. Effectiveness is reflected in client and user satisfaction, and achieved through the use of the enhanced asset. Takim concludes that project success measures in the form of KPIs must be overtly founded in an understanding of the CSFs for the project.

An interpretation of Takim's research leads to a proposal for a two-step process for WLV:

- **Step 1** – The CSFs are founded in a WLV conceptual model comprising the required benefits, defined in the Client's Project Value System Matrix and the Functional Specification, as related to Whole Life Cost and Time Factor. The WLV conceptual model is used for strategic option appraisal and informs the Strategic Outline Case.
- **Step 2** – Uses the Client Project Value System and the Functional Requirements as effectiveness measures together with Whole Life Cost, and Time Factor as efficiency measures. The effectiveness measures and the efficiency measures combine in a WLV heuristic used as KPIs to assess the project from concept design to use.

The two-step process is illustrated in Figure 12.1.

The component parts of a WLV model: Part 1 – Conceptual model for option appraisal

The WLV conceptual model must be first, in a sufficiently robust form to enable option appraisal at the strategic briefing stage, and second, be in a form that allows a transformation such that it can be used in subsequent stages for budgeting, benchmarking and as KPIs. This section describes the logical development of the conceptual model for use at option appraisal in three parts:

1. The characteristics of a successful WLV conceptual model.
2. A brief discussion of measurement and scaling.
3. A review of option appraisal as described in HM Treasury Green Book (TGB) (HM Treasury, 2011) and a discussion of the fit of the proposed WLV model into the TGB approach.

The characteristics of a successful WLV conceptual model

The debate on the characteristics of a successful WLV conceptual model must address three questions:

1. What are concepts in the context of a WLV conceptual model?
2. What does a conceptual model look like?
3. How accurately can the model represent reality?

Items in the environment may be discovered but until concepts are attached to these discoveries they cannot be described. Concepts do not naturally occur; we invent them (Rigby, 1965). For example, a piece of rock may be perceived as being large and heavy but until we invent the concept of volumetric measure and the concept of numerical weight we cannot fully describe the rock. All physical laws rely on concepts for their representation. Concepts are therefore part of the language used to describe the real world.

Conceptual models are constructs of the real world; inventions of the human mind that provide a means for organising and understanding observations. Conceptual models are constructed to facilitate the interpretation of an idea or a natural occurrence. However, in some circumstances this interpretation can be influenced by culture, perspectives and existing paradigms. Ideas and natural occurrences fall into two distinct categories:

1. Those that can be judged by physical laws and are measured usually with a physical tool. Examples are speed, force, stress, pressure and torque. The measurement is on an interval scale (see next section), for example, weight, dimension, capacity, temperature and magnetism.
2. Those that are measured subjectively. Examples of subjective measures are quality, aesthetics and ethics, where the scale relates to safety, security, goodness, compassion, excitement, comfort, and so on. Clearly, the more accurate the scale the more accurate the measure. However, it is the ideas and natural occurrences measured subjectively that are more prone to variance by culture, perspectives and existing paradigms than those judged by physical laws.

Economic models and cost models are a special case in which the numerical measure relates to the monetary amount of an item's production cost, sale price or worth. Models vary from highly subjective economic models of an economy, which generate theories of likely out-turns, to objective cost models of a production process. Within this range are models that rely on a data set comprised of a monetary valuation. Those responsible for monetary valuations can display a significant degree of variance in making a monetary valuation of the same object or idea.

The accuracy of any model in representing reality relies on the accuracy of the calibration of the measurement scale and the benchmark against which the scale is set. The world standard kilogram is held in a vault at the International Bureau of Weights and Measures near Paris. Without this benchmark nothing could be accurately weighed. Logically therefore, the accuracy of the conceptual model increases as variance in measurement decreases.

Measurement and scaling

All conceptual models rely on a measurement system. There are four generic scales for measuring data termed nominal, ordinal, interval and ratio scales, which have the following characteristics:

- *Nominal scale* is an integer scale based upon counting the number of occurrences of an event. For example the number of votes cast in an election, the number of males in a population sample or the number of times '6' occurs on the throw of a dice. The numbers are pure integers and can be statistically processed or otherwise manipulated.
- *Ordinal Scale* is a ranking scale where the number indicates a position in a series or where the number is a surrogate for descriptive criteria. An example of the former is a class of children lined up according to height, shortest to the right, and numbered in sequence. The number given to each child indicates position in the sequence according to height but does not reflect the actual difference in height, that is, the interval between numbers is not constant. Situations where the number is a surrogate for descriptive criteria arise in surveys where, for example, a '5' is excellent and '1' is poor. Statistical processing is relatively straightforward on an ordinal scale, but care has to be taken in other mathematical processing particularly in the context of multiplication within a weighting and scoring process.
- *Interval Scale* is one in which the interval between numbers is exactly the same but where there is no natural zero. The most quoted example is temperature (indeed it is difficult to think of another example). The interval between each degree is the same anywhere on the scale but it is meaningless to state that a rise in temperature from 15° to 30° means that it is now twice as hot as it was.
- *Ratio Scale* is an interval scale with a natural zero. Measurements of weight, length, area, volume, voltage, time, and so on, can be taken and the results multiplied and divided. The notion that something is twice as heavy as something else, 2 h is twice as long as 1 h, or that 6 m is twice as long as 3 m is meaningful. Logarithmic scales, for example, decibels, obey the same rules.

Measurement of subjective data

The measurement of data that is subjective in nature for the purposes of option appraisal is a challenge to those accountable for decisions particularly in the public sector. Two approaches predominate:

- The first approach uses proxies. A common proxy is currency. For example, the best of three optional road safety schemes may be justified by balancing the capital cost of each scheme against the monetary saving to society based on the estimated reduction of fatal accidents resulting from the implementation of each scheme.

  An alternative proxy is the use of parallel data. For example, it may be possible to make an assessment on the number of uncomfortable houses in the United Kingdom, by using proxy data on age and location offset by data on the number of properties that have been in receipt of a grant for improvement in heating or insulation.

  Both types of proxy measures are described in social return on investment literature for example, the Cabinet Office (2009), Kirkland (2012), and Wood and Leighton (2010). However, the latter state that the Gates Foundation investigation on the creation of social value found eight characteristic approaches that all used currency-based proxies; no evidence was found of the use of parallel data.
- The second approach uses multicriteria assessment (MCA) in conjunction with a validated conceptual model. MCA is commonly used where a subjective assessment has to be made taking account of a number of factors, for example, quality assurance, sustainability and environment. Accuracy in modelling increases when the MCA method is replicable to a high degree and the data is at a level where variance is perceived to be minimal. Accuracy also increases when the measurement scale, whilst ordinal, tends towards the integer values of a nominal scale.

Models for option appraisal

The Treasury Green Book (TGB) defines the purpose of option appraisal as a facilitation of the development of a value for money solution that meets the objectives of the strategy, Programme and/or project. The TGB approach to option appraisal is reviewed in Chapter 10. The important elements of the option appraisal process from the perspective of WLV are as follows:

- The requirement for a methodology and a set of principles to appraise Programmes or projects, assessing measurable benefits and/or cost at inception (strategic briefing) before significant funds are committed and
- Evaluating the performance of past and present activities to enable learning from experience.

The TGB approach is one of relating benefits and sacrifices to whole life cost. TGB describes two types of methods (see Chapter 10 for more details) for enumerating benefits and sacrifices:

- Cost–Benefit Analysis (CBA) represents the most popular form of proxy modelling in which the benefits less sacrifices are given monetary values through substitution costing, opportunity costing, revealed preference or stated preference techniques. CBA as a method has attracted criticism. Ding (1999) gives a comprehensive description of CBA but concludes with the statement that public sector projects commonly attract externalities and intangibles, which make the outcomes of a CBA exercise highly questionable. Kennedy (1981) and Heinzerling and Ackerman (2002) are critical from the perspective of the subjective assessments in law and matters relating to the environment.

Provided a detailed methodology is followed, MCA is a more accurate, credible and easier to manage evaluation method for use with stakeholders than CBA. Therefore, MCA is the method used in this description of WLV.

The WLV conceptual model is developed and used together with value management activity through the progression of the project and subsequently in asset management, facilities management and benefits realisation. The phases in the development of the model are described next.

Phases in the development of the WLV conceptual model

Phase 1 – Context and inception

The initial phase in the development of any project or Programme of projects will occur within the client organisation. Understanding the context is an important step in the WLV process and relies on making overt the asset management strategy of the client, which involves the whole life management of assets from 'cradle to grave'. Chapter 8 describes how physical assets have a vital role in successful business and organisational functioning and should be planned, managed, maintained, refurbished and disposed of according to an agile asset management plan. The presumption is that infrastructure and space should be conducive to efficient business activity and not the business activity being designed to fit the facility and infrastructure available.

Chapter 9 explains the purpose of Portfolios, Programmes and projects and the importance of their explicit definition to the business/organisation. Chapter 10 outlines methods of option appraisal, which aims to satisfy all those concerned with the outlay of resources that there is a clear requirement for this investment at this time.

The definition of the context of the enterprise gives scope and direction. This may be as straightforward as 'we are building an estate of 500 new homes and require an addition to our primary education provision' to a more complex 'we anticipate that 50% of our future business will be conducted "on line" and we require a new logistical distribution network'. Those who will ultimately be called upon to fund the enterprise will gain confidence through the proper resourcing of a strategic briefing study resulting in clarity of project definition.

Phase 2 – Strategic briefing

The WLV conceptual model is developed during strategic briefing. Strategic briefing (described in detail in Chapter 3) identifies the broad scope and purpose of the programme or project and its important parameters. The focus is on articulating strategic needs and wants and the role and purpose of the investment and business project for the client organisation particularly the reason for this investment. A strategic briefing study describes clearly and objectively the mission of the programme or project in business terms and its strategic fit within the corporate and/or social aims of the client organisation. The strategic brief answers the following questions:

- What are the goals of this project?
- What is the definition of this project?
- Why is this investment needed at this time?
- Does this project fit the strategic plan of the organisation?
- Is this project part of a Programme?
- Is this project dependent on other projects? If yes are they affordable/likely to go ahead?
- Is this project competing with other projects? If yes then which project will bring about the greatest WLV benefit?

The primary purpose of the strategic briefing study is to ascertain and appraise the options and permit the decision to proceed to be taken in the full knowledge of all relevant facts. On completion of the study, the decision to pursue the selected option can proceed with confidence, given that all relevant issues and options have been explored and addressed. Generally, the options will be ascertained and short-listed during the workshop phase of a value study and appraised during the implementation phase.

During the study, three important steps are undertaken:

1. Defining the function of Programmes and projects. Acting upon initial awareness of the necessity for a Programme or project is always a development stage within the client organisation. At this stage the need for a construction project to satisfy a corporate objective has yet to be determined. Unfortunately, many clients define projects in constructional terms, for example, we need a new headquarters building. Such a definition is certain to lead to a construction solution that may not be the best option. Function analysis, described in Chapter 4, makes no presumption of solution or indeed specification; it merely expresses the need functionally. Equally, an asset management approach, as described in Chapter 8, also argues for the investigation of non-asset-dependent approaches in satisfying functional need. Therefore, function analysis is a vital step in the WLV methodology.
2. In defining the value of Programmes and projects the majority of value management texts cite value as a relationship between function and cost or as a relationship between time, cost and quality. In Chapter 11, an argument is made that intrinsic value (a type of value that can be specified in anticipation of products or services) can be defined by time, cost and quality subdivided into the facets of capital cost and operating cost, time, esteem, flexibility, comfort, community, environment and exchange (financial return). Chapter 11 further identifies (Figure 11.16) a relationship between the corporate client's value system, the client's project value system, the influential stakeholders' value system and the project value system. The project value system may or may not be influenced by the value system of the design and construction team as discussed in Chapter 11. An understanding of the client's project value system and its relevance to the client's core business allows quantitative and qualitative measures to be attributed to value.
3. Generate outline solutions to the requirements of the strategic brief and develop and present as options in sufficient detail for an option appraisal exercise to be undertaken.

The development of a WLV conceptual model and its use in option development and option appraisal is described in Phases 3 and 4.

Phase 3 – Development of the WLV conceptual model

The WLV conceptual model is a methodological approach that facilitates an option appraisal exercise, based on the quantitative measurement and qualitative assessment of whole life cost and whole life benefits. The whole life benefits of the proposed project are defined by the client's project value system and the functional requirements of the project. As discussed in Chapters 4 and 11 the functional requirements and the client's project value system are established at the strategic briefing stage before any options are produced. The mission statement of the project and the supporting strategic functional requirements are defined in a function analysis system technique (FAST) diagram structured to express the relative importance of functional needs and wants. The client's project value system matrix, described in Chapter 11, is a method for expressing the characteristic high-level values of the client with respect to the proposed project in order of relative importance. The options considered in option appraisal are produced in answer to the functional requirements and the client's project value system. Once options are generated they can be assessed on the basis of the extent to which the options satisfy the functional requirements and the client's project value system. Clearly, a whole life cost estimate for each option is always option specific. The anticipated whole life cost of each option should be adjusted to take account of the risk involved in the option selected that the project will not be completed on time. In undertaking an option appraisal exercise at the strategic options stage, the heuristic used to assess each option is represented by the following expression:

$$\text{WLV} = \frac{\text{Whole-Life Benefits (functions and value)}}{\text{Whole-Life Costs}}$$

The form of this expression follows the logic discussed in detail in Chapter 11. Whilst the majority of those authors reviewed operationalize value as a relationship between function and cost, a significant proportion of particularly later authors refer to value as a relationship between benefits and cost.

It is important to recognise that NO author of a value management text seeks to determine how much a unit of benefit costs by using the following expression:

$$\text{Cost of a unit of benefit} = \frac{\text{Whole-Life Costs}}{\text{Total Units of Benefit}}$$

The reason why this expression poses difficulties is in the calibration of what constitutes a unit of benefit in the context of a unit of currency.

It is practical to understand the function requirements of a project and represent them in a hierarchy diagram as described in Chapter 4. It is also practical to understand the client's project value system as described in Chapter 11. Both the function diagram and the client's project value system can be constructed as a part of the strategic brief before any options are considered. The client's project value system matrix diagram results in a hierarchy and a weighting reflecting the importance as determined by the stakeholders (the client representatives and the influential stakeholders), for each of these nine facets:

1. Capital cost
2. Operating cost
3. Time
4. Esteem
5. Flexibility
6. Comfort
7. Community
8. Environment
9. Exchange/Financial return

The function diagram and the client's project value system as a part of the strategic briefing process, prior to the consideration of options, answer the following questions:

- What is the mission of this project?
- How do we judge success?

Phase 4 – The numerical form of the conceptual model

As discussed earlier, the three elements of the WLV conceptual model are the functional requirements of the project, the client's project value system and the whole life cost adjusted for the time factor.

The functional requirements of the project and the client's project value system are derived as a part of the strategic briefing of the project and apply to the project prior to the development of any options. In the development of the function diagram, a numerical weighting of each of the level 2 functions is applied using the SMART technique described in Chapter 4. In the development of the client's project value system, an importance weighting is given to the nine facets as described in Chapter 11. The weighting numbers are derived from the votes of the client stakeholder team and are on a nominal scale.

Once options to satisfy the project requirements have been developed, option appraisal can commence by asking each member of the client stakeholders' team, including the influential stakeholders, to complete a questionnaire with the following questions:

- How confident are you (on a scale of 1 to 5) that the option under consideration will meet each functional requirement?
- How confident are you (on a scale of 1 to 5) that the option under consideration will meet each value facet?
- How confident are you (on a score of 1 to 5) that the estimated whole life cost for the option under consideration can be achieved?
- How confident are you (on a score of 1 to 5) that the option under consideration will permit the project to be completed on time?

The questionnaire uses a Likert scale where the numbers 1 to 5 have a specific meaning:

5 = Strongly agree
4 = Agree
3 = Uncertain
2 = Disagree
1 = Strongly disagree

The use of a Likert questionnaire is necessarily accompanied by a debate on the meaning of the numbers. Strictly speaking the numbers 1 to 5 are ordinal indicating no more than a position in a series. However, it is argued that in the context of a value management exercise in which stakeholders have been facilitated through a process in which consensus has been achieved and explicitly recorded at so many levels, those stakeholders will be able to grasp the concept of voting points on a scale of 1 to 5 thereby introducing a measure of calibration. The second argument in favour of the proposed form of conceptual model is that the procedure is replicable from project to project and is applied in an identical manner to each option in the option appraisal.

Phase 5 – The logic of the whole life value conceptual model

The output of the conceptual model is a Whole Life Value Factor representing a number on a scale that is indicative of value for money. This permits comparison between options in an option appraisal based upon a single summary figure. The logic of the operations preceding the production of the Whole Life Value Factor is explained later but relies on the argument that quantitative and qualitative measures can be amalgamated by normalising them into a consistent notional scale with 100 notional units. This is a pragmatic approach to the examination of data and has the following advantages:

- Logical
- Replicable
- Capable of being improved by calibration over time
- Entirely transparent from the first stage of the strategic briefing exercise

The whole life value of a specific option in an Option Appraisal exercise represents the relationship between the degree to which stakeholders are confident that the required whole life benefits (project functions and the client's project value system) are satisfied by the specific option being examined and are confident that the whole life cost of the specific option, adjusted for time, can be achieved. For each option, both whole life benefits and whole life costs are represented by an index of 100 notional units.The whole life value factor relies on logic statements that guide the mathematical procedure for the development of the WLV factor. For the expression

$$\text{WLV factor} = \frac{\text{Whole-Life Benefits index (functions and value)}}{\text{Whole-Life Costs index}}$$

The logic statements are as follows:

1. For constant whole life benefits, the WLV factor increases as the WLC index decreases.

2. Time is a factor of importance and confidence. Empirical evidence suggests that the capital cost will increase as the importance of time increases. The capital cost will further increase as the confidence in meeting the planned completion date decreases, that is, as a project becomes more time risky the capital cost will increase.
3. The WLC index is comprised of the following:
   a. The capital cost index, which represents the total amount of capital cost for one option relative to the other options being considered. The capital cost index is based upon 100 notional units distributed proportionately amongst the individual options considered.
   b. Similarly, an operating cost index is based upon 100 notional units distributed proportionately amongst the individual options considered
   c. An adjustment on (a) and (b), which reflects the importance of the capital cost and operating cost (project specific) as stated in the client's project value system matrix.
   d. An adjustment on (a) and (b), which reflects the confidence of the stakeholders in the estimated capital cost and operating cost (option specific).
4. No assessment is made of the relative importance of function and value. In calculating an index for the whole life benefits, the function and the project value are presumed to have equal weight (50) and are represented by a combined maximum index score of 100 units.
5. The capital cost index will increase as the importance of capital cost to the client increases. Similarly, the operating cost factor will increase as the importance of operating cost to the client increases (project specific and reflected in the project value matrix).
6. The capital cost index increases as confidence decreases in the accuracy of the capital cost estimate as determined by the client stakeholder group at the option appraisal exercise (option specific).
7. The operating cost factor increases as the confidence of the client stakeholder group decreases in the operating cost estimate during the operating phase, that is, as the operation of the asset or service resultant from the project becomes more risky the operating cost factor will increase (option specific).

These seven statements support the WLV conceptual model to derive the WLV Factor.

Phase 6 – Option development, option appraisal and the strategic outline case

The option development process follows the strategic briefing value study workshop. The strategic briefing value study report will include a description of those brainstormed solutions to the requirements of the strategic brief that are considered by the strategic briefing workshop team worthy of carrying forward for evaluation and development. These solutions are described in the action plan. As part of the development process an outline WLC budget should be developed for each option together with any potential high-level risks. A base case, commonly the current or 'do nothing' option, is always included in the option list.

Each option resulting from the development phase is subject to option appraisal using the Whole Life Value conceptual model described earlier. The strategic outline case will report the option appraisal exercise and make a recommendation of the option to be adopted. Once an option has been adopted and recommended for concept design the WLV conceptual model will transform into KPIs to be used as an audit tool in the subsequent development of the project.

Phase 7 – Goal and systems modelling

Goal and systems modelling is a discretionary activity undertaken during the strategic briefing workshop, which adds to the data and the understanding by the team of the functional project. Its primary purpose is to examine the 'do nothing' option. It requires a listing of all the level 2 functions of the project from the FAST diagram and the consideration of whether these objectives are being provided currently by the client organisation within another system. In practice, this has proved a helpful step in meeting the TGB requirements for checking for duplication of service and/or asset reduction. The goal and systems modelling technique is illustrated in the case study in this chapter.

Part 1 – Conclusion

At the end of Part 1 of the Whole Life Value exercise, a conceptual model has been created that integrates the evaluated constituents of Project Function, Client's Project Value, Whole Life Cost and Time Factor to generate a WLV Factor for each option considered. The model is in a form that permits a transparent, effective and auditable justification of the option that best serves the project objectives. The model is simple enough to use within an option appraisal workshop and is conducive to transforming to a KPI assessment model to be used at key stages to ensure that development of the selected option remains true to the original project objectives and that benefits are likely to be achieved.

The component parts of a WLV model: Part 2 – KPI model

The WLV KPI model is used following the acceptance of the strategic outline case. It differs from the conceptual model in that it specifically applies to a project that has form and structure, that is, one of the options has been accepted and is being developed further. The client's project value system and the functional requirements and the whole life cost and time factor that form and structure the WLV Factor for the selected project, carry forward as the basis of KPIs for the developing project.

The WLV KPIs objectives are as follows:

- To provide a means of monitoring the developing design by the use of the WLV Factor.
- To apply WLV measurement by circulating the stakeholder questionnaire to be completed again at targeted stages of the developing project. The importance weights relating to function and value should remain the same.
- To record improvement in the developing project or to record the reasons why targets have not been achieved.

Were the WLV methodology to be grounded then it would be possible to widen the benchmarking activity from a single project to benchmarking between projects and indeed between clients as was the aspiration of the South West Councils Regional Improvement and Efficiency Partnership (Kelly and Gale, 2008).

The WLV KPI model will collect data through a client stakeholder questionnaire based on the following questions:

1. Now that the project has shape in the concept design, are you confident (on a scale of 1 to 5) that each of the functional requirements stated in the strategic function diagram are being met at the highest level?
2. Now that the project has shape in the concept design, are you confident (on a scale of 1 to 5) that each of the client's project value system requirements stated in the client's project value system matrix are being met at the highest level, specifically
   a. Does the developing project give benefit to the whole community?
   b. Is the project's carbon footprint acceptable? Clearly until the project has shape and form the carbon footprint cannot be assessed. However, at the stage of the application of KPIs, Life Cycle Assessment will become relevant.
   c. Is the project likely to generate the required income?
   d. Will the project be admired by all for its function and aesthetics? Although assessed for importance previously, once the project has shape and form tools such as the Design Quality Indicator can be applied (CIC, 2013).
   e. Will the project be comfortable and efficient for all users?
3. Is there a high confidence that the budget will not be exceeded? This question carries two dimensions: first, the level of detail upon which the project whole life cost plan is based, and second, the level of risk to the project schedule. As the design progresses the confidence in the budget should increase and the schedule risks should decrease.
4. Are the operating costs optimal and predictable?

The KPI model is developed at the concept design stage and used at intervals to monitor the developing technical and specialist design of the project. The KPI model structure is unaltered after its development. The WLV Factor is recorded and forms an important part of the benefits realisation process discussed next. It is expected that the WLV Factor will increase during the development of the study. If it decreases then questions are prompted as to whether this is acceptable.

Benefits realisation

The benefits realisation timeline is described in Chapter 6. Benefits realisation has two key elements: first, monitoring projects at key stages to ensure that proper governance procedures have been followed, and second, that WLV is increasing or at the very least being maintained. Another important feature of a properly constructed benefits realisation process is the mapping of beneficial outcomes of the project onto the project schedule such that any change is recognised as it occurs. Minor change should not impact significantly the client's project value system or the functional requirements, but may result in a reconfiguring of the KPI model to reflect an evolving project value system, the implications of which are discussed in Chapter 11. Major change involving changes to business objectives may require a change to the project definition, a reworking of the conceptual model, and possibly a change to the business case. Major change can result in a reconsideration of options requiring a return to the option appraisal stage. Any shift in WLV should be examined to determine whether a change has occurred either overtly or incrementally.

12.3 Case study – Illustration of a method for developing and using the whole life value conceptual model

The following method for deriving the WLV Factor has been used successfully by the authors in practice where it was proved to be conducive to team participation. The method reported in the case study includes minor modifications from that used in practice to reflect improvements in technique although the core logic remains unchanged. The method follows the steps described earlier and outlined in the flowchart illustrated in Figure 12.2.

The steps illustrated in Figure 12.2 follow the description and logic of the construction of a model to deliver the Whole Life Value Factor in phases 1 to 5 mentioned earlier. The diagram plots the derivation of the importance weight of the following:

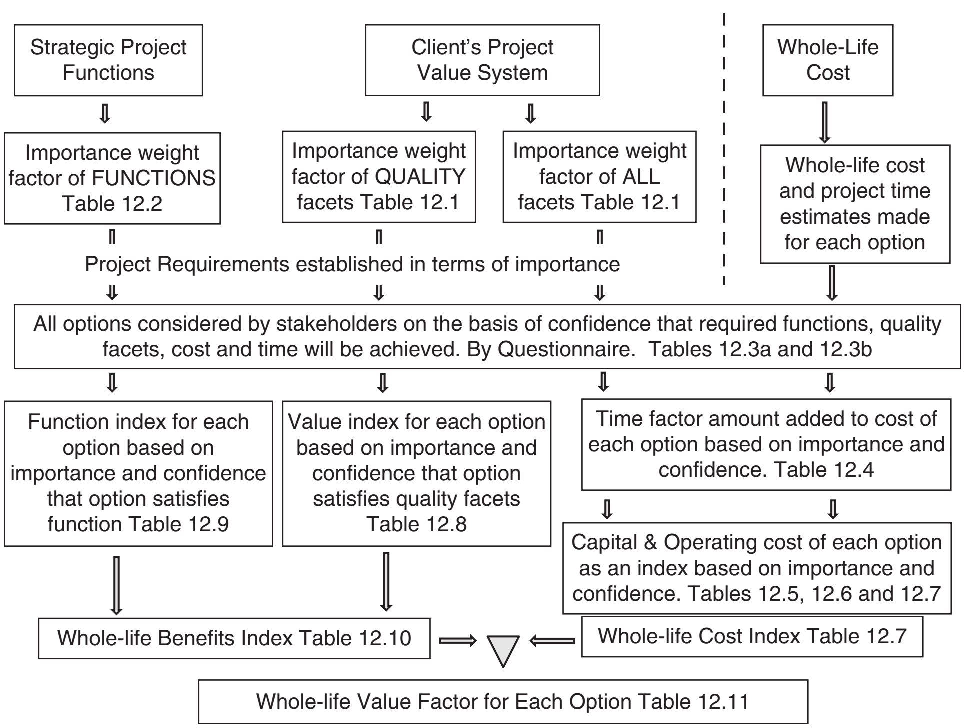


Figure 12.2 Flowchart – the steps to the Whole Life Value Factor.

- Strategic functions – from the strategic function FAST diagram.
- The Client's Project Value System facets – from the client's project value system matrix.
- Those Client's Project Value System facets relating to Quality only – from the client's project value system matrix.

The importance weights are determined at the strategic briefing workshop before any options have been generated.

Once options have been generated with some idea of form and structure, an estimate can be made of the Whole Life Cost of each option.

The long bar in the centre of Figure 12.2 describes the completion of a stakeholder questionnaire and illustrates the point where each member of the client stakeholder team individually expresses confidence that a particular option will deliver the required functions and quality facets and also confidence that the option will deliver the project within the estimated whole life cost and within the time frame discussed during the strategic briefing workshop.

The steps below the long bar in Figure 12.2 are the mathematical operations to realise the Whole Life Value Factor based upon the importance of the functions and values and the confidence that these will be delivered by the option under consideration, and also the importance of WLC and time and the confidence that these will be satisfied.

