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NON-FINANCIAL PERFORMANCE MEASUREMENT AND MANAGEMENT PRACTICES IN MANUFACTURING FIRMS: A COMPARATIVE INTERNATIONAL ANALYSIS

AHMED B. ABDEL-MAKSOUD
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Editors

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For their love, support and encouragement, to our …
parents,
wives, *Rania* & *Magda*
children, *Kariem and Aaya Abdel-Maksoud & Mohamed Abdel-Kader*

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PREFACE

Performance measurement is a key part of any organisational infrastructure and an integral part of all management processes. Commentators advocate that performance needs to be assessed to determine the adequacy of the strategies for achieving organisations' objectives, to revise and communicate strategies, and to develop tactical objectives. It is argued that performance measurement process should begin with strategy establishment and determining how strategic objectives can be related to the products and services that customer's need. Organisations' strategies and objectives will be achieved through all management levels in the organisation – from the top management level down to the shop-floor level. Everyone in the organisation should understand the organisation's strategy, be motivated to contribute to its achievement, align his/her day-to-day activities to accomplish strategic objectives, and find new and innovative opportunities to contribute to achieve the organisation's objectives.

Performance evaluation could be based on financial and/or non-financial measures, and previous literature shows that performance evaluation of each level of management is different. It is argued that senior managers are well trained and adapted with financial measures and that the use of financial measures at middle and top management levels is normally linked to compensation. Contrarily, shop-floor staff – who perform the day-to-day activities – are preferred to be evaluated using non-financial performance measures.

Leading manufacturers worldwide have been found to focus on certain broad categories of performance measures. These categories formed the framework that guided this book and, given the importance of the role played by shop-floor staff, operational performance is central to this book. Thus, the focus of this book is confined only to the shop-floor non-financial performance measures (SFNFPMs) in each of the following five evaluation categories: product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation.

The book presents a cross-countries comparative study that provides a framework for exploring the relationships between the use of non-financial performance measures of the above five categories at the shop-floor level of manufacturing firms across four different countries (UK, Italy, Japan, and Canada) and a range of contingent factors incorporating technological, managerial, organisational, and environmental factors. The study aims to achieve three main objectives. First, to explore the contemporary characteristics of the specified technological, managerial, organisational, and environmental factors and the use of SFNFPMs in manufacturing firms in the four countries surveyed. Second, to provide an understanding of the relationships between the use and importance of SFNFPMs and the levels of deployment/extent of importance of the contingent variables. Third, to design shop-floor non-financial performance measurement scorecards in manufacturing firms in the surveyed countries.

The proposed 'scorecards' are logical, and mathematically proven, cause-and-effect models aiming at providing a better understanding of the use of SFNFPMs in manufacturing firms. The proposed scorecards could be used to help achieve integrity of the applied SFNFPMs and to identify any lack of coordination/completeness. They, also, could be useful in making a shop-floor performance measurement system a 'forward looking' control system thereby mitigating the problem of the historical nature of accounting data.

Achieving the above objectives can assist in gaining a better understanding of non-financial performance measures at shop-floor level in manufacturing firms and in contributing to a more effective management of manufacturing firms in the four countries. It, also, is expected to enhance organisational knowledge about the use of non-financial measures in performance measurement systems in manufacturing firms.

The inclusion of manufacturing firms from different countries was purposive as to broaden the study across the borders of a single country. The purpose was to cover manufacturing firms belonging to industrial countries in various continents. However, the choice of the four industrial countries included in this book was largely based on availability of funding and access to data.

This book is organised into four parts. The first part comprises three chapters and gives an introduction and framework to this research. Part II (Chapters 4–8) gives details of the research method used and the results related to each country under study. Part III (Chapters 9–10) provides comparisons of the results across the four countries. Finally, Part IV highlights some further developments and suggests avenues for future research in this field. Three different areas are covered in Part IV. First, the possible influence that managers' perception of the importance of competition could exert on their decisions to deploy certain contemporary management accounting practices in manufacturing firms. Second, the role of performance measurement systems in the effective management of organisational change – particularly discontinuous change. Third, the role of a performance measurement system and performance measures in organisational social context. Each of these three areas sheds light, and invites further research studies, on different interpretational aspects of the book theme.

Ahmed Abdel-Maksoud
Magdy Abdel-Kader
Editors

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LIST OF ABBREVIATIONS

SFNFPM	Shop-floor non-financial performance measure
AMT	Advanced manufacturing technology
FMS	Flexible manufacturing systems
CAD	Computer aided design
CAM	Computer aided manufacturing
CIM	Computer integrated manufacturing
CNC	Computer numerical control
CAE	Computer aided engineering
AS/RS	Automated storage and retrieval system
AGVS	Automated guided vehicles systems
IMP	Innovative managerial practice
JIT	Just-in-time
TQM	Total quality management
TPM	Total preventive maintenance
MRPI/II	Materials requirements/manufacturing resource planning
ERP	Enterprise requirement/resource planning
OPT	Optimised production technology
CMAP	Contemporary management accounting practice
CPA	Customer profitability analysis
BP	Benchmarking of performance
SMA	Strategic management accounting
ABT	Activity-based technique
TA	Throughput accounting
BSC	Balanced scorecard
EVA	Economic value added

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PART I: INTRODUCTION AND FRAMEWORK

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CHAPTER 1

NON-FINANCIAL PERFORMANCE MEASURES – AN OVERVIEW

Ahmed Abdel-Maksoud and Magdy Abdel-Kader

INTRODUCTION

To be successful in today's worldwide competitive environment, companies must be capable of manufacturing products of high quality at low cost and providing a first-class customer service. Many companies have responded to these competitive demands by implementing advanced manufacturing technologies (AMTs), innovative managerial practices (IMPs), and emphasising quality, delivery, innovation, and flexibility to meet customer needs in their corporate objectives (Banker, Potter, & Schoreder, 1993).

The adoption of AMTs and the redesign of work processes affected organisations as these technologies rely on increased worker involvement in the control of all phases of manufacturing and in the identification of opportunities for process innovations and manufacturing performance improvement (Kaplan, 1983; Banker et al., 1993). One approach to addressing these changes is to revise the information captured for performance measurement (Clark, 1989; Mather, 1989; Dixon, Nanni, & Vollmann, 1990; Kaplan & Norton, 1992).

In this chapter an introduction is given to the research problem, objectives, and importance. The remaining of this chapter is organised in four sections. The next section highlights the importance of the use of

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non-financial performance measures in manufacturing firms. This is followed by explaining the research problem and objectives. Fourth section elaborates on the research importance and the final section gives an outline of the book.

THE USE OF NON-FINANCIAL PERFORMANCE MEASURES IN MANUFACTURING FIRMS

It has been argued that performance measurement systems in manufacturing enterprises have remained static in spite of significant transformations in management accounting approaches and production processes (Bhimani, 1993). The so-called traditional financial performance evaluation systems do not provide feedback on the effectiveness of AMTs and IMPs. Moreover, they are not sufficiently comprehensive to assess efforts to improve competitiveness through AMTs and IMPs (Kaplan, 1983; Vollman, 1989; Drucker, 1990; Johnson & Thomas, 1990; Hall, Johnson, & Turely, 1991; Conti, 1993). Maskell (1989a) argues that

> Commentators on manufacturing performance have strongly advocated the use of non-financial measures in managing production activities. Words such as customer service, productivity, quality, flexibility, delivery time, competitive position, and production process time permeate the literature on manufacturing performance measures. (p. 33)

The 'day-to-day' control of the manufacturing and distribution operations is better handled with non-financial measures (Maskell, 1989a; Bhimani, 1993; Bromwich & Bhimani, 1994; Otley, 1997). Bhimani (1993) states that British manufacturers have begun to deploy novel manufacturing work methods such as AMTs and IMPs. He argues that such changes require fundamental alterations in performance measurement systems (Bhimani, 1993).

Survey results on UK manufacturers (Department of Trade & Industry (DTI), 1989; CIMA, 1993; Drury, Braund, Obsorne, & Tayles, 1993) indicate more emphasis within the surveyed companies on the use of non-financial indicators, focusing particularly on quality issues and marketing activities and a general awareness of different types of non-financial measures which manufacturers could potentially use. Dimensions of non-financial performance such as customer satisfaction, employee efficiency, and quality levels were considered important by all companies surveyed but not all of them had developed satisfactory methods of dealing with non-financial measures (CIMA, 1993).

Recent trends against the pervasive use of financial performance measures are due to the emphasis in the academic business literature on such topics as responsiveness, innovativeness, and quality. While traditional financial performance measures do not capture all of the information manufacturers required to consider, they are still of a considerable value. Commentators implicitly assume that financial and non-financial performance measures can be combined in complementary ways (CIMA, 1993). However, "there appears not to be an optimal mix of specific financial and non-financial indicators applicable to all manufacturers" (CIMA, 1993, Executive Summary). The use of non-financial performance measures is seen by all manufacturers as becoming more relevant (CIMA, 1993). A discussion of the critique of financial measures and the use of non-financial measures is shown in Chapter 2.

The application of AMTs/IMPs depends crucially on shop-floor workers and this organisational level provides the focus of this research. In addition, given the importance of non-financial performance measures in an AMT/IMP environment, the focus, thus, is confined only to the non-financial performance measures at shop-floor. Fig. 1 presents a hypothesised effect of the deployment of IMPs/AMTs on both performance measurement systems and on the shop-floor of an organisation.

Fig. 1 depicts the potential influence of the deployment of IMPs/AMTs on performance measurement systems. On the one hand, it intensifies the deployment of non-financial performance measures and, on the other, it emphasises the increased role of shop-floor involvement (empowerment, motivation, etc.).

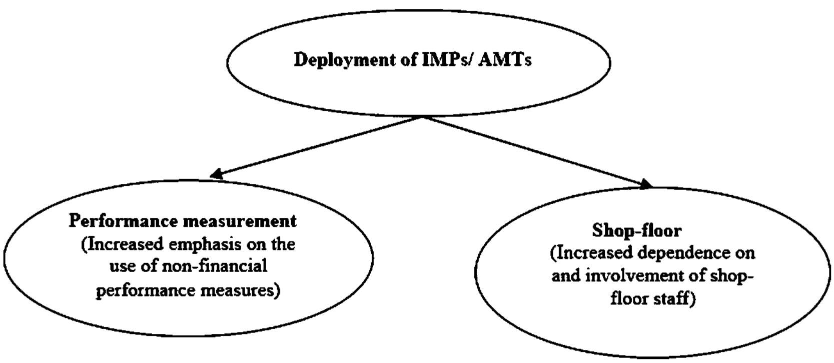

Fig. 1. The Effect of Deploying IMPs/AMTs on Performance Measurement and Shop-Floor of an Organisation.

RESEARCH PROBLEM AND OBJECTIVES

Manufacturing firms striving for continuous improvements often deploy AMTs/IMPs. While some firms excel because of their emphasis on AMTs/IMPs, other firms that have implemented AMTs/IMPs do not appear to have improved their performance. There is, however, little empirical evidence that provides reasons for these mixed results (Powell, 1995). Some researchers (see, for example, Kaplan, 1983; Johnson & Kaplan, 1987; Banker et al., 1993) argue that the poor performance of many new manufacturing initiatives is due, in part, to continued reliance on management accounting systems that fail to provide appropriate goals, performance measures, or reward systems.

It is argued that traditional accounting measurements and control systems are not appropriate in such a manufacturing environment (Drury, 1990). Efficiency measures, for example, in traditional accounting measurements can lead managers to increase batch sizes that increase inventory levels and lead times while decreasing customer responsiveness. This is considered a drawback in the development of AMTs/IMPs. Traditional performance measurement systems also fail to report key variables such as quality, reliability, lead time, flexibility, and customer satisfaction (Drury, 1990). They may also have a delayed feedback in reporting while just-in-time (JIT) requires real time information (Drury, 1990).

Effective implementation of AMTs/IMPs requires major changes in organisational infrastructure. For instance, Wruck and Jensen (1994) suggest that an effective implementation of total quality management (TQM) requires major changes in systems of allocating decision rights, performance measurement systems, and reward and punishment systems.

More research is needed on how the design of management accounting systems interacts with manufacturing techniques to affect performance (Ittner & Larcker, 1995), and commentators recommend that the nature of manufacturing performance measures appropriate for different elements of AMTs/IMPs are a useful area for further research (Kaplan, 1993; Kaplan & Norton, 1992, 1996; Ittner & Larcker, 1995; Chenhall & Langfield-Smith, 1998a, 1998b; Neely & Adams, 2000; Kennerley & Neely, 2003).