Step 1 – Function analysis

The case study of Old Cross Library described in Chapter 3 is used to illustrate the following steps towards the production of the Whole Life Value Factor. All functions to be provided by Old Cross Library are brainstormed by the strategic briefing team and recorded on sticky notelets. The functions are generated in random order and require sorting. The method of sorting advocated in Chapter 4 requires all the high-order needs to be positioned at the top-left of a large display with the low-order wants at the bottom-right. This process is illustrated in Figures 12.3 and 12.4. The resultant FAST diagram is illustrated in Figure 12.5.

Step 2 – Client's project value system

The client's project value system matrix is constructed in the manner described in Chapter 11. This involves the client representatives and the influential stakeholders, the client stakeholder team, participating in a facilitated process to construct the client's project value system matrix through a paired comparison exercise. The position of influential stakeholders is discussed in detail in Chapter 11. The influential stakeholders are those who have a real stake in all or parts of the client's project value system. It is argued for example that the design and construction team are not influential stakeholders according to the definition but have to understand and reflect the client's project value system in their work. The completed value system with weighting is shown in Figure 12.6.

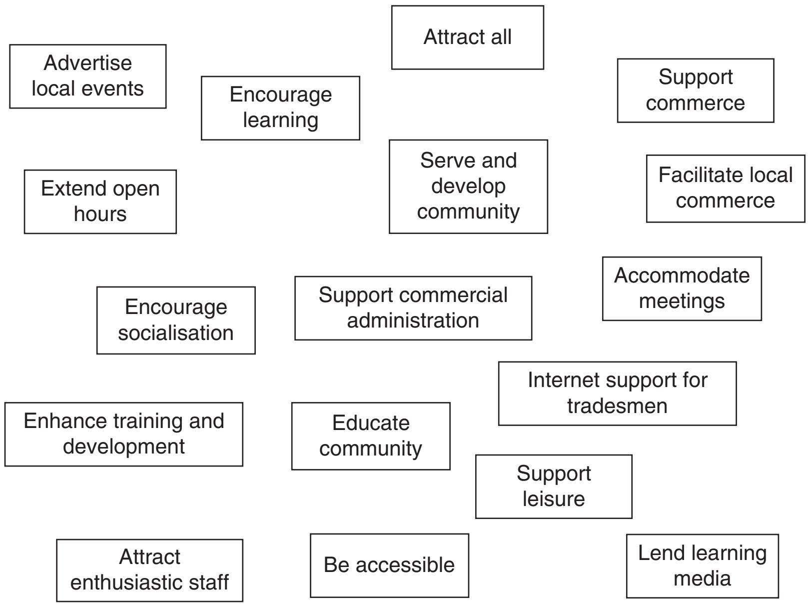


Figure 12.3 Functions for a library project are generated in a fairly random manner.

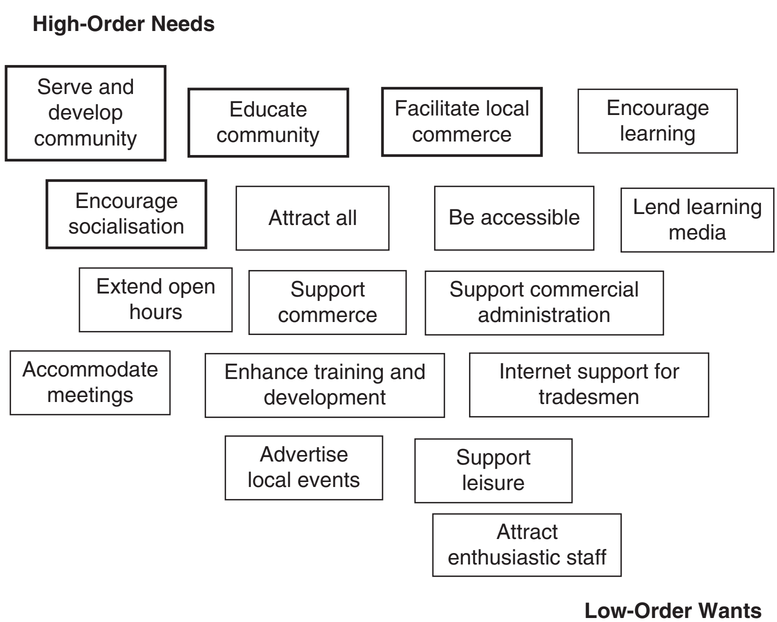


Figure 12.4 Functions are sorted with High-Order Needs at top and Low-Order Wants at bottom. The Mission of the Project tends to be grouped at the top.

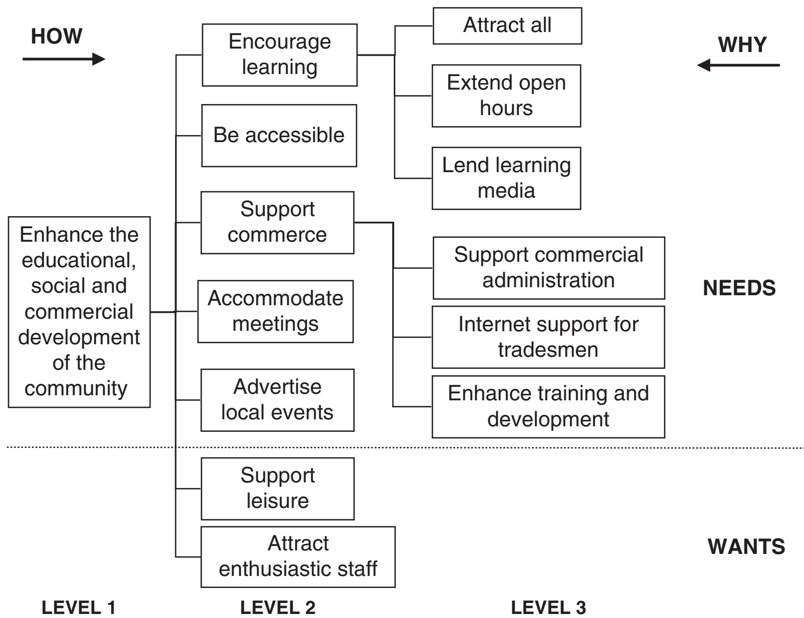
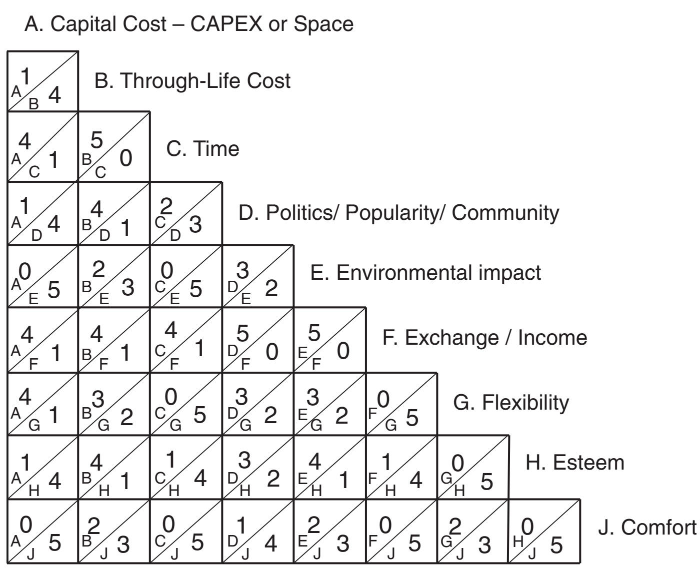


Figure 12.5 The mission of the library project is word-crafted from highest-order functions into a FAST diagram. Other functions are organised logically into level 2 and level 3.



A	B	C	D	E	F	G	H	J	
15	28	8	23	29	4	19	21	33	Total

Figure 12.6 Completed client's project value system with weighting for the library project.

The completed client's project value system demonstrates that the client stakeholder team regard the comfort of users as the most important value criteria closely followed by through life cost and environmental impact. Popularity with the community and the projection of esteem by the project is also seen as important with all other facets less important. In the context of a fixed budget, those contributing to the value system would prefer to accept a smaller building to gain the most important facets.

As discussed in Chapter 11 the client's project value system comprises facets that can be grouped under the headings of time, cost and quality. In the client's project value system paired comparison exercise it is necessary to consider all nine facets together. However, it is important to note that

> only those facets which fall under the quality heading (together with the functional requirements of the project) contribute to the defined benefits of the project.

Therefore, from the data derived from the client's project value system paired comparison exercise it is necessary to consider the proportional weight of all nine facets with respect to importance and also the proportional weight of the six facets that define the importance of quality as shown in Table 12.1.

The weighting carried forward to the WLV calculation is for two groups of facets:

1. The importance weight as a proportion of 1.00 for all facets. For example the importance weight of Politics/Popularity/Community as a proportion of 1.00 is calculated as

$$\frac{23}{180} \times 1.00 = 0.13$$

Table 12.1 Weighting of client's project value matrix for WLV calculation.

Facets of Client's Project Value System	Weight from Figure 12.6	Proportional Weight (Importance Factor)	Weight from Figure 12.6	Proportional Adjusted Weight for Quality Facets Only Excluding Cost and Time
Politics/Popularity/ Community	23	0.13	23	0.18
Environmental impact	29	0.16	29	0.22
Exchange/Income	4	0.02	4	0.03
Flexibility	19	0.11	19	0.15
Esteem	21	0.12	21	0.16
Comfort	33	0.18	33	0.26
Capital cost – CAPEX or Space	15	0.08		
Through life cost	28	0.16		
Time	8	0.04		
Totals	180	1.00	129	1.00

2. The proportional adjusted weight for the quality facets only, excluding capital cost, through-life cost and time. For example the proportional adjusted weight with respect to the quality facets only for Politics/Popularity/Community as a proportion of 1.00 is calculated as

$$\frac{23}{129} \times 1.00 = 0.18$$

Step 3 – Weighting the FAST diagram

Following the completion of the client's project value system, attention is returned to the FAST diagram where the functions in each level are weighted to reflect the strength of the function in the overall assessment of satisfaction. The reason for undertaking this exercise after completing the client's project value system matrix is that the team is sensitised to thinking in terms of what is of real value. However, to ask a team to contribute weightings can be extremely time-consuming since the exercise is subjective and may take several iterations before the team is satisfied that the weighting is correct.

A method used by the authors to reduce time and improve the process is to use a weighting scale. The weighting scale method is as follows:

1. First, draw a long line on a sheet of paper. If in a facilitated workshop this will be on about four sheets of A0 paper set landscape. The line length should be easily divisible by 100, for example, 1.5 or 2 m.
2. The level 2 functions are rewritten on sticky notelets and set in the hierarchical order of the FAST diagram above the line. Each sticky notelet is ascribed an adhesive coloured shape. The purpose of ordering in the hierarchical order of the FAST diagram is to reflect the fact that the team has already reached some consensus of order so the exercise is one of adding a weighting without revisiting previous discussion.
3. Each member of the team is given a number of adhesive coloured shapes, one for each shape on the sticky notelets. Each team member now places their coloured shape on the line according to the individual's view of the importance weight of the function represented by the shape.
4. To calculate the weight for each function, the scores attributed by team members are summed for each function and the average determined. The averages for all level 2 functions are proportioned such that the total summed weight for the level 2 functions equals 1.00.
5. Whether or not to weight level 3 and level 4 functions is open to debate. In complex diagrams, level 3 and level 4 functions could be treated similarly; however, it is generally easy to apportion subjectively as there are usually a maximum of four level 3 functions from each level 2 function. As earlier, the total summed proportionate weight for the level 3 functions relating to a *single* level 2 function is equal to 1.00. It is stressed that it is rarely necessary to consider functions beyond level 2 for a WLV conceptual model.

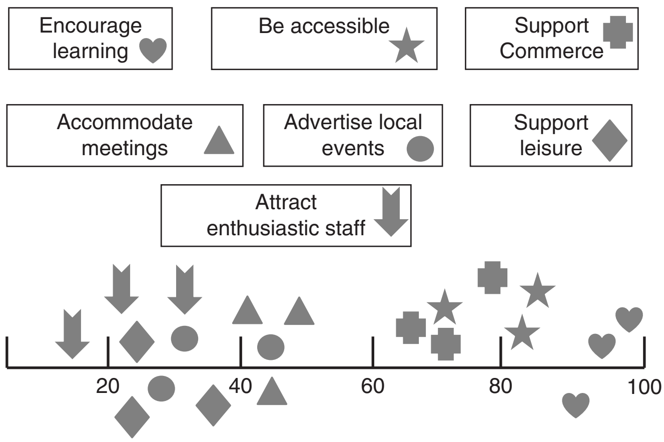


Figure 12.7 Determining weighting by a team undertaking scaling.

The process is illustrated in Figure 12.7.

Figure 12.7 illustrates the use of scaling by a team of three people. Clearly, in a live workshop the team would be larger but the principles are the same as the illustration. Having affixed the sticky coloured shapes, the VSL would undertake the calculation as Table 12.2. If there is a general view that a high-order function has a lower weight than a lower-order function, then this implies that the function diagram is incorrect and

Table 12.2 Weighting of functions for WLV calculation.

Function	Weighting	Average	Proportion Average of Total (377)
Encourage learning	98	94	0.25
	95		
	90		
Be accessible	85	80	0.21
	82		
	72		
Support commerce	80	73	0.19
	72		
	67		
Accommodate meetings	50	45	0.12
	45		
	40		
Advertise local events	45	34	0.09
	30		
	28		
Support leisure	35	28	0.08
	25		
	25		
Attract enthusiastic staff	30	23	0.06
	22		
	16		
Total		377	1

requires revisiting. Outliers would require discussion. The VSL notes the position of the shapes and allocates the three team members' scores to the function. For example, the function 'encourage learning' is represented by the heart shape. The scores read from the scale are 90, 95 and 98. The average score is 94. Once all the averages are summed and a total of 377 realised the proportion of the average score to the total of 377 can be calculated. For example, for the function 'encourage learning' the proportion of 1.00 is calculated by taking the average weighting as a proportion of the total of the average as

$$\frac{94}{377} \times 1.00 = 0.25$$

The result gives the weight for each level 2 function, which is written onto the existing function diagram as Figure 12.8.

Also illustrated in Figure 12.8 are weightings given to level 3 functions. This exercise may be undertaken to show how level 3 functions (children) contribute to their parent function and add more information on how the team believes the parent function should be performed. The weight of the children functions of a single parent function sum to 1.00. The hierarchy of level 2 functions developed by the team would be discussed with the team to ensure that the correct emphasis is given at the stage of developing the strategic brief. The team has to be confident that the project will be driven from this point forward based on the functions selected which, as well as being a fundamental part of the strategic brief, also contribute to the WLV conceptual model, KPI and benefits realisation management process.

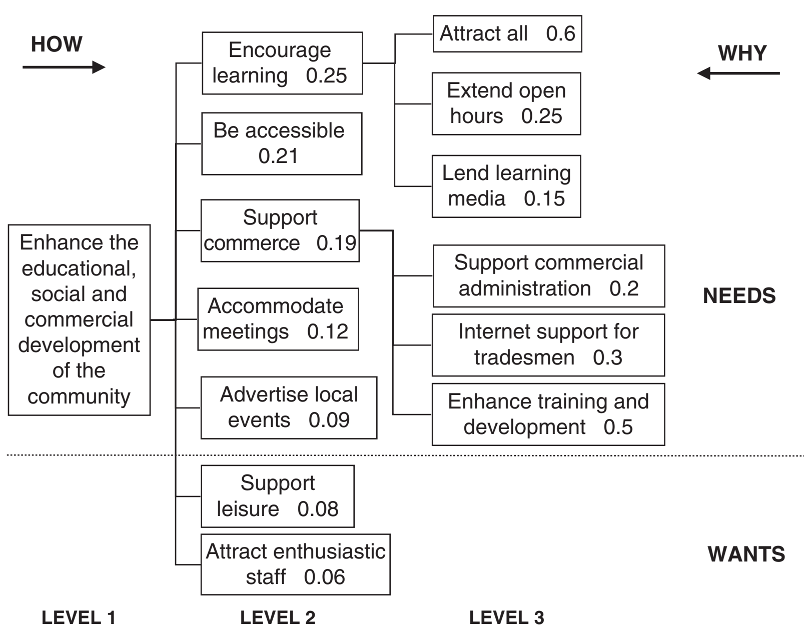


Figure 12.8 Weightings applied to the FAST diagram.

Step 4 – Goal and systems modelling

The primary purpose of the goal and systems modelling approach is to examine the 'do nothing' option and confirm that the functional requirements of the proposed project as reflected in the FAST diagram are not currently being provided satisfactorily through another system. A system in this context refers to a number of individual processes working synergistically to deliver the functional requirement expressed in the function diagram. If it is found that an existing system is providing an identified function in a satisfactory manner then that function may be deleted from the proposed project. Alternatively a case may be made to replace the existing system for reasons of efficiency. If it is found that required functions are not being provided at all or are being provided unsatisfactorily then there is a strong argument in favour of the investment in a project. In all of these situations, goal and systems modelling is a powerful tool in the option appraisal process.

The goal and systems model considers the ranked functions against the systems currently in place to answer those functions. The lines in the goal and systems diagram (Figure 12.9) join the functions required with the systems already in place. In the context of the library case study the goal and systems model reveals that whilst there are systems in place to meet the functional requirements many do not satisfy the value criteria previously developed. Furthermore, the current systems for 'encourage learning' and 'be accessible' are focused on children. The function 'support commerce' is satisfied in part by evening classes at the college but these tend to be, for example, DIY plumbing and French for beginners rather than commercial development for tradesmen in business. There is little to support commerce on the council's website.

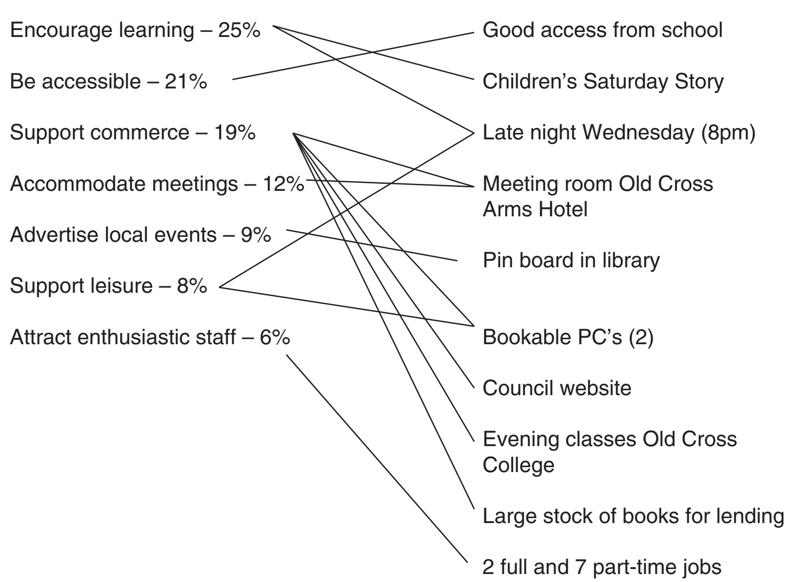


Figure 12.9 Goal and systems model.

Goal and systems modelling is an optional but useful step in bringing into clear focus the required functions of this project prior to developing the WLV conceptual model, which is the subject of the next section.

Step 5 – Developing the WLV conceptual model

At the strategic briefing stage, the WLV Conceptual Model is developed to appraise the strategic options and subsequently transformed as KPIs to monitor the developing design and to contribute to benefits realisation management. The development of the conceptual model follows a prescribed pattern but the resulting model is project specific. The WLV Conceptual Model is determined from the following:

- An assessment of the confidence of the client stakeholders that a project option achieves the functions from the weighted function diagram and achieves the values from the client's project value system. These two assessments are related to the next point.
- The confidence in the prediction of whole life cost including a factor related to confidence in the project delivery time.

WLV is expressed as

$$\text{WLV} = \frac{\text{Whole-Life Benefits (functions and value)}}{\text{Whole-Life Cost}}$$

Step 6 – Option appraisal using the WLV conceptual model

The strategic options are generated and judged at the strategic briefing workshop. Evaluation and development work may continue at the workshop or be undertaken as detailed in the action plan by individuals post-workshop.

Step 6a – Stakeholder questionnaires

Following the evaluation and development work on a number of strategic options to meet the project requirements, a questionnaire is completed by the client stakeholder team, who ideally has attended the strategic briefing workshop. All strategic options are considered on the extent to which they meet the function, value, time and cost criteria. Questions generated from the value matrix and the function diagram are asked in the manner illustrated in Table 12.3a and b. The framing of the questions will take account of the stakeholder input to the strategic briefing workshop. The questions require a response based on a five-point Likert scale:

5 = Strongly agree
4 = Agree
3 = Uncertain
2 = Disagree
1 = Strongly disagree

Table 12.3a Illustration of scoring of questionnaire responses from three team members.

	Option 1				Option 2			
	Do Nothing – Retain Existing				Refurbish Existing			
	Smith	Jones	Brown	Total	Smith	Jones	Brown	Total
Value								
Gives benefit to the whole community	1	1	1	3.0	1	1	2	4.0
Minimises carbon footprint	1	1	1	3.0	2	3	2	7.0
Likely to generate expected income	2	3	3	8.0	4	3	3	10.0
Is flexible in use and can accommodate change	1	1	1	3.0	1	1	1	3.0
Is admired by all for its function and aesthetic	1	1	1	3.0	1	1	1	3.0
Is comfortable and efficient for all users	1	1	1	3.0	2	1	1	4.0
Cost and Time								
High confidence in the budget estimate	3	3	3	9.0	4	3	3	10.0
Operating costs are optimal and predictable	1	1	1	3.0	1	1	1	3.0
The project will be delivered on time	3	3	3	9.0	3	4	4	11.0
Function								
Will encourage learning across community	1	1	1	3.0	1	1	1	3.0
Will be accessible to all members of community	1	1	1	3.0	1	1	1	3.0
Will support commerce	1	1	1	3.0	1	1	1	3.0
Will accommodate meetings	1	1	1	3.0	1	1	1	3.0
Will advertise local events to community	1	1	1	3.0	1	1	1	3.0
Will support leisure activities	1	3	3	7.0	1	3	3	7.0
Will attract enthusiastic staff	1	1	1	3.0	1	1	1	3.0

Table 12.3b Illustration of scoring of questionnaire responses from three team members.

	Option 3				Option 4			
	New Build on High St				Locate in Council Offices			
	Smith	Jones	Brown	Total	Smith	Jones	Brown	Total
Value								
Gives benefit to whole community	5	5	5	15.00	4	5	5	14.0
Minimises carbon footprint	5	5	5	15.00	3	3	4	10.0
Likely to generate expected income	5	5	5	15.00	4	4	3	11.0
Is flexible in use and can accommodate change	4	5	4	13.00	3	3	4	10.0
Is admired by all for its function and aesthetic	5	5	5	15.00	1	1	1	3.0
Is comfortable and efficient for all users	5	5	5	15.00	5	4	5	14.0
Cost and Time								
High confidence in the budget estimate	3	3	4	10.00	3	3	3	9.0
Operating costs are optimal and predictable	4	4	5	13.00	2	3	3	8.0
The project will be delivered on time	4	4	3	11.00	3	4	4	11.0
Function								
Will encourage learning across community	5	5	5	15.00	1	1	1	3.0
Will be accessible to all members of community	5	5	4	14.00	1	1	1	3.0
Will support commerce	5	5	5	15.00	3	4	4	11.0
Will accommodate meetings	5	4	5	14.00	1	1	1	3.0
Will advertise local events to community	5	5	5	15.00	2	2	2	6.0
Will support leisure activities	4	4	4	12.00	1	3	3	7.0
Will attract enthusiastic staff	5	5	5	15.00	1	1	1	3.0

The questionnaires are analysed and presented, ideally at an implementation workshop. The result of this activity, whether at an implementation workshop or not, is a decision on which option to take forward. An illustration of the questionnaire summary is given in Table 12.3a and b.

The four options from the Old Cross Library case study in Chapter 3 are as follows:

1. Do nothing – the through-life NPV cost of facility management over 10 years is estimated at £500 000
2. Refurbish existing library with new entrance pathway through school grounds and rerouting perimeter fence. The whole life cost of new build and facility management is £600 000 comprising an estimated capital cost £150 000 and an estimated through-life NPV cost of facility management of £450 000 over 10 years.
3. Accommodate a new library on council-owned ground to the rear of High St shops. This option would require the negotiated or compulsory purchase of an access lane from the High St to the rear of the shops. The whole life cost of new build and facility management over 10 years is £2.5 million comprising an estimate of capital cost of £2.2 million and an estimate of the through-life NPV cost of facility management over 10 years of £300 000.
4. Rearrange main council offices in town centre to accommodate library by relocating education department staff to a new office to be constructed in the grounds of an existing secondary school 2 miles from the town centre. Whole life cost of new build offices, refurbishment of existing council offices and facility management over 10 years is £3.5 million, comprising an estimated capital cost of £3.2 million and the estimated through-life NPV cost of facility management over 10 years of £300 000.

Step 6b – Evaluating time factor for each option

Logic statement 2, from Phase 5 earlier, states that the capital cost will increase as the importance of time increases, and further increase as the confidence in meeting the planned completion date decreases. For the case study this is operationalised in Table 12.4:

- Column A. The time importance factor (0.04) is taken from Table 12.1 the Client's Project Value System. This factor is project related and therefore the same for the four options under consideration.

Table 12.4 Evaluating Time Factor Addition.

	A Time Importance	B Time Confidence	C Time Factor (A × B)	D Budget Capital Cost	E Time Factor Addition (D × C)
Option 1	0.04	1.67	0.067	£0	£0
Option 2	0.04	1.37	0.054	£150 000	£8 100
Option 3	0.04	1.37	0.054	£2 200 000	£118 800
Option 4	0.04	1.37	0.054	£3 200 000	£172 800

- Column B. The time confidence factor is option related and reflects the stakeholders' confidence that the option will be delivered on time. As this factor results in an increase in cost as confidence decreases the confidence factor is the reciprocal of the vote from the stakeholder questionnaire as a proportion of the total potential votes. For example in option 2 the total potential votes from 3 stakeholders is 15. The stakeholders awarded 11 votes; a proportion of $11 \div 15 = 0.73$. Therefore, the time confidence factor for option 2 is $1 \div 0.73$, which is 1.37.
- Column C. The time factor is the product of time importance and time confidence.
- Column D. The budget capital cost is taken from Step 6a.
- Column E. The time factor multiplied by the capital cost gives a working time factor addition. It is acknowledged that this method is relatively crude but at the Strategic Outline Case, in the absence of any technical design, is acceptable on an *a priori* basis for the purposes of determining an addition to the WLC for the importance and confidence in time.

Step 6c – Evaluating the capital cost factor for each option

Logic statements 5 and 6 from Phase 5 state that the capital cost factor will increase as the importance of capital cost to the client increases and that the capital cost factor further increases as confidence in the capital cost estimate decreases.

This logic enables Table 12.5 to be constructed using exactly the same heuristic as that used for time:

- Column A. The capital cost importance factor is taken from the client's project value system (Table 12.1). This factor is project related and therefore the same for all four options considered.
- Column B. The capital cost confidence factor is option related and reflects the confidence that the stakeholders have that the option will be delivered on budget. As this factor results in an increase in cost as confidence in meeting the budget decreases, it is the reciprocal of the vote from the stakeholder questionnaire as a proportion of the total potential votes. For example, in option 2 the total potential votes from the three stakeholders is 15. The stakeholders awarded 10 votes (therefore a proportion of $10 \div 15 = 0.67$); therefore, the capital cost confidence factor for option 2 is $1 \div 0.67$, which is 1.50. The capital cost factor is the capital cost importance factor multiplied by the capital cost confidence factor.

Table 12.5 Evaluating the capital cost factor.

	A Cap Cost Importance	B Cap Cost Confidence	C Cap Cost Factor (A × B)
Option 1			
Option 2	0.08	1.5	0.12
Option 3	0.08	1.5	0.12
Option 4	0.08	1.67	0.13

Table 12.6 Evaluating the operating cost factor.

	A Op Cost Importance	B Op Cost Confidence	C Op Cost Factor (A × B)
Option 1	0.16	5	0.80
Option 2	0.16	5	0.80
Option 3	0.16	1.15	0.18
Option 4	0.16	1.88	0.30

Step 6d – Evaluating the operating cost factor for each option

Logic statements 5 and 6 from Phase 5 state that the operating cost factor will increase as the importance to the client increases. Also, the operating cost factor will increase as confidence decreases, that is, as the cost of operation of the asset or service resultant from the project becomes more uncertain the operating cost factor will increase. This logic is reflected in Table 12.6, which is constructed in an identical manner to Table 12.5.

Step 6e – Calculating the Whole Life Cost index

Table 12.7 illustrates the construction of a WLC index following the logic explained earlier. The Whole Life Cost index is the denominator of the following expression:

$$\text{WLV Factor} = \frac{\text{Whole Life Benefits Index (functions and value)}}{\text{Whole Life Costs Index}}$$

The Whole Life Benefits are calculated in Steps 6f to 6h shown later.

The calculation illustrated in Table 12.7 commences with a restatement of the total capital cost and the time factor. The capital cost index is produced by multiplying the time factor adjusted capital cost by the capital cost factor (to take account of importance and confidence calculated in Table 12.5), and representing this figure as a proportion of 100 notional units. It is emphasised that the case study exercise described here is an option appraisal referring to four options of a single project. It is therefore perfectly acceptable to internalise the indexing making 100 units a notional total for both the WLC index and the Whole Life Benefits Index. These indices are valid only for this option appraisal exercise and should not be used in benchmarking other projects. The operating cost index is calculated in an identical manner to the capital cost index. The average of the capital cost index and the operating cost index gives a WLC index based upon the proportionate sharing of 100 notional units.

The WLC index is carried forward to the Whole Life Value Index calculation.

Step 6f – Calculating the client's Project Value System index

Figure 12.6 and Table 12.1 illustrate the construction of the client's Project Value System, which is undertaken prior to the generation of the options to satisfy the project. The four options are evaluated by means of the stakeholder questionnaire illustrated in

Table 12.7 Constructing the WLC index.

	Option 1	Option 2	Option 3	Option 4
Capital cost	0.00	£150 000.00	£2 200 000.00	£3 200 000.00
Time factor	0.00	£8100.00	£118 800.00	£172 800.00
Risk adjusted capital cost	0.00	£158 100.00	£2 318 800.00	£3 372 800.00
Capital cost factor (Figure 12.14)		0.12	0.12	0.13
Impact of capital cost adjusted for importance and confidence		£18 972	£278 256	£438 464
Capital Cost Index	0.00	2.58	37.82	59.60
Total operating cost	£500 000.00	£450 000.00	£300 000.00	£300 000.00
Operating cost factor (Figure 12.15)	0.80	0.80	0.18	0.30
Impact of operating cost adjusted for importance and confidence	£400 000	£360 000	£54 000	£90 000
Operating cost index	44.25	39.82	5.97	9.96
WLC index (average capital cost index and operating cost index)	22.12	21.20	21.90	34.78

Table 12.3a and b. The client's Project Value System is comprised of facets that can be grouped under the headings of time, cost and quality. The importance and confidence aspects of the client's project value system relevant to the WLC (time, capital cost and operating cost) have been dealt with earlier in Table 12.7. The remaining facets (aligned to quality) are analysed for their project-specific weighting and their option-specific stakeholder vote as described in Table 12.8. The calculation outlined in the table gives a value index that describes the value part of Whole Life Benefits.

Step 6g – Calculating the Project Function index

Table 12.2 and Figure 12.8 illustrate the construction of the Project Function weightings, which are realised prior to the generation of the options to satisfy the project. Options 1 to 4 are evaluated by means of the stakeholder questionnaire illustrated in Table 12.3a and b. The Project Function index for all options, illustrated in Table 12.9, is calculated in an identical manner to the Client's Project Value System Index.

Step 6h – Calculating the Whole Life Benefits index

The WLB index is calculated by following Phase 5 logic statement 4, which states 'In calculating an index for the Whole Life Benefits, the function factor and the project value factor are presumed to have equal weight and are represented by a combined maximum index score of 100 units'. The function index is shown in Table 12.9 and the value index in Table 12.8. The Whole Life Benefits Index is illustrated in Table 12.10.

Table 12.8 Calculating the client's project value system index.

	A	B	C	D	E	F	G	H	I
		Option 1		Option 2		Option 3		Option 4	
	Adj. Wt from Table 12.1	Total Vote from Table 12.3a	Score A × B	Total Vote from Table 12.3a	Score A × D	Total Vote from Table 12.3b	Score A × F	Total Vote from Table 12.3b	Score A × H
Gives benefit to whole community	0.18	3	0.54	4	0.72	15	2.70	14	2.52
Minimises carbon footprint	0.22	3	0.66	7	1.54	15	3.30	10	2.20
Likely to generate expected income	0.03	8	0.24	10	0.30	15	0.45	11	0.33
Is flexible in use and can accommodate change	0.15	3	0.45	3	0.45	13	1.95	10	1.50
Is admired by all for its function and aesthetic	0.16	3	0.48	3	0.48	15	2.40	3	0.48
Is comfortable and efficient for all users	0.26	3	0.78	4	1.04	15	3.90	14	3.64
Total	1.00		3.15		4.53		14.70		10.67
Value index		Index 1	9.53	Index 2	13.71	Index 3	44.48	Index 4	32.28

Table 12.9 Calculating the project function index.

	A	B	C	D	E	F	G	H	I
		Option 1		Option 2		Option 3		Option 4	
	Wt from Table 12.2	Total Vote from Table 12.3a	Score A × B	Total Vote from Table 12.3a	Score A × D	Total Vote from Table 12.3b	Score A × F	Total Vote from Table 12.3b	Score A × H
Will encourage learning across community	0.25	3	0.75	3	0.75	15	3.75	3	0.75
Will be accessible to all members of community	0.21	3	0.63	3	0.63	14	2.94	3	0.63
Will support commerce	0.19	3	0.57	3	0.57	15	2.85	11	2.09
Will accommodate meetings	0.12	3	0.36	3	0.36	14	1.68	3	0.36
Will advertise local events to community	0.09	3	0.27	3	0.27	15	1.35	6	0.54
Will support leisure activities	0.08	7	0.56	7	0.56	12	0.96	7	0.56
Will attract enthusiastic staff	0.06	3	0.18	3	0.18	15	0.90	3	0.18
Total	1.00		3.32		3.32		14.43		5.11
Function index		Index 1	12.68	Index 2	12.68	Index 3	55.12	Index 4	19.52

Table 12.10 Calculating the whole life benefits.

	A Function Index from Table 12.9	B Value Index from Table 12.8	C WLB = (A + B)/2
Option 1	12.68	9.53	**11.10**
Option 2	12.68	13.71	**13.20**
Option 3	55.12	44.48	**49.80**
Option 4	19.52	32.28	**25.90**

Step 6j – Calculating the Whole Life Value Factor for all options

The WLV Factor is calculated as shown in Table 12.10

$$\text{WLV Factor} = \frac{\text{Whole Life Benefits Index (functions and value)}}{\text{Whole Life Costs Index}}$$

The result of the calculation illustrated in Table 12.11 means that option 3 gives value for money and the other options do not. The WLV Factor for options 1, 2 and 4 are so close that they could not be reliably ranked.

In the interpretation of Table 12.11 two conclusions are reached:

1. The highest WLV Factor indicates the most advantageous option to satisfy the project based upon the client's project value system, the project's functional requirements, the WLC adjusted for the time factor. All factors have been determined by the stakeholder group through a workshop and a questionnaire.
2. A WLV Factor exceeding 1 means that the benefits (as determined by stakeholder vote) exceed the WLC, and therefore give value for money.

The heuristic to discover the Whole Life Value Factor for each option appears a fairly laborious process however, once committed to a spreadsheet the calculations can be carried out in a matter of minutes. Four important points need to be made:

1. The tables just mentioned have been calculated using a calculator with each calculation rounded to two decimal places. A spreadsheet works to a far greater accuracy and even if numbers are displayed to two decimal places they are retained to many more places of decimals within the sheet. Therefore, the reconstruction of

Table 12.11 Calculating the WLV factor for all project options.

	A WLB Index from Table 12.10	B WLC Index from Table 12.7	C WLV Factor = A/B
Option 1	11.10	22.12	**0.50**
Option 2	13.20	21.20	**0.62**
Option 3	49.80	21.90	**2.27**
Option 4	25.90	34.78	**0.74**

the tables as a series of cells within a spreadsheet where values are carried from table to table by means of cell references will result in numbers displayed different to those shown in this book. The spreadsheet will be more accurate.

2. The most important aspect of the process described earlier lies in its replicability and the output of an auditable ranking based upon the WLV Factor, which gives powerful support to a strategic outline case. The calculation of whole life cost, the construction of a function analysis diagram, the completion of a client's project value system matrix and the processing of stakeholder questionnaires has been undertaken by the authors on numerous occasions and these are replicated here with a high degree of confidence. The calculation of the WLV Factor based on the logic described in Phase 5 has only been completed once on a live project in a workshop environment but was successful and very useful. Further use will lead to better calibration and interpretation. This is a fertile topic for further research.
3. What do the numbers mean? Numbers presented to two decimal places appear to signify a high level of accuracy. However, precision cannot be assumed. As stated in the preceding point 2, further use and research will lead to greater understanding.
4. Does the best option not become apparent before the calculation of the WLV Factor? It may well be true that when constructing the tables using a calculator the best option begins to reveal itself before the process is complete and indeed that some calculations are carried out on variables where the difference in values and/or votes is minimal. Hammond, Keeney and Raiffa (1998) address this issue in their discussion of simplifying complex decisions by making trade-offs against identified criteria. Whilst relevant, it is concluded here that no decision can be made before processing the stakeholder questionnaire and once the stakeholder questionnaire is input into the WLV spreadsheet then the answer described in this chapter is produced within minutes.

The data generated by strategic briefing and the use of the WLV Factor to identify the option, which gives the greatest value for money, give confidence in the further development of the identified option in the project briefing and concept design stages described in the following section.

Concept stage use of WLV KPI

Project briefing is the next stage in the project development process, and in the case study follows the selection of option 3, the proposed new build library on the High St. The work that went into the formulation of the whole life value conceptual model and the option appraisal exercise reported in the strategic outline case will inform the briefing exercise. Briefing as discussed in Chapter 3, and described in the toolbox, is an exercise that can be carried out by investigation or through a facilitated value study. The briefing study reacts to but cannot be analysed by the whole life value conceptual model. In answer to the project brief for option 3, the design team will produce a number of concept designs. It is at this stage that the whole life value conceptual model will transform into a whole life value KPI model.

Nine questions are asked of each concept design to answer the brief for option 3. For the case study project, these questions are as follows:

1. Are the functional requirements of the project being met? To answer this question, the seven functional requirements are listed together with the benchmark score for option 3 ascertained through the WLV conceptual modelling exercise. Stakeholders of the project are invited to score the extent to which each of the optional concept designs meet the seven functional requirements using a questionnaire with a Likert scale identical to that used earlier.
2. To what extent do the concept design options give benefit to the whole community? The approach taken to answering this question will be similar to the WLV conceptual modelling exercise.
3. Is the project's carbon footprint acceptable? Each concept design option will be examined to determine its impact on the environment. It is at this stage that life cycle assessment (LCA) method can be used. LCA can only be used once designs are available.
4. Is the project likely to generate the required income? Each concept design option will be examined to determine its likely income generation.
5. Will the project be admired by all for its function and aesthetics? Although entirely subjective each of the concept designs will be examined by the stakeholders. It may be possible to include tools such as the design quality indicator (DQI) (Construction Industry Council, 2013) to assist the subjective judgement of the stakeholders.
6. Will the project be comfortable and efficient for all users? Efficiency in use will be determined by the relationship of spaces as reflected by each of the concept designs.
7. Is there high confidence that the capital cost budget will not be exceeded? Whereas the budget at the strategic outline case stage is based on imprecise data, at concept design a capital cost plan can be developed based upon actual areas and a more exact understanding of the likely specification for the majority of elements for each of the concept design options presented.
8. Are the operating costs optimal and predictable? Questions 7 and 8 are considered together through the outline whole life cost plan produced for each of the options being considered. The whole life cost plan will rely on data from such sources as the Building Cost Information Service (BCIS) and the Society of Construction and Quantity Surveyors whole life costing service. An outline risk analysis should also be provided for each concept design. The comparison between the budget produced at the strategic outline case stage and the whole life cost plan adjusted for the level of risk for each concept design option will indicate the level of confidence in the projected whole life cost figure for each concept design. The risk figures included in the conceptual model can be modified once better data become available. This will influence the WLV factor.
9. Is there high confidence that each of the concept design options will be delivered on time? The answer to this question will impact the WLV offered by each option and is considered together with the preceding questions 7 and 8.

The answer to the nine questions will result in an update to the spreadsheet envisaged for the conceptual model. A WLV Factor score is produced for each concept design alongside the benchmark score generated at the strategic outline case stage. Generally, the concept design with the highest whole life value factor will be carried forward. The whole life value factor for the selected concept design becomes the new benchmark and is reported in the outline business case. From this point onwards the benchmark is used as an audit and benefits realisation tool to monitor the developing design and whole life cost plan. It is expected that the WLV Factor will continually rise. Certainly, were the WLV Factor to fall, an investigation as to why would be prompted.

12.4 Conclusion

At the commencement of this chapter a number of challenges were set by Bourke *et al.* (2005) regarding the practical application of whole life value. These were seen to require a consistent application of whole life value principles, the availability and reliability of data, the method of involving stakeholders, and overcoming the current perceived conflict between budgets and the whole life value process. In addition, managing initiative fatigue and the question of who pays for and benefits from a whole life value exercise is also raised.

In this chapter, the authors have described a theoretical methodology tested in practice that answers the majority of the challenges set by Bourke *et al.* (2005). The methodology relies heavily on the earlier chapters of the book for the theoretical framework for whole life value. In this chapter, we have been careful to use the term heuristic rather than equation or algorithm recognising that the methodology progresses to a solution through a set of procedures that rely on considered but nevertheless loosely defined logic.

The challenge of managing initiative fatigue is one familiar to value management practice. It can only be resolved by being selective in those projects put forward for a value study and selecting tools and models that make the process efficient. In general these projects need to be those that are either high cost or mission critical. The question of who pays for a whole life value exercise goes to the heart of who pays for a strategic briefing study. That a strategic briefing study will pay for itself many times over is beyond dispute. Whole life value is a methodology that extends through the whole project and should be a part of effective project management and paid for as such.

The barriers facing the adoption of whole life value by government departments as outlined by the NAO (2005) are overcome by the methodology. The primary barrier remains the client's will to do it.

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13 The Theory, Practice and Future of VM: A Revisionist Interpretation

13.1 Introduction

This chapter explores some of the developmental challenges that continue to face value management (VM). The chapter addresses a number of issues, a reinterpretation of aspects of the authors' research in the light of their current thinking, the nature of the VM practice setting and service offered and the issues surrounding 'hard' versus 'soft' value management debate. The chapter is subdivided into the following sections:

- Demand and supply of value management, concluding on issues raised in the book with regard to the practice of VM.
- The theoretical knowledge base of value management, concluding on the conceptual frameworks under which VM operates, the current state of VM practice, the potential for theoretical and practice development and a redefinition of VM.
- A drawing together of the debate on stakeholders and a conclusion on the definition and role of stakeholders in a VM context.
- The nature of professions, professional territoriality and the institutional structuring and positioning of VM, and where it may or may not be heading.

Finally, the chapter reviews the implications of this analysis for the continued development of value management, and argues the need to position it as a distinctive professional management style that revolves around a value-based, function-oriented, stakeholder decision methodology.

13.2 Demand and supply: the practice of VM

The marketplace for VM services is structured by those that provide (practitioners) and those that purchase VM services (clients, procurers and commissioners of the service).

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

This section explores the market-based relationships that exist and the forms of VM practice that may result.

Procuring and commissioning clients of VM

On the purchasing side of the marketplace for VM, the procurers of VM services in construction can be broken down into the following:

- *Ad hoc or one off procurers.* These have very limited or no knowledge of VM. In this instance, the role of qualifications and certification of practitioners are important for their peace of mind in ensuing they receive a service either to a defined standard or one that meets or exceeds their expectations. Also, this could be linked to the reputation of the VM practitioner's employing organisation depending on the nature of employment for the practitioner.
- *Intermittent procurers.* Whilst this group will have an opportunity to learn about VM, that knowledge is unlikely to remain current given their intermittent use of the discipline. Again, in this instance, qualifications and certification of practitioners are important for their peace of mind, as will the reputation of the VM practitioner's employing organisation.
- *Regular procurers – Type 1.* These have ongoing requirements for VM, but their procurement knowledge is not embedded deep within the organisation and resides within a procuring and commissioning organisational unit. That organisational unit will build up knowledge of VM quickly if it is used regularly on projects. These types of procurers are likely to operate prequalification mechanisms for VM practitioners. Qualifications and certification of a VM practitioner (Value Study Leader – VSL) and the reputation of that person's employing organisation will be important for prequalification. The importance of these aspects could diminish as the client becomes more familiar with which VSLs are good at undertaking value studies. Over time the important issue for this type of client is one of who is capable of undertaking successful value studies. This raises issues over the individual patronage of VSLs compared to that of the VSLs' employing organisation.
- *Regular procurers – Type 2.* These have consistent and ongoing requirements for VM, and their knowledge of it is embedded deep within the organisation. Over time the important issue for this type of procurer is also who has the capability to undertake successful value studies regardless of whether or not they have formal VM qualifications and certification. These clients are likely to have framework arrangements for VSLs but it is more likely to be with their employing organisations. These types of procurers will also use the option of continuing to procure VM services from the marketplace. If their requirement is sufficient and ongoing they may also set up their own internal unit staffed with VM practitioners. Even where an internal unit of practitioners exists, for very specialist requirements for particular value studies these clients may well commission from the marketplace on an ad hoc competitive basis rather than from framework suppliers.

The empirical evidence indicates that both types of regular procurers dominate the marketplace for VM practitioners.

A typology of VM organisational practices

Male *et al.* (1998b), Male and Kelly (1999) and Kelly, Male and Graham (2004) identified a typology of VM practitioners and organisations, indicating different tensions and pressures that are present in the supply-side marketplace. Two different roles are distinguished in this section, that of VSLs to denote those practitioners that design and deliver value studies and a Value Study Commissioner (VSC) to denote the role of a person who only commissions value studies but does not design and deliver them in that role. It is argued here that a VSL must have the full gambit of skills to undertake a value study whereas a VSC must have sufficient understanding of value management to be able to commission value studies, but might not necessarily possess or practice the VSL skill set. The term 'VM organisational practice' is used here to refer to organisations operating under a series of different market structures, either internally within an organisation or procured externally in the marketplace by clients.

A clear message from Male *et al.* (1998b) is that regular procuring clients of VM services rely on the reputation of a VSL. However, there are two interrelated reputational modes, namely, that which accrues to a particular VSL, and that which accrues to the VSL's employing organisation. This provides the context for the organisational practice settings of VM.

The *Type 1 VM organisational practice* is the VSL who is a sole trader (or perhaps two to three VSLs at the very most within the organisation) operating within the confines of a pure 'cottage industry' role. The VSL is able to compete very effectively on price with a low overhead structure. Their main pressures in the marketplace stems from the need to maintain a steady volume of work. Resourcing can become an issue when workload peaks. Consequently, the Type 1 VM organisational practice can also operate within a network of other VSLs to offset the problem. For continued success, personal reputation as a VSL provides the primary competitive edge, followed by price.

The *Type 2 VM organisational practice* has similarities to the first type. It works in association with a larger consultancy organisation either from within that organisation's premises but not directly employed by them, or subcontracted in by the organisation to use VM on its own projects, or as part of the larger organisation's suite of service offerings. The Type 2 VM organisational practice has the advantage of marketing under an umbrella provided by a larger consultancy organisation with its associated brand reputation. The two intersecting reputational advantages are operating with the type of organisational practice as noted earlier, namely, that of the VSL and the associated larger consultancy organisation.

A *Type 3 VM organisational practice* is located within a larger commercial organisation that offers VM as a specialist service to clients. The Type 3 has volume from turnover and offers a dedicated VM service with the intention of sustaining the business over the longer term as part of its substantive service base. The Type 3 may be susceptible to internal tensions because clients prefer particular VSLs to others from the same consultancy organisation. This creates a centrifugal tendency within the Type 3 VM organisational practice for spin-off competing Type 1 VM organisational practices who take their established clientele with them due to the strength of client patronage with the individual rather than the consultancy brand. The strong internal tension may become too great for the Type 3 to retain internal cohesion for a VM internal unit of VSLs into the longer term with the attendant problems of resourcing and growth. The Type 3 VM organisational practice has two subtypes. *Type 3a* is a stand-alone VM consultancy organisation that is a subsidiary of a larger corporate structure, perhaps a large consultancy group. It develops its own brand reputation for VM, along with that of the individual VSLs, but also has the reputational advantage provided by that of the larger corporate structure. The Type 3a would operate autonomously as a profit centre. *Type 3b* is a standalone VM consultancy unit within a larger corporate professional consultancy, or other types of service providers, such as contractors, that offer services internally on projects and/or externally to the marketplace. It is likely to be structured as an internal cost centre.

The *Type 4 VM organisational practice* occurs where value management is not the sole activity of the consultancy practitioner(s). The advantage here is that the organisation and the individual are not reliant on VM to sustain primary business income. The main disadvantages lie in the consultancy organisation being unable to demonstrate to potential clients' continuing commitment to VM, the ability to keep abreast of VM current practice and issues, and the ability to create a wide enough portfolio of value studies to convince a diversity of clients that the VSLs can operate across a range of industrial sectors if there is insufficient VM turnover. To some extent, depending on the parent organisation, drawing on other internal VSLs across the consultancy organisation may offset this difficulty.

The *Type 5 VM organisational practice* operates as an internal VM unit within a large corporate client, for example, a utilities organisation, or a corporate client with a large physical infrastructure base that it requires to operate in support of its core business, for example, airport or rail infrastructure operators. These clients will typically have significant capital and revenue investment cycles, and operate Major Project, Portfolios, and/or Programmes of projects structures as well as having asset management capabilities. The Type 5 VM organisational practice operates under internal and not external market structures and practitioners are paid as full-time staff by the organisation. Internal charging mechanisms may also be in place. The Type 5 VM organisational practice comprises three subtypes:

- The *Type 5a* is essentially a Type 1 practice but where a VSC is responsible for commissioning and managing VM programmes and not undertaking value studies. The VSC will be embedded within the wider organisation, and may either be dedicated to commissioning value studies or VM programmes only or also performing other organisational duties. They will subcontract in from the external marketplace those offering VM services under practice Types 1, 2, 3 and 4.
- The *Type 5b* has similarities to Type 3 except that the VM unit's focus is to provide an internal dedicated VM service only to the client organisation. The primary pressure here is internal volume of work to justify a separate VM organisational unit and internal charging mechanisms for the service can also raise difficulties.
- The *Type 5c practice* is a distinct VM unit that can operate internally and/or also offer under very specific circumstance external services in VM to other clients. The primary pressure and tensions here are first, one of where their priorities lie, internally or externally, and where the trade-off occurs when conflicting priorities arise. Second, offering an external VM service brings the Type 5c into direct competition with

Types 1, 2, 3, 4 and potentially other Type 5c's from other clients. Again, the problem facing this type of practice is one of sustaining full-time employment from VM to the satisfaction of the employing organisation.

The Type 1 to 5 VM organisational practices are all evident in the United Kingdom at the moment.

Research on the status of VM in the marketplace

The evidence indicates that VM is seen in the construction marketplace as having a strong cost-cutting legacy, is typically a one-off project intervention predominantly at or around the concept and sketch design stages, although multiple interventions are possible with more knowledgeable clients (Ellis, Wood and Keel, 2005). Fong (2004) and Cheah and Ting (2005) argue that VM's continued development may have plateaued, or at worse is in decline, perhaps due to that cost-cutting legacy, a lack of understanding of the methodology, its image and confusion with other management techniques dealing with value. Commercial pressures by clients have appeared to drive workshop durations downwards to typically one-day, or perhaps less, and there is a clear danger of workshop fatigue and a tick box mindset in its use (Ellis, Wood and Keel, 2005). However, VM is also seen as a very good methodology for creating shared understanding and decision-making across project participants and stakeholders (Green and Liu, 2007), is seen by numerous industry and government reports as good practice, and can have a much greater impact in the early stages of projects. The danger remains that clients may not make the most of this powerful process in that stage of projects.

Green and Liu (2007), continuing their dialogue on 'hard' and 'soft' VM, argue that the Ellis, Wood and Keel (2005) sample is restricted to large surveying consultancy organisations only and does not generalise easily to a wider constituency. Simister and Green (1997) researched a much broader sample of VM practitioners who discussed value studies that did or did not work well. A constellation of six emergent themes are identified for VM practice, and are acknowledged by interviewees and those researchers to overlap in reality. An analysis of practice by the Simister and Green themes is provided in Table 13.1 and encapsulates the chapter authors' own views from their research and practice.

The authors have adjusted their stance on the role of value workshops in the VM process since the Male *et al.* (1998a, 1998b) international benchmarking study. For example, when comparing Ellis, Wood and Keel (2005), the SAVE International Standard (SAVEI, 2007), and the Australian Standard (AS, 2007) they adopt terms such as pre-workshop and post-workshop, which attests to the centrality given by these publications to the role of workshops in value management. A value workshop is not the sole focus and reason why VM exists. However, as outlined in earlier chapters, the authors argue that the success of a value study is dependent on the three equally important but interrelated phases, namely, the *Orientation and Diagnostics phase*, the *Value Workshop phase* and the *Implementation phase*. From this perspective, a value workshop is no more or less important than the other two phases. Its role in a value study is to bring the value team together, as stakeholders, in order to share, analyse and restructure information such that values-based and value-based options can be developed and decisions made to

Table 13.1 Commentaries on VM Practice.

VM Practice Topic	Simister and Green (1997) Findings and Comments	Kelly, Male and Graham Comments
Participation	This represents the extent of stakeholder participation, and commitment. It was the most frequently occurring theme in the studies analysed. VM studies were seen to work well where the participants considered they had made a positive contribution to the study and its outcomes. The primary purpose of VM is to build consensus, create ownership of decisions and outcomes, and carry these through into implementation.	The authors would concur with this view from their experience.
Expectations	This relates to the extent to which the expectations of the value team were met in terms of outcomes and objectives. It was the second most frequent theme mentioned by research participants. VM practitioners would structure the VM study so that only certain relevant issues would be addressed. It was noted that the participants expected a certain outcome, which was subsequently achieved, perhaps indicating the presence of a self-fulfilling prophecy. VM practitioners will tailor the VM exercise to meet expectations, and that VSLs were acting in a consultancy mode and needed to balance their own expectations versus those of the client.	The authors would concur with the sentiments of this theme at one level. It is important to meet the expectations of the participants and the client. However, the authors would design a value study with no pre-determined view on outcomes, but with pre-determined objectives. The study process would be tailored to meet the requirements of the client, the situation confronted and the likely value challenges being faced and needing to be resolved. All too often the authors, in their role as VSLs, have had to adapt the ongoing value study process, especially in a value workshop, to unexpected or emerging issues.
Power	This relates to the extent to which the consultant, as VM practitioner, is advising on rather than implementing decisions. It was noted that a number of consultants in the survey were restricted by their terms of engagement in relationship to the extent to which they could implement outcomes. Equally, practitioners would not advise the client to undertake a VM exercise unless they thought the client would accept it as a way forward. It was noted this was an overlap with the Expectations theme cited earlier.	Based on the authors' experience and research, a number of observations can be made on this theme. First, the Implementation phase is seen as a key weakness of VM if not carried through appropriately. Second, in some studies, and as noted in the case studies presented in earlier chapters, the authors' remit has ceased with the production of a report and implementation of ideas and outcomes is taken up by others in the project team. However, there has always been a dialogue with the client from the outset around implementation, and an Action Plan does in the majority of situations address this issue. Third, the authors have conducted studies where they were involved in the early stages of implementation. Fourth, many VM practitioners will only accept responsibility and accountability for the value study up to the point of producing a report. Implementation is seen as the responsibility and hence liability of the project team. Finally, the authors have on occasions made recommendations to the client that a value study is not an appropriate way forward.