The development of key performance measures may require companies to look at the external environment (Otley, 1997; Ittner, Larcker, & Randall, 2003). It has been suggested (Drucker, 1990; CIMA, 1993; Bhimani, 1993, 1994; Otley, 1997) that elements such as the nature of competition and the extent of AMTs/IMPs and structural innovations such as team-based work groups are important in understanding the type of performance measures best suited to the development of AMTs/IMPs within organisations. Various studies have emphasised the use and performance consequences of non-financial measures in organisations adopting AMTs/IMPs. Virtually, all of these studies have found positive associations between the emphasis placed on IMPs/AMTs and the provision of non-financial measures such as defect rates, on-time delivery, and machine utilisation (Daniel & Reitsperger, 1991; Banker et al., 1993; Abernethy & Lillis, 1995; Perera, Harrison, & Poole, 1997). Positive associations have also been found between IMPs/AMTs and the use of non-financial measures in reward systems (Daniel, Reitsperger, & Gregson, 1995; Ittner & Larcker, 1995; Said, HassabElnaby, & Wier, 2003; Surysekar, 2003).

Accordingly, it can be concluded that there are different contingent managerial, technological, organisational, and environmental factors that influence manufacturers' performance measurement. In particular, this study considers the following contingent aspects:

1. IMPs and AMTs as managerial and technological factors, respectively.
2. Contemporary management accounting practices as an organisational factor.
3. The competitive environment a company operates in as an environmental factor.

Two main research questions are addressed in this study:

First: to what extent are there cause-and-effect relationships among five specified evaluation categories of shop-floor non-financial performance measures (SFNFPMs) in the UK, Italy, Japan, and Canada? These evaluation categories are: product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation.
Second: to what extent are the use and importance of SFNFPMs associated with the level of deployment/importance of certain contingent factors in manufacturing firms in the UK, Italy, Japan, and Canada?

To address these research questions we can set the objectives of this research as follows:

First: Investigating the existence and level of importance of shop-floor non-financial performance measures, which are grouped in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the level of deployment (or extent of importance) of a number of contingent variables. The following managerial, technological, organisational, and environmental variables are considered:

1. Level of application of IMPs.
2. Level of application of AMTs.
3. Level of deployment of contemporary management accounting practices.
4. Level of competitive environment a company operates in.

Second: Examining the relationship between the existence and level of importance of shop-floor non-financial performance measures in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the level of deployment/extent of importance of the specified contingent variables.

Third: Developing a theoretical SFNFPMs scorecard that examines the cause-and-effect relationships among the five performance evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation).

RESEARCH IMPORTANCE

An organisation's choice of appropriate performance measures is significant as it can affect its commercial success. Many manufacturing firms search for appropriate information about their internal processes to establish ways of cost cutting, enhancing performance, and building a better product in a highly competitive market (CIMA, 1993; Bhimani, 1993, 1994).

In his identification of the contemporary research opportunities in management accounting, Kaplan (1993) suggested the area of 'integration of performance measurement systems with the many other initiatives occurring in organisations' to be of interest. Kaplan (1993) argues that

> … recent innovations in management accounting are not occurring in a vacuum. Organisations are simultaneously exploring programs such as total quality management, time-based management, business process re-engineering, employee empowerment, customer-focused service-driven organisations, design-for-manufacturability, computer-integrated manufacturing, theory of constraints, strategic alliances with suppliers and customers, core competencies, and shareholder value analysis. What is the role for new performance measures, for activity-based cost and profitability measurement, for new incentive and compensation schemes, and for newly-designed management control systems as organisations implement some or all of these initiatives? Are new measurement systems necessary? Are they enabling factors? What new barriers arise if new measurement systems do or do not change? (p. 11)

Furthermore, Kaplan (1993) urges management accounting researchers to place more emphasis on the area of performance measurement.

> Opportunities clearly exist to study the extension of newly developed measurement procedures, whether activity-based costing or performance measurements- on quality, cycle time, on-time delivery, time-to-market, and cost of non-conformance – outside the manufacturing setting in which these procedures were initially developed. (p. 9)

Kaplan (1993) continues:

> Management accounting researchers following this route will be moving beyond their traditional technical, analytic skills to develop knowledge and expertise in organisational change as well as in contemporary developments in related management disciplines such as operations and technology management, marketing, human resource management, and strategy. (p. 13)

Achieving the three objectives of this research should provide a better understanding of non-financial performance measures at shop-floor in manufacturing firms in four countries; UK, Italy, Japan, and Canada. The outcome of this research should also enhance organisations' knowledge about the use of non-financial measures in performance measurement systems. The investment of time, effort, and economic resources in developing better performance measurement tools, and training managers to use them, could contribute to the more effective management of manufacturing firms (see, for example, CIMA, 1993).

SUMMARY AND OUTLINE OF THE BOOK

Literature on the issue of performance measurement, though has received attention in numerous publications, is argued to be rare on specialised research studies on the use of operational non-financial measures; their relations with levels of deployment of some technological, managerial, organisational, and environmental factors; and causal relationships among shop-floor non-financial performance evaluation categories. The investigation of such relationships at the shop-floor level in four different countries fills in this gap. Furthermore, the proposed shop-floor non-financial performance measures scorecard provides a framework for understanding the use of SFNFPMs in the five evaluation categories. It is also argued that empirical studies of the interrelationships among different performance perspectives and their measures are in their infancy (Brignall, 2002). De Haas and Kleingeld (1999) and Norreklit (2003) ascertain that the assumption that there is a cause-and-effect relationship between areas of measurement is crucial because measurement of non-financial areas makes the performance measurement system a forward facing control system which mitigates the problem of the historical nature of accounting data (Kaplan & Norton, 1996).

The inclusion of manufacturing firms from different countries was purposive as to broaden the study across the boarders of a specific country. The purpose was to cover manufacturing firms belonging to industrial countries in various continents. However, the specific choice of the four industrial countries included in this research study was largely based on availability of funding and access to data.

The book is organised in four parts and includes 14 chapters. The first three chapters are included in Part I. This chapter introduced the research problem and its importance and Chapters 2 and 3 provide an overview of the relevant literature concerning shop-floor non-financial performance measures and the technological, managerial, organisational, and environmental factors.

Part II comprises five chapters (4–8) and presents the research design and methodology, data collection, and data analyses for the surveyed manufacturing firms in the four countries under study: UK, Italy, Japan, and Canada, respectively.

Part III consists of Chapters 9 and 10. Chapter 9 provides cross-country comparisons while Chapter 10 presents the design and implementation of shop-floor non-financial performance measures scorecard in manufacturing firms of the four countries surveyed.

Finally, Part IV consists of four chapters (11–14) and presents further developments and concluding remarks.

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CHAPTER 2

PERFORMANCE MEASUREMENT SYSTEMS AT OPERATIONAL LEVEL

Ahmed Abdel-Maksoud

1. INTRODUCTION

A key factor in determining commercial viability for an organisation is the role of information about performance, whether for internal or external use (Bhimani, 1993). Performance measurement provides information to assist any organisation in tracking whether what is done is compatible with its strategies and goals. Performance measurement incorporates both financial and non-financial performance indicators. This book focuses on the non-financial performance measures on shop-floor level in manufacturing firms.

This chapter explores the role of performance measurement systems in organisations and the use of financial and non-financial performance measures. It concludes with a discussion of the non-financial performance measures in manufacturing firms. The remaining of this chapter is organised in six sections. The next section discusses the role of performance measurement systems in organisations. The relationship between performance measurement and organisational strategies and objectives is presented in Section 3. Section 4 presents a discussion of the use of financial performance measures, a critique of the dependence on financial measures, and the use of non-financial performance measures. A discussion of the integration between financial and non-financial measures is presented in Section 5. A discussion of non-financial performance measures at shop-floor level, the

Non-Financial Performance Measurement and Management Practices in Manufacturing Firms: A Comparative International Analysis
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focal issue in this book, is presented in Section 6. The last section is a summary of this chapter.

2. THE ROLE OF PERFORMANCE MEASUREMENT SYSTEMS

> Interest in performance measurement is growing at a massive rate. Executives, public policy makers and Government ministers all are seeking new ways to assess the performance of the organisations for which they are accountable. (Neely & Adams, 2000, p. 390)

'Performance' is a difficult term to define. The term does not specify to whom the organisation delivers its 'performance'. It is assumed that any organisation that performs well is one that effectively implements an appropriate strategy (Otley, 1999). An integrated performance measurement is defined as

> The process of acquiring cost and other performance knowledge and employing it operationally at every step in the strategic management cycle. (Shank, 1989, p. 50)

Shank (1989) argues that

> The choice of the term performance measurement reflects an attempt to avoid more traditional accounting terms like control or performance evaluation. If management accounting and the environment in which it operates are currently facing a paradigm shift, it is best to use a term without strong connections to the old paradigm. The interdisciplinary view required by strategic management calls forth a wider frame of reference than traditional notions of control or performance evaluation. (p. 50)

Performance measurement is a key part of the organisational infrastructure (Neely & Adams, 2000; Kennerley & Neely, 2002; Epstein, 2006). "Performance measurement is an integral part of all management processes and traditionally has involved management accountants through the use of budgetary control and the development of financial indicators" (Chenhall, 1997, p. 187). It encompasses the set of organisational polices, systems, and practices that co-ordinates actions and transfers information in support of the entire business management cycle. This cycle is comprised of (Shank, 1989, p. 50):

- Formulating strategies.
- Communicating those strategies throughout the organisation.
- Developing and carrying out tactics to implement the strategies.
- Developing and implementing controls to monitor the success of the implementation steps and hence the success in meeting the strategic objectives.

The relationship between performance measurement and organisational strategies and objectives is discussed next.

3. PERFORMANCE MEASUREMENT AND ORGANISATIONAL STRATEGIES AND OBJECTIVES

Performance measurement is involved in all aspects of a business management cycle. Performance needs to be assessed in determining the adequacy of the strategies for achieving organisational objectives, in revising the strategies, in communicating them, and in development of tactical objectives as well as in its traditional role of control feedback (Maskell, 1992; Nanni, Dixon, & Vollman, 1992; Neely & Adams, 2000; Kennerley & Neely, 2002; Epstein, 2006).

Otley (1999) argues that "the process of performance measurement begins with the establishment of strategy. What is the business unit attempting to achieve and why? How do these strategic objectives relate to the products and services that customers will want and be willing to pay for?" (p. 44).

Five main sets of issues need to be addressed in developing a framework for managing organisational performance. They can conveniently be represented as a set of five questions. Otley (1999) argues that "the questions themselves appear to remain constant, but organisations need to continually develop new answers to them. This is because the context in which the organisation is set is constantly changing and new strategies need to be developed to cope with new operating environment" (p. 365). The five sets of questions are (Moon & Fitzgerald, 1996; Otley, 1999, pp. 365–366):

1. What are the key objectives that are central to the organisation's overall future success, and how does it go about evaluating its achievement for each of these objectives?

   This is concerned with the definition of goals and measurement of goal attainment in terms of meeting stakeholder aspirations. The relative importance given to different goals reflects the relative power of different stakeholders. The issue of evaluating organisational effectiveness cannot be addressed without confronting these issues.
2. What strategies and plans has the organisation adopted and what are the processes and activities that it has decided will be required for it to

successfully implement these strategies? How does it assess and measure the performance of these activities? This is connected with strategy formation and deployment, business process and operations management. It presents the codification of the means by which objectives are intended to be attained.

3. What level of performance does the organisation need to achieve in each of the areas defined in the above two questions, and how does it go about setting appropriate performance targets for them?

   This is more traditional and a long degree of research connected with it, but remains important, as is reflected in the emphasis given to practices such as benchmarking.

4. What rewards[1]/penalties will managers (and other employees) gain/suffer by achieving/not achieving these performance targets?

   This has tended to be neglected by those concerned with performance measurement as being in the purview of the human resources management function. However, the interconnection between the two fields needs to be better recognised to avoid counter-productive examples of short-termism driven by financial incentive schemes.

5. What are the information flows (feedback and feed-forward loops) that are necessary to enable the organisation to learn from its experience, and to adapt its current behaviour in the light of that experience?

   This needs to be better linked to issues such as the learning organisation, employee empowerment and emergent strategy.

Otley (1999), in commenting on the questions above, argues that information is necessary to complete any control loop (feedback/feed-forward)[2] where there is a role for immediate corrective action to rectify the perceived problem, and for double-loop learning to take place to improve the system in such a way that errors do not occur again in the same way. A key issue in documenting such feedback loops is to, Otley continues, "distinguish the different timescales and learning processes involved. These timescales may range from the instantaneous (in real-time production control systems) through hours, days, weeks, months, quarters, years, and beyond. The learning processes range from simple corrective action through to the revision of a corporate strategy if it becomes apparent that the current strategy is proving inefficient". Otley, accordingly, advocates the integration of the five areas – objectives, strategies and plans, performance, rewards/penalties, and information flow – to provide a description of overall management control and performance management systems of an organisation.

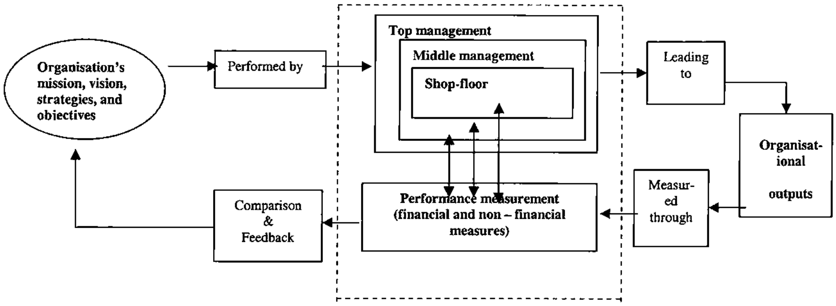

Fig. 1. The Proposed Role of Performance Measurement in an Organisation.