Table 13.1 (*Continued*)

VM Practice Topic	Simister and Green (1997) Findings and Comments	Kelly, Male and Graham Comments
Implementation	This is the fourth most important theme and concerns the extent to which VM study outcomes were implemented. For a VM study to be seen as a success, the project needs to be modified in some way from the state prior to the study being conducted. The intervention of the VM study allows decisions to be taken in a rapid, cohesive and structured way. However, in one example quoted where changes were evidently possible, the study was undertaken as a policy requirement of the client, and the value team played lip service to study outcomes with no intention of modifying the project.	Aspects of implementation have been noted earlier and in earlier chapters. The authors have encountered situations where lip service has been given to a value study, or severe constraints placed on it, but this is the exception. On the positive side, a significant majority of value studies have ended with the value team immediately after the Action Planning stage of the workshop viewing their diaries to plan implementation meetings. The timing of issuing the Action Plan is usually the first question following its development in a value workshop. The authors' experience is consistent with the positive and negative aspects of implementation noted in this theme.
Time constraints	This is the next most important theme and deals with the extent to which the project schedule allows for sufficient duration of the study and for initial preparation. The fieldwork data from the researchers suggested that in situations where VM studies were deemed unsuccessful by practitioners due to project time pressures, there was insufficient time to collect information to structure the study appropriately. However, the converse applied for studies deemed successful, even though significant time pressures were evident; the key in the latter case was the ability of the VSL to engage in a dialogue with the client with the aim of making sufficient time available within the project schedule. The conundrum that prevails with VM studies is the time taken to structure the study appropriately and for key stakeholders to take time to attend workshops, versus the potential benefits that can accrue from undertaking a VM study.	The authors agree that the time spent prior to undertaking a value workshop is vital for the success of a study overall. Equally, projects have their own momentum with importance placed on the time dimension, and there is a balance to be struck to accommodate the value study. This point also raises a number of fundamental issues around the reasons for undertaking a value study in the first place. Unfortunately, emphasis is often placed on the fact that VM is about facilitating value workshops, and is only a workshop process per se. It is much more than that. Equally, there are issues around whether VM is seen as a 'tick-box' exercise or is seen as good practice with proper scheduling and something important to add to projects. The case studies presented in the various chapters had different Orientation and Diagnostics phases in which the levels of information gathering involved initial discussions with the commissioning client about the purpose, requirements, process and consequences of a value study. These discussions are vital to ensure it is designed as effectively and efficiently as possible.
Uncertainty	This is the final and lowest ranked theme identified. It concerns the relative absence of knowledge about a project. VM combines information from a range of sources including that provided by key stakeholders either through interviews or at a value workshop, or both. One of the problems confronting a value study in the early stages of a project is that uncertainty is higher, and there is often incomplete information. However, even with key stakeholders as decision makers present at a value workshop there were situations where there were too many problems to resolve at the front end of a project.	The authors' experience at the front end of the project aligns in principle with this theme. It would be fair to say, however, that an extensive, extended and prioritised Issues Analysis, based on the framework for Major Projects proposed by Morris and Hough (1987), assists greatly in identifying where information exists and where there are gaps. A value study conducted in the early stages of projects has the greatest likelihood of coalescing information from a range of sources to assist in reducing uncertainty. Uncertainty can arise when due to poor planning a key stakeholder is missing from the study team.

resolve value challenges, and to seek consensus, or otherwise, on agreed outcomes and a way forward.

Furthermore, it is useful in the early stages of designing a project level value study, perhaps in the initial orientation meeting with the client, to explore a potential set of influencing characteristics on that study. Some of these relate to those characteristics identified by Morris and Hough (1987) and the work of the Major Projects Association, whilst others relate to the authors' experience. The important issue is not to be confined just by considerations around project value as the only defining need for a value study. Some or all of these characteristics may interact, may help shape or challenge the exact need for or requirements of a value study:

- The extent to which a project is mission critical and why.
- Why and how a project has a strategic fit with the client's organisational strategy, and any asset management plans.
- Whether the project possess a high risk to the client's core business, and/or has high reputational risk, and the extent and nature of these risks.
- Whether the project is over or under budget and the reasons for this.
- Whether the project is within scope, or there are aspects outside scope and the reasons for this.
- The extent and nature of the sanctioning, approvals and variations processes.
- If the project is time urgent, and why.
- If there are difficulties caused by the choice of procurement route and/or the operation of the consequent project team.
- The number, nature and complexity of any managerial or key stakeholder interfaces.
- The level of interdependency between the prospective project under study and any other projects, perhaps making up a Programme or Portfolio, together with the nature, extent and reasons for that interdependency.

In drawing together a number of issues raised earlier, and also those from preceding chapters, the authors would contend the following:

- The success of a value study is clearly dependent on the detailed design of each of the three phases of a value study by the VSL. The subsequent delivery must be carried out in such manner that the VSL can adapt that design flexibly to emerging issues.
- A further key aspect of designing a value study is the important role that the VSL undertakes in each of the three phases of a value study. Within this aspect, the authors have always opted, when possible, to conduct project level value studies with two VSLs for the following reasons:
  - It maintains the effectiveness, efficiency and momentum throughout a value study.
  - During a value workshop in particular it permits an increased level of momentum to be maintained; it also assists with multiple working group operations, to accommodate any significant changes to ongoing workshop delivery as a result of emerging issues, and at times to deal with value management and value engineering (VE) aspects simultaneously.

  The authors accept that this adds additional costs compared to the employment of only one VSL to lead a value study. The important point is to include this aspect in the dialogue with a client about the design of a study and the advantages and disadvantages of this approach.

- Value studies conducted on multiple projects have always involved more than one VSL. They will have higher degrees of complexity, value studies are extended and extensive, with each of the phases potentially overlapping to a large extent, and any major value workshop typically involves large teams. This places significant emphasis on detailed value study design, and the need for increased levels of flexibility in delivery.

In summary, a typology of VM clients and VM organisational practice has been identified, with subtypes. The construction industry in the United Kingdom now has examples of all five VM organisational practice types in existence. It is clear that there is currently a strong cost-cutting perception about value management, it is seen as lacking a professional image, it is said also to have a confused image, and is seen as having implementation difficulties on projects. The authors would agree with these findings. Part of the problem may well stem from the fact that facilitating workshops and VM are seen as being synonymous, an issue disputed by the authors. Equally, 'optioneering', using multidisciplinary brainstorming workshops, whilst having a role to play on projects, lacks the depth of investigation that function analysis brings in value studies. Equally, the VSL has a vital role to play in assessing the defining characteristics, and the subsequent design and delivery of a value study. There is a series of implications stemming from the foregoing for the continued development of value management in the United Kingdom, and for that matter potentially in other countries. Section 13.3 explores the interplay between theory and practice in more detail.

13.3 Theoretical underpinnings

Conceptual frameworks

Two distinct strands of thinking have consistently informed the theoretical and practical insights of the authors, namely, that of building economics and insights derived from organisational behaviour, organisational psychology, intra- and interpersonal psychology, together with the sociology of the professions (Male, 1984; Kelly and Male, 1988). From within this context, Kelly and Male (1988) argue that VM provides a method of integrating the client and stakeholders to a project that no other management structure in construction can provide. This remains the case, especially when coupled with its use in collaborative procurement routes, such as those with a strong partnering emphasis.

Additionally, Male and Kelly (1991) and Kelly and Male (1991) explored the notion of the 'economic management of projects', identifying different study styles. These were set out in Chapter 3. Subsequently, Kelly and Male (1993) adopt the term 'project economics', in bringing together value management and cost management into an integrated approach for projects. Kelly and Male (1991) note these are different and should not be confused; the distinction between these two types of studies is primarily around the use of function analysis, the former using it and the latter not. Kelly and Male

(1993), in elaborating this distinction further, set out a series of discrete study styles for VM and also for structured cost studies. The structured multidisciplinary technically focused cost review is seen as a valid exercise on projects; however, since it would not involve detailed function analysis it should not be confused with VM or VE. The latter type of study would be typical of that termed 'optioneering' as noted earlier and has very close similarities to the findings reported in Ellis, Wood and Keel (2005).

For the client, a decision point occurs at or around 35% design (Stage C RIBA 2007, Concept Design RIBA 2013) where a series of economic choices are available on a project, namely, to undertake a value study or opt for cost management with a structured cost study. Male and Kelly (1991) conclude that commercial pressures are likely to force a momentum at this decision point towards cost management studies. Formal structured optioneering studies are less time consuming to apply than using comprehensive function analysis, and can demonstrate identifiable cost savings, if that is the required strategy. They will not challenge or make any changes to the underlying project concept and operate within the given parameters of that concept. Male and Kelly (1991) add that if this pressure is sustained over time in the UK construction industry it will diminish the in-depth analytical power that function analysis can bring in value studies. Saxon (2005) and the Ellis, Wood and Keel (2005) study confirm the existence and consequences of those commercial pressures, and the Green and Liu (2007) commentary provides additional weight to the experience of VM practitioners noted in the former's research. In essence, the evidence indicates it is easier to offer structured optioneering cost management studies masquerading as value management or value engineering than the more rigorous, in-depth function-oriented value studies from within the philosophical and methodological domain of value management. Depth is being sacrificed for speed, and commercial pressures drive a cost-focused strategy rather than a value-focused strategy.

Equally, the client is not a unified entity in making value judgements; the consequent result is that in the project gestation, or strategic phase, information is often unstructured, typically expressed in broad project requirements, and that deep within the client organisation economic, organisational and political influences help shape these requirements (Male and Kelly, 1991). Kelly and Male (1991) argue further that the forces driving a project – the project drivers – can often be diverse, and are a direct result of those economic, organisational, political and psychological behaviours that are present within a client organisation. In this context, VM, as much a philosophy rather than an absolute method or set of procedures, continues to have clear and major benefits to add in the early stage of projects. It clarifies thinking and provides a deeper understanding of requirements, makes project drivers and value systems explicit, removes ambiguity and enables decision-makers to reach a common consensus on the relative importance of project objectives expressed in the language of function. As a consequent result, VM will have an intangible but direct effect on cost. Kelly and Male (1991) add further that through the noun–verb language of function analysis, the client in-house team, and subsequently the appointed project team, can use a common language-based technique to understand requirements expressed as functions, and consequently relate this to performance and specification. Through this they gain a deeper understanding of those requirements and expectations, not only about function but related also to expectations about performance. Consequently, decisions around cost in relation to worth can be made more appropriately.

Kelly and Male (1993) identified four levels of function-oriented thinking for value studies. These have been detailed in Figure 2.3, Chapter 2. These interrelated function levels directly impact how a value study is carried out and the type of function analysis required. These levels of function thinking have proven to be robust regardless of the type of project – civil engineering, building, process plant, and so on. Case studies presented in Chapters 7–10 indicate how function analysis has been applied in different types of projects and also how it has a much wider application in organisational type value studies.

Furthermore, a strong philosophical and practical relationship also exists between the dynamics and principles of value management, the origins of the client value system concept and Porter's (Porter, 1985) view of the value chain from an industrial and organisational economics perspective (Male and Kelly, 1991; Kelly and Male, 1991, 1993). By adopting a strategic management perspective for positioning value management and arguing a project is an extension of the value chain concept, Male and Kelly (1992), Bell (1994), Standing (1999, 2001) and Alajmi (2009) highlight the consequential, philosophical, conceptual and practical linkages provided between the 'markets' served by client organisations, and their needs derived and articulated subsequently from within the client organisation. Consequently, this necessitates an explicit assessment of the contribution that built assets make to a client's ongoing corporate strategy (Male and Kelly, 1991; Kelly and Male, 1993). These insights have been developed much further in Chapter 8 dealing with asset management, the linkages between corporate strategy and P3 in Chapter 9, option appraisal in Chapter 10, whole life value in Chapter 12 together with an exploration of value studies in each of these contexts as provided through in-depth case studies presented in those chapters.

Function analysis, objectives hierarchies and value trees

As noted in Chapter 2, the origins of value management as proposed by Miles (1989) are rooted in an understanding of functions and use of function analysis. A review of guidance notes highlighted a divergence of views on the use of function analysis; Objectives Hierarchies and Value Trees in value management (Male *et al.*, 1998b). This continues to be an issue within the UK construction industry. In the Ellis, Wood and Keel (2005) study the importance of determining client functional requirements was unanimously accepted by respondents. Some form of function hierarchy was used by 75% of respondents. Function analysis system technique (FAST) diagrams were sometimes used, but with reservations. They were seen as a difficult technique to use in workshops, turned workshop teams off, or the use of a verb–noun statement was seen as confusing. The FAST 'verb–noun' statements were generally avoided, and the 'how–why' convention associated with functional hierarchy models only loosely applied. The authors would generally agree with the sentiments of this finding about the difficulties of applying function analysis in a workshop setting. However, they have adopted different approaches to function analysis depending on the requirements of a value study, and these have been described within Chapter 4. It should also be stressed that the use of a short verb–noun statement does provide absolute clarity of expression of a function requirement. The strict requirement for this can be relaxed to some extent in a value workshop environment provided statements are short, concise, clear and function oriented as set out in the various figures in Chapter 4.

The experience of the authors is that the use of function analysis is of paramount importance to the further success of a value workshop. It establishes a common understanding and meaning amongst the value team by using natural language. The Ellis, Wood and Keel (2005) study also investigated the use of the Simple Multi-Attribute Rating Technique (SMART), similar to FAST, to create objectives hierarchies and using weighted value trees. Their findings note it was not widely used; however, this finding was disputed by Green and Liu (2007). This text's authors have adopted SMART when necessary and have utilised a weighted FAST hierarchical diagram when appropriate. An example is provided in Chapter 12.

In attempting to reconcile these differences of approach, Male *et al.* (1998b) noted that there are similarities between the logic diagrams inherent within the structuring of function analysis and that used in creating objectives hierarchies. They argue that the differing perspectives can be easily reconciled with reference to the discipline of psychology and the theories inherent within Personal Construct Psychology developed by Kelly (1955). Kelly's approach argues that people develop hierarchical bipolar constructs to map reality in their thinking in order to understand the world around them. They make sense of the world, and use language to assist with bipolar discriminations of reality, for example, good/bad, up/down, hot/cold and thick/thin (Kelly 1955).

From the perspective of Personal Construct Psychology, since the techniques FAST diagramming and Objectives Hierarchies use, structure and prioritise short statements as a workshop methodology, they are in essence using natural language to secure a consensus amongst stakeholders around a value problem that needs resolution; one emphasises the language of function and the other the language of objectives. However, their underlying purpose is the same, namely, the deep structuring hierarchically of a value problem statement and the value challenge for the 'business project'. However, unlike Objectives Hierarchies, Function Analysis is taken further and more deeply through its use in spatial, elements and components analysis. This adds to and extends the continuity of the value thread deeper into the minds of the project team across the project life cycle. That extended and deeper analysis would not be present in 'optioneering' studies. It is the importance of the debate, the creation of a shared understanding, seeking consensus around the prioritisation of the language driven hierarchy. Hence, the debate over functional analysis versus objectives hierarchies becomes unproductive when looked at in this context. They both serve a common end; however, function analysis, if applied correctly, seeks that greater depth and clarity but takes more time to achieve this.

VM, the briefing process and the business and technical projects

Kelly, McPherson and Male (1992, 1993b), Kelly, Male and McPherson (1993a), and Kelly and Male (1995) propose an alternative approach to the theories and practice of briefing using a value management methodology. Building on the work of Rittel and Webber (1973), Kelly, McPherson and Male (1992) discussed the notion of 'wicked' problems in the context of complex design tasks, with theories and models of the design process, briefing and briefing practice reviewed.

The recognition of a two-stage briefing process is the primary outcome of this work, one dealing with the 'business brief' or 'strategic brief' for a project and the second dealing with the 'technical brief' or 'project brief'. These were discussed in detail in earlier chapters. The most striking finding is the fact that the skill sets required for each of these two aspects of the brief are different; the first focused around understanding a client organisation, and the second around the operational aspects of the built asset and the more detailed construction consequences of this (Kelly, McPherson and Male, 1992, 1993b; Kelly, Male and McPherson, 1993a; Latham, 1994).

In the context of the foregoing, Male *et al.* (1998b) argue that VM encompasses an understanding of and provides solutions to two distinct types of 'projects'. The first, the 'Business Project', concerns the implementation of an investment decision and is the focus of the Stage 1 briefing process; with origins in establishing 'need' and the consequent reason for an investment. The language of the 'business project' should not be defined in construction or built asset terms but expressed and communicated in the language of business, the client organisation's raison d'être, its activities and culture. The 'business project' must also address why a built solution is the appropriate resolution to the identified need. The outcome is the strategic brief. The second project, termed the 'Technical Project', the focus of the Stage 2 briefing process, is the manner in which the business project is translated into the requirement for a built facility or asset through design and construction. The outcome of the Stage 2 briefing process is the 'project brief'.

The 'business project' – the domain of value management – remains investment focused throughout the project life cycle. The 'technical project' enters the domain of value engineering after the Feasibility stage and once a single preferred option has been chosen to go forward for the remainder of the project in its technical configuration. There is also a close alignment between these project 'types' and the disciplines of asset management. As noted in Chapter 8 this discipline requires the need for a built asset solution to be challenged, and this has to occur in Stage 1 Briefing – it may provide the best value-for-money eventual solution. By the time Stage 2 Briefing is reached and the 'project brief' is defined, a built asset solution is already the chosen strategy to address organisational need, and it remains to scope and deliver that in requirements and construction terms. Case studies presented in Chapter 7, one dealing with the food manufacturing silo (case study 2) and the other dealing with the College Library (the third value study in case study 5) are two examples of briefing studies where these principles have been used in practice. In these cases, and in other value studies not presented in Chapter 7, the authors have commissioned a briefing architect as part of the VSL's team to work with the client. In the case of the College Library, the strategic and project briefs were developed within one value study and the subsequent documentation, including the exploration of appropriate procurement strategies.

Conclusions on current VM practice

The preceding text has demonstrated a number of important principles of relevance now and for the future of value management. First, at a philosophical, conceptual and practice level there is an established and clear theoretical and practical linkage between value management, the P3 environment, asset management and corporate and business strategy.

Value management, as a business-focused discipline, describes a philosophy, methodology, service and approach to ensure the 'value thread' is maintained coherently throughout the Organisational and Project Value Chains. At a single project level, the notion of 'project economics' strongly favours the fact that clients and their advisors have an important choice to make in the strategic phase of a project, namely, whether to (i) conduct multidisciplinary structured value studies or (ii) structured cost management/ optioneering studies. To complement this, the single profession focused cost management skills of the quantity surveyor augments both. Regardless of that choice, empirical evidence indicates a convergence point occurs in a project at or around 35% design where commercial pressures strongly favour shorter duration structured multidisciplinary optioneering studies, led by a VSL. The Ellis, Wood and Keel (2005) study adds weight to this conclusion. However, neither optioneering nor single profession cost management adopt in-depth function analysis. The sacrifice that is made at or around the 35% design convergence point, if strong commercial pressures prevail, is to forgo a more in-depth, comprehensive, holistic, and perhaps slightly longer, value study. Depth and breadth of understanding to drive appropriate value focused solutions is being sacrificed for cost driven pragmatism.

Figure 13.1 identifies an important value/cost management decision fulcrum at or around 35% design. Saxon (2005) makes a number of important points in this context.

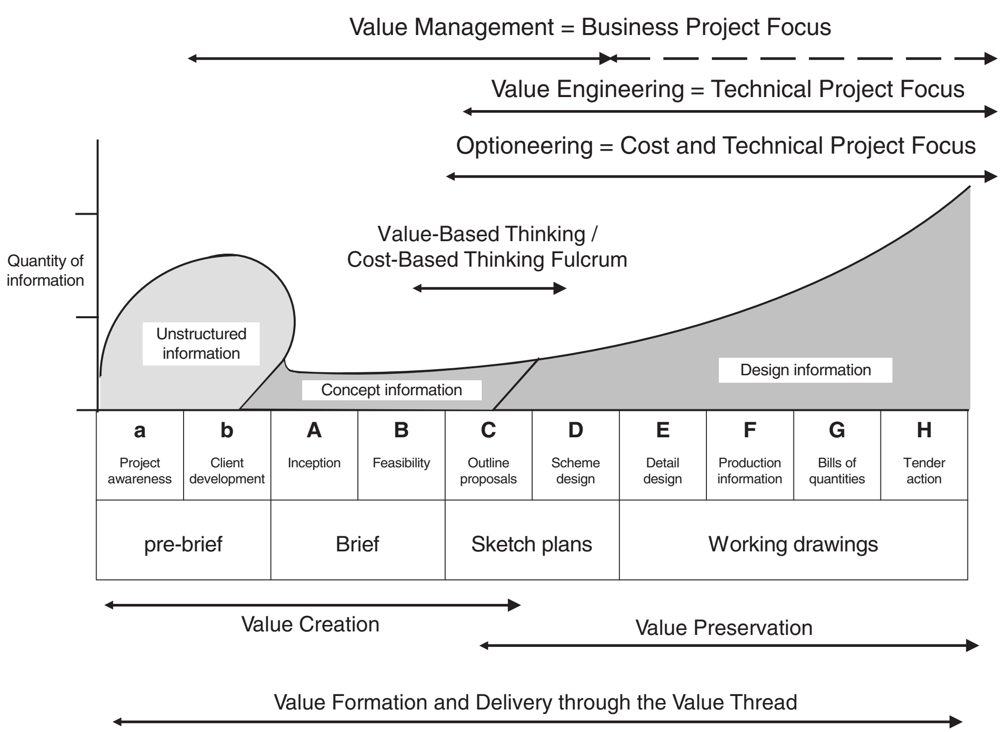

Figure 13.1 The fulcrum of value creation and preservation. *Source*: Adapted from Kelly and Male (1993).

First, he highlights that the mindset of the industry has traditionally been cost focused and it has to shift to a value focus but economic pressures increase the tendency towards the former. Second, he states that it is important to recognise the distinction between the value creation and value preservation phases of projects claiming that most value is created in the early stages of projects by defining need and designing the response to that. Once the delivery phase begins the challenge then becomes one of defending the value proposition against erosion. Third, he further argues that 'value engineering' to minimise cost if unskilfully undertaken can erode the value proposition. Equally, changes or substitutions to meet practical needs or increase supplier levels of profit can achieve the same erosion. It is contended here, and as noted in Figure 13.1, that the fulcrum between value creation and value preservation occurs at or around the 35% design stage and is the point at which the choice between value and cost management is at its most critical and potentially more heavily influenced by commercial pressures. The authors would also contend that it is this zone on a project where they have conducted the Charette study style that reviews a project's history to the present and consequently look to affirming or improving its future delivery.

In summary, the evidence presented earlier, the dangers of which were articulated by Kelly and Male (1993), attested to by Ellis, Wood and Keel (2005), Saxon (2005) and Green and Liu (2007), is that VM has a confused image largely due to cost-focused optioneering and cost reduction/substitution type studies masked under the title of value management or value engineering. This is in contrast to undertaking a deeper understanding of client and project requirements interpreted through the language of function and resolved through value-focused and not cost-focused options that are chosen within the parameters of an explicit client value system – the domain of value studies.

13.4 Future directions: Theoretical and practice developments

From the commencement of this millennium, theoretical development by the authors has focused on building 'the value case', briefing and architectural programming (Male, 2002; Kelly and Duerk, 2002). Kelly, Male and Graham (2004), Kelly (2007), and Male *et al.* (2007) subsequently consolidated these to encompass a greater focus on integrating the long-standing themes of projects and Programmes of projects into value management thinking; addressing further work on value study styles, the client value system, the client project value system; and the behavioural aspects and institutional structures for value management. The next section will briefly touch on these and related areas.

Generic formal value study styles

The VM methodology has been operationalised by the authors through a series of study styles informed by theoretical perspectives from business strategy, project management, the project value chain, and Programme and Project Management. Kelly, Male and

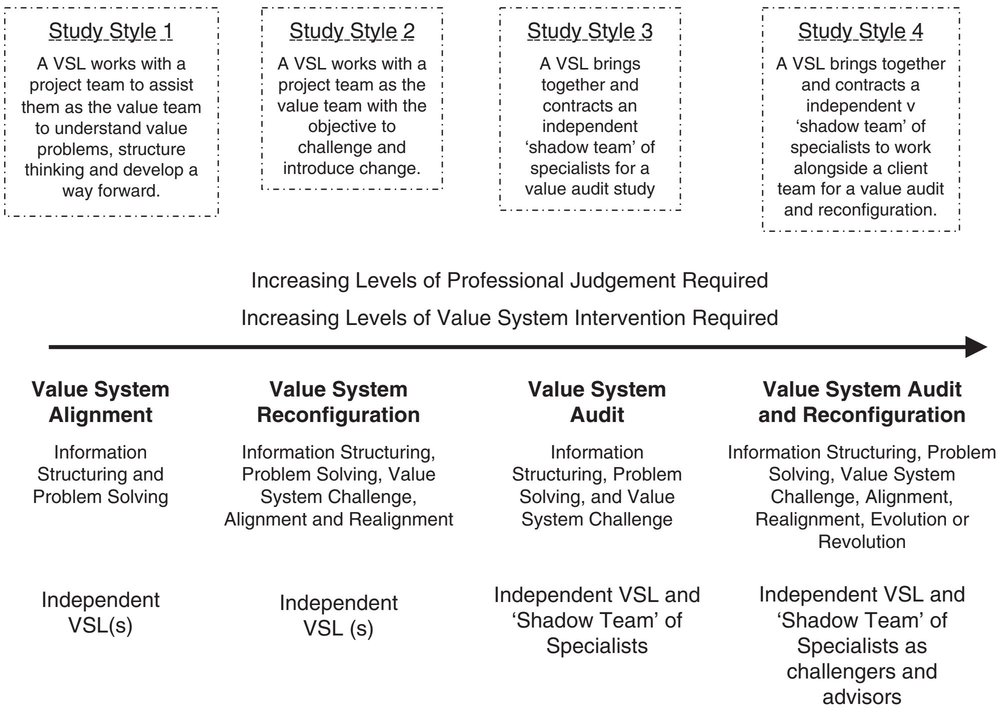

Figure 13.2 A generic study style continuum.

Graham (2004) define a study style as the configuration and desired outcome of the VM process that is required to intervene in a particular stage in a project life cycle or in an organisation, process, product or service delivery. It represents a combination of method, process and approaches to value workshop management and facilitation. Chapter 3 has set out the project-level study styles. As work progressed on developing a framework and theoretical underpinning to value management, it became evident that more fundamental study styles underpinned these and other types of value interventions (Male *et al.*, 2007). These more generic study styles are consolidated and presented in Figure 13.2 and discussed further below.

Generic Study Style 1 (SS1) involves project value system alignment and occurs where an independently appointed VSL works with a project team and adopts the structured VM process to assist them in integrating and prioritising information, understand value problems, structure and restructure their thinking, and develop a way forward such that the various value systems comprising the project value system are made explicit and remain in alignment. With SS1 challenging assumptions is less in evidence and the process, tools and techniques of value management are used to assist a project team think through a value problem/challenge and find a way forward. A typical example encountered by the authors with this study style is assisting a bid team develop a tender submission. SS1 is fast, efficient, increases cross-team learning, information sharing and focuses on solving the real problem at hand. The authors have increasingly worked with contractors using this study style with their bids teams across a range of procurement routes and supply chain situations. It has also been used in designing and implementing partnering structures on projects. The emphasis for the VSL in SS1 will be more on the Orientation and Diagnostics and Value Workshop phases and less on the Implementation phase since the value team should be highly motivated towards implementation.