The author suggests that a separation between different management levels needs to be precisely drawn when considering the role of performance measurement in organisations. A proposed multi-level illustration of the role of performance measurement in achieving organisational strategies and objectives is presented in Fig. 1.

Fig. 1 explains that an organisation's strategies and objectives will be achieved through every management level in the organisation (from the top management level down to the shop-floor level). Everyone in the organisation should understand the organisation's strategy and be motivated to help to achieve it (see Kaplan & Norton, 2001). Everyone in the organisation should align his/her day-to-day activities to accomplish strategic objectives and to find new and innovative opportunities for contributing to organisational objectives (Ittner & Larcker, 1998; Kaplan & Norton, 2001).

Evaluating performance differs across the three different management levels (top management, middle management, and shop-floor level) specified in the figure above (see, for example, Ittner & Larcker, 1998; Kaplan & Norton, 2001). Performance measurement of each management level comprises financial and non-financial performance measures. It is argued that senior managers are well trained and adapted with financial measures (McWilliams, 1996; Anthony & Govindarajan, 2001) and that the use of financial measures at middle and top management levels is linked to compensation (Lingle & Schiemann, 1996; Ittner & Larcker, 1998). Kaplan and Norton (2001) argue that shop-floor staff are the ones who will be implementing the strategy and that non-financial performance measures are preferred to financial measures in evaluating performance at shop-floor level. Accordingly, the emphasis of this research study is confined to non-financial performance measures on the shop-floor level as detailed in the following section.

4. FINANCIAL AND NON-FINANCIAL PERFORMANCE MEASURES

A performance measurement system incorporates both financial and non-financial measures. Performance measures are designed to help an organisation to track whether it is moving in the direction it wants (Neely & Adams, 2000; Kennerley & Neely, 2003).

The role of information about performance in any organisation is a key factor in determining commercial viability (Bhimani, 1993). The role of performance measures in an organisation is in providing information to assist in both operational and strategic controls. The former is concerned with maintaining the process capabilities of elements within advanced manufacturing technology (AMT) and innovative managerial practice (IMP) programmes (Chenhall, 1997). Strategic control encourages managers to examine the outcomes of various parts of the manufacturing process. It assists in assessing potential complementarities among elements of AMTs and IMPs (Chenhall, 1997).

Performance measures may be used for different organisational purposes (CIMA, Open Forum, 1999, p. 38):

- Cultural changes, e.g. from administrative to managerial.
- Realignment of focus, e.g. inward-looking to customer-oriented.
- Education of personnel, in concepts like accountability and services.
- Initiating, monitoring, and evaluating change, e.g. strategic plan, re-engineering.

Commentators advocate that performance measures should have some key characteristics and values such as (CIMA, Open Forum, 1999, p. 40):

- They should be simple, relevant, and balanced.
- Existing information systems should be used, if possible.
- Performance measures do not exist in isolation, and should be used in the context of the integrated system of planning, budgeting, objective setting, monitoring, and controlling in which they exist.
- Even the best performance measures by themselves are valueless, but if they promote proper action, they are priceless.

Performance measures comprise both financial and non-financial indicators. The next two sections shed light on the use of financial performance and non-financial measures, respectively.

4.1. Financial Performance Measures

In the nineteenth century, during the industrial revolution, enterprise owners committed significant sums of capital to their production processes, and in order to use these sums efficiently, they hired workforce staff on a long-term basis rather than spot contracting (Johnson & Kaplan, 1987; Borden, 1990). That was synchronised with the deployment of an 'organisational hierarchy' theme that created a demand for an accounting information system which provides management with the information it needs. Information provided by that system was tailored to meet management's need and there was a demand to determine the 'price' of output from production operations (Johnson & Kaplan, 1987; Borden, 1990). Such a system devised simple measures to summarise the efficiency with which labour and material were converted into finished goods and to motivate and evaluate managers (Johnson & Kaplan, 1987). These measures were mainly financial and focused on conversion costs and production measures such as cost per hour produced (Johnson & Kaplan, 1987).

In the early twentieth century, the demand for financial reporting and disclosure flourished because of pressures placed on firms by capital markets, regulatory bodies, and taxation of income. But, by that time, the demand for financial reports audited by independent public accountants was paramount (Johnson & Kaplan, 1987). Johnson and Kaplan (1987) argue that effective management accounting systems were necessary by that time to co-ordinate efficiently the logistical, conversion, and distribution activities and to provide summary measures of performance. Manufacturing firms, in that era, were keen to provide statements to the market that focused on financial performance measures.

In the late twentieth century, researchers (e.g. Kaplan, 1983; Johnson & Kaplan, 1987; Vollman, 1989; Chenhall, 1997; Otley, 1997; Kaplan & Norton, 1996; Ittner & Larcker, 1998) criticised traditional management accounting systems that depended heavily on financial performance measures. They urged the development of measures of manufacturing performance to assess the key factors that affect a company's performance in a rapidly changing environment. Johnson & Kaplan (1987) argue that financial measures, in the late twentieth century, became invalid indicators of the performance of the enterprise. They argue that the role of financial performance measures was undermined by changes in technology, shortened product life cycles, and innovations in the organisation of production operations. Commentators (e.g. Kaplan, 1983) recommend that improved measures of quality, inventory performance, productivity, flexibility, and innovation are essential. The next section discusses the critique of the use of financial performance measures.

4.2. Critique of Financial Performance Measures

Commentators argue that traditional management accounting systems provide a misleading target for managerial attention and fail to provide the relevant set of measures that appropriately reflect the technology, the products, the processes, and the competitive environment in which the organisation operates (Johnson & Kaplan, 1987). It is argued that traditional performance measures are 'followers' of action and are too general to provide effective assessments of managerial competence and too late to render timely feedback (Vollman, 1989; Chenhall, 1997). Otley (1997) argues that

> Sometimes we only measure what is easy to measure (often hidden under the term 'performance indicators'). Sometimes we focus on the relatively unimportant and neglect the critical success factors. Sometimes we confine ourselves to considering only financial performance measures rather than a wider range. (p. 44)

The deployment of financial performance measures has been widely criticised. Financial measures are not sufficiently meaningful for the control of a production or distribution plant (Maskell, 1989; Bhimani, 1993). Johnson and Kaplan (1987) argue that managers relying on financial information become isolated from the value creating operations of the organisation.

Several reasons have been identified as causes for the adoption of non-financial performance measures by firms (Brancato, 1995; Ittner & Larcker, 1998, pp. 217–218):

1. *Perceived limitations in traditional accounting-based measures*. Companies believed that, relative to key non-financial indicators, traditional accounting measures:
   - Are too historical and 'backward-looking'.
   - Lack predictive ability to explain future performance.
   - Reward short-term or incorrect behaviour.
   - Are not actionable, providing little information on root causes or solutions to problems.
   - Do not capture key business changes until it is too late.
   - Are too aggregated and summarised to guide managerial actions.

- Reflect functions, not cross-functional processes, within a company.
- Give inadequate consideration to some 'intangible' assets such as intellectual capital.

  By incorporating non-financial indicators into their measurement systems, many firms have opted to create a wider set of measures that capture not only firm value, but also the factors leading to the creation of value in the business.

2. *Competitive pressure*. Many firms experience a shock to their operating environments that motivate management to find new ways of managing, measuring, and controlling operations. The substantial changes in the nature and intensity of competition force firms to determine and measure the non-financial 'value drivers' leading to success in the new competitive environment.

   The greater emphasis placed on non-financial measures in firms facing competitive pressure is consistent with research finding positive associations between perceived environmental uncertainty and the demand for broad-based information systems incorporating non-financial indicators (Chenhall & Morris, 1986).
3. *Outgrowth of corporate initiatives*. Some firms adopt non-financial measures as an outgrowth of improvement initiatives that require new performance indicators, especially the adoption of IMPs/AMTs.

   Many management accounting researchers argue that effective IMPs/AMTs require timely, detailed process information for identifying the sources of defects and monitoring the consequences of subsequent improvement activities – information that typically is not available from aggregate accounting data (Kaplan, 1983; Johnson, 1992). The quality management literature also maintains that IMPs/AMTs require greater emphasis on customer requirements and customer satisfaction with the firm's products or services, leading to greater emphasis on non-financial customer measures such as complaints, satisfaction, and retention.

The next section introduces the use of non-financial performance measures, while the importance of the integration between financial and non-financial performance measures in any performance measurement system is discussed in the fifth section.

4.3. Non-Financial Performance Measures

It has been argued that traditional accounting measures do not provide feedback on the effectiveness of IMPs/AMTs (Kaplan, 1983; Drucker, 1990;

Conti, 1993; Ittner & Larcker, 1998). It is also argued that traditional financial performance evaluation systems are not sufficiently comprehensive to assess efforts to improve competitiveness through IMPs/AMTs (Kaplan, 1983; Vollman, 1989; Borden, 1990; Johnson & Thomas, 1990; Kaplan & Norton, 1996; Neely & Adams, 2000; Taylor, Soobaroyen, & Ah-hen, 2001).

There has been a transformation from an emphasis on financial indicators to non-financial indicators.[3] Commentators argue that financial reports are confusing, misleading, and irrelevant to the daily operations of a business. They do not address aspects of a company's business such as quality, employee participation, production synchronisation, on-time deliveries, and customer satisfaction. Commentators, also advocate the use of non-financial measures in reporting performance (Kaplan, 1988; Otley, 1997; Kaplan & Atkinson, 1998; Neely & Adams, 2000). For instance, Kaplan (1988) argues that

> Every time you send a financial report from an operating unit to some level of management, you should also include a set of operating performance measures showing physical rather than financial information. These show much better how well the company has been performing and are much more action-orientated than are the usual monthly financial reports. Short-term measures of financial performance and profit are very poor measures of how much wealth the company has created in a short period of time. (p. 39)

Johnson and Kaplan (1987) argue that "a call for more extensive use of non-financial indicators is a call for a return to the operations-based measures that were the origin of management accounting systems" (p. 259). They continue that, the initial goal of management accounting systems in the nineteenth century was to provide information on the operating efficiency of organisations. Measures were designed to help management, not to prepare financial statements.

Non-financial performance measures should be based on the company's strategy and include key measures of manufacturing, marketing, and R&D success. For instance, a company emphasising quality could measure internal failure indicators (scrap, defects, rework) and external failure indicators (customer complaints, service calls) (Johnson & Kaplan, 1987).

Production rates, yield quantities, reject rates, schedule changes, and on-time deliveries are some of the aspects that the interest of manufacturing operators is directed to (Maskell, 1989; Bhimani, 1993). It is argued that day-to-day control of the manufacturing and distribution operations are better handled with non-financial measures (Maskell, 1989; Bhimani, 1993; Taylor et al., 2001). These measures should be in real time and in a much finer level of detail than traditional financial controls (Vollman, 1989; Chenhall, 1997). Aspects such as customer service, productivity, quality, flexibility, delivery time, competitive position, and production process time permeate the literature on manufacturing performance measures (Maskell, 1989; Bhimani, 1993).

5. NON-FINANCIAL AND FINANCIAL PERFORMANCE MEASURES: A COMPLEMENTARY PERSPECTIVE

The recent emphasis on the use of non-financial indicators in evaluating performance does not mean that financial indicators are becoming obsolete. Commentators advocate a complementarity between the use of financial and non-financial measures in any performance measurement system (Bourguignon, Malleret, & Norreklit, 2004). For instance, Bromwich and Bhimani (1994) argue that monitoring performance may be improved if non-financial information is utilised together with financial information.

Commentators interested in the choice of performance measures indicate that performance measurement and reward systems should incorporate any financial or non-financial measure that provides incremental information on managerial effort (Holmstrom, 1979; Bhimani, 1994; Ittner & Larcker, 1998). For instance, Kaplan (1988) states that

> Financial results will still be important, but they should be just one of several types of performance measurements. (p. 39)

Also, Bhimani (1993) argues that

> Many commentators implicitly assume that financial and non-financial performance measures can be combined in complementary ways. (p. 20)

Kaplan and Atkinson (1998) advocate that financial control will continue to be an important management tool because of its aggregate nature and its direct relationship to the primary objectives of profit-seeking organisations.

There is ample evidence from surveys conducted in many countries that financial performance measures continue to be important (Lyall, Okah, & Puxty, 1990; Mckinnon & Bruns, 1992; CIMA, 1993; Drury, Braund, Obsorne, & Tayles, 1993; Dugdale, 1994; Bruggeman, Slagmulder, & Waeytens, 1996; Groot, 1996; Israelsen, Anderson, Rohde, & Sorensen, 1996; Lingle & Schiemann, 1996; Chenhall & Langfield-Smith, 1998a, 1998b, 1998c).

In the UK, Lyall, Okah, and Puxty's (1990) study of 423 British companies suggests that traditional financial control systems continue to be used extensively in industry and are adapted successfully to meet the challenges of developments in production and information technologies. Also, the CIMA (1993) survey of the use of performance measures found that financial measures, such as financial return and working capital, dominated. Moreover, Drury et al. (1993) found that 76% of companies used standard costing widely to aid budgeting as well as performance evaluation.

In further UK studies, Dugdale (1994) reported that respondents identified budgeting as a key activity, ranking budget-related items third and eighth out of a range of 30 management accounting techniques. Chenhall and Langfield-Smith (1998a) argue that

> Evidence from mainland Europe confirms the importance of financial measures. For example, cost-based performance criteria are considered very important in Belgium (Bruggeman et al., 1996) and Denmark (Israelsen et al., 1996); budgetary measures based on standard costing and contribution margins are used widely in Germany (Scherrer, 1996); and financial accounting-based measures, particularly ROI and profit, dominate performance evaluation in the Netherlands. (Groot, 1996, p. 6)

In the USA, a survey by Mckinnon and Bruns (1992) indicates that managers rate budgeted compared to actual sales, profit, and income as the most important performance measures out of a list of 96 financial and non-financial measures. Also, Lingle and Schiemann (1996) surveyed 203 executives on the quality, uses, and perceived importance of various financial and non-financial performance measures. The majority of respondents (82%) evaluated financial information highly. In Canada, Gosselin (2004) survey shows that most of the surveyed companies use primarily financial measures.

Furthermore, the Chenhall and Langfield-Smith (1998a) study of Australian companies shows that respondents perceive financial measures as being important in a long-term perspective. Their study reports that financial measures will continue to be important in the future. For example, they report that the importance of financial characteristics such as budgeting for controlling costs, budget variance analysis, return on investment, and divisional profit and controllable profit are affirmed by their high future emphasis and are regarded as having continuing relevance in the future.

> Respondents indicated that traditional planning techniques will retain their importance in the future. (Chenhall & Langfield-Smith, 1998a, p. 12)

In the meanwhile, the growing importance of non-financial measures is noted in many surveys. In the UK both CIMA's (1993) and Drury et al.'s (1993) report an increase adoption of non-financial indicators in the surveyed firms. Bhimani (1994) reports that executives are receptive to the use of non-financial indicators. In Dugdale's (1994) survey, despite the high ranking given to budgetary measures, non-financial measures ranked relatively high in importance. In Italy, Arena, Azzone, and Caimi (2004) survey highlights the growing interest, among the surveyed Italian firms, on the use of non-financial performance measures.

Commentators argue that the monitoring and planning of performance may be improved when non-financial information is utilised together with financial information (Bromwich & Bhimani, 1994). For instance, Banerjee and Kane (1996) found that 85% of surveyed CIMA members believe that accountants need to integrate non-financial and financial information in their reporting. This could be of a great help when some costs are difficult to define and to measure (Bromwich & Bhimani, 1994).

This consensus among commentators in management accounting about the increased emphasis on both financial and non-financial measures is consistent with two trends that have dominated recent arguments about performance measurement. These are (Ittner & Larcker, 1998, p. 209):

- Deployment of 'new' financial measures that are claimed to overcome some of the limitations of traditional financial performance measures.
- Greater emphasis on 'forward-looking' non-financial measures such as customer satisfaction, employee satisfaction, and defect rates.

The integration between financial and non-financial measures creates the need for a balanced set of measures that provide both short-term performance measures and indicators of future financial performance. The balanced scorecard (BSC) emerged in the 1990s as an example of the recent trends in emphasising the integration and complementarity between financial and non-financial performance indicators in any performance measurement system (Kaplan & Norton, 1992, 1996; Ittner & Larcker, 1998). The balanced scorecard (BSC) incorporates four financial and non-financial perspectives and aims to "provide a comprehensive framework for translating a company's strategic objectives into a coherent set of performance measures" (Drury, 2001, p. 493). A brief description of the BSC is presented in the appendix.

The next section discusses the use of performance measures at operational level in manufacturing firms.

6. NON-FINANCIAL PERFORMANCE MEASURES AT OPERATIONAL LEVEL IN MANUFACTURING FIRMS

It has been claimed that performance measurement systems in use in manufacturing firms have remained static in spite of the significant transformation witnessed in management approaches and production processes.[4] Commentators advocate the revision of the information captured by performance measurement as one approach to address these changes (Clark, 1989; Mather, 1989; Dixon, Nanni, & Vollmann, 1990; Kaplan & Norton, 1992).

The issue of non-financial performance measures has been addressed by many researchers from different perspectives. For instance, some researchers advocate the use of non-financial performance measures as 'leading' indicators that provide information on future performance that is not contained in current accounting measures (see, Ittner & Larcker, 1998; Neely & Adams, 2000). Other researchers focus on integrating non-financial performance measures within performance measurement systems (see, for instance, Kaplan & Norton 1992, 1996; Neely & Adams, 2000; Kennerley & Neely, 2003). Others focus on the use of non-financial performance measures and its implications on performance consequences (see, Said, HassabElnaby, & Wier, 2003; Surysekar, 2003) and environmental uncertainty (Hoque, 2005).

Manufacturing performance measurement on operational control is important in ensuring that production elements operate efficiently (Chenhall, 1997). Operational and strategic control are linked (Chenhall, 1997). Using manufacturing measures for operational control provides the capability to recognise deviations in the manufacturing process and signals a need for process adjustments (Chenhall, 1997). Ferreira and Lin (1990) argue that firms need to collect, report, and analyse data about key operational factors. They argue that these measures should be linked to the company's strategy. Operational measures should be "derived directly from the strategies chosen and be consistent with the long-term organisational goals" (Ferreira & Lin, 1990, p. 249).

Leading manufacturers in Europe, Japan, and USA have been found to focus on certain broad categories of performance measures (Maskell, 1989; CIMA, 1993, 1996; Otley, 1997; Ittner & Larcker, 1998):

- On-time delivery.
- Product quality.
- Customer satisfaction.
- Employee morale.
- Efficiency and utilisation.
- Product development.

The first five categories formed the framework that guided this research and, given the importance of the role played by shop-floor, operational performance is central to this research. In addition, despite the importance of non-financial performance measures, previous research results indicate the lack of a link between key non-financial performance measures and the shop-floor. Brancato's (1995) case study on USA firms reports that none of participants could precisely quantify the link between key non-financial performance measures and the bottom line. The focus of this research is confined only to the shop-floor non-financial performance measures in each of the following five evaluation categories: on-time delivery, product quality, customer satisfaction, employee morale, and efficiency and utilisation.

The relationship between these five evaluation categories and performance measurement at shop-floor level is depicted in Fig. 2. Fig. 2 expands Fig. 1 (see, Section 3) further whereas it presents a proposed structure of performance measurement on the shop-floor of manufacturing firms with a specific emphasis on non-financial performance measures.

The product development category is not included in this framework as being irrelevant at the shop-floor. This was revealed from different piloting stages that have been undertaken on the questionnaire form, including interviewing managers of two UK manufacturing firms. Incorporating measures of product development was considered, but it was concluded that these measures are more related to engineering and marketing functions in organisations and are generally at a higher organisational level than at shop-floor level (see next chapter).

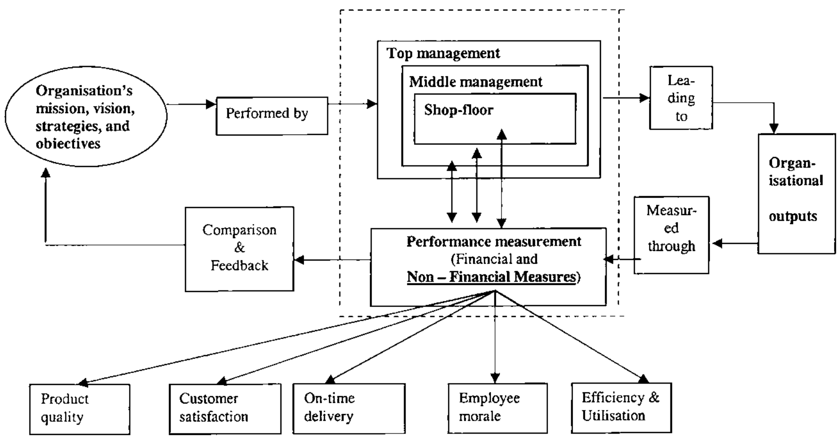

Fig. 2. Proposed Components of Shop-Floor Performance Measurement.

7. SUMMARY

This chapter has shed light on performance measurement systems in manufacturing firms and emphasised the important role of non-financial performance measures in performance measurement systems. It has also emphasised the integration of non-financial and financial performance measures. It finally discussed the use of non-financial performance measures at shop-floor level where five evaluation categories are proposed.

Performance measurement is argued to be a key part of any organisational infrastructure and an integral part of all management processes. Performance measurement has, traditionally, involved the use of budgetary control and the development of financial indicators. It encompasses the set of organisational polices, systems, and practices that co-ordinates actions and transfers information in support of the entire business management cycle. Commentators advocate that performance, in its traditional role of control feedback, needs to be assessed in determining the adequacy of the strategies for achieving organisational objectives, revising and communicating strategies, and developing tactical objectives.

It is recommended that performance measurement process begins with strategy establishment, determining how these strategic objectives would be related to the products and services that meet customers' need. The author presents a proposed multi-level illustration of the role of performance measurement in achieving organisational strategies and objectives. The proposed illustration suggests that a separation among different management levels (top management, middle management, and shop-floor level) needs to be precisely drawn when considering the role of performance measurement in organisations. An organisation's strategies and objectives will be achieved through every management level in the organisation (from the top management level down to the shop-floor level). Everyone in the organisation should understand the organisation's strategy, be motivated to help to achieve it, align his/her day-to-day activities to accomplish strategic objectives, and to find new and innovative opportunities for contributing to organisational objectives (Ittner & Larcker, 1998; Kaplan & Norton, 2001).

Performance evaluation differs across the three different management levels (Ittner & Larcker, 1998; Kaplan & Norton, 2001). Performance measurement of each management level comprises financial and non-financial performance measures. The chapter presents a discussion of the use of financial performance measures in performance measurement systems and the evolution of such systems to deploy, more heavily, non-financial performance measures. However, the chapter highlights the need for complementarity between the use of financial and non-financial performance measures in any performance measurement system.

It is argued that senior managers are well trained and adapted with financial measures (McWilliams, 1996; Anthony & Govindarajan, 2001), and that the use of financial measures at middle and top management levels is linked to compensation (Lingle & Schiemann, 1996; Ittner & Larcker, 1998). Kaplan and Norton (2001) argue that shop-floor staff are the ones who will be implementing the strategy and that non-financial performance measures are preferred to financial measures in evaluating performance at shop-floor level.

Operational and strategic controls are linked (Chenhall, 1997). Manufacturing performance measurement on operational control is important in ensuring that production elements operate efficiently and providing the capability to recognise deviations in manufacturing process and signalling a need for process adjustments (Chenhall, 1997).

Leading manufacturers in Europe, Japan, and USA have been found to focus on certain broad categories of performance measures (Maskell, 1989; CIMA, 1993, 1996; Otley, 1997; Ittner & Larcker, 1998). These categories formed the framework that guided this research and, given the importance of the role played by shop-floor, operational performance is central to this research. The focus of this research is confined only to the shop-floor non-financial performance measures in each of the following five evaluation categories: on-time delivery, product quality, customer satisfaction, employee morale, and efficiency and utilisation. The relationship between these five evaluation categories and performance measurement at shop-floor level is depicted in Fig. 2 which presents a proposed structure of performance measurement on the shop-floor of manufacturing firms with a specific emphasis on non-financial performance measures.

The next chapter reviews the literature related to the association between shop-floor non-financial performance measures in each of the five evaluation categories above and different contingent managerial, technological, organisational, and environmental factors.

NOTES

1. Otley argues that "rewards should be understood in the widest possible sense, and not be restricted to just short-term financial rewards, important though these may well be" (p. 366).

2. "In its traditional feed-back form, information on actual performance is compared with pre-set targets and standards and deviations used to signal the need for corrective action. In addition, feed-forward (or planning) information may be used to predict the need for corrective action before adverse consequences are observed" (Otley, 1999, p. 368).

3. See, for example, Kaplan (1983, 1988), Clark (1989), Mather (1989), Maskell (1989, 1992), Vollman (1989), Dixon et al. (1990), Drucker (1990), Johnson and Thomas (1990), Hall, Johnson, and Turley (1991), Kaplan and Norton (1992), Bhimani (1993, 1994), Bromwich and Bhimani (1994), Otley (1997), Chenhall and Langfield-Smith (1998a, 1998b), Kaplan and Atkinson (1998), Jazayeri and Hopper (1999), and Neely and Adams (2000).

4. See, for example, Kaplan (1983), Clark (1989), Mather (1989), Maskell (1989), Vollman (1989), Dixon et al. (1990), Drucker (1990), Johnson and Thomas (1990), Hall et al. (1991), Kaplan and Norton (1992), Conti (1993), Banker, Potter, and Schoreder (1993), Bhimani (1993, 1994), Bromwich and Bhimani (1994), Otley (1997), and Chenhall and Langfield-Smith (1998a).