Generic Study Style 2 (SS2) involves Value System Reconfiguration and is the normal UK approach to VM, and is also encountered in Australia and in the North American private sector. An independently appointed VSL works with a project team with the objective of challenging assumptions and potentially introducing change into the project/organisation's value system. SS2 can be adopted for projects, Programmes of projects, business process or organisational change studies. It typifies the majority of the studies conducted by the authors as illustrated by case studies 1 to 8 in Chapter 7. The learning curve is reduced for everyone and it increases ownership of outcomes. It is relatively inexpensive but places considerable reliance on the VSL challenging current perceptions, attitudes, the assumptions, ideas and options generated by the project team. This becomes more acute on complex projects, especially where there is a high degree of technological innovation, or, organisational or project politics. As these increase or are found in combinations a greater onus is placed on the VSL to achieve the appropriate balance of time between the Orientation and Diagnostics, Value Workshop and Implementation phases.

Generic Study Style 3 (SS3) is concerned with Value System Audit and occurs where an independently appointed VSL brings together and subcontracts a 'shadow team' of specialists for an audit study. It is the classic US study style for public sector activity, and is also encountered in the US private sector. Essentially, the value audit team intervenes on a project, a Programme of projects, or in an organisational process. The VSL selects the appropriate multidisciplinary team and they work independently of the appointed project team. Its major strength comes from bringing together specialists to provide a fresh look at a problem and provided the VSL selects the team appropriately, it can handle any level of complexity within a value problem/challenge situation. It has the additional advantage that it can cut through organisational or project politics. It can, however, also exacerbate project level or organisational politics if the findings and recommendations diverge significantly from client and, in particular, project team expectations. It is more expensive than SS1 or SS2, can be time consuming, and has the further disadvantage of increased learning curves for the independently appointed value team. The authors have never conducted such an exercise in the United Kingdom in its purest form; however, case study 1 and the second value study of Case Study 5 in Chapter 7 are the closest to this study style, although in those instances client representatives were working with the independent value study team. The clients were concerned about progress and value-for-money. There is greater emphasis for the VSL on the Orientation and Diagnostics phase and the Implementation phase; less on the Value Workshop phase since they are much more in the role of process manager than challenger.

Generic Study Style 4 (SS4) involves Value System Audit and Reconfiguration and is a hybrid between study styles 1, 2 and 3. It occurs where an appointed VSL brings together and subcontracts a tailored independent value team of specialists – the 'shadow team' – for a value system audit, and potentially for subsequent value system realignment or reconfiguration. Unlike SS1 to SS3, the independent 'shadow team' acts also in an advisory capacity. The process is underpinned by the VM methodology, is not bound by it in a rigid procedural way but uses its flexibility as a change oriented value process.

The 'shadow team' works alongside client personnel to develop and implement solutions and be held accountable professionally for that involvement, the advice given and any recommendations made. In SS4, the Orientation and Diagnostics phase could be extensive and adopt value workshops in a variety of concurrent ways throughout the value study. Implementation is an ongoing process throughout. It typifies the study style adopted for two of the value studies in Chapter 7, namely, the third value study in case study 5 and case study 9. Exemplars of SS4 are also presented in the case studies in Chapters 8–10. The adopted method uses the VM process for gathering, sharing and exploring information, challenging assumptions usually but not always in a workshop environment, developing options and also advising. The emphasis for the VSL with SS4 is on designing a reinforcing relationship between the distinct phases of the VM process, with Orientation and Diagnostics, Value Workshop(s) and Implementation phases, which at times may run concurrently as the change process unfolds. Importantly, value workshops may be used with SS4 in each of the three phases to bring different or the same stakeholders together. However, there is likely to be one significant workshop comprising the 'shadow team' and stakeholders that addresses the problem and value challenges as the carefully selected value team in order to develop options and/or solutions.

The role of the VSL, when set against these different generic study styles, becomes one of designing and implementing study styles to suit a whole range of different situations at organisational, Programme, or project levels. Progressing from left to right in Figure 13.2 involves greater degrees of value system intervention, the extent to which the VSL can be held accountable for the outcomes of a value study and also held professionally liable as the level of independent advice increases. The continuum also demonstrates a shift from recommendations made by the project team guided by the VSL to one where the VSL is the primary point of contractual contact and held liable for the advice provided by the 'shadow team' under the VSL's appointment. SS4, in this instance, aligns value management process liabilities with that of the liability stemming from those of intensive periods of management consultancy.

Redefining VM as a values and value-based stakeholder decision methodology

Value management is often discussed in the context of bringing stakeholders together during the Value Workshop phase. A typical definition of stakeholders was provided in Chapter 1. Its import is wide ranging. There is a substantive theoretical underpinning to the analysis and management of stakeholders, termed Stakeholder Theory. Its focus, as originally conceived, encompasses organisational management and ethics; its origins are in strategic management; and providing corporate perspectives on shareholders, stockholders and managerial capitalism. It typically includes graphical modelling or mapping of stakeholders (Freeman, 1984). Stakeholder Theory has meant different things to different people, has been heavily criticised, misrepresented, misunderstood and has been argued to have developed flexibly beyond its original intended scope. A central feature of Stakeholder Theory is that it addresses organisational morals and values; it has a principal tenet of attending to the interests and well-being of those that can assist or hinder achieving an organisation's objectives (Phillips, Freeman and Wicks, 2003).

There appears, however, little consensus on the definition of the term stakeholder. Miles (2012) reports numerous studies that attest to the confusion and lack of clarity surrounding the term. In a project context, this has been reinforced by Achterkamp, Janita and Vos (2008) and Littau, Jujagiri and Adlbrecht (2010). Some have even gone as far as to say Stakeholder Theory has added so much confusion there is now a need to go beyond it (Orts and Strudler, 2009). There is a potential opportunity for deeper investigation of Stakeholder Theory in the context of value management, given the continued references to stakeholders in VM and also in the wider construction, asset management and P3 literature. Therefore, it cannot be ignored.

Fassin (2009) defines a stakeholder as any individual or group that maintains a *stake* in an organisation in the same way that a shareholder possesses shares. Fassin further argues that this leads to two different and distinct views on stakeholders – those that have a *claim* over an organisation, and those that can *influence* it, or some combination of the two. Littau, Jujagiri and Adlbrecht (2010), in a project management context, noted a growing and diversifying attention to stakeholder management in the project management field and identify three stakeholder definitions:

- The Type 1 stakeholder definition refers to those that have an *interest in a project*. It stems originally from Clelland (1985). It dominated the PM literature prior to 2002 but also had a significant effect over the 25 years of their analysis.
- The Type II definition is characterised by the term 'those that *can affect and are affected by*'. It has its origins with Freeman's definition (Freeman, 1984). The project management literature is dominated by this definition from 2002 onwards.
- The Type III definition combines Type I and Type II.

For example, in a specific construction context, Moodley (2008) adopts a Type II approach, and differentiates between primary and secondary stakeholders, Yang *et al.* (2011) adopted a Type III approach and Fellows and Liu (2012) used the term stakeholders extensively but do not specifically define the term in their useful theoretical exploration of boundary spanning activities and boundary management on complex engineering projects.

In summary, stakeholders is a term often used in relation to Asset Management, Programmes, projects, Value Management and the general construction literature. The evidence indicates that the term and its consequences are rarely defined and explored in construction or for value management in particular.

Value management and stakeholders

A study of the theory of value in Chapter 11 identified a number of useful concepts from the perspective of value management. Primary among these concepts is intrinsic value, which is that value contained within an object (physical asset and/or service) and more importantly from a value management perspective can be anticipated before the object exists and can be described by reference to a defined number of facets. Furthermore, extrinsic value is that element of value that is given by an object once it exists in terms of pleasure and aesthetic appreciation, and so on. In the value management literature there is a reasonable consensus on the definition of value being either a relationship between function and cost or between cost, time and quality.

In these value contexts the term stakeholders is used extensively in VM and Asset Management standards and the use of the term is typically linked to the following:

- Value (BS EN, 2000; BS EN, 2004; BS EN, 2014; AS, 2007).
- To value study outcomes and stakeholders deciding on what will change in a project as a result of a value study (BS PD, 2000; SAVEI, 2007).
- That differing stakeholder views should be reconciled through VM (BS EN 12973, BS EN, 2004; BS EN, 2014),
- That stakeholders should be present in value study teams (AS, 2007; SAVEI, 2007),
- Can be internal or external to an organisation (BS EN, 2004; BS EN, 2014).
- Need to be considered within an organisation's value culture and value policy (BS EN, 2000; BS EN, 2014).

The previous version of BS EN 1325 (BS EN, 1997) did not use or define the term stakeholder. It did however, talk in terms of value for a user or different users (Pp 3). However, the recently published version of BS EN 1325 (BS EN, 2014) places at the core of defining value satisfying stakeholder needs, with a consequent requirement to define more clearly who is a stakeholder (Pp 5). The standard defines a stakeholder as person or organisation which has an interest in and influence on a product at any time during its life cycle (Pp 6), and this definition is supplemented further in the standard, The new ISO Standard on Asset Management (BS ISO, 2014) defines a stakeholder as a person or organisation that can affect or be affected by a decision or activity (Pp 12). Note 1 of that standard adds further that stakeholder can also be an interested party.

Defining and Selecting Stakeholders for Value Studies

Fassin (2009) extends the notion of stakeholder into three subsets to differentiate between different types:

- Real *stakeholders* are those that have a legitimate claim on an organisation, and it, in turn, has a reciprocal responsibility to them, with a consequent power relationship established. This category would typically encompass those that finance the organisation's operations, employees, customers, and business groupings, such as suppliers, strategic alliances, trade and professional associations, and competitors since they have the potential to also impact the organisation's actions. In a VM context, these are the stakeholders that have direct and reciprocal impact on a built asset in its various stages of inception, development and use, within P3 structures and related procurement, and hence should be involved or considered in value studies.
- *Stakewatchers*, analogous to 'watchdogs', are pressure groups in wider civil society that will have an indirect claim on an organisation, but they are independent from it. Their legitimacy is derived from power over the organisation but it, in turn, has little or no power over stake-watchers, or responsibility to them. This group requires close monitoring and evaluation by the client organisation and its advisors. In the context of a value study, their influence would need to be taken account of during the Orientation and Diagnostics Phase of a study, in particular, but also in each of the other two stages. Representatives may or may not be invited to take part in a value

study directly, but their influence may well have to be taken account of as part of the analysis within it.

- *Stakekeepers* are analogous to gatekeepers, who hold an independent monitoring and scrutiny role, and derive their power from grading, rating, regulating or assuring an organisation. Industry Regulators, the courts, Local Authority Panning Departments, those organisations that develop Standard Forms of Contract, Codes of Practice and Building Regulations are examples. They have influence and control, can impose regulations and constraints, but a client corporate organisation would have little reciprocal impact. In a VM context, their impact would need to be assessed in each of the three phases of a value study.

Steurer (2006), having investigated an extensive body of literature on stakeholder theory, provides a useful taxonomy for exploring its consequences for managerial actions. The taxonomy covers the corporate perspective, the stakeholder perspective and the conceptual perspective. Each will be discussed in turn.

The *corporate perspective* focuses on why and how corporations should deal with stakeholders, and how stakeholder relationship management can help to improve corporate performance. This provides the original context from within which stakeholder theory was developed. It is also the primary perspective adopted here for exploring the implications for VM for the client organisation as the body corporate and the sanctioning of investment for built assets at corporate level via the Management Board, and which is subsequently implemented and controlled through P3 structures to provide the coherency, or otherwise, of the 'value thread'.

Chapters 9 and 11 describe a body of literature relating to corporate and business values, practitioner's values, consumers (customer/user) values, an individual's values, and the value thread. Corporate and business values arise from deep within the business as the perspectives and paradigms existing within the organisation's governing Management Board, departments and individuals. It is these values that are transmitted through the client's core supply chain as a value thread. The corporate and business values are also portrayed to the public at large and generally accepted as being the value system of the organisation.

The research literature reviewed in Chapter 11 provides a firm foundation from which to build a methodology to make explicit the value system of the corporate client and importantly the value system of the project. A project arises when a client wishes to invest for the purpose of enhancing or creating a new physical asset to give a quantifiable return for the core business. The authors argue in Chapter 11 that the client's organisational value system feeds into the client's project value system at the point of the inception of the project. Ideally, from the client's perspective, the client's project value system should feed directly and untainted into the subsequent project value system. However, in reality, stake-watcher and stake-keeper stakeholders will feed into the project value system such that the original client's project value system could be amended if the client permits this to happen, either knowingly or inadvertently. The design and construction team may also feed into the project value system and potentially further adjust or change the original client's project value system. Indeed, the danger is that in the event the client either does not make explicit, or is unable to make explicit, their project value system, then those comprising the project team may well be left to interpret the client's (corporate) value system, and subsequent client project value system as best they can. The authors' experience is that when this occurs value management interventions are often required to reset the client's project value system (whether or not it was previously made explicit).

Chapter 11 also illustrates the use of a value system matrix as a means of operationalising and ranking those characteristic facets that describe the intrinsic value of a construction project. The client's project value system when operationalised through the Client's Project Value Matrix (Figure 11.13 is an example), identifies priorities and potential areas for value trade-offs within P3 structures, procurement strategies and consequent commissioned project supply chains. The value system matrix has been used successfully on a number of projects as a means of illustrating the project value system at a strategic briefing workshop or as an audit tool to ratify the developing design in a Charette or later value study.

In Chapter 12, following prompting by a number of primarily public sector reports, the authors have undertaken research to analyse the whole life value for an asset. This research is complete and the resulting whole life value methodology has been successfully trialled on one project. The combination of the primary elements of strategic function diagramming, the client's project value system matrix and whole life costing when applied within the whole life value methodology generates a whole life value factor that can be used in option appraisal, benchmarking and benefits realisation that involves stakeholder inputs. This is new, innovative and answers the requirements of the various public sector reports reviewed.

Figure 13.3 is a schematic representation of the preceding text and the discussions in earlier chapters. Reading from top-left to bottom-right in Figure 13.3, the Client Organisational Value Chain creates, develops and infuses throughout the organisation a 'value culture' (Figure 9.12). This also provides the origins of and encapsulates the multifaceted client value system which pervades the client organisation to influence decisions on asset management as well as P3 structures (Figures 9.5a and 9.13). It also configures and shapes the corporate governance framework. Typical organisational representatives with executive control for built assets, a Programme or project would be the Head of Asset Management, Programme Director(s), and Project Sponsor(s). They are also examples of internal stakeholders that could well be involved in value studies.

The client value system is transmitted to the client's supply chain as a value thread through each successive stage of a project (Figure 11.13). Once construction supply chains have been procured the project value system is created and develops. It comprises the client value system and the various internal client and external stakeholders that have a legitimate influence on the evolution of the Client's Project Value System, the project functions and the project(s) itself. The key issue for value management is the extent to which:

1. The client's project value system can and has been made explicit using strategic value studies, possibly using the Client's Project Value System Matrix.
2. At project level, the extent to which that value system has been communicated to and aligned with the project team using value management proactively to confirm the project value system.

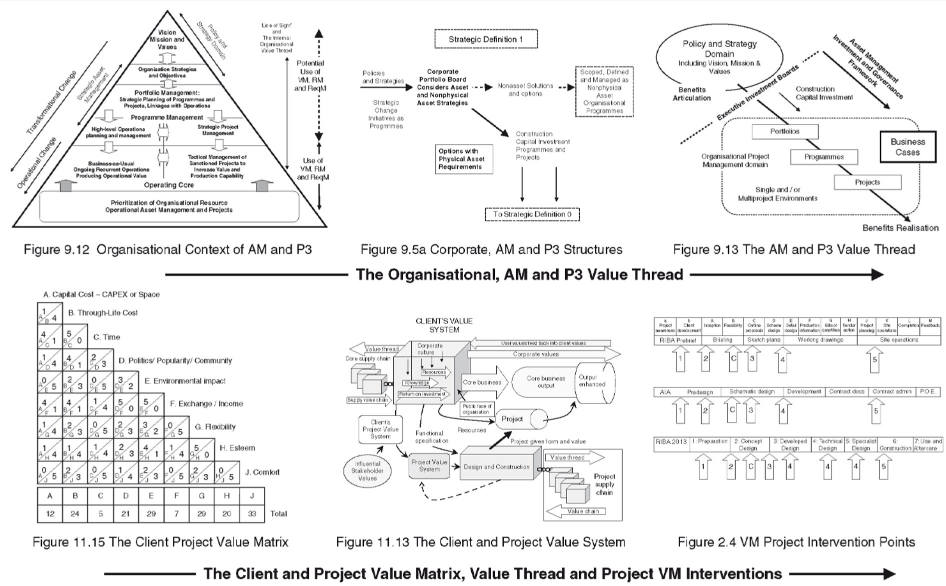

Figure 13.3 The relationship between client corporate value thread, asset management, P3 and VM project interventions.

3. At project level, the extent to which any changes or adjustments to the client's project value system by the project team have resulted in a project that is out of alignment with its original intentions, and in which case there is a need to use value management reactively to align or realign those value systems.

Figure 2.4 in Chapter 2 sets out the possible intervention points for value studies at project level; these were detailed subsequently in Chapter 3. Case studies have been presented throughout this text providing examples of this. Consequently, Points 1 to 3 will therefore require careful consideration of which internal and external stakeholders should be involved in any consequent value study.

The *stakeholder perspective* focuses on stakeholders' legitimacy, their claims on a client organisation how they should accomplish their stakes. In a project context, Achterkamp, Janita and Vos (2008) argue convincingly for a role-based approach to stakeholder management, which also has a close alignment with stakeholder perspectives in Stakeholder Theory. In a VM context, end-users, with their representative organisational roles drawn from across a client organisation, are internal stakeholders that may have different levels of legitimacy related to their interest in a built asset, Programme or project. Equally, Heads of Department, Divisions or strategic and tactical units would also be classified as internal stakeholders to the client's organisation. Furthermore, at project level, the project team comprising design, cost and construction expertise in the stakeholder perspective fall within the business grouping of external stakeholders to a client organisation. The choice of procurement strategy may also bring other supply organisations within the external client stakeholder domain, or it may retain them within the main contractor internal supply chain. An example is Prime Contracting where involvement of a range of stakeholders in a value study may extend deep into a construction clients supply chain. Project team legitimacy stems from a number of sources:

- From the procurement strategy adopted for a Programme or project that sets up the managerial, administrative and legal structures within a construction supply chain.
- From that provided by the form of contract within the procurement strategy, the defined roles within this and the services they offer to the client organisation.
- From their knowledge, skills and expertise that is brought to a project and is crucial for built asset and P3 success.
- From the fact that they are dependent on the client for payment of services, and equally profit levels for their own organisations.

It is the extent and nature of this legitimacy that would have a strong influence on inclusion within the value team for a value study. In addition to the foregoing, a role and legitimacy analysis conducted by the VSL during the Orientation and Diagnostics phase may also highlight other important internal and external stakeholders that need to be considered as part of the value study for interview, and/or for inclusion in the Value Workshop phase. For example, in value studies conducted by the authors that were influenced by partnering or collaborative working structures, strategic subcontractor and supplier organisations were often involved.

Finally, the *conceptual perspective* focuses typically on community or societal concepts, topics or particular important issues such 'the Common Good', rights and sustainable development, and what strategic issues should corporations and stakeholders take into account. For example, the authors were involved on a number of projects where, due to the partnering overlay, it was important to involve local resident representative associations in value studies first via interviews in the Orientation and Diagnostics phase and subsequently in the Value Workshop phase since they were an important issue-based stakeholder. In the parlance of Fassin (2009), they were stakewatchers.

The empowerment of stakeholder participants to take decisions in a value workshop was explored by Male *et al.* (1998b). This influences the effectiveness of the value workshop in terms of the subsequent implementation of ideas. That research differentiated between *decision-makers* and *decision-takers*. The latter represents an individual who has the authority to make and take decisions during the value workshop. The former only has the power to provisionally endorse solutions and needs to refer to a higher authority for these to be ratified and then implemented. In parallel and related work, Woodhead (1999), in his investigation of the 'decision to build', extended these designations further. Woodhead identified four roles within the constituent groups making up an experienced client organisation:

1. *Decision Approvers* are senior managers at the organisational strategic/institutional level who approve investment sanctioning, and in particular for substantive projects. Typically in large client organisations they would be the Management Board.
2. *Decision Takers* are those senior managers who sanction the progress of a project proposal to the next stage of its development. They would typically operate at the P2 level of an organisation (Portfolio Director or Programme Director), or have the role of Project Sponsor.
3. *Decision Shapers* are those managers operating at the integrative organisational mid-level who develop and test a project proposal before submitting it to decision takers for their sanction. Examples quoted by Woodhead include the client's internal project team that tests for internal rates of return, carry out market research, and apply for planning permission. A further example is a Property or Estates Department, who sees its role as one of delivering projects. These may also include internal project managers. Shapers see their primary role as driving potential-projects through the sanctioning process to achieve budgetary endorsements and are often in competition with other shapers from different parts of the same organisation. Woodhead (1999) noted that decision shapers see the sanction and approvals process not as a mechanism to improve decision quality, but as a series of challenges to be overcome in a project's progress through the client organisation. In the project gestation stage, for example, should anything inhibit shapers' efforts to get a proposal through they will make modifications, adapt their approach and attempt to ensure that the project proposal becomes a 'live project'.
4. *Decision Influencers* are formal and informal parties whose expectations influence the shape and perhaps content of a project proposal. Examples would include users, financiers, customers, shareholders and local authority planning departments.

These different roles in the client organisation, the subsequent decision to build and consequent project development brings into sharper focus the notion of internal stakeholders. Shapers and Influencers, in particular, are stakeholder types also relevant externally to the client organisation.

In a value management context Kelly and Male (1988) argue that VM, as an excellent mechanism for establishing a common understanding and consensus in a value team, builds effective project integration. By doing this, it also acts as a boundary spanning method and has the potential for the boundary management of important interfaces (Fellows and Liu, 2012). The key issue becomes one of who to involve in the value management process. As noted in Chapters 2 and 3, the ACID test provides a powerful guidance framework for selecting a value team when combined with stakeholder theory and Woodhead's decision framework. This is set out in Table 13.2.

Green (1992, 1994, 1996, 1999), aligning his research on VM from the outset with Group Decision Support methodologies and coining the term SMART value management, also articulated arguments around 'hard' versus 'soft' VM. Green and Liu (2007) in clarifying, updating and for brevity also simplifying their position on Soft VM argue that there remains a definitional vagueness of VM per se and contend that the focus of Soft VM is on social constructivism, which emphasizes the way groups of individuals participate in the creation of a shared social reality. This is in contrast to the implicit positivism of Hard VM, which adopts an objectivist stance and views reality as essentially independent of individual participants' views and beliefs. The stance adopted consistently by the authors is that both views have to be taken into account in designing and delivering value studies. Equally, as highlighted in Table 13.1, is the important role the Value Workshop phase plays in ensuring the appropriate stakeholders are brought together to share their perspectives, assumptions, facts, opinions and make decisions within a formal Value Workshop setting. In this sense it is the role of a Value Workshop to act as the conduit to generate the shared social reality represented by Soft VM. It is also why the Orientation and Diagnostics phase is equally important to correctly structure the value workshop to this end, and also why the Implementation phase is also equally important to ensure stakeholder expectations and objectives are met as a consequence of the Value Workshop.

To conclude, Chapter 1 highlighted that Value Management, as a philosophy, is a set of principles, and a formal and structured methodology for improving organisational decision-making. The basis of a formal value study is that it is a function-oriented, values-based and value-based style of management that can be adopted in a wider organisational context at Corporate level, at Portfolio, Programme and/or project level, or at service and/or product level. It is also a structured, challenging and mediating process involving key stakeholders drawn from across key value interfaces. As such it addresses the 'hard' facets of VM, namely, optimising costs, profits, options, solutions and trade-offs, together with the 'soft' facets of VM – the shared social understanding of problems, value challenges and seeking a consensus of what value means across stakeholders. This is undertaken in the context of exposing, making explicit and exploring a construction client's 'value criteria'. By so doing, it permits 'value systems' to coalesce to the benefit of the project, Programme, Portfolio, and client organisation who wishes to use a built asset or assets, and as a consequence it is also a change-oriented methodology. The role of a Value Study Leader is to tailor, design and implement a value study or studies to achieve this.

Section 13.5 explores the foregoing in terms of the institutional and professional structures for value management.

Table 13.2 Stakeholder management within value studies.

	Authorise		**Consult**	**Inform**	**Do**
	Approve, sanction, authorise, including institutional and managerial roles within the client organisation		**Need for expert knowledge input**	**Only need to inform of decisions**	**Carry out major tasks**
Stakeholder Orientation	**Have an Interest in**		**Can affect and affected by**		**Mixed Orientation**
Corporate Decision Approvers	Management Board				
Decision Takers – sanctioning role		Head of Asset Management, Portfolio Director, Programme Director, Project Sponsor			
Decision-makers – may need to refer to higher authority		Project Manager	End Users, Internal client project team.		Design and Constructor Teams, supply chain members
Decision Shapers – develop, test and validate ideas and decisions			End Users, Internal client project team. Internal Client Heads of Division, Department or other strategic and tactical units influenced by a project. Particular external stake-keepers		Design and Constructor Teams, supply chain members
Decision Influencers – expectations that need to be taken account of			Particular external Stake-keepers	Particular Stake-watchers	

13.5 VM practice and professional territoriality

Male and Kelly (1999), Male *et al.* (1998b), Kelly, Male and Graham (2004), and Green and Liu (2007) provide sufficient empirical evidence to indicate that the knowledge base of VM as exemplified now, in contrast to that proposed by Miles, continues to be ill defined, regardless of the existence of numerous standards and guidance documents, which in many respects add to that lack of clarity. Equally, many of the tools, techniques, models and methods can be found within other disciplines. In addition, there have been attempts to broaden the knowledge base of VM to include concepts from operational research, such as objectives hierarchies and to distinguish between 'hard' and 'soft' value management (Green, 1994; Green and Liu, 2007). Furthermore, a fundamental operating domain of value management during the value workshop phase involves the management of teams, the domain of psychology, organisational psychology and organisational behaviour. In sum, whilst there is a theoretical underpinning to value management, with the exception of the technique of function analysis, its principles are derived from other disciplines. Furthermore, in some countries, value management has been dominated by practitioner development rather than involving academia, favoured by many professions. The diversity of the knowledge base, tools and techniques is a strength and also a weakness. The strength comes from the richness of tools, techniques and perspectives that can be drawn on to solve client value problems. The weakness is the lack of clarity in defining exactly what value management is. This lack of clarity in the United Kingdom has led to interdisciplinary and interprofessional competition over who 'owns' value management and within which institutional structure it should reside, which is the subject of the next section.

Occupations, professional structures and VM

Professions are about occupational power, status, esteem and consequently money (Male, 1984). They have also been argued to be a special form of occupation that uses institutional structures to control entry by certification, often termed 'credentialing'. As occupations move towards becoming professions they are said to be professionalising. A common feature in the growth of a profession is the demand for a particular service where that demand is matched by an increase in the level of formal provision as the service grows and becomes more recognisable in terms of its skills, inputs and outputs. Consequently, the limits of the knowledge base become more established. This can be a positive as well as a negative development, turning inclusivity into exclusivity or those that are 'in' versus those that are 'out'. A further feature of the growth of a profession is the monopoly, power and influence accrued by it in society and consequently the price that it can charge for its services in the marketplace.

Professions as institutionalised occupational groups exercise a form of control over highly specialised skills in an occupational hierarchy. The potential for high incomes in the professions stems historically from their power, prestige and status. In order to be perceived and accepted as a profession an occupation requires wider public recognition. Professionalism is the occupational ideology of those that are traditionally called 'professions' such as medicine and the law. However, it is often used by occupations seeking to gain prestige and status. Professionalism, as a form of occupational ideology, is rooted historically in the institutional structures established in the Victorian era, and is largely a strategy used by an occupation to seek, gain or retain occupational power by means of the system of 'credentials' and qualifications offered through its institutional associations. However, there are many types of 'professional associations', from those that are essentially trade associations representing the interests of their members, to learned societies, through to those associations concerned with ensuring that individuals are fit to practice through a qualification system. Some professional associations combine several of these functions.