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APPENDIX. THE BALANCED SCORECARD

The balanced scorecard (BSC) was developed by Kaplan and Norton at Harvard Business School since early 1990. It is a "multi-dimensional approach to performance measurement and management that is linked specifically to organisational strategy" (Otley, 1999, p. 374). It is, also, defined as a set of measures that gives top management a fast but comprehensive view of the business (Kaplan & Norton, 1992, 1996). It translates the vision and strategy of an organisation into a comprehensive set of performance measures (Kaplan & Norton, 1996).

The BSC measures an organisation's performance from four key perspectives: financial, customer, internal business processes, learning and growth (*ibid.*). "It suggests that as well as financial measures of performance, attention should be paid to the requirements of customers, business processes and longer-term sustainability'' (Otley, 1999, p. 374). These performance measures represent the critical success factors necessary for continued business success and they must be linked to the business strategy (Kaplan & Norton, 1996; Otley, 1999). The tighter connection between the measurement system and strategy elevates the role for non-financial measures from operational checklist to a comprehensive system for strategy implementation (Kaplan & Norton, 2001).

Kaplan and Norton (1996, p. 31) assume causal relationships among measures in the four perspectives. They assume that measures of 'learning and growth' are drivers of the measures of 'internal business processes' which in turn are drivers of measures of 'customer perspective', and that the latter measures are drivers of financial measures. Each strategic area should have both lead and lag indicators, yielding two directional cause-and-effect chains: lead and lag indicators (Kaplan & Norton, 1996; Bourguignon et al., 2004). Kaplan and Norton (2001), in their book *The Strategy Focused Organization*, illustrate by means of case studies how many companies have implemented the BSC.

CHAPTER 3

SHOP-FLOOR NON-FINANCIAL PERFORMANCE MEASURES AND THE CONTINGENT VARIABLES

Ahmed Abdel-Maksoud

INTRODUCTION

In order to fully understand the use of non-financial performance measures (NFPMs) in shop-floor performance measurement systems, there is a need to focus not only on the non-financial measures themselves, but also on the stage of choosing and using these measures. Contemporary management practices, balanced scorecard for instance, emphasise the importance of the deployment of NFPMs, but they do not determine factors that drive the use of specific NFPMs in different firms.

The determination of factors that affect, in reality, the use and importance of non-financial performance measures could be essential in enhancing firms' knowledge about achieving a better use of non-financial measures. As the shop-floor is the central theme of this research, the focus will be on factors that affect the use and importance of the deployed shop-floor non-financial performance measures (SFNFPMs).

This chapter introduces a contingency framework for the factors that potentially affect the use and importance of SFNFPMs in manufacturing firms. The remainder of this chapter is organised in seven sections. The next

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section discusses a contingency-based approach to factors affecting SFNFPMs, these factors are classified into internal factors (managerial, technological, and organisational factors) and external (environmental) factors. The chapter then discusses the managerial, technological, organisational, and competition-incorporated factors.

A CONTINGENCY APPROACH TO FACTORS AFFECTING PERFORMANCE MEASUREMENT

The literature provides evidence of the effect of different managerial, technological, organisational, and environmental factors on performance measures in organisations. Some commentators (Khandwalla, 1972; Otley, 1980; Chenhall & Morris, 1986; Lee, 1987; Drucker, 1990; CIMA, 1993; Otley, 1997, 1999) suggest that elements such as the nature of competition, the extent of deployment of innovative managerial practices (IMPs) and advanced manufacturing technologies (AMTs), and structural innovations such as team-based work groups are important in understanding the type of performance measures best suited to particular organisations.

Chenhall and Morris (1986) have called for more research that examines the influence of contextual settings on the effective design of management accounting systems. They argue that a variety of contingency frameworks have shared a concern with organisational factors such as the external environment, organisational size, diversity, technology, and formal structure. Also, Lee (1987) argues that performance measures are explained by different environmental, functional, and asset variables. He states that "strategic variables, which are regarded as the key factors in explaining success or failure of the organisation, include competitors' actions and changes in industry (environmental variables); market share, product quality, and delivery performance (functional variables); and return on investment and inventory turnover (asset variables)" (Lee, 1987, p. 64). He emphasises the speed and unpredictability of change in these variables. Thus, they need constant attention since management controls that focus on the wrong variables produce adverse results.

In addition, Bruggemman and Slagmulder (1995) suggest that "changes in the environment, the strategy, the organisation, and the technology of a company lead to new decision making and control problems. Thus there will be a need for relevant management accounting and cost information" (p. 249).

The use and performance consequences of NFPMs in organisations adopting AMTs/IMPs have been the focus of various studies. Virtually, all of these studies prove positive associations between the emphasis placed on IMPs/AMTs and the provision of NFPMs such as defect rates, on-time delivery, and machine utilisation (Daniel & Reitsperger, 1991; Banker, Potter, & Schoreder, 1993; Abernethy & Lillis, 1995; Perera, Harrison, & Poole, 1997). 'World class' performance became essential to UK companies' international competitiveness in the late 1980s (Jazayeri & Hopper, 1999). The term 'world class' tended to be associated with the benchmarking of UK companies against the performance and attributes of their major international competitors (Jazayeri & Hopper, 1999). World class manufacturing (WCM) is

> A synthesis of management techniques in a contemporary manufacturing environment covering three broad areas: people, process, and quality. In WCM, eight areas are deemed to be crucial: structured management skilled in managing cultural changes, a total quality ethic, employee involvement, an awareness of customers, supply chain management, business process engineering, integrated and automated manufacturing, and product innovation. (Jazayeri & Hopper, 1999, p. 265)[1]

WCM is based on the belief that competitive manufacturing requires an emphasis on customer service, high quality, timeliness, and employee involvement (Hall, Johnson, & Turley, 1991). Although new performance measures used by world class manufacturers vary considerably among different manufacturers, commentators argue that measures in any successful performance measurement system must (Maskell, 1992, p. 44):

- Be directly related to manufacturing strategy.
- Deploy non-financial performance techniques.
- Vary between locations.
- Change over time as company needs change.
- Provide fast feedback to operators and managers.
- Intend to foster improvement rather than just monitoring.

With emphasis placed on non-financial measures in WCM, Jazayeri and Hopper (1999) argue that issues such as: continuous improvement, computerised information systems, and changed management structures and roles are likely to impact upon the role of management accounting.

Evidence permeates the literature on the influence of different factors in determining the type of performance indicators in UK firms. For instance, Drury, Braund, Obsorne, and Tayles (1993) survey of UK manufacturing firms identifies some significant management accounting problems. These are (pp. 71–72):

- Obtaining accurate and timely information online to the shop-floor level.
- Educating employees to interpret more fully the information produced.
- Adaptation to the deployment of advanced manufacturing techniques.
- Keeping up with changes in manufacturing philosophy and practice.
- Changing information gathering systems so that they become real time and interface with each other.
- Improving ability to do competitive analysis.

Also, the CIMA (1993) study of UK manufacturers shows that a number of influencing factors exist in determining the types of performance indicators a company is likely to adopt and the way in which they might be used (CIMA, 1993; also reported in Bhimani, 1993, 1994):

1. Many performance indicators in small companies appear to be primarily for the use of top managers, or the managing director. Thus performance indicators reflect the management style of the manager concerned.
2. The manufacturing process plays a large part in determining the preferred performance measures, for example, a company adopting just-in-time (JIT) production is likely to deploy novel measures of stock levels and delivery performance. Also, the adoption of a total quality management (TQM) philosophy tends to be matched by an enhanced level of quality tracking. In compliance with this trend, the Jazayeri and Hopper (1999) survey shows that changes in performance measures in some surveyed companies began with their adoption of manufacturing resource planning (MRPII).
3. The dynamics of the market in which a company operates affects the choice of performance indicators. For example, where the market becomes more competitive a company often reacts by reorganising itself. External influences therefore often affect an enterprise's approach to measuring the performance of its activities by forcing a reassessment of its very structure.

CIMA (1993) also focuses on the important role of 'front-line' workers. If an organisation wants to grow beyond today's financial and customer satisfaction performance, adhering to standard operating procedures established by organisational managers is not sufficient. Ideas for improving processes and performance for customers must increasingly come from 'front-line' workers who are closest to internal processes and the organisation's customers.

The Contingency Framework

Following Khandwalla (1972), Otley (1980), Lee (1987), Drucker (1990), Daniel and Reitsperger (1991), Banker et al. (1993), CIMA (1993), Abernethy and Lillis (1995), Bruggemman and Slagmulder (1995), Drury and Tayles (1995), Ittner and Larcker (1995), Otley (1997), Perera et al. (1997), Chenhall and Langfield-Smith (1998a, 1998b, 1998c), and Jazayeri and Hopper (1999) who suggest that variables such as organisational structure, environmental factors, and the extent of IMPs/AMTs are important in understanding performance measurement systems, a contingency framework has been adopted in this research.

Hartmann (2000) argues that, in most cases, there is a pragmatic motive for the use of contingency framework, which is presented by using the outlines of contingency theory to study any contextual variable. The contingency approach to management accounting is based on the premise that there is no universally appropriate accounting system which applies equally to all organisations in all circumstances. Rather, it is suggested that particular features of an appropriate accounting system will depend upon the specific circumstances in which an organisation finds itself. Thus a contingency theory must identify specific aspects of an accounting system which are associated with certain defined circumstances and demonstrate an appropriate matching (Otley, 1980).

Luther and Longden (2001) argue that contingency theory is concerned with relationships between exogenous and endogenous factors that influence organisational performance. They argue that the most appropriate organisational management information and control systems will be contingent upon the specific circumstances in which an organisation finds itself. Nanni, Dixon, and Vollman (1992) argue that "one way to describe the process inherent in a contingency approach to management accounting services is by recognising the complementary relationships among strategies, actions, and measures" (p. 8). They argue that an organisation's actions should be taken to support its strategies, while performance measurement should be based on a system that tracks progress in executing the strategies in terms of the actions taken (Dixon, Nanni, & Vollmann, 1990; Nanni et al., 1992).

This research study's methodological approach is based on contingency theory with its central premise that each structure is a response to a set of various contingencies. Variables that are commonly identified in the contingency theory literature are size, production technology, corporate strategy, market environment, and environmental uncertainty (Covaleski, Dirsmith, & Samuel, 1996; Otley, 1995; Mitchell, Reid, & Smith, 2000).

A management accounting system is seen as a significant element of an organisational structure. In addition, features of an appropriate accounting system depend upon specific circumstances that a company faces (Otley, 1980). Accordingly, many researchers[2] attempted to identify various contingencies and assess their impact on designing management accounting systems.

As explained by Hartmann (2000), the contingency framework is adopted as a pragmatic device to explore this specialist field with a view to theoretical development. Also, this study differs from the formal contingency approach in that some of its 'contingent variables', e.g. management accounting practices or innovative managerial practices, would normally be outcomes rather than inputs.

In this study, the internal factors include: levels of application of IMPs and AMTs, as managerial and technological factors, respectively, and level of deployment of contemporary management accounting practices (CMAPs) as an organisational factor. The competitive environment a company operates in is considered as an external factor.

More specifically, this research study examines the possible association between the emphasis placed on the use of SFNFPMs and level of application/extent of importance of the following factors:

1. IMPs;
2. AMTs as managerial and technological factors;
3. CMAPs as an organisational factor;
4. The competitive environment in which a company operates as an environmental or external factors.

The technological and managerial factors (AMTs/IMPs) are discussed in the following three sections. Then, CMAPs and competitive environment are discussed in fifth and sixth sections, respectively.

MANAGERIAL AND TECHNOLOGICAL FACTORS AND SHOP-FLOOR PERFORMANCE MEASUREMENT

Manufacturing companies today are becoming increasingly aware of the great importance of manufacturing excellence in providing a competitive weapon to compete in sophisticated world-wide markets (Drury, 1997). Prior to the 1970s, many organisations in Western countries operated in a protected competitive environment (Drury, 1997). At that time, barriers of communications, geographical distance, and protected markets conspired to give little incentive for firms to maximise efficiency and improve management practices or to minimise cost as the costs burden could be easily passed on to customers (Drury, 1997).

In the 1980s, AMTs and IMPs dramatically changed production processes in many organisations. In order to compete successfully, companies had to produce innovative products of high quality at a relatively low cost and provide a first-class customer service (Drury, 1997).

The deployment of AMTs/IMPs has caused many problems such as how to appraise investments in AMTs/IMPs, how to compute product costs in this changed environment, and how to modify control systems and performance measures (Drury, 1997). Consequently, revolutionary transformations in management accounting have been called for by management accounting academics, practitioners, and consultants for at least a decade (Kaplan, 1983, 1990, 1993; Johnson & Kaplan, 1987; Kaplan & Atkinson, 1998).

Despite ample evidence of the effect of the deployment of IMPs/AMTs on the use and importance of performance measures in organisations, commentators suggest that the appropriateness of performance measures for different elements of AMTs/IMPs continues to be a useful area for further research (Kaplan, 1993; Drury & Tayles, 1995; Ittner & Larcker, 1995; Chenhall & Langfield-Smith, 1998a, 1998b). Moreover, Drury and Tayles (1995) suggest that factors that influence changes to management accounting systems are not yet well understood and have received little attention by researchers.

> Further empirical studies are required that provide a detailed description and evaluation of these new systems and the factors that influence change. (Drury & Tayles, 1995, p. 278)

In the next two subsections, various IMPs and AMTs are identified and their effects are considered. In addition, the role of the shop-floor in deploying these practices and technologies is highlighted.

Innovative Managerial Practices (IMPs)

IMPs include: just-in-time (JIT), total quality management (TQM), material requirements planning (MRPI), manufacturing resource planning (MRPII), total preventive maintenance (TPM), enterprise requirement planning (ERP), and optimised production technology (OPT).[3]

In this subsection, a definition and an overview of each practice is presented. This sheds light on the nature of each practice and how it could be linked with the role shop-floor staff play in these practices. However, an indepth discussion of IMPs is beyond the scope of this research. The role shop-floor staff have in IMPs environment is discussed in fourth section in this chapter.

Just-in-Time (JIT)

Many definitions have been put forward for JIT manufacturing[4] and they are being continuously updated as JIT is being more globally accepted. Many contemporary definitions focus on JIT as an approach that minimises waste in manufacturing or aims at zero-level inventory. For instance, Goyal and Deshmukh (1993) define JIT as "a system of production based on the philosophy of total elimination of waste, that seeks the utmost rationality in the way we make things" (p. 2). CIMA (1993) defines it as "a technique for the organisation of work flows, to allow rapid, high quality, flexible production whilst minimising manufacturing waste and stock levels" (p. 56).

On the other hand, others (Murphy & Braund, 1990; Barnett, 1992; Goyal & Deshmukh, 1993) focus on JIT more as a philosophy of manufacturing rather than just a technique. Goyal and Deshmukh (1993) argue that "it may be difficult to put forward an all encompassing definition and JIT may be viewed as a philosophy cutting across all the functional departments" (p. 3).

Moreover, Less and Ebrahimpour (1984) suggest that although JIT is a production system, it involves all levels of the organisation and requires modifications from top to bottom. The philosophy of integrating all the departments (production, marketing, personnel, etc.) in JIT is crucial (Less & Ebrahimpour, 1984).

> JIT must be viewed as a binding force coupling all the activities, from incoming raw materials to the finished goods. (Goyal & Deshmukh, 1993, p. 8)

The researcher argues that JIT should be considered more a philosophy than a system as it encompasses all parts of the organisation in addition to its suppliers.

Bromwich and Bhimani (1994) argue that JIT comprises two main sets of activities: JIT purchasing and JIT production. JIT purchasing attempts to match the acquisition and receipt of material sufficiently closely with usage such that raw material inventory is reduced to near-zero levels. In JIT production, production takes place only through a pull-system driven by the demand for finished products. JIT production aims to obtain low-cost, high-quality, on-time production to order (Bromwich & Bhimani, 1994).

Cobb (1992) identifies seven aspects or elements that comprise JIT. These are:

- *JIT purchasing*: incorporates using small and frequent deliveries against bulk contracts. This requires integration of suppliers with the company's manufacturing process.
- *Machine cells*: grouping of machines/workers by product instead of by type of work performed.
- *Set-up time reduction*: set-up time is recognised in JIT as a non-value adding activity which should be reduced and eliminated.
- *Pull system* (*Kanban*): products are produced only when demanded by a customer.
- *Total quality*: incorporate designing products, processes and suppliers' quality assurance programmes to ensure that a product is made to the appropriate quality, first time.
- *Employee involvement*: employees at all levels are involved in the process of change and continuous improvement.
- *Uniform loading*: where the speed of operating parts of the productivity process matches the rate at which the final product is demanded by the customer.

It could be concluded, from these aspects, that shop-floor workers (SF) have a vital role in the successful deployment of JIT in any organisation.

Total Quality Management (TQM)

The concept of quality assurance is central in total quality management and is concerned with all procedural aspects of what assures the quality of a product. It is concerned with assuring that an organisation has installed a proper quality system (Barnett, 1992). Barnett (1992) defines total quality management as "the spirit of quality which is imbued in every employee from top management down, every one of whom is devoted to doing the best in their own particular job" (p. 33). Accordingly, it is more likely that customers get precisely what they need (Barnett, 1992; Bromwich & Bhimani, 1994).

TQM was first implemented after World War II by Japanese enterprises as a comprehensive quality control philosophy. It emphasises the elimination of defects and rework (Bromwich & Bhimani, 1994, pp. 32–33). Bromwich and Bhimani (1994) argue that there are different types of quality systems in organisations which can be categorised into a 'progression of discrete stages'. These stages are (Bromwich & Bhimani, 1994):

- *Inspection*: At the most basic level it comprises the traditional quality inspection. It is a process applied to incoming goods, as well as to manufactured components and assemblies at different points in the manufacturing process.
- *Quality control*: In this stage, raw materials and intermediate stage products are tested, with a certain level of self-inspection by operators taking place.
- *Quality assurance*: Encompasses planned and systematic actions required to provide adequate confidence that a product or service will satisfy identified requirements of quality. It embodies a shift in emphasis from detection to prevention of non-conformance.
- *TQM* is concerned with the overall implementation of quality policy under the responsibility of top management. It requires the principles of quality management to be applied in every branch and at all levels of the organisation (Bromwich & Bhimani, 1994).

Again, it could be concluded that SF have a vital role in the successful deployment of TQM in any organisation.

Total Preventive Maintenance (TPM)

The deployment of total preventive maintenance practice entails a recognition of the importance of issues such as reliability, maintenance, and economic efficiency in plant design (Nakajima, 1988). Slack, Chambers, Harland, Harrison, and Johnston (1995) state that:

> In Japan, where TPM originated, it is seen as a natural extension in the evolution from run-to-breakdown to preventive maintenance. TPM adopts some of the team-working and empowerment principles as well as continuous improvement approach to failure prevention. It also sees maintenance as an organisation-wide issue, to which staff can contribute in some way. It is analogous to TQM. (p. 796)

Total preventive maintenance systems list: "autonomous maintenance schedules, record downtime and minutes of maintenance meetings, monitor maintenance calls, and specify lubrication and inspection points" (Schonbeger, 1996, p. 86).

TPM aims to establish good maintenance practice in operations through the pursuit of five goals. These goals are as follows (Nakajima, 1988; Slack et al., 1995):

- *Improve equipment effectiveness*: incorporates examining how facilities are contributing to the effectiveness of the operation by analysing losses due to increased down-time and defects, or reduced speed, etc.
- *Achieve autonomous maintenance*: allowing operators of equipment to take responsibility for at least some of the maintenance tasks. Also, encouraging maintenance staff to take responsibility for the improvement of maintenance performance.
- *Planned maintenance*: incorporates a fully worked out approach to all maintenance activities. This includes the level of preventive maintenance which is required for each piece of equipment, the standards for condition-based maintenance and the respective responsibilities of operating staff and maintenance staff.
- *Train all staff in relevant maintenance skills*: TPM emphasises appropriate and continuous training.
- *Achieve early equipment management*: incorporates tracing potential maintenance problems back to their root cause and eliminating them at that point.

There is an obviously important role for shop-floor staff in the successful deployment of TPM.

Material Requirements Planning (MRPI)

MRPI is defined as "a system which maximises the efficiency in the timing of raw material orders through to the manufacture and assembly of the final product" (Bromwich & Bhimani, 1994, p. 250). Barnett (1992) defines MRPI as "a planning process for products which consist of assemblies and subassemblies" (p. 130).

MRPI is used for individual parts where their demand is related to other parts. MRPI makes purchased and company manufactured components and subassemblies available just before they are needed by the next stage of production for dispatch (Bromwich & Bhimani, 1994). The role shop-floor staff have in the deployment of MRPI is discussed in fourth section.

Manufacturing Resource Planning (MRPII)

MRPII is an extension of MRPI (CIMA, 1993). The deployment of MRPII entails "a movement away from focusing on enhanced production and inventory control toward linking top management strategic action to detailed manufacturing plans" (CIMA, 1993, p. 3). MRPII is defined as "a method for the effective planning for all resources of a manufacturing company" (CIMA, 1993, p. 57). Jazayeri and Hopper (1999) define MRPII as "data integration through computerised control systems" (p. 283).

MRPII addresses operational planning in units, financial planning in monetary terms, and has a simulation capability to answer 'What if?' questions (Barnett, 1992; CIMA, 1993). In MRPII, all information regarding product requirements, manufacturing capacity, inventory, engineering, design, distribution, sales, and marketing is integrated in order to take into account the whole capability and limitations of the entire plant (Barnett, 1992; CIMA, 1993; Bromwich & Bhimani, 1994).

The process of MRPII starts with a product demand forecast supplied by the marketing area and approved by management. A manufacturing plan then, based on the forecast by time period, is adopted with other inputs from the various functional areas such as purchasing, production, and accounting (Lee, 1987).

Lee (1987) argues that MRPII receives its information input from the master production schedule and other inputs.[5] Based on these data, the mainframe computer will determine the material requirement for each component in each time period needed to produce items in the master production schedule, adjusted for the inventory on hand and in transit. The system can then plan in advance a series of released production orders or purchase orders. As the material requirements are determined, the need for machine and human capacities can also be planned for the same time period.

In MRPII, a link between strategic planning and management control is provided. Managers can simulate and compare competing strategies in light of actual manufacturing capacities and changing environments (Lee, 1987). The role shop-floor staff have in the deployment of MRPII is discussed in fourth section.

Enterprise Requirement Planning (ERP)

Advances in information technology have brought new manufacturing control systems to market (Russell & Taylor III, 1998). One of these is the enterprise requirement planning . ERP is an updated system of MRPII with "relational database management, graphical user interface (GUI), and client/server architecture" (Russell & Taylor III, 1998, p. 654). Client/server systems use high-performance computers and servers to move data, distribute processing, and transport information across the network (Russell & Taylor III, 1998). The role shop-floor staff have in the deployment of ERP is discussed in fourth section.

Optimised Production Technology (OPT)

OPT is defined as a "computer-based technique and tool which helps to schedule production systems to the pace dictated by the most heavily loaded resources, i.e. bottlenecks" (Slack et al., 1995, p. 581). By identifying the location of constraints, working to remove them, then looking for the next constraint, an operation is always focusing on the part that critically determines the pace of output (Slack et al., 1995). If the rate of activity in any part of the system exceeds that of the bottleneck, then items are being produced that cannot be used. Once the rate of working falls below the pace at bottleneck, then the entire system is underutilised (Slack et al., 1995).

The following principles underlying OPT demonstrate this focus on bottlenecks (Slack et al., 1995, p. 581):

- Balance flow, not capacity.
- The level of utilisation of a non-bottleneck is determined by some other constraints in the system, not by its own capacity.
- Utilisation and activation of a resource are not the same.
- An hour lost at a bottleneck is an hour lost for every output of the entire system.
- An hour saved at a non-bottleneck is a mirage.
- Bottlenecks govern both throughput and inventory in the system.
- The transfer batch may not, and many times should not, equal the process batch.
- The process batch should be variable, not fixed.
- Lead times are the result of a schedule and cannot be predetermined.
- Schedules should be established by looking at all constraints simultaneously.

Applying OPT helps in focusing on critical constraints and reduces the need for detailed planning of non-bottleneck areas (Slack et al., 1995). The role shop-floor staff have in the deployment of OPT is discussed in fourth section.

Advanced Manufacturing Technologies (AMTs)

AMTs include: flexible manufacturing systems (FMS), computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM), computer numerical control (CNC), automated material handling (AMH), and computer aided engineering (CAE).[6]

In this subsection, a definition and an overview of each technique is presented. However, an indepth discussion of AMTs is beyond the scope of this research. The role SF have in AMTs environment is discussed in fourth section of this chapter.

Flexible Manufacturing Systems (FMS)

FMS is defined as an "integrated production system which is computer controlled to produce a family of parts in a flexible manner" (Bromwich & Bhimani, 1994, p. 250). Lee (1987) defines FMS as a "bundle of machines that can be reprogrammed to switch from one production run to another. It consists of a cluster of machine tools and a system of conveyor belts that shuttle the work piece from tool to tool" (p. 35). Therefore, the benefits of FMS lie in the flexibility to change from making one product to another (The Economist, 1989).

An FMS employs robots and computer-controlled material handling systems to link various stand-alone and computer-programmed machine tools. In addition, a system-level computer controller is also used to coordinate the manufacturing system (Lee, 1987).

In an FMS, work pieces of different types are processed at various programmable, multi-purpose machine tools. Parts flow through the system according to production requirements by a 'materials-handling system' and possibly by 'direct numerical control devices' and robots. An advanced FMS can also include an 'automated storage and retrieval system' for fixtures, raw material, and parts featuring automated washing, assembly, and inspection (Bennett & Hendricks, 1987).

The role shop-floor staff have in the deployment of FMS is discussed in fourth section.

Computer Aided Design (CAD)

CAD is defined as a "computer-based technology allowing interactive design and testing of a manufacturing component on a visual display terminal" (Bromwich & Bhimani, 1994, p. 249). CAD refers to:

> A computerised system for design purposes consisting of a computer with a high-resolution display screen, a plotter, and sophisticated software for creating graphics and for combining and recombining graphic elements. CAD allows multidimensional images to be manipulated and redesigned. (Bromwich & Bhimani, 1994, p. 26)

The application of CAD systems makes it possible for designers to manipulate pieces of their design to see how the shapes change from various angles, and so forth, on their CAD terminals (Lee, 1987). CAD systems are made more convenient and economical as computer technology develops (Lee, 1987). The role shop-floor staff have in the deployment of CAD is discussed in fourth section.

Computer Aided Manufacturing (CAM)

CAM is defined as a "computer-based technology to permit the programming and control of production equipment in the manufacturing task" (Bromwich & Bhimani, 1994, p. 249).

> CAM systems are high-level computer supervisory systems that may carry out planning and scheduling functions for a production plant and generate programs for individual machine tools and cells. CAM in effect uses computerised technology to plan, implement and monitor the manufacture of a product. (Bromwich & Bhimani, 1994, p. 27)

There are some advantages that an organisation could gain from linking CAD and CAM systems together[7] (Bennett & Hendricks, 1987; Bromwich & Bhimani, 1994). The role shop-floor staff have in the deployment of CAM is discussed in fourth section.

Computer Integrated Manufacturing (CIM)

The deployment of CIM in any organisation incorporates "the use of computers and other advanced manufacturing techniques to monitor and perform manufacturing tasks" (Bromwich & Bhimani, 1994, p. 249). CIM refers to the communication and control system where all systems which are required to operate a manufacturing process are computerised so that information regarding inputs are all automatically available to all subsystems (Barnett, 1992).

In a CIM system there is a link between material processing control, production control, and distribution and financial control. This link enables managers to obtain, interpret, act upon, and update at any time information required (Barnett, 1992).

By applying CIM in an organisation, a manufacturer's production process will be controlled entirely through a computer network which can be linked with the systems of suppliers and customers (Lee, 1987). The role shop-floor staff have in the deployment of CIM is discussed in fourth section.

Computer Numerical Control (CNC)

CNC is a computer-controlled machine tool. Each machine tool is controlled by an operator who determines a set of instructions for guiding desired processes within predefined performance criteria (McNair, Mosconi, & Norris, 1988; Dhavale, 1989; Abdel-Kader, Dugdale, & Taylor, 1998).

The principal aim of a CNC machine is to minimise production times through the reduction of set-up activities which do not have added value to the processing function (McNair et al., 1988). An example of a CNC machine is a grinder where factors such as cutting speed of the machine and depth of cut are determined and controlled by a computer (Dhavale, 1989; Abdel-kader et al., 1998). The role shop-floor staff have in the deployment of CNC is discussed in fourth section.

Computer Aided Engineering (CAE)

In CAE products designers work on computer terminals, linked to central databases and softwares, to find out whether a new product can feasibly be produced with the available machines and how much the cost will be. This is done by sending the CAD information through a CAE system (Lee, 1987). Once feasibility is verified, using CAE, information for manufacturing the product will be transmitted to a CAM system. Accordingly, there will be very little time lag between design and manufacturing (Lee, 1987). The role shop-floor staff have in the deployment of CAE is discussed in fourth section.

Automated Material Handling (AMH)

AMH is divided into two parts: 'automated storage and retrieval system' and 'automated guided vehicles systems'. The former is defined as a computer-controlled stocking system in which parts are stored on racks and received and retrieved using computerised robots, cranes, and/or similar devices (Gerwin & Kolodny, 1992). The latter provide unmanned transportation of materials in the factory and are equipped with automatic guidance devices programmed to follow certain paths (Gerwin & Kolodny, 1992).

The role shop-floor staff have in the deployment of AMH is discussed in the next section.

THE IMPORTANCE OF THE ROLE OF SHOP-FLOOR STAFF IN IMPs/AMTs

SF play an important role in assuring quality of products and the deployment of IMPs/AMTs in manufacturing firms has seriously affected their role. The effects range from the need for training of SF to workforce downsizing. This section presents a summary of the potential effects of deploying IMPs/AMTs on shop-floor in manufacturing firms.

The deployment of IMPs/AMTs in manufacturing firms on the shop-floor is potentially controversial. Some view these effects in a positive way, while others view them passively or evenly negatively. The effects are summarised in the following points:[8]

- SF play an important role in assuring quality of products in IMPs/AMTs environments.
- SF have to know how their own job contributes to the final products.
- SF are encouraged to solve problems as they occur in production. This entails the existence of multi-functional, or multi-skilled, SF staff.
- SF need to be at a certain level of education to fulfil the requirement of implementing IMPs/AMTs.
- Implementing IMPs/AMTs involves the training of groups of SF in different techniques and practices. An example of these techniques and practices is 'quality circles' which represent one approach to quality management approach.
- Team work is an important management approach which would be synchronised with the deployment of IMPs/AMTs in any organisation.
- In IMPs/AMTs, SF staff are encouraged to submit good suggestions for implementation by their organisation. One way of doing this is through suggestion schemes.
- The implementation of AMTs in any organisation affects the long-term future of that organisation and its SF in terms of job redefinition and job

numbers. It is generally synchronised with either a downsizing or a reallocation of the workforce in an organisation.

The performance of shop-floor staff is evaluated by financial and non-financial performance measures. The possible association between implementing IMPs/AMTs and the use of SFNFPMs in manufacturing firms is considered next.

SFNFPMs AND IMPs/AMTs

The effect of the deployment of IMPs and AMTs on different organisational aspects has drawn a lot of research attention. Changes in manufacturing companies as a result of deploying AMTs and IMPs have led managers to seek different elements of information about activities under their control (Kaplan, 1983; Maskell, 1989a, 1989b; CIMA, 1993; Drury et al., 1993).

Many commentators have suggested that performance indicators need to be revised as a consequence of novel manufacturing work methods and advanced forms of technologies.[9] The adoption of IMPs/AMTs is seen to demand new accounting measures as it makes traditional accounting measures redundant. For instance, a company adopting JIT is likely to deploy novel measures of stock levels and delivery performance (CIMA, 1993). Also, the adoption of a TQM philosophy might be matched with an enhanced level of quality tracking (CIMA, 1993). Accordingly, commentators argue that there is a need for new types of performance measures in an IMP/AMT environment.[10]

Commentators also argue that such revised performance measures need to be a part of the accounting system and that whether they are or not will depend on how fast management accountants react to the challenge (Blackburn, 1988; Cobb, 1992). CIMA's (1993) study of UK manufacturers shows that the manufacturing process would play a large part in determining the adopted performance measures (see also, Bhimani, 1993, 1994). Also, Drury et al.'s (1993) survey of UK firms indicates that

> There was little evidence to suggest that those organisations that extensively used AMTs and IMPs had made any significant changes to their management accounting information systems. However, the respondents support the claim that implementing AMTs and IMPs resulted in greater emphasis being placed on the use of non-financial measures. (Drury et al., 1993, p. 76)

Chenhall's (1997) survey of 39 Australian organisational units shows that the type of manufacturing performance measures applied in a firm may differ depending on whether the firm employs AMTs and IMPs or not. He shows that all entities with extensive AMTs/IMPs applications place more emphasis on the use of NFPMs. Some of these NFPMs listed are as follows (Chenhall, 1997, p. 197):

- Customer service measures such as delivery-on-time and in full.
- Maintenance of quality of final products.
- Success in introducing new products, and development of linkages with customers.
- Materials throughput time or cycle time.
- Quality (e.g. defects).
- Reliability and responsiveness of suppliers.
- Productivity and inventory measures.

Moreover, he recommends that the nature of manufacturing performance measurement appropriate for different elements of AMTs/IMPs would be a useful area for further research.

It can be concluded that there is a positive association between the application of IMPs/AMTs and the use of non-financial measures in organisations. However, the effect of IMPs/AMTs on performance measures at shop-floor level has not yet been examined in depth. This research includes an examination of associations between the deployment of IMPs/AMTs and the use and importance of SFNFPMs in manufacturing firms. The formulation of hypotheses and identification of measurable variables are presented in detail in Part II.

CONTEMPORARY MANAGEMENT ACCOUNTING PRACTICES AND PERFORMANCE MEASUREMENT

This section explores the association between the application of contemporary management accounting practices and the use and importance of SFNFPMs. To ensure a coherent presentation of this issue, a brief discussion of the evolution of management accounting practices is presented first. Then a synthesis of previous surveys of the application of contemporary management accounting practices is presented to show the extent of using these contemporary practices in real life. Finally, the association between the application of these contemporary practices and the use of SFNFPMs is explained.

The Evolution of Management Accounting Practices

The objectives of management accounting are to "assist managers and to influence their behaviour" in a way that results in a goal congruent action (Anthony, 1989, p. 3). Traditional management accounting approaches have been criticised for their failure to achieve this goal, some commentators (e.g. Lyall, Okah, & Puxty, 1990; Drury et al., 1993) argue that traditional financial control systems are being adapted successfully to meet the challenges presented by developments in production and information technologies.

However, the increasingly widespread deployment of IMPs/AMTs alongside the growing application of altered work organisation techniques and management approaches are viewed by many academics, practitioners, and managers as having considerable implications for management accounting (Campbell & Porcano, 1979; Bromwich & Bhimani, 1994; LingSim & Killough, 1998). In addition, the increasing level of global competition intensified the challenges for managers in adapting their management accounting practices to meet changing needs.[11] Accordingly, many commentators argue that changes in management accounting systems are synchronised with changes in technologies (Van Hipple, 1988; Murphy & Braund, 1990; Nanni et al., 1992; Bhimani, 1993, 1994; Bromwich & Bhimani, 1994).

In response to these changing requirements, many of the contemporary management accounting techniques now consist of both financial and non-financial information and take an explicitly strategic focus (Chenhall, 1997; Ittner, Larcker, & Randall, 2003). This can be seen, for instance, in the use of the balanced scorecard, activity-based techniques, contemporary performance measurement systems and benchmarking techniques (Kaplan & Norton, 1992, 1996; Bromwich & Bhimani, 1994; Chenhall, 1997). A brief discussion of previous surveys of contemporary practices is presented hereafter.

Contemporary Management Accounting Practices: Synthesis of Previous Surveys

Many surveys of different organisations indicate that there is an increasing emphasis on the implementation of significant changes in management accounting systems.[12] In the UK, for instance, Murphy and Braund (1990) surveyed 263 management accountants who were CIMA members in different firms. Surveyed firms operated in a broad cross-section of industry where new technology was used. The survey focused on how often firms change their management accounting systems. Results showed that 48% of respondents had reviewed their systems and 14% intended to undertake a review in the next five years. Murphy and Braund (1990) state that new technology tends to reinforce the importance of management accounting for organisations and increases their reliance on it. There is evidence showing that management accounting has adapted to some of its challenges (Murphy & Braund, 1990).

Davies and Sweeting (1991a, 1991b) carried out a major survey to examine cost management techniques and practices in use and those being planned for introduction at UK manufacturing enterprises. Their sample comprised 677 companies involved in different industries. Results show that the percentage of respondents who used (or were planning to use) specific management accounting techniques were as follows: activity-based costing 60%, cost of quality 52%, target cost planning 46%, strategic management accounting 44%, and throughput accounting 40%. However, Davies and Sweeting's (1991a, 1991b) survey results can be criticised in that there is no distinction between the percentage using and the percentage planning the introduction of these management accounting techniques. Bromwich and Bhimani (1994) indicate that there is ample evidence in UK that the availability and uptake of IMPs and AMTs are associated with a level of change in accounting practices in UK companies. Dugdale, Jones, and Green (2006) document-based interviewing study of 41 UK manufacturers indicates a diverse use of contemporary reporting practices covering a wide range of management accounting, traditional as well as contemporary, techniques.

In Australia, Chenhall and Langfield-Smith (1998a) surveyed 140 large Australian companies to find whether they had adopted certain management accounting practices and then, for those who had adopted the practices, to assess the benefits gained over the past three years. Respondents were also asked about the degree of emphasis that their business would give to each practice over the next three years. The survey shows relatively low adoption of activity-based techniques but high adoption of benchmarking of operational processes, strategic priorities, and management processes (Chenhall & Langfield-Smith, 1998a).

On the other hand, Bromwich and Bhimani (1989), Lyall et al. (1990), Bright, Davies, Downs, and Sweeting (1992), Drury et al. (1993), and Abdel-Kader and Luther (2006) suggest that the evidence is not sufficient to justify revision of management accounting in the UK. Lyall et al.'s (1990) survey of 423 UK companies suggests that traditional financial control systems continue to be used extensively in industry and are probably being adapted successfully to meet the challenges presented by recent developments in production and information technologies. Bright et al. (1992) state that many manufacturers are still actively working on introducing and developing traditional management accounting methods.