Over time sociologists, occupational psychologists, organisational analysts and business strategists have analysed professions from different perspectives and a number of models of professions and professional behaviour have emerged. The *trait approach* attempts to identify common attributes separating professions from other occupations. Proponents of the trait approach argue that occupations can possess more or less of these traits in their progress towards becoming a profession. Political economists have become very interested in professions as a specialist occupational grouping because of their linkages to power and status structures in society that have resulted in the potential to accrue high incomes. As a result, the *market closure* perspective argues that the occupational strategy of professionalism confers market power on an occupation. This power is derived from the credential awarded to members of the profession by their professional associations, and through this professions are able to exert market closure and control the number of prospective candidates entering. They enforce exclusivity and thereby enhance the market value of the profession through the forces of supply and demand. Within this perspective, three forms of institutionalised occupational control are recognised:

- *Professionalism*, where the power balance favours professions compared to their clients.
- *Patronage* and its modern equivalent *Corporate patronage*, where the power balance favours clients rather than the professions serving them.
- *Mediation*, where the institutional power structures of government (or some other powerful mediating agency) intercede in the relationship between the professions and their clients.

Other researchers have been interested in the skill and knowledge base of professions and the link to and balance of power between practitioner and client. Occupations are alleged to possess a combination of cruciality and mystique. An occupation has *cruciality* when perceived as vitally necessary for the prosperity or survival of 'significant others' that use the services of the occupation, namely, its clients. *Mystique* develops from cruciality and accrues when an individual or organisation seeks out a practitioner seen as crucial for solving a problem. Mystique – the 'aura of mystery' surrounding an occupation – is created when the practitioner is perceived as possessing extensive knowledge on the relevant subject in comparison to the lay person. This creates an authority relationship in favour of the practitioner. Cruciality and mystique work in tandem such that the greater the cruciality and mystique of an occupation, the higher is its status as a profession.

Furthermore, as Kelly, Male and Graham (2004) noted, other researchers have focused on the processes operating within professions, arguing that professions are made up of different segments of practitioners. This is the *occupational segmentation* perspective. Proponents of the segmentation perspective argue that professions are coalitions of major segments of practitioners who are organised around a particular specialism. Each segment has its own ideology. Within a particular profession loose amalgamations of practitioner segments can exist and operate under a common institutional umbrella. The medical profession is one example, the surveying profession another. Within this perspective, the professional association, existing as an organisational form in its own right and with its own structures, represents the locus for competing power groups within a profession. The professional association is the arena where these power groupings come together at an institutional level to present their own view of professionalism to the outside world. Over time the fortunes of powerful coalitions change as individuals come and go and the profession, and its ideology, evolves and changes to reflect adjustments in those power groupings.

Finally, a more recent variant of the professional model has arisen due to the large professional service organisations that have emerged as a result of the operations of a global marketplace. Many of these organisations stem from the accountancy, engineering and management consultancy arena. The concept of *brand professionalism* has emerged where the control of practitioner behaviour is regulated by the internal organisational codes of conduct, training systems, credentialing, and also organisational cultures of the employing organisation that have a stronger influence over the practitioner compared to historically a professional association (Kipping, 2011).

The evidence presented by Simister and Green (1997), Male *et al.* (1998b), Kelly, Male and Graham (2004), Ellis, Wood and Keel (2005), Green and Liu (2007), Bowen, Edwards and Cattell (2009), indicates that value management falls within the sphere of influence of many traditional professional qualifying associations in construction. However, the picture remains unclear as to which has the greater claim.

Professional territoriality and VM

In the United Kingdom, the RICS, CIOB, ICE, CIBSE and APM have all expressed interest in value management; some have published guidance on the topic, or are actively pursuing it as a disciplinary agenda through Special Interest Groups. They are all qualifying associations. They test competency to practice. They are also actively involved in consolidating and developing the knowledge base associated with their own occupational domains. As qualifying associations the RICS, CIOB, CIBSE and ICE, in particular, all exercise occupational control over entry and the award of credentials at undergraduate degree level. As part of this process, they will accredit or recognise undergraduate degree courses in tertiary educational establishments that meet their institutional criteria.

It is contended here that members of these professional associations who practice as VSLs have already gone through a certification process for their own core professional knowledge base. In addition, members of the APM with an interest in VM will often have multiple professional qualifications from different institutions due to the broad nature of project management. Members within these qualifying associations who have an interest in VM, practice it, or are actively involved in VM Special Interest Groups is consistent with the segmentation perspective of established professions. It also clearly typifies a segmented approach to the practice for VM. This certainly creates a lack of clarity over institutional and practice boundaries for VM, and the situation exists where one institution alone is unable to ensure market closure for recruitment through VM certification. It is not necessary to have a certificate to practice value management in the United Kingdom although in certain countries certification is a requirement for undertaking the service on public sector work, such as in the United States. Exploration of a typology of practice setting has identified that value management is a service that does not necessarily require a significant supporting infrastructure but does require an effective network of practitioners in place to handle different workloads and also to obtain work.

The Institute of Value Management (IVM) in the United Kingdom, is recognised by the European Union as the appropriate and relevant body dealing with value management matters. The IVM is not a qualifying association in the same manner as the RICS, CIOB, CIBSE and ICE, who all confer chartered status on their members. The Institute of Value Management, encompassing construction as well as other industry sectors, has indicated that management approaches such as business process reengineering, total quality management and other related value orientated methods should also be part of a VSL's armoury. By broadening the methods and toolbox of the VSL, VM is also potentially brought within the ambit of those professional associations having an interest in management in its broader sense, such as the Institute of Management. The IVM recruits members from the construction industry and other industries. It can be argued that SAVE International faces similar challenges. The European Governing Body for Value Management, through Value for Europe, sets out the training scheme for VSLs across European countries; SAVE International does the same for its affiliates. There is a strong argument that the IVM and SAVE International should position themselves and form strategic alliances with those professional associations having an interest in VM as extended credentialing institutes for those associations.

It is argued here that the further development of value management has to go far beyond just being seen as a methodology that predominantly includes workshop facilitation and at project level. The future lies in presenting VM as a value and values-based stakeholder management-style and decision-making methodology that operates regularly at a range of organisational levels. It has to be seen as holistic and incorporate greater involvement in the diagnostics, planning, option development and implementation of organisational strategies, processes and procedures, and Programmes, projects and/or asset management strategies. It should also involve designing and implementing a range of different study styles. This will bring with it issues of liability and professional negligence, which is the subject of the next section.

Liability and professional negligence in VM

Professional liability and negligence is an aspect of 'profession' in construction (Barnes, 2012). Many of the established professional associations have standard terms of professional engagement. Value management may well fall within those terms of engagement as an additional service. VM may well be commissioned by a client under a bespoke form of engagement. The issue of professional responsibility, negligence and liability in general for the provision of VM services, and also design liability for VM proposals has remained an unresolved research and practice issue. Five posits have been articulated:

1. The first line of argument is that the VSL is only liable for the professional conduct of the value study, namely, the design and implementation of the process, and nothing else. The VSL is the person that is contracted by the commissioning client to design, lead and implement a study. That is where the VSLs expertise is, and where they may have secured additional training under perhaps IVM, SAVE International, or Management of Value auspices. There is considerable merit to this argument and the authors would contend that this is the minimum defensible position for professional responsibility, liability and negligence to reside.
2. The second line of argument, in a similar vein to the first, is that the VSL is only a facilitator of a value team in a value workshop. As such they have no liability at all since recommendations are developed by the project team, not the VSL, and it is they, as the value team, who make the recommendations to the client for acceptance within a value study. Whilst there is some limited merit to this argument, the authors would argue that it downplays totally the role of the VSL. If VM is only about facilitating workshops that is a learned skill, and operates at the level of a 'master artisan' (Woodhead and McCuish, 2003).
3. The third line of argument and encountered in Kelly and Male (1986, 1988) is that the liability accrued depends on the professional background and qualifications of the VSL. For example:
   - If the VSL due to their professional base discipline sees a clear error in project documentation or a design, as a professional they are duty bound morally and professionally to bring it to the attention of the client and project team. Should this error prove to cause later difficulties on the project, and it can be proven that the VSL was aware of this at the time of the value study and did not bring it to light, then they may have a consequent liability. However, there is the issue of the liability of the project team in the first instance in making the error. It must also depend on whether the VM practitioner remains active regularly in their background professional discipline or not, and the extent to which VM versus other aspects of their skill and practice base dominate.
   - Should a VSL design any aspect of a solution, then they may retain the liability even if the project team subsequently takes this on board.

   It should be noted that this third line of argument was developed in the context of practicing consulting engineers in the United States who also acted as VSLs. The authors would argue that a VSL should not have a joint role of leading a value team and also providing solutions under either an SS1 or SS2 study style. It confuses the liability issue.
4. The fourth line of argument surrounds the use and contracting in of an independent 'shadow team' by the VSL within SS3 or SS4 style approaches noted earlier. In terms of SS3 and the recommendations made by the 'shadow team' the following issues arise:

  - Since it is the VSL that has chosen and contracted in the 'shadow team' and designed and delivered the value study, and since this is germane to the success of the study, there would be a consequent liability.
  - The 'shadow team' presents its ideas to the project team, and it is argued that it is the latter's decision as to whether to incorporate them or not into a project. Once the project team takes on board the recommendations, it has accepted the responsibility, and hence liability. The authors would contend that the VSL and 'shadow team' are responsible and liable for the outcomes of the study, but once those recommendations have been investigated and validated by the project team, it is the team that takes on any subsequent liability. This aspect has been known to cause difficulties in the United States with the project team. Some large client organisations have been prepared to accept the liability of an idea from a workshop and relieve the project team of liability if the team feels an idea unreasonably enhances their liability, for example, the idea requires the use of an untried product or requires the use of an existing product in an innovative manner.
5. The final line of argument involves the use of an independent 'shadow team' that also provides advice under SS4. Based on the arguments for SS3, the authors would contend the following:
  - The VSL, having chosen and contracted in the 'shadow team', and also designed and delivered the value study, there would be a consequent liability.
  - The VSL and 'shadow team' would be liable for any recommendations and advice given.

Professional behaviour is usually characterised by making decisions that are in the best interest of the client and not the practitioner. Armstrong, Dixon and Robinson (1999) argue that ethical decision-making is about the quality of the decision, taking account of justice, equity and the consequences for those affected by the decision with the personal and collective responsibilities that lie behind any moral or contractual obligation that is entered into. Ethical decisions are concerned with what is 'good' and 'right' and dealing with conflicts between rival 'goods' and 'ills. Armstrong, Dixon and Robinson add further that ethical problems do not have easily defined solutions but are usually surrounded by ambiguities, complexity and ill-defined boundaries. In this sense, ethical decision-making requires high-level cognitive and judgemental skills, normally seen as the domain of the 'professional practitioner'. They argue that professional codes are important for ethical, reflective development and are the mechanism for developing the integrity of the collective of practitioners. The Institute for Value Management, SAVE International and other professional associations normally associated with VE/VM will have codes of conduct to regulate professional behaviour embracing value management.

The evidence suggests at best that it forms part of the segmented professional structures operating in UK construction, and there will continue to be interprofessional debate over its positioning within those institutional structures. From this, the key question for the future of value management is whether the service as currently practiced is closer to that of a 'master artisan' or of a 'profession'. The authors would contend that the VSL is held liable for the design and delivery of the value study under SS1 and SS2. With SS3, the VSL would be liable for this, including the choice of 'shadow team' and the recommendations made. With SS4, the VSL would be liable as with the preceding but also the advice given.

13.6 The future of VM: Summary and conclusions

Value management is a values- and value-based stakeholder and organisational decision-making methodology. As a management style it derives its power from focusing on first effectiveness (doing the right things) and then efficiency (doing those things as expeditiously as possible). That power also comes from integrating value-based thinking with stakeholder values brought together in an intensive, structured, challenging, team-based, process-driven, function-oriented, intensive workshop environment. It seeks to do this through an investigation of optimum whole life value, performance and cost but without detriment to quality and fitness for purpose. Within this, a value study is the vehicle for implementing the philosophy and principles of value management,

In this context, values- and value-based thinking keeps the client, customer, end-user and other key stakeholder requirements to the fore of the methodology. It emphasises their requirements and typically expresses these in the language of functions to facilitate a shared and common understanding and consensus building. As a management style, it also seeks innovative alternatives to meet those functions and requirements. Typically, VM will also involve making explicit any trade-offs, clarity over value-criteria, engagement with the marketplace, and considerations of risks to creating and delivering value throughout the process of whole life delivery and management of built assets.

In organisations, the principles set out earlier can occur at an individual level, in different types of team situations, or in more formal settings, such as value studies. Where all of the facets are present, the organisation has an embedded value culture as its normal way of working. Figure 13.4 brings these ideas together.

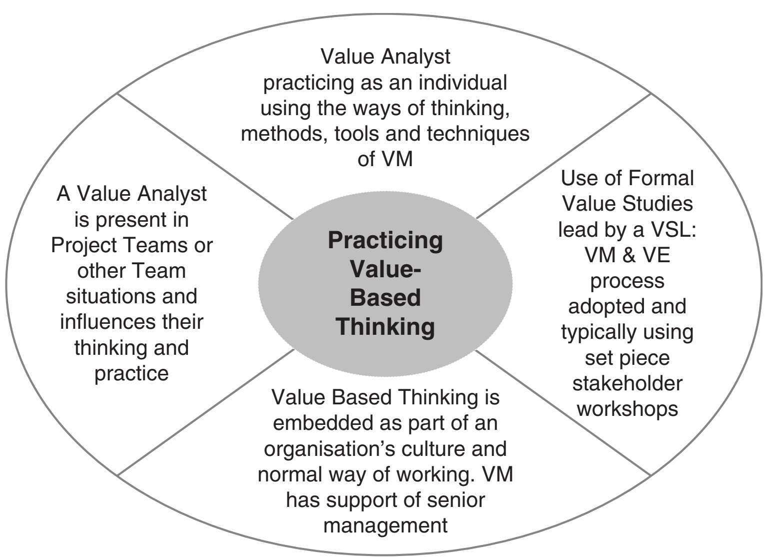

Figure 13.4 Feature of value-based thinking.

The discussion in this chapter has explored ideas behind occupations, the nature of professions and the location of VM in such a framework. Empirical evidence indicates that VM at present should not be considered any more than a methodology; it is not recognised a specialism within official government job structures defining occupations for statistical purposes, for example, either in the United Kingdom and/or the United States. However, it is argued here that the methodology requires a skill set that necessitates high-level cognitive functioning at practitioner level, not just facilitating a workshop, but planning for, conducting and ensuring value study outcomes are implemented to the benefit of the commissioning client and stakeholders. To do this requires the integration of knowledge and mastery of the process, tools and techniques, and designing and delivering a range of different value study styles to meet a diversity of value problems and challenges (strategic, organisational and operational). It also involves using advocacy to a wide audience together with ethical decision making. Value management has been endorsed by governments as good practice in Australia, the United Kingdom and the United States, to name but a few.

A number of conclusions can be reached concerning the skill base of VM practitioners. First, the evidence strongly supports the view that good practitioners are in short supply. Those that are seen to be effective in the marketplace have an opportunity to establish an authority relationship between them and their clients based on cruciality; that is, they are seen to be delivering a service that the client sees as critical. Second, the use of high-level cognitive skills varies along the continuum of practitioner-chosen study styles, from that of facilitating workshops only through to those that operate on the basis of a comprehensive service covering an extensive Orientation and Diagnostics phase, a flexible and adaptive Value Workshop phase and a focused Implementation phase. This may also involve providing advice depending on the study style chosen and subsequently adopted.

The economics of the marketplace also appears to be driving VM to a shorter study duration, and hence a less comprehensive service. There is a real danger that VM is verging on a 'commodity' service. In terms of the generic study styles, Study Style 1 places less emphasis on the importance of the Orientation and Diagnostics and Implementation phases, and raises the importance of workshop facilitation skills. Hence, it operates at the level of 'master artisan', requiring skills that can be learnt through some training but mainly experience. Study Style 2, the typical approach adopted by the European/Australian Schools of Thought operates at the boundary between 'master artisan' and 'professional'. There is a very strong emphasis on the design of the whole study and its subsequent delivery. Cognitive skills come to the fore in each of the three phases. It is the extent to which the Orientation and Diagnostics phase and the Implementation phases are seen as being more subservient to the Value Workshop phase or seen as of equal importance, which determines whether it is closer to the 'master artisan/process manager' or professional end of the spectrum.

The use of high-level cognitive skills throughout each of the three phases of a value study has the capability to enhance cruciality and mystique. However, as Male *et al.* (1998b) and Ellis, Wood and Keel (2005) identify empirically, one major problem is that in certain organisations in the United Kingdom, Australia and the United States, VM has become a box-ticking exercise. This suggests it is performing merely a routine function within those organisations where this is occurring rather than being used to bring innovative change from a multidisciplinary team. Again, this drives its standing towards that of the 'master artisan' end of the VM organisational practice spectrum. However, generic Study Styles 3 and 4 move VM clearly into the professional realm, with the selection of an independent 'shadow team', a greater audit focus with Study Style 3 and management consultancy, advice and an interventionist approach with Study Style 4. In the case of Study Styles 3 and 4, in particular, there is the potential for effective VSLs to create a mystique around the value management process since not every VSL or every VM organisational practice is capable of undertaking these types of study and taking on the associated liability.

At present in the United Kingdom, chartered institutes with an interest in VM are already well embedded with many of the traits of a profession and the associated trappings of professionalism, housing VM among their specialist services within a wider array of services. However, to the best of the authors' knowledge, none of these have specific training and certification programmes dedicated to VM, although this was recommended to the RICS (Kelly and Male, 1986). These institutions certify within their core disciplines, and with components focusing on value management. The IVM as a certification body administers the European Certification Scheme in the United Kingdom on behalf of the European Governing Board. This does have the advantage of representing value management in all industrial sectors. To add to the richness of the territorial debate over value management, SAVE International is promoting itself as the premier association for the value methodology, with the aim of continuing to widen its influence and membership internationally. This adds a further dimension to the institutional framework within which VM continues to develop. As the original founding association for a value orientated approach, coupled with the fact that there are a number of SAVE franchised associations internationally, it remains an important player. The introduction of the UK Government sponsored Management of Value initiative adds a further new dynamic to the VM arena. The foregoing discussion continues to suggest no clear picture has emerged as yet of a unique institutional framework within which VM can easily reside and develop in the United Kingdom. What is clear, however, is a potential for continued interprofessional competition counterbalanced by the fact that the certification for VM in the United Kingdom is currently managed on behalf of the European Union by the Certification Board of the IVM, and, in the United States by SAVE International.

If VM continues to move along a continuum such that higher-level cognitive skills are essential to design, run and implement a value study on a regular basis and VSLs are held accountable for a total service package beyond just workshop activity, then it may well have the potential to become a profession in its own right. This will require the full infrastructure of a qualifying association to be in place, graduate or postgraduate entry, and clear boundaries around the knowledge and practice base. The corollary is that if VM attains professional status then a standard is not required since certification is achieved through an autonomous, self-regulating, independent qualifying association. A VSL continuing to operate to a particular national or international standard, however, operates within an occupational framework where the service as implemented remains ill-defined or subject to practitioner variation and clients need some protection. It is also evident that no one professional institute has the power of market closure to control the recruitment and practice of VM.

The conclusion from this analysis is that VM as a stakeholder decision methodology needs to move increasingly towards the professionalised management style end of the occupational spectrum. Unfortunately, much of the individual and VM organisational practice domain currently falls within the ambit of the 'master artisan' capability (Male and Kelly, 1989). Professional development relies on a stricter control of recruitment and certification, setting the boundaries and codification of the knowledge base, and moving education and training deeper into the university sector with the IVM in the UK and SAVE International in the United States becoming more widely recognised and seen as qualifying associations or increasingly allied to other qualifying associations through strategic alliances.

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Appendix: Toolbox

A.1 Introduction

The Toolbox describes commonly used tools and techniques used in value management workshops. The tools are listed in alphabetical order and are referred to in the chapters to this book. Primary reference should be made to Chapter 3, Value Study Styles, and particularly Table 3.4.

A.2 ACID test – Selecting the team

The VSL should work with the client in selecting value study team members to include those representatives of the client organisation, influential stakeholders and construction practitioners relevant to the particular stage in the development of the project. The ACID test, as shown in the Table A.1, is used to determine who should be a member of the team. Generally team membership tends to be greater in number at the strategic stage of projects when a large number of issues are being considered and smaller when the technical details of the project are being investigated.

Factors that the VSL may wish to take into account in selecting the team are as follows:

1. Limit multiple representations from one organisation or one department. For example, three members from one organisation where other organisations and have single representation will lead to a weight of argument in favour of the multi-represented organisation.
2. Understand the hierarchical mix (senior, subordinate) within the team.
3. Understand the relationships between team members, for example, is one member dependent financially on another member of the team?
4. Consider the completeness of the team. Discuss with the client any apparently missing members.

A.3 Action plan

Actions will always arise out of workshops. The action plan is the summary document that is usually incorporated within or added as an addendum to the executive summary of the workshop report and describes the action in detail, the members of the team best suited to take the action (whether present at the workshop or not), and the date by which the action is to be completed. Members of the workshop team will carry out all of the items in the action plan, if the ACID test was correctly carried out.

Value Management of Construction Projects, Second Edition. John Kelly, Steven Male and Drummond Graham.

Table A.1 The ACID test for study team membership.

A	Authorise – Include those who have the authority to take decisions appropriate to the stage of the development of the project. Those that have executive authority to take decisions are invaluable members of the value study team through their ability to immediately sanction a particular line of discovery or take a decision during the workshop which resolves an issue or unblocks a particular line of investigation.
C	Consult – Include experts who have to be consulted regarding particular aspects of the project during its evolution at the workshop. If a particular line of investigation is dependent upon consultation with an absent expert, workshop progress may be compromised.
I	Inform – Do not include those who have only to be informed of decisions reached during the workshop.
D	Do – Include those who are to carry out major tasks specified at the workshop. In this way those who are for example, to design or construct, based on decisions taken at the workshop will be fully conversant of that decision.

The action plan is included in the project execution plan. The team's actions will be reviewed at a future design team meeting.

A.4 Adjacency matrix

See Space Adjacency.

A.5 Audit – See also benefits realisation

An audit is a systematic check or assessment typically carried out by an independent assessor. In the context of a value management workshop the term audit is used to describe the activity of checking stages between workshops. For example, it is entirely practical to undertake the production of a project brief as a performance specification within a value management workshop. However, there comes a point when each member of the design team has to work alone to translate the performance specification into a constructible design. Once this design work is complete an audit is undertaken to determine how effectively the resultant design answers the performance specification. In this context the audit questions are as follows:

1. Which element of design is being subjected to audit.
2. What are the strengths of the design in meeting the performance criteria.
3. What are the weaknesses of the design in meeting the performance criteria.
4. How might the strengths be improved and/or the weaknesses be addressed.
5. Do the ideas stimulated by preceding point 4 still meet the original performance specification criteria.
6. If the check reveals or inspires an excellent design then a decision is taken to move to the next stage.

It is vital that an audit is undertaken at every stage of design development to prevent antipathy towards change that arises from too much work being undertaken and time expended before the audit is undertaken. It is vital that the design team accept that this is good practice rather than seeing the audit as a criticism of their work.

A.6 Benchmarking

Benchmarking, as a means of cultivating continual improvement, is recognised as one of the main tools of Total Quality Management and has a proven track record in manufacturing and in public and private service sectors. Strictly applied, structured benchmarking involves undertaking an exercise with a co-operative or collaborative partner to improve performance based on a clearly identified study objective. Boxwell (1994) identifies six steps, identifying and planning the project, understanding your own and others' performance, interpreting and learning from the data. In practice, in construction, benchmarking often involves comparing one's own performance with a published data set.

A.7 Benefits realisation

Benefits realisation is an audit process conducted at each stage in the development of the project to ensure that the benefits identified in the business case are embodied in the developing project. Benefits realisation has two levels of audit:

1. To ensure that the governance procedures for the project described in the business case have been and are being adhered to.
2. To ensure that the developing design of the project is compliant with the value system for the project as defined by the stakeholders.

Benefits realisation is discussed in more detail in Chapter 6.

A.8 Brainstorming – Creativity

Structured brainstorming is the technique most commonly used during the creativity stage of a value study although there are a number of other techniques for catalysing idea generation. The 'rules' for brainstorming and other creativity techniques are discussed in Chapter 6.

A.9 Briefing (by investigation or by facilitation)

The following quotes are just two of the many conclusions from reports over the past 50 years that point to inadequate briefing as a cause for client dissatisfaction and poor industry performance:

> Many of the difficulties and criticisms of present practices and procedures arise from the fact that those who find it necessary to spend money on construction work seldom

> spend enough time at the outset on making clear in their own minds exactly what they want or the programme of events required in order to achieve their objective; nor is the importance of spending time in this way sufficiently emphasised by their professional advisers.
>
> Banwell, Sir Harold (1964), The placing and management of contracts for building and civil engineering work: report of the committee Ministry of Public Buildings and Works HMSO London.

> One of the major barriers to improving construction performance is poor briefing and definition of requirements with insufficient focus on user needs and the functionality of the construction.
>
> National Audit Office, 2001, Modernising Construction, The Stationery Office, London.

Studies of briefing practice by Newman et al. (1981), White (1991), Kamara *et al.* (2002), Barrett and Stanley (1999), and Blyth and Worthington (2001) all conclude that the majority of UK briefing tends to be an unstructured assembly of variable information with methods of briefing based upon experience. All conclude that briefing should be at least a two stage process of strategic briefing and project briefing. Blyth and Worthington (2001) describe the urban brief (the master plan), the strategic brief, the project brief, the fit out brief and the furniture brief.

Duerk (1993) recommends an iterative briefing programme of information gathering and processing under the headings of; facts, issues, values, goals and performance requirements. She advocates a process of interviewing, processing and presentation. The presentation sessions are effectively consultation workshops in which the gathered and processed information is displayed and commented on by the project stakeholders. It should be emphasised that there is no drawn information at this stage. Only when the brief is finalised and signed off by the client as an accurate statement of requirements does drawing commence.

The primary conclusion from the various studies is the requirement for a structured two stage process of strategic and project briefing. Whether this process is based on interviewing, processing and presentation or facilitated workshops is less important than the adherence to a structured process. However, it has been proved that the structured process of facilitated value management at the strategic and project briefing stages at which information is supplemented and processed by the attending stakeholders, will lead to economies of time and consultant effort and is more likely to give value for money.

Table A.2, adapted from Kelly and Duerk (2002) summarises the advantages and disadvantages of an investigation approach and of a facilitated approach.

A.10 Checklist

This technique is adapted from Morris and Hough (1987) who undertook a study of major projects internationally and identified that the probability of project failure was high when certain key information was missing. Adapting the Morris and Hough work it has been determined that most information relevant to projects can be summarised under the following generic headings. The use of these headings, a full description of

Table A.2 Briefing by investigation or by facilitation.

An investigation approach to strategic and project briefing	
Advantages	**Disadvantages**
A skilled architect/project manager will be able to logically collect data using proven techniques in an efficient manner, minimising client input. More than one person can be used on a project to gather data in the shortest possible time. It is not necessary to identify all stakeholders at the commencement of briefing. If an important stakeholder comes to light during the process they can be interviewed in turn. By interviewing individuals in turn it is likely that the honest views of those junior in the client organisational hierarchy will be obtained. A confidential interview on a one to one basis is likely to uncover hidden agenda. Interviewing will reveal those with authority in situations where their identity is not clear.	Points raised later in the process may require re-visiting earlier investigation to clarify issues. Checks need to be made to ensure that data gathering is consistent in its approach, particularly the description of the potential project. It may be necessary to enlist the help of an expert to ensure the right questions are asked. It is difficult to counter the 'wish list' syndrome, particularly where a forceful stakeholder puts over their requirements as a *fait accompli*. Data from many interviews will take considerable time to process. Feed back and validation checks may reveal discrepancies late in the briefing process.
A facilitation approach to strategic and project briefing	
Advantages	**Disadvantages**
A facilitated team strategic or project briefing exercise will extract all of the information in the shortest time. In a facilitated team exercise any misunderstandings and/or disagreement can be resolved immediately. A full team will contain all of the experts necessary to feed information into the project and ask appropriate questions of others. This is particularly useful at a project briefing exercise that includes appropriate client representatives and the full design team. The facilitator or other members of the team can challenge 'wish lists'. The facilitator will summarise the data contributed by the team at stages during the team exercise therefore the brief will largely comprise a collation of these conclusions. An intensive, focused, facilitated briefing exercise will encourage good team dynamics and effective team building.	A facilitated strategic or project briefing exercise demands a skilled facilitator knowledgeable in briefing. A representative client team will contain members from different levels in the client hierarchy, which may stifle contributions from junior members. If a key stakeholder is missing from a facilitated team meeting then key information may be omitted. This may be difficult to subsequently incorporate. Hidden agenda may be difficult to uncover in a facilitated team exercise. It is impractical to undertake a facilitated team meeting without some prior interviewing that requires a measurable investment in terms of client team time. Facilitated team meetings can challenge the authority of the architect or project manager.

which is given in Chapter 4, facilitates the discovery of information either through interviewing, interrogation of the team, or by issues analysis. These techniques are described elsewhere in the Toolbox. The headings are as follows:

- Client organisation and stakeholder analysis
- Project context

- Location
- Community
- Politics
- Finance
- Time
- Legal and contractual issues
- Project parameters and constraints
- Project drivers
- Change management

A.11 Client's Value System and Client's Project Value System matrix

For a full discussion of the client value system, the influential stakeholders' value system and the project value system refer to Chapter 11 Discerning Value. Throughout this book the Client's Value System refers to the values of the corporate client and describes the value system relating to the client's core business. It is this that is transmitted to the client's core supply chain as a value thread and also expressed as the corporate values of the client to the public at large.

The Client's Project Value System comes into being when the client establishes a project. The Client's Project Value System will be founded on the Client's Value System but will relate to the 9 facets in the value matrix (see Chapter 11) that make up the project specific facets of time, cost and quality. Influential stakeholders will input into the Client's Project Value System and effect influence on the construction of the matrix at a value study workshop. Further influence, sometimes post-contract can (if the client allows) modify the Client's Project Value System. The resulting value system, reflected within the design and construction of the project, is the Project Value System.

Chapter 11 describes the use of a matrix as a paired comparison exercise, illustrated in Figure A.1, to make explicit the Client's Project Value System. The matrix is completed by asking the question 'which is more important to you A or B'. Totalling the number of times a selected letter occurs gives a ranking.

The ranking resulting from the paired comparison can be further refined by asking for example, 'by how much is A more important than B on a score of 1 to 5', The score split, for example, 4 to A and 1 to B, is entered into a refined matrix as illustrated in Figure A.2.

If there is uncertainty in the team each variable can be explored further by examining its continuum. This is done by asking each member of the team who partook in the paired comparison exercise to place a dot on a voting slip that describes each variable. The VSL will collate the voting slips onto a master diagram illustrated in Figure A.3. The clustering of the dots reflects the extent of common understanding. A wide spread and/or outliers would need to be discussed.

A.12 Delphi

The Delphi technique, developed by the Rand Corporation during the 1950s, is a variation on the questionnaire. In this technique the questionnaire is designed such

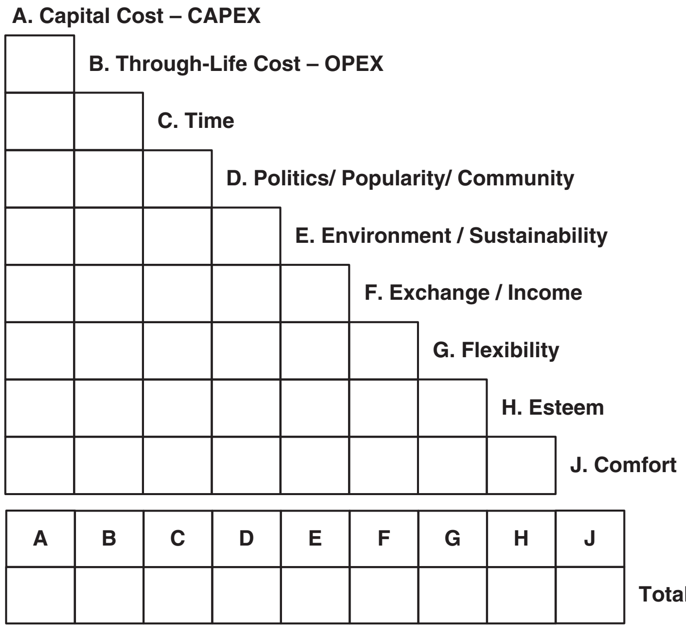

Figure A.1 The Client's Project Value System matrix.

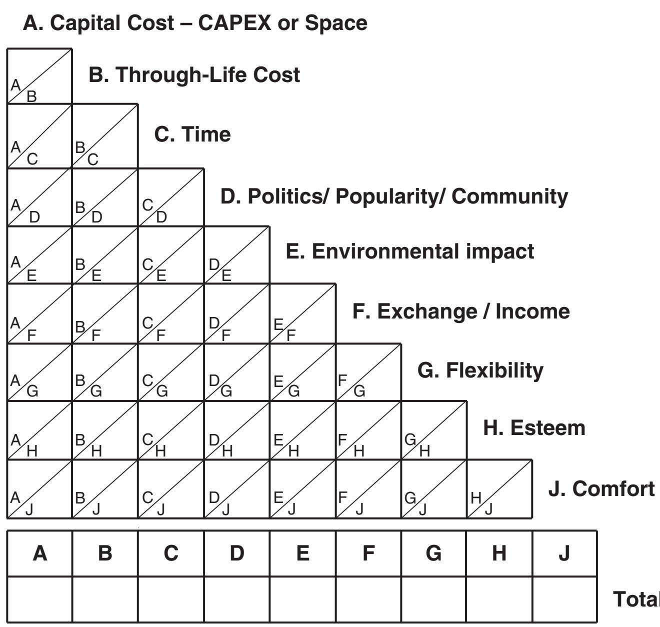

Figure A.2 Value System matrix divided for scoring.

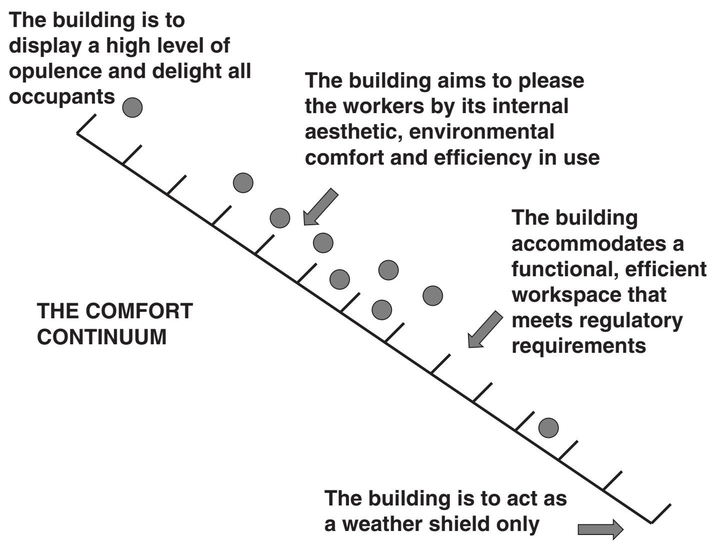

Figure A.3 Exploring team perspective on a continuum.

that the results from the questionnaire group are fed back either to the same group or more commonly to a smaller group with the aim of; eradicating any lack of consensus in the questionnaire results, and to elicit further information, usually in a form of ideas to satisfy a particular requirement highlighted in the questionnaire. This process can have any number of iterations but normally does not have more than three.

A.13 Design to Cost – BS EN 12973:2000 value management

Design to cost is a method used from the start of the development programme of a product or system that uses the market price or customer budget as the foundation for production costing. The anticipated production cost is considered as a performance that must be attained together with the technical performance. During development, the balance between cost, performance and schedule is continuously assessed. Design to objectives occurs when design to cost expands to incorporate other objectives one of which is cost.

A.14 Document analysis

The document analysis is undertaken as a part of the orientation and diagnostics stage of a value study and serves a similar function to the interviews in informing the VSL about the background to the project. Whether the document analysis is undertaken first to frame the interview questions or whether the interviews focus the document search is a decision that can only be taken with reference to the particular project. The document search should initially focus on the client's correspondence file, particularly where the project has had a long gestation.

The VSL may need to assemble some of the information from the document search for use in the workshop. Certainly, current drawings and contract programme should be available to the workshop team.

A.15 Driver analysis

Driver analysis can be undertaken either as a part of the issues analysis or as a self contained exercise. The essential question is 'What/Who is driving this project?' It can be utilised in different forms – at project, service or design level. It forces team to think about what is driving a project or design. At technical project level it can be used to identify what is driving Cost, Time or Quality, since these relate to value drivers. At design level this can be used to identify design drivers, for example, what is driving:

- Architecture/aesthetics
- M and E
- Structure
- Space

The driver analysis leads towards capturing and encapsulating value drivers, which can subsequently be used to refine Functional Analysis and Elements and Components Function diagramming.

A.16 Element function analysis

An element for cost analysis purposes is defined as a component that fulfils a specific function or functions irrespective of its design, specification or construction (BCIS).

An elemental cost plan, a common format in the United Kingdom, therefore gives the cost breakdown of construction projects according to functions. Theoretically a standard list of functions apply to each element, however, in practice differences occur for each specific building. Table A.3 is taken from an actual value engineering study and is useful as an aide memoir. Elemental function analysis is a value engineering technique that seeks to identify innovative technical solutions that retain or add value to the project. Being a value engineering technique the following definitions apply.

Element function analysis seeks to provide the necessary element functions at the required quality and at the lowest cost whilst identify and eliminating any unnecessary cost. The five key questions to ask are as follows:

What is it?	Description of element
What does it do?	Functional definition of element
What does it cost?	Exploration of cost to complete value equation.
What else will do it?	Innovative alternatives
What does that cost?	Comparison of functions given and relative costs

Table A.3 Example Element Functions from a VE Study.

1A SUBSTRUCTURE Transmits load Prevents collapse Supports ground floor Minimises movement Retains earth Resists damp Insulates from cold	**2A FRAME** Transmits load Resists wind load Supports floors Resists excessive deflection Resists fire Resist corrosion Expresses structure Conducts lighting	**2B UPPER FLOORS** Transmits load Resists fire Contains space Separates space Receives finish Supports load Acts as a diaphragm Acoustic barrier Insulates against sound Provides security
2C ROOF Transmits load Excludes climate Filters climate Filters sound Resists decay/corrosion Directs rainwater Contributes to aesthetic/built form Creates shading Resists uplift Assures security Attracts lightning	**2D STAIRS** Vertical circulation Connects levels Interrupts floor Transmits load Creates means of escape Base for finishes Controls safety Aesthetically pleasing	**2E EXTERNAL WALLS** Transfers load Filters climate Resists wind load Resists vandalism Conducts heat Attenuates noise Filters light Prevents spread of fire Supports finish Contributes to aesthetic Encloses space Aids security
2F WINDOWS AND EXTERNAL DOORS - SECTION 1 WINDOWS Filter light Control ventilation Conducts heat Conducts noise Views (in/out) Create aesthetic Filters climate Ensure security Frequent maintenance	**2F WINDOWS AND EXTERNAL DOORS - SECTION 2 DOORS** Allows access/egress Aids security Architectural feature Conducts heat Controls climate Filters light Amplifies heat loss Encloses space Controls ventilation	**2G INTERNAL WALLS AND PARTITIONS** Base for finishes Reduce space Divide space Enclose space Attenuates noise Transmits light Supports services/ fittings Transfers load Maintains security Resists fire Impedes ventilation Separates climate Separates function Architectural feature
2H INTERNAL DOORS Enclose space Separate functions Provides access/egress Resists fire Noise reduction Separate environments Support signs Resists vandalism Aids security Aids vision Architectural feature		

(*continued*)

3A WALL FINISHES
Modify light
Isolate from heat
Resists vandalism
Spatial awareness
Controls acoustic
Encase services
Facilitate upgrading
Express function
Architectural aesthetic
Resists wear
Supports colour/texture
Takes up tolerances
Allows hygiene
Allows security
Conveys information

3B FLOOR FINISHES
Contribute to aesthetic
Resists wear
Contributes to colour/texture
Resists noise transfer
Resists slip
Encloses services
Takes up tolerances
Responds to function
Resists vandalism
Responds to life expectation
Allows security
Controls acoustics
Spatial awareness
Direct traffic

3C CEILING FINISHES
Enclose services
Support services
Contribute to aesthetic
Reduce sound
Aid security
Create thermal barrier
Create plenum
Enclose space
Aids fire resistance
Filters light
Reflects light
Absorbs light
Controls acoustic
Allows flexibility

5 SERVICES
5A SANITARY APPLIANCES
Contributes to aesthetic
Soil and waste disposal
Ensure hygiene
Resist vandalism

5B SERVICES EQUIPMENT
Prepare food
Process food
Serve food
Ensure hygiene
Store food
Clean equipment

5C DISPOSAL INSTALLATIONS
Effects disposal
Contributes to aesthetic
Soil and waste disposal
Ensure hygiene
Resist vandalism

5D WATER INSTALLATIONS
Distribute hot and cold water
Store water
Maintain water temperature
Contributes to aesthetic
Ensure hygiene
Resist vandalism

5E HEAT SOURCE
Environmentally friendly
Create energy source
Heat water
Heat air

5F SPACE HEATING AND AIR TREATMENT
Distribute heat
Distribute air
Condition air
Create noise
Minimise heat loss
Control internal environment
Protect fabric

5G VENTILATION
Distribute air
Remove contamination
Create noise
Control internal environment
Condition air
Protect fabric
Air for combustion
Ensure smoke detection
Encourage vermin

5H ELECTRICAL ELECTRICAL SOURCE AND MAINS
Distribute power
Control consumption
Measure consumption
Control environment
Maintain 24 hr access

5H ELECTRICAL ELECTRICAL POWER SUPPLIES
Drive equipment/plant
Contributes to aesthetic

5H ELECTRICAL ELECTRICAL LIGHTING AND FITTINGS
Light task
Emits light
Improves security
Creates noise
Maintains fire escape
Controls energy consumption
Controls lighting environment
Contributes to interior design

5I GAS INSTALLATION
Environmentally friendly
Create energy source
Distribute fuel
Measure consumption

5J LIFT INSTALLATION
Improves vertical circulation
Enables disabled vertical circulation
Improves fire fighting
Reflects function
Improves aesthetics
Necessitates regular maintenance
Creates vertical structure

(*continued*)

Table A.3 (*Continued*)

5K PROTECTIVE INSTALLATION Assists fire fighting Protects building Protects contents	**5L COMMUNICATIONS** Distributes information Controls information Improves security Protects people Transmits information Aids security Records information Aids disabled Improves safety	**5M SPECIAL RAMP HEATING** Improve safety Avoid freezing surface Increase drainage
5N BUILDER'S WORK IN CONNECTION WITH SERVICES Accommodate plant Accommodates distribution systems Penetrates barriers Modifies structural design		
6A SITE WORKS Create access Prevent access Define site Contributes to aesthetic Affects security Modifies external spaces Affects maintenance Discourages loitering Resists vandalism	**6B DRAINAGE** Transmits effluent Controls flow Increases security risk Ensures hygiene Requires access Processes contaminants	**6C EXTERNAL SERVICES** Measures water consumption Protects supplies Distributes services Aids security Discourages vandalism

A.17 Evaluation and development

The aim of the evaluation and development phase is to increase the level of certainty on the factors pertaining to the adoption of the ideas generated during creativity and surviving the judgement phase (see idea reduction). The four factors to be considered are:

- Technical development
- Whole-life cost appraisal
- Risk assessment
- Consequences for the project programme

For full details see Chapter 6.

A.18 Facilities walkthrough

Similar to function space analysis but relies on following a user's use of the building by following a route on a drawing and asking what function takes place in each space. In situations where the functional use of space is solely for transit then a question has to be raised relating to whether the space is unnecessary or whether a user will be wasting time transiting the space for the life of the building.

Note: see also impact mapping and function space analysis.

A.19 Failure mode and effects analysis – BS EN 12973:2000 value management

Failure mode and effects analysis is a technique used to identify and eliminate possible causes of failure. The technique requires the sequential, disciplined approach to assess systems, products or processes. The technique involves establishing the modes of failure and the effects of failure on a system, product or process. This insures that all possible failure modes have been fully identified and ranked in order of their importance.

A.20 FAST (Function Analysis System Technique) diagramming/function logic diagram

FAST diagramming/Function Logic Diagramming is a technique to represent functions diagrammatically and can be used, for example, to illustrate the mission and objectives of a project, through to the primary function and related functions of a component.

A full description of the technique can be found in Chapter 4.

A.21 Functional performance specification – BS EN 12973:2000 value management

A functional performance specification is a document by which a customer expresses a requirement in terms of user related functions, constraints and evaluation criteria. The expression of these user needs in the functional performance specification without reference to the technical solution gives freedom to the designer, manufacturer or supplier to select, incorporate or design the most efficient product to satisfy the specification.

A.22 Function space analysis

Function space analysis relies on a number of sequential techniques using flow diagramming, space descriptions and specifications to accurately describe the functional spaces required of a facility. The function space analysis forms the basis of the construction of room data sheets and thereby is a foundation component of a construction project brief.

A full description of the technique can be found in Chapter 4.

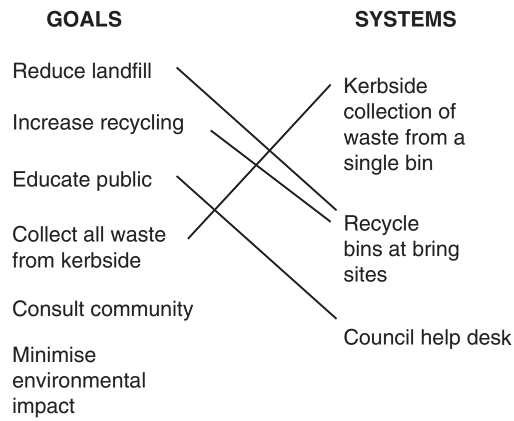

Figure A.4 Goal and Systems Model.

A.23 Gap analysis

Generally used in conjunction with other tools, for example, function analysis, goal and systems modelling, SWOT analysis. Gap analysis defines the difference between the status quo and what could potentially be achieved in terms of service, performance, production, and so on.

A.24 Goal and systems modelling

In its simplest form Goal and Systems modelling relates the goals of a project with existing systems available to achieve the goal. In its more complex form it draws together the aspirations represented by the function diagram in a Quality Function Definition methodology. A description of this technique is found under Quality Function Deployment (QFD).

An example of a simple system for waste management is shown in Figure A.4.

This simple example illustrates the absence of a system for community consultation and minimising environmental impact. The systems that are in place and linked to goals have to be questioned in terms of adequacy. Goal and systems modelling is used in interrogating the 'do nothing' option in option appraisal.

A.25 Idea reduction – Judgement (see also weighting and scoring)

Assume an exercise to alleviate station overcrowding and that a brainstorming exercise has taken place and the ideas are listed on flip chart paper ruled as under. Good ideas can be determined in three stages. In the first stage – called 'silence means no' – team members remain silent if they believe that the idea is not worthy of further consideration. The VSL reads out ideas and if no one has responded within 2 s the idea is crossed

Table A.4 Idea reduction – judgement - silence means no.

Idea	Description					
1.	~~Demolish existing station structure~~					
2.	~~Close all retail outlets~~					
3.	Widen platforms for increased capacity					
4.	Lengthen platforms for increased capacity					
5.	~~Reduce number of stopping trains~~					
6.	Increase exits from stations					
7.	~~Make people run~~					
8.	~~Discourage anyone leaving a train~~					
9.	Separate arriving and departing passengers					
10.	Install indicator screens so people wait in the right place					

through. This can reduce over 100 ideas to a limited few worthy of consideration in a few minutes. The result of the exercise is shown in Table A.4.

In the second stage a vote is taken on which ideas are likely to succeed based upon subjective judgement only. An effective method of voting is the sticky dots technique whereby each member of the team is given a number of dots, the number being say 20% of the total number of ideas to each team member. The VSL may ask the team to consider voting only for those ideas that individually they would be willing to champion, whether or not they have the technical expertise to do so. The dots are placed in the column to the right of the descriptions as shown in Table A.5.

In the third stage those ideas that have attracted the majority of dots are analysed by reference to four criteria:

1. Is the idea acceptable to the client and does it reflect positively the client's value system? (Client Acceptable – CA)
2. Based upon a subjective judgement only is the idea technically feasible bearing in mind the constraints on the project discovered during the information stage? (Technically Feasible – TF)
3. Again based upon subjective judgement only is the idea economically viable? (Economically Viable – EV)
4. Finally, with reference to the functional analysis undertaken is the idea functionally suitable (Functionally Suitable – FS).

In the example illustrated in Table A.5, any idea that attracted three or more dots was analysed.

In this exercise the two ideas worthy of further development are idea 6 and idea 10.

Table A.5 Idea reduction stage 2.

Idea	Description		CA	TF	EV	FS
1.	~~Demolish existing station structure~~					
2.	~~Close all retail outlets~~					
3.	Widen platforms for increased capacity	●●●●	✓	×	✓	✓
4.	Lengthen platforms for increased capacity	●●				
5.	~~Reduce number of stopping trains~~					
6.	Increase exits from stations	●●●●●	✓	✓	✓	✓
7.	~~Make people run~~					
8.	~~Discourage anyone leaving a train~~					
9.	Separate arriving and departing passengers	●●●	✓	×	×	✓
10.	Install indicator screens so people wait in the right place	●●●●●●●	✓	✓	✓	✓

A.26 Impact mapping

Impact mapping is a statement of how each individual user has to modify their ideal work method to accommodate the building layout. For example:

- If a user's job requires on average 12 visits per day to a file store that is a five minute journey from the user's workstation then that user will spend on average 1 hour per day accessing the file store.
- Good sightlines from a nurses station in a hospital might lead to more or less staff being required.

Similar to the facilities walkthrough, a study of the impact of the building on users, at the design stage, may lead to efficiencies in design.

A.27 Interviews

Interviews during the orientation and diagnostics stage of a value study are undertaken to:

1. Give the VSL an overview of the strategic and tactical issues surrounding the project and allow the first identification of mismatches.

2. Enable the VSL to begin to understand the issues surrounding the project. In this respect the check list, described in this toolkit, provides a sound basis for the development of the interview questions addressing for example
   a. The place of the project within the client's core and non-core business.
   b. The client's hierarchical organisational structure including a diagram of departmental structure.
   c. The client's key activities and processes that would impact the project.
   d. The decision-making structures of the client, including timetables of relevant meetings and boards.
   e. The limits to the executive power of the client's project sponsor or project manager.
   f. The identity of all stakeholders.
   g. Tradition and cultural background.
   h. The characteristics of the chosen or yet to be chosen site.
   i. The identify of community groups who may require to be consulted with respect to the proposed project. A general view on whether the project is going to be popular with the project's neighbours.
   j. The impact of a change in the political party in power at local or central government level.
   k. The financial structuring of the project, cash flow issues and annuality.
   l. The timing of the project and the chronological procedures.
   m. Any legal issues and procurement preferences.
   n. Any constraints or boundaries that the client wishes to impose any why.
3. Sensitise the VSL to any controversial issues or hidden agenda.
4. Enable the VSL to discuss with the client the team membership.
5. Derive an appropriate agenda and the initial selection by the VSL of the tools and techniques to be used in the workshop.

A.28 Issues analysis

Issues analysis is described in detail in Chapter 4. Using this approach the VSL will ask the team for all factors impacting the project. The issues will tend to be uncovered in a relatively random fashion and therefore the VSL records the issues on repositionable sticky notelets. After, typically, about an hour the team will have exhausted all of the issues impacting the project.

The next stage in the process is for the team to the sort the sticky notelets under the 11-point checklist generic headings supplemented as necessary. The headings are written on card at the top of blank flip chart paper that lines the wall. Where a particular checklist heading has no sticky notelets notes attached to it, the VSL will ask for further issues under that heading.

After all the issues have been sorted each member of the team is given approximately 10 black sticky dots to spend on those issues (on sticky notelets, not on the card headers) that the particular team member believes important.

On completion of this exercise each team member is given approximately three red sticky dots to spend on those issues of importance, previously highlighted, which the team member believes are so important that the project may be compromised unless that issue is resolved at the workshop.

At this stage all of the issues are under headings and effectively ranked by importance, based upon the number of sticky dots attached to the notelets. The VSL then interrogates the team and records in detail, on flip chart paper, the information behind those issues that have black or red dots attached to them. It is common for some issues to be ranked highly important by the majority of the team and therefore these are investigated in some considerable detail. The issues analysis and the ensuing information on key issues is pinned to the wall and surrounds the team for the remainder of the workshop.

A.29 Kano

The Kano model (Bicheno, 2000) developed by the Japanese quality guru Dr Noriaki Kano states that maximum quality is realised when targeted characteristics are achieved and the customer is delighted. There are three variables within the model, basic factors, performance factors and delighters, which have a relationship to the presence of characteristics and customer satisfaction. This is illustrated in Figure A.5.

In the model, a basic characteristic is expected to be present, the customer will be dissatisfied if it is absent and only neutral if the characteristic is completely fulfilled. The performance characteristic relates to the essential function. The customer will be more satisfied if higher levels of performance are achieved. The delighter is the unexpected extra characteristic that was not expected. There is however a time dimension to the model such that the three variables will tend to sink over time, that is, what once delighted is now expected and higher levels of performance are always sought. For example, power steering

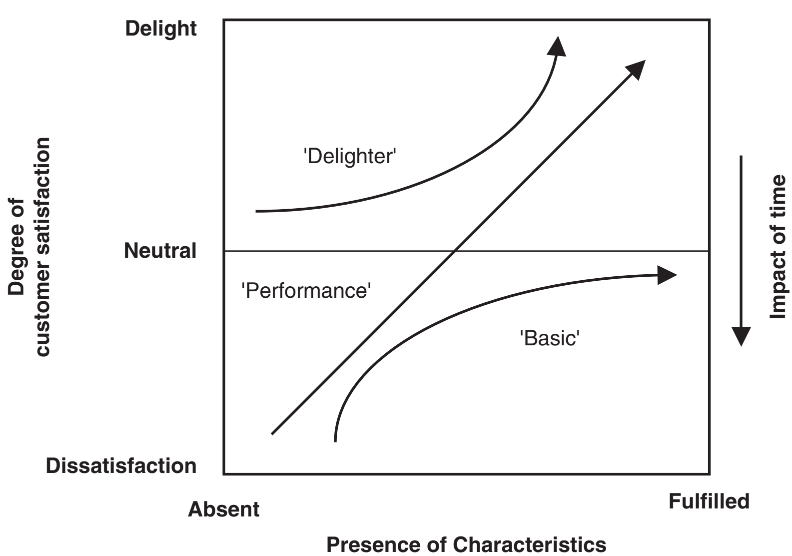

Figure A.5 The Kano model (adapted from Bicheno, 2000).

on small cars as a standard feature once delighted customers but now power steering is expected as a basic characteristic and its absence would lead to dissatisfaction.

The Kano model is used in value management to orientate the team following the goal and systems modelling exercise either in its simple form or following a full QFD exercise. The construction of the model requires the identification of basic, performance and delighter characteristics. In the waste management example used in the description of the goal and systems model earlier, kerbside waste collection from a single bin is a basic function. Performance characteristics would relate to the number of collections and the build up of waste at customer's premises. Delighters generally refer to innovations, for example it may be possible to incorporate a deodorising spray to the emptying mechanism on the collection vehicle such that each bin has a pleasant smell at the time of first use. Analysis of basic, performance and delighters enable the team to be focused in terms of actions that need to be taken forward. A failure of a basic function will lead to dissatisfaction irrespective of the number of delighters.

A.30 Lever of value

The lever of value is an orientation tool used to demonstrate to clients and stakeholders the characteristic stages in the development of a project and the value potential at each stage. Figure A.6 illustrates that for a given amount of effort, the lift in value is greater if that effort is expended at an early stage in the project's development. Value is always enhanced if effort is applied to the lever; the debate is on how much effort is it worth expending to get a given lift in value.

A.31 Life-cycle costing

See Whole-Life Costing.