Drury et al.'s (1993) survey examined the changes that UK organisations had made, or planned to make, to their management accounting systems. Results show that many organisations were focusing on the development of more accurate methods of product costing and profitability analysis, placing more emphasis on the control of raw material costs and the implementation of AMTs and IMPs (e.g. ABC). Drury et al. (1993) state, however, that there is no evidence to suggest that new innovative management accounting techniques had actually been implemented. Sixty-five per cent indicated that they were planning to make changes to their management accounting systems within the following two years. The following is a list of some significant changes that had been made between 1988 and 1993 in UK manufacturing firms (Drury et al., 1993, p. 71):

- More use of non-financial operating measures.
- Integrated management accounting produced down to departmental level.
- The determination and measurement of key success criteria and a realisation of the non-financial measures of quality and service.

The following is a summary of the most frequent comments made by respondents when asked to describe the nature of proposed changes (Drury et al., 1993, pp. 70–71):

- Further expansion of JIT, ABC, and cellular manufacturing.
- Data collection and throughput accounting on the shop-floor.
- Increase in non-financial strategic controls.
- Examining the use of some kind of throughput measures for production performance.

Accordingly, Drury et al. (1993) suggest that the claim made by some commentators that a revolution in management accounting is required to match the revolution in manufacturing technology may not be applicable to many organisations. Similarly, Abdel-Kader and Luther (2006) survey of the UK food and drink industry, although report diverse usage of both traditional and contemporary management accounting techniques, concludes that the deployment of contemporary management accounting techniques, in their surveyed firms, is less widely than might be assumed by the reading of textbooks.

Similar findings are also reported in surveys in the USA (Cohen & Paquette, 1991; Emore & Ness, 1991; Green & Amenkhienan, 1992), and Sweden (Ask & Ax, 1992). For example, Green and Amenkhienan (1992) state that there is still a significant lag between innovations in manufacturing and innovations in management accounting. Green and Amenkhienan (1992) argue that while changes are taking place, firms continue, to a large extent, to rely on 'outmoded accounting methods'. In addition, Ask and Ax (1992) state that there is little evidence that advanced (or contemporary) management accounting practices have been adopted by the surveyed companies.

However, Drury and Tayles (1995) argue that "in view of the considerable amount of publicity that has been given over the past 10 years to the apparent limitations of traditional cost systems and the urgent need for organisations to change their management accounting systems, it is puzzling why most firms have been reluctant to change their systems" (p. 276). Drury et al. (1993) relate this lag to the considerable burden placed on the management accounting function arising from meeting the demands of monthly profit reporting. Many practising accountants are therefore likely to have little time for working with managers, devising new systems, reforming existing systems, and even thinking critically about accounting issues (Bromwich & Bhimani, 1994). But, this constraint could be removed by investing additional resources for designing and operating improved systems (Drury & Tayles, 1995).

In conclusion, evidence of implementing contemporary (advanced) management accounting practices in recent years is equivocal. While some commentators support the view that implementing these contemporary management accounting practices is pervasive, others are sceptical about such a view.

The author is inclined to support the view that deployment of contemporary management accounting practices in organisations is pervasive for the following reasons:

- Proponents of this view have provided practical evidence (surveys) in support of their view.
- Even opponents of this view have provided evidence of potential deployment of contemporary management accounting practices in manufacturing firms (Drury et al., 1993).

A discussion of the association between the deployment of contemporary management accounting practices and the use and importance of shop-floor performance measures is presented in the next subsection.

Contemporary Management Accounting Practices and Shop-Floor Performance Measurement

There are two different views concerning the role of management accounting in developing performance measures. First, some commentators argue that management accounting is well placed to provide information to develop performance measures (Shank, 1989; Back–Hock, 1992; Nanni et al., 1992; Shields & Young, 1992; Chenhall & Langfield-Smith, 1998a, 1998b; Horngren, Foster, & Datar, 2006). Proponents of this view see an extension to the established role that management accounting has played in evaluating managerial and organisational performance. It is argued that some contemporary accounting techniques have been promoted to enhance the way in which performance measures assist in the management of change. These techniques incorporate the design of balanced scorecard models and performance measurement hierarchies (Kaplan & Norton, 1992; Lynch & Cross, 1992; Nanni et al., 1992; Chenhall & Langfield-Smith, 1998a, 1998b).

The second view is that the involvement of accountants does not necessarily lead to an improved design of performance measurement system (Johnson, 1992; McKinnon & Bruns, 1992). It is argued that there is a potential for management accountants to bring an overly financial view to the task, which may lead to an unbalanced set of performance measures (Vollman, 1989; Ecceles, 1991). In addition, management accountants tend to provide performance measures with a product-oriented rather than a process-oriented focus. It is the latter that is more helpful in the integration of activities with strategies (Nanni et al., 1992; Chenhall & Langfield-Smith, 1998a, 1998b).

This study follows the first view that management accounting techniques have a role in providing information to develop performance measures. The study investigates whether the deployment of contemporary management accounting techniques, as an organisational factor, is associated with the use and importance of SFNFPMs. Formulation of hypotheses and measurement of this factor are presented in detail in Chapter 4.

COMPETITIVE ENVIRONMENT AND SHOP-FLOOR PERFORMANCE MEASURES

In recent years many management innovations have been developed as a response to the changing nature of operations and competition (Hayes, Wheelwright, & Clark, 1988; Chase & Garvin, 1989; Hamel & Prahalad, 1994; Chenhall & Langfield-Smith, 1998a, 1998b, 1998c). The dynamics of the markets in which a company operates are recognised as an important factor influencing the use and importance of performance measures (Khandwalla, 1972; Otley, 1980; Bhimani, 1993, 1994; CIMA, 1993; Drury et al., 1993; Otley, 1999).

Khandwalla (1972) concludes that the sophistication of accounting and control systems in organisations is influenced by the intensity of the competition faced. Otley (1980) argues that different types of competition (price, marketing, or product competition) have different impacts on the use of accounting controls in manufacturing firms. Drury et al. (1993) advocate a more strategic perspective for management accounting by reporting information relating to a firm's markets and competitors. In addition, Otley (1999) argues that "there is a need to focus on the external context within which the organisation is set, rather than just being concerned with internal activities" (p. 381).

In the UK, CIMA (1993) suggests a number of influencing factors that determine the type of performance measures each company is likely to adopt and how to use them. One of these factors is the dynamics of the market in which a company operates. Where the market becomes more competitive a company often reacts by reorganising itself. External influences can therefore affect an enterprise's approach to measuring the performance of its activities by forcing a reassessment of its structure. In addition, Drury et al. (1993) underline the need to improve the ability to do competitive analysis as one of the most significant management accounting problems in UK organisations.

Substantial changes in the nature and intensity of competition force firms to determine and measure the non-financial 'value drivers' leading to success in the new competitive environment (Chenhall & Morris, 1986; Ittner et al., 2003). The greater emphasis placed on non-financial measures in firms facing competitive pressure is consistent with research showing positive associations between perceived environmental uncertainty and the demand for broad-based performance measurement systems incorporating non-financial indicators (Chenhall & Morris, 1986). As the shop-floor constitutes the core of this research, the emphasis is placed on possible association between competitive environment and the use of SFNFPMs. Formulation of hypotheses and measurement of issues related to this factor are presented in detail in Part II.

SUMMARY

This chapter discussed the literature related to the contingent factors, incorporated in this study, which potentially affect the use and importance of SFNFPMs in manufacturing firms in the four countries involved (i.e. UK, Italy, Japan, and Canada).

Contingency approach to management accounting is based on the premise that there is no universally appropriate accounting system which applies equally to all organisations in all circumstances. Rather, it is suggested that particular features of an appropriate accounting system will depend upon the specific circumstances in which an organisation finds itself. The contingency framework is adopted as a pragmatic device (Hartmann, 2000) to explore this specialised field. Also, this study differs from the formal contingency approach in that some of its 'contingent variables', e.g. management accounting practices or innovative managerial practices, would normally be outcomes rather than inputs.

Four contingent factors are considered to potentially have effects on the use and importance of SFNFPMs. Three factors are internal factors – innovative managerial practices (IMPs), advanced manufacturing technologies (AMTs), and contemporary management accounting practices (CMAPs) – and the fourth is an external factor – the competitive environment in which a firm operates in. More specifically, this research examines the possible association between the emphasis placed on the use of SFNFPMs and levels of deployment/extent of importance of these four contingent factors.

Arguably, there are positive associations between the application of IMPs/AMTs and the use/importance of non-financial measures in manufacturing firms. However, the effect of IMPs/AMTs on performance measures at shop-floor level has not yet been examined in depth. This research provides an examination of associations between the deployment of IMPs/AMTs, and the use and importance of SFNFPMs in manufacturing firms in the four countries under study.

Two different views concerning the role of management accounting in developing performance measures have been discussed. First, some commentators argue that management accounting is well placed to provide information to develop performance measures. For instance, some contemporary accounting techniques have been promoted to enhance the way in which performance measures assist in the management of change (e.g. the design of balanced scorecard models and performance measurement hierarchies). The second view is that the involvement of accountants does not necessarily lead to an improved design of performance measurement system, for instance commentators argue that management accountants tend to provide performance measures with a product-oriented rather than a process-oriented focus. It is the latter that is more helpful in the integration of activities with strategies. This study follows the first view that management accounting techniques have a role in providing information to develop performance measures. The research study investigates whether the deployment of contemporary management accounting techniques, as an organisational factor, is associated with the use and importance of SFNFPMs in manufacturing firms in the four countries studied.

Finally, the possible effect of competition on the use of NFSFPMs was discussed. Evidence permeates the literature on positive associations between perceived environmental uncertainty and the demand for broad-based performance measurement systems incorporating non-financial indicators. As shop-floor constitutes the core of this research, the emphasis of this study is placed on possible association between competitive environment and the use of SFNFPMs in manufacturing firms.

The formulation of hypotheses and identification of measurable variables included in this study are presented in detail in Chapter 4.

NOTES

1. See, also, Hall et al. (1991), Maskell (1992), and Schonbeger (1996).
2. See, for example, Gordon and Narayanan (1984), Chenhall (1997), LingSim and Killough (1998), and Anderson and Lanen (1999).
3. See, for example, Campbell and Porcano (1979), Hoeffer (1982), Schonbeger (1982), Hall (1983), Monden (1983), Less and Ebrahimpour (1984), Dilts and Russell (1985), Harper (1985), Richard (1985), Bennett and Hendricks (1987), Lee (1987), Voss and Robinson (1987), Blackburn (1988), The Economist (1989), Murphy and Braund (1990), Cobb (1992), Barnett (1992), CIMA (1993), Goyal and Deshmukh (1993), Bromwich and Bhimani (1994), Bruggemman and Slagmulder (1995), Schonbeger (1996), Chenhall (1997), Russell and Taylor III (1998), and Jazayeri and Hopper (1999).
4. See, for example, Hoeffer (1982); Schonbeger (1982), Hall (1983), Monden (1983), Less and Ebrahimpour (1984), Harper (1985), Richard (1985), CIMA (1993), Goyal and Deshmukh (1993), and Bromwich and Bhimani (1994).
5. Inputs are also received from an inventory file, a product structure file containing data on the need to purchase or produce various components, and a production routing file that explains the work sequence, production lead time, lot size, etc., for all products (Lee, 1987, p. 37).
6. See, for example, Bennett and Hendricks (1987), Lee (1987), McNair et al. (1988), Dhavale (1989), Hilton (1991), Astebro (1992), Barnett (1992), Gerwin and Kolodny (1992), Bromwich and Bhimani (1994), Bruggemman and Slagmulder (1995), and Abdel-Kader et al. (1998).
7. Bromwich and Bhimani (1994) argue that: "CAD and CAM systems presently tend to be used independently of each other but the advantages of linkage are evident since a CAD/CAM system blending mechanical and computer technology can facilitate the design and manufacture of a product. Design changes can automatically be reflected in altered production programmes. Presently, CAD/CAM systems

comprise a number of subsystems, including mathematical and mechanical models, computer graphics, design documentation, production planning, numerical controlled (NC) machines and group technology (Bennett & Hendricks, 1987) which continue to evolve as integration possibilities come to light'' (p. 27).

8. See, for example, Dilts and Russell (1985), Lee (1987), Nakajima (1988), Dale, Lascelles, and Plunkett (1990), Zipkin (1991), Barnett (1992), Cobb (1992), Bhimani (1993), Goyal and Deshmukh (1993), Bromwich and Bhimani (1994), and Slack et al. (1995),

9. See, for example, Otley (1980), Drucker (1990), Banker et al. (1993), CIMA (1993), Kaplan (1993), Bruggemman and Slagmulder (1995), Drury and Tayles (1995), Ittner and Larcker (1995), Otley (1997), Chenhall and Langfield-Smith (1998a, 1998b), and Jazayeri and Hopper (1999).

10. See, for example, Kaplan (1983), Blackburn (1988), Drucker (1990), Harries (1990), Kaplan (1990), Cobb (1992), Kaplan and Norton (1992), Banker et al. (1993), Bromwich and Bhimani (1994), Bruggemman and Slagmulder (1995), Ittner and Larcker