A.32 Likert

See Questionnaire (Table A.6).

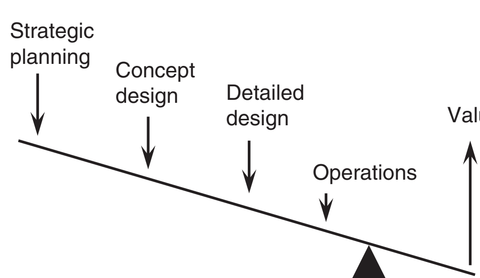

Figure A.6 Lever of value.

A.33 Presentation

A presentation is an opening technique when given at the commencement of the workshop to provide key stakeholders with an opportunity to present their viewpoint before the main workshop process commences. Presentations are also useful as a closing-down technique when given at the completion of a workshop, either for working groups to present their ideas and solutions for interrogation and validation by other working groups and also to decision takers invited to the final stages of the workshop for that purpose.

Presentations can also be used both as an opening and closing technique as part of the workshop process during plenary sessions. As an opening technique the presentation is being used to inform other groups of ideas and current thinking for further discussion and as a closing technique to present back at a final plenary session for agreement.

A.34 Project Value System

See Client's Value System and Client's Project Value System Matrix. The Project Value System comprises the Client's Project Value System as subsequently modified (if the client allows) by the design and construction team. It is the project value system that is embodied in the design and construction of the project and strictly any changes from the Client's Project Value System should be revealed through the benefits realisation process.

A.35 Post-occupancy evaluation

A fully structured post occupancy evaluation of the client's last completed building can highlight efficiency gains that might be possible in the current project. A note of caution however, is not to collect information for the sake of collecting information. All information sought should be sought for a reason and be capable of being presented to the individual members of the workshop team in a form conducive to being understood in the shortest possible time.

Steps in a post-occupancy evaluation include:

1. A clear decision on the sort of information to be collected and key questions to be asked of the information. The questions may have arisen from a document search of the proposed project or from interviews.
2. Examination of all possible documented information including pre and post contract correspondence files, the project brief, drawings and specification. The tender documentation and preferably an elemental cost analysis.
3. Examination of any previous customer care surveys.
4. A schedule of areas of functional space.
5. A walk through of the existing building addressing the questions highlighted in point 1. Taking photographs as necessary.
6. Interviews with users of the existing facility.

Questions that might be posed prior to commencing a post-occupancy evaluation might include:

1. In comparing or benchmarking costs, how did the last completed building of the client compare with the cost of other similar buildings from the same industry sector?
2. Critique of the design: are there any obvious elements of redundancy? For example possibly the structural design incorporates a frame. Is the building sufficiency and permanently compartmentalised such that the use of a frame might be questioned to determine its redundancy.
3. A common feature of post-occupancy evaluations is the fact that considerable complaint attaches itself to items that were promised but do not appear in the final outcome. Is there evidence of this here?
4. Is there evidence that the designers have allowed a particular briefing statement to drive the design. For example, the brief might state 'the design to provide as much natural light as possible . . . '. This could easily drive the whole design approach if not clarified.
5. What is the percentage of circulation space?
6. Are there any specific safety or security issues?
7. Is there evidence that a standard specification has been slavishly adhered to? For example: it may be that the hardwood joinery and suspended ceilings are used in all areas even those where they are inappropriate.
8. Has sufficient thought been given to cleaning and maintenance?
9. Is the heating, lighting and ventilation sufficient, comfortable?
10. Are the occupants satisfied? Do they feel that the building works for them or are they constantly adapting their own method of working to match the configuration of the building?

A.36 Process flowcharting

See function space analysis.

A.37 Project execution plan (PEP)

The project execution plan is a dynamic document that commences at the inception of the project and includes, where appropriate, the options appraisal report. It is a dynamic management document used by all members of the team that records the project strategy, organisation, control procedures and responsibilities. It contains a formal statement of:

- The user needs, the strategic brief,
- A performance statement of all aspects of the project, the project brief and
- The strategy agreed for their attainment, the project execution strategy.

It is a live, active management document, updated regularly during the project's life cycle and used by all parties both as a means of communication and as a control and performance measurement tool. It begins life as an empty file with dividers indicating the documents to be included.

Examples of the items that a PEP should contain are:

- The project mission.
- The aims and objectives of the PEP.
- The procedures for updating the PEP.
- The project organisation structure of the client.
- A list of consultants and a description of the consultants' responsibilities.
- The contractor's, management contractor's, construction manager's organisation.
- The form of contract, partnering agreement, and so on.
- Project reporting procedures and particularly the procedures for information distribution, and communication, between the client's project team, consultants and contractor.
- A full project brief incorporating the project value system.
- The health and safety plan.
- The quality plan.
- The latest cost report and predicted cost and cash flow. This will be updated at regular intervals.
- The executive summaries and action plan from value management workshop reports.
- The risk management strategy and the latest risk analysis.
- Copies of key permission documents such as, the planning permission, the building warrant, listed building consent, and tree preservation orders.
- The latest contract programme with milestone activities.
- Change management procedures and design freeze dates related to milestone activities.
- A schedule of key meetings and workshops (including value and risk workshops).
- Procedures for PR and dealing with community and media enquires.

A.38 Quality function deployment

Quality Function Deployment as a technique originated in 1972 at Mitsubishi's Kobe shipyard. The technique aims to represent on a single diagram (the House of Quality) the relationship between functional requirements and technical solutions. In addition to its traditional application in manufacturing the technique can be adapted to offer valuable insights into a wide variety of construction management and service applications. In a value management context the use of the House of Quality is preceded by functional analysis and Goal and Systems modelling as illustrated in Figure A.7.

In the context of value management QFD is a team-orientated tool that aims to promote the exploration of innovative ways of meeting the necessary functions represented on the function diagram. It does this by translating functions into measurable goals, promoting the identification of the optimal service or product solution. The measurable goals are themselves attributed to stages of the lever of value namely, strategic, systems, service definition or production planning and operations. The aim of QFD is to represent all attributes on a single diagram and thereby ensuring a complete understanding. In order to construct the QFD diagram it is necessary to complete the function diagram and the earlier goal and systems model. An innovation

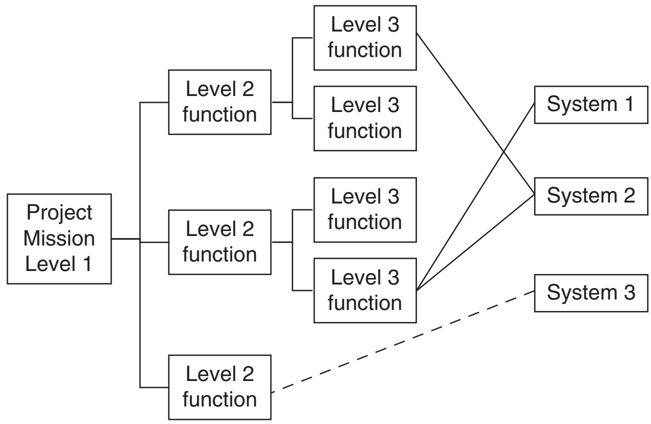

Figure A.7 Linking functions and existing systems.

session precedes the discovery of missing systems or attributes. In Figure A.7, two level 3 functions are required but have no systems in place to satisfy them. One level 2 function is only partially satisfied by system 3.

Once assured that systems are in place to satisfy all of the required goals the House of Quality diagram is constructed as shown in Figure A.8.

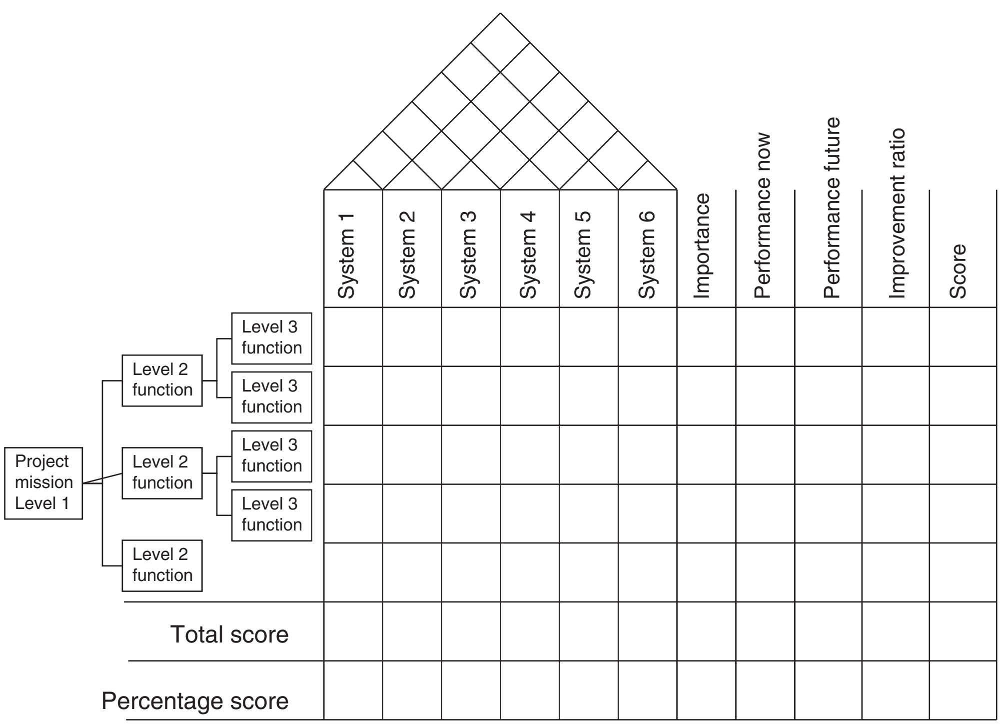

Figure A.8 House of Quality.

The phases of construction are:

1. Construct the function diagram on the left of the House of Quality diagram or alternatively list the functions from the extreme right of the function diagram. These represent the goals, often referred to as 'the voice of the customer'.
2. Across the top are the systems, which either are in place or have been derived as a part of the innovation exercise.
3. The roof of the house accommodates the relationships between systems.
4. Assessing the relationship between the goal and the system completes the matrix, the wall of the house. Traditionally, a double circle is entered in the cell denoting a strong relationship and is usually given a score of nine, a single circle indicates a moderate relationship and is given a score of three and a triangle indicates a possible or low relationship and given a score of one. A blank cell indicates no relationship and has the value zero.
5. The roof of the house is also completed using the same three symbols. This denotes the relationship between systems.
6. The right hand side of the diagram is a facility to undertake weighting and scoring exercises as follows:
   a. Column 1 defines the importance of the identified goals using a rating scale of 1–5 where five represents very important and one signifies low importance.
   b. Column 2 rates the client's current service to satisfy the identified goals based upon the judgement of the team . The rating scale is again 1–5 where 5 represents excellent service, 2 the lowest level of service to perform the basic function and 1 where the function is not provided.
   c. Column 3 is the team's opinion of the possible future provision. This may be based on the team's estimation with or without formal benchmarking with other providers of similar services. The scoring system is as column 2.
   d. Column 4 is the improvement ratio computed by dividing the future rating by the current rating.
   e. Column 5 is the score for each function determined by multiplying the goal importance by the improvement potential and representing this as a percentage such that the summation of all of the scores equals 100.
7. The total scores for each system is calculated by first, multiplying the values for each goal (9, 3, 1 or 0) by the percentage score for that goal and second by summing through all the values for that system. The total score for the system can be converted to a percentage such that the addition of the scores for all systems equals 100.
8. The system on which the client should commit the majority of resources is indicated by the highest system score.

A.39 Questionnaire

A questionnaire is an efficient method of gathering information from a large number of people. It is also effective in determining the extent to which respondents share the same point of view.

Table A.6 Headings suitable for a 5-point likert questionnaire.

1.	Strongly disagree	Unnecessary	Unlikely
2.	Disagree	Unimportant	Possible
3.	Tend to agree	Desirable	Likely
4.	Agree	Important	Highly probable
5.	Strongly agree	Essential	Certain

As the questions in a questionnaire are developed and structured to permit response in a predetermined manner it is important that sufficient information is available at the outset for meaningful questions to be posed. The questions in a questionnaire must be piloted in a small survey or posed at an interview to ensure succinctness, clarity, and capability of being answered concisely. A pilot survey in which respondents indicate ambiguity in the question by their answers indicates a problem with the question.

The questionnaire must be designed with the method of summarising and tabulating the results already decided. The response to a question may be, 'yes', 'no' or 'don't know', or a short statement. In a Likert questionnaire the respondent is asked to indicate a preference commonly on the scales illustrated in Table A.6.

A.40 REDReSS

REDReSS is an acronym for the final stage of the information validation exercise. Key prompts allow a final analysis of the information to ensure that it precisely represents the project. The prompts are:

Reorganisation
Expansion
Demolition
Refurbishment and Maintenance
Safety
Security

A full discussion of this technique may be found in Chapter 4.

A.41 Risk analysis and management

Risk is commonly defined as being a hazard, the chance of a bad consequence or loss, or the exposure to mischance. However it is defined, it is normally considered to be those issues that prejudice the outcome of an event. Risk management is a planned and systematic process of identifying, analysing and controlling the outcome of a particular event to achieve the planned objective and thereby maximise value in the project process. Risk management and its relationship with value management and option appraisal is discussed in detail in Chapter 10.

Table A.7 List of users of a community library.

• Senior librarian • Librarian • Leisure users • Information seekers • Those attending meetings	• Internet users • College/University students • Press • Persons with a disability • Parents with pushchairs • Children

A.42 SMART methodology

SMART is an acronym, in a value management context, for Simple Multi Attribute Rating Technique. For a full description see Chapter 4.

A.43 Space adjacency

For space adjacency method see Chapter 4.

A.44 Space diagramming – User pathways

User pathways and function space analysis is a technique used at the project briefing stage either before or after the production of the concept design. It involves the identification all of the users of the building. Invariably this will be a longer list than at first sight anticipated. Table A.7 indicates the users of a community library project.

Each user from the list is studied in turn and a pathway flowchart prepared of their use of space. This is undertaken by anticipating each activity as part of the user's daily routine on their approach to, within and exiting from the building. Each activity is connected by arrows to the next activity. It is presumed that each activity will require space. Even the activity of entering the building will require an entrance lobby of some sort, and the activity of moving from one space to another indicates circulation space. Figure A.9 illustrates simplistically the activities of a parent with a child in a pushchair seeking specific information. It should be noted that this is a step in understanding the functional space requirement and therefore a crudely drawn and roughly annotated diagram will suffice.

A.45 Space requirement user function

Each activity undertaken by the user will require space and that space will have the attributes of size, servicing (heating, lighting, ventilation, acoustic, etc.), quality, normally defined by fittings and furnishings and finally the technology support required. An outline of the functional requirements of space is a useful precursor to the eventual compilation of room data sheets. It is important for this process to remain dynamic as it is easy to get bogged down if spaces are considered one at a time from the flowcharts. It is more efficient to list all spaces from the flowchart and then group those spaces that are similar in terms of their attributes.

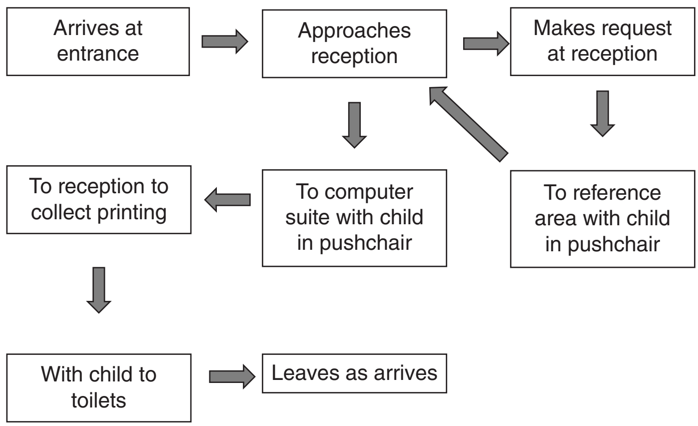

Figure A.9 User pathway.

Timetabling is an important factor in the efficient use of space. A definition of space by function is therefore important. An assembly hall, can be a gymnasium, a dining room, a badminton court, and so on, but only if the necessary activity associated storage and manpower for its conversion within a timetable is practical. Spaces used by the general public out-of-hours may need separate entrance, cloakroom, toilet facilities, heating, lighting, and so on.

A.46 Stakeholder analysis/management/mapping

Thiry (2010) defines stakeholders as individuals or groups that are positively or negatively affected by a planned process, project or programme or can influence them. Stakeholder analysis consists of identifying the different stakeholders and their influence as defined in the ACID test earlier. Stakeholder management is the understanding of stakeholder goals and values and the monitoring, informing, and influencing of different stakeholders. Stakeholder mapping consists of grouping stakeholders into categories, for example, executive stakeholders, supplying stakeholders and community stakeholders. A discussion of stakeholder values is given in Chapter 11 and discussed generally in Chapter 13.

A.47 Strengths, opportunities, weaknesses and threats (SWOT)

A general management technique but one that can be used at the information stage to scrutinise a service or a design by analysing its strengths, weaknesses, the opportunities for improvement and the threats imposed by adopting a particular approach. In a workshop a matrix is constructed and the project analysed by listing the appropriate attributes of the project in the boxes of the matrix as illustrated in Figure A.10.

A.48 Site tour

For the VSL, and the major participants, to visit the site is a major advantage in placing the project within its physical boundaries. Where a site tour is not possible or where the

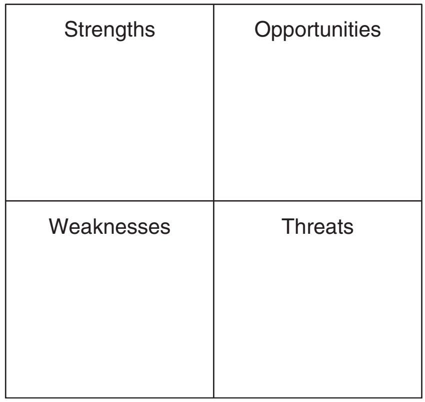

Figure A.10 SWOT analysis.

site has only been visited by a number of workshop participants, photographs may be sufficient to answer any queries.

A.49 Timeline

On flip chart paper in front of the team, horizontal lines are drawn to represent the number of years over which the project may extend. The date of the workshop is indicated. All of the preparatory stages of the project up to the decision to proceed are included on the time line as are key events during the progress of the project prior to its adoption by the client's core business team. This is a useful technique that focuses the team on the permissions and procedures that precede the decision to proceed with the project and the major events during the project. The timeline should not be confused with a highly developed computer generated programme, the timeline is purely a focusing technique used during the information stage.

A.50 Time, cost and quality

A triangle is drawn on a flip chart in front of the team as illustrated in Figure A.11. The team is invited to agree on the position of a dot within the triangle that describes the relative importance of the parameters of time, cost and quality in relation to the project. A dot hard against the time corner would indicate that time was all-important to the extent that the client would accept an increasing cost and the lowering of quality. A dot hard against the cost corner would indicate that the project has to come in on budget even if time was exceeded and quality was lowered. Finally, a dot in the quality corner would indicate that a stated level of quality has to be achieved even if cost and time are exceeded.

This simple technique can easily lead to considerable debate. Once consensus is reached the diagram is pinned to the wall in full view of the team for the remainder of the workshop.

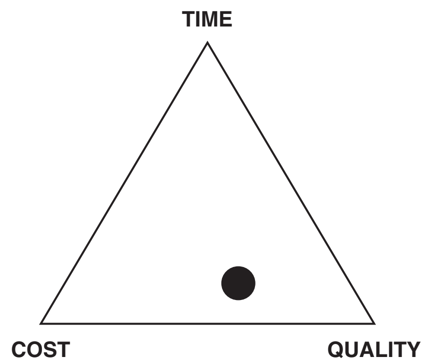

Figure A.11 Time, cost and quality triangle.

A.51 User flow diagramming

See previous space diagramming and function space diagramming in Chapter 4.

A.52 Weighting and scoring – (see also idea reduction)

Weighting and scoring techniques are relevant in value management and particularly value engineering exercises in situations where a decision needs to be made in selecting an option from a number of competing options and where the best option is not immediately identifiable.

Weighting and scoring lies at the heart of many decision support systems including the technique of Multi Attribute Value Theory, which itself is related to value trees and SMART (see earlier text).

The first stage in the weighting and scoring methodology is to determine the criteria by which the options are to be judged. In selecting criteria it is important not to select criteria that are highly correlated for example in judging between floor finishes it would be a mistake to include two criteria such as 'ease of cleaning' with 'cost of cleaning' since the two are highly correlated.

Consider the following example. A large research consultancy organisation undertakes research, development and training for a wide variety of public and private sector organisations. It is currently commissioning a 12-storey, 8000 m^2 building on a city centre site. Its work is organised around projects for specific clients that tend to last for between two and six years. Teams for each client project will have a dedicated space for the period of the project. Residual space is rented on short leases at attractive rates. The building interior has to be flexible to cater for reorganisation on a 2 to 6 year basis. In considering internal partitions a number of options have been suggested. In determining the criteria for judging the options the following have been agreed:

- The ability to be demounted easily with minimum disruption to services, structure and finishes.
- Good noise attenuation.

A. Demountable							
B	B. Noise attenuation						
C	B	C. Attractive finish					
A	B	C	D. Support fittings				
A	B	E	E	E. Conceal services			
A	B	F	F	E	F. Capital cost		
A	B	G	G	E	G	G. Maintenance cost	
H	H	C	H	E	F	G	H. Reliability of supply

A	B	C	D	E	F	G	H
4	6	3	0	5	3	4	3

Figure A.12 Weight and score part 1 – determine weights.

- Attractive finish.
- Ability to conceal services.
- Ability to support fittings and fixtures.
- Cost.
- Reliability of supply over a period of years.

A paired comparison exercise, illustrated in Figure A.12, is held to determine the weighting to be given to each attribute as shown in the Figure. The weights are carried forward to the scoring matrix and entered under their respective attribute. The scoring exercise then determines how well each option meets the attributes based on a scale of 1 to 5 as illustrated in Figure A.13. These scores are entered in the top left triangle in each cell of the matrix. The score is multiplied by the weight in each cell and the amount entered in the bottom right triangle. All amounts are summed for each option and the total entered.

Based upon the decisions taken by the team traditional stud and plasterboard partition is the best option with traditional plastered blockwork a close second. The propriety partitions did not score well in the exercise and this may require a second look. Indeed a sensitivity analysis should take place by changing some of the weights and some of the scores to see the impact. In the exercise here, the team gave a high weight to sound attenuation against which some of the proprietary partitions scored poorly.

A.53 Whole-life costing

Whole-life costing is a technique for economic evaluation, which accounts for all relevant costs during the study period (time horizon) and adjusting for the time value of money. It is a methodology for predicting present and future costs for the purposes of comparing

		Demountable	Noise attenuation	Attractive finish	Support fittings	Conceal services	Capital cost	Maintenance cost	Reliability of supply	
		A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	
		4	**6**	**3**	**0**	**5**	**3**	**4**	**3**	Total
	Blockwork	1 / 4	5 / 30	4 / 12	4 / 0	3 / 15	4 / 12	4 / 16	5 / 15	104
	Stud	3 / 12	3 / 18	4 / 12	3 / 0	5 / 25	5 / 15	3 / 12	5 / 15	109
Proprietary	Metal	5 / 20	3 / 18	3 / 9	1 / 0	2 / 10	2 / 6	4 / 16	2 / 6	85
Proprietary	Timber	5 / 20	2 / 12	4 / 12	1 / 0	2 / 10	3 / 9	4 / 16	2 / 6	85
Proprietary	Polystyrene	5 / 20	1 / 6	2 / 6	1 / 0	2 / 10	4 / 12	4 / 16	2 / 6	76
Proprietary	Plasterboard	5 / 20	1 / 6	4 / 12	1 / 0	2 / 10	5 / 15	4 / 16	4 / 12	91

Figure A.13 Scoring matrix using weights from Figure A.12.

options and/or determining the most probable future facilities management cost of a facility. A fundamental principle of value management is that options generated through innovation are evaluated using whole-life cost criteria. The terms listed in Table A.8 have specific meanings in WLC – see Chapter 10.

Table A.8 Meanings of common terms used in whole-life costing.

Term	Meaning
Core Definitions:	
Base case	The existing situation against which improvement options can be compared or a specific solution selected as the benchmark against which other options can be compared.
Mortgage	Strictly, the conveyance of an asset by a debtor to a creditor as security for a debt. In the context of Whole-Life Costing the mortgage is the amount to be paid at regular intervals at a given interest-rate to repay a debt.
Sinking funds	Funds accumulated by equal payments made at regular time periods into an account that attracts a given interest-rate to accumulate a required sum of money established prior to undertaking the sinking fund calculations.
Whole-Life Appraisal	The systematic consideration of all relevant costs, revenues and performance associated with the acquisition and ownership of an asset.
Whole-Life Costing	The quantification of the total cost of an enterprise for input into a decision making or evaluation process. (BS ISO 15686-5 definition)

(*continued*)

Table A.8 (*Continued*)

Term	Meaning
Cost Definitions:	
Acquisition cost	All costs, including capital costs, incurred prior to time zero in acquiring an asset.
Annual equivalent	The present value of a series of discounted cash flows expressed as a constant annual amount.
Capital cost	Initial cost of the asset – often the same as acquisition costs.
Cost	The total paid for labour, materials, plant and equipment, overheads and profit.
Depreciation	The distribution of the monetary value of an asset over a period of time commonly related to its productive or useful life.
Discounted cost	The resultant of discounting a cost to be incurred in the future at a given interest rate.
Disposal cost	The costs associated with the disposal of an asset at the end of its life cycle.
Externality costs	Costs associated with an asset not reflected in the transaction costs of the acquisition.
Hard FM cost	The cost of necessary replacement, redecoration, repair and corrective, responsive and preventative maintenance necessary for the continued specified functional performance of the asset.
Net present value	The total present day worth of a future cash flow discounted at a given interest-rate.
Nominal cost	The estimated future amount to be paid that includes the estimated changes in price due to inflation, deflation, technological advances, etc.
Present value	The present day worth of a future cost discounted at a given interest-rate. It can be considered to be the amount to be invested in a bank today at a given interest rate to accrue a required amount at a given point in the future.
Real cost	Adjusted for changes in the value of money. (Present orientation as opposed to nominal).
Real Opportunity Cost of Capital	The interest rate reflecting the earnings possible from an activity other than that being studied.
Residual value	The value assigned to an asset at the end of the period of analysis.
Soft FM cost	All costs incurred in running and managing the facility including administration support services, cleaning, security, rent, rates, insurances, energy, local taxes and charges.
Sunk costs	Costs of goods and services already incurred or irrevocably committed.
Terminal value	The scrap value of a component or asset at the point of its replacement.
Interest Rates and Discount Rates Definitions:	
Base rate	The interest rate selected as the basis of the discount rate. This could be the current bank base rate or bank borrowing rate. The base rate can be used, adjusted by the inflation rate, to give the discount rate. Alternatively, the client's opportunity cost of capital may be used as the discount rate.
Discount rate	The interest rate used for bringing future costs to a comparable time base (time zero).
Inflation/deflation	A sustained and measurable increase/decrease in the general price level.

(*continued*)

Table A.8 (*Continued*)

Term	Meaning
Internal rate of return	The discount rate that when applied to a cash flow containing positive and negative amounts gives a net present value of zero.
Nominal interest rate	The actual interest rate applied not adjusted for inflation. Note Fisher equation (real interest rate = nominal interest rate – inflation).
Real interest rate	The rate adjusted for inflation.
Treasury Discount Rate	The rate specified as the discount rate by the Government Treasury to be used as the discount rate in public sector whole-life cost calculations.
Time definitions:	
Period of analysis/ period of study	The length of time over which the whole-life cost assessment is analysed.
Physical life of a component	The time at which a component fails to meet the performance criteria required of it and has to be removed and replaced.
Residual life	When applied to an asset is that remaining at the end of the study period.
Time Period	The time interval used in Whole-Life Cost calculations. It may be any unit of time measurement (day, week, month, year). However, in the calculations the time period and interest rate per time period must be synchronised.

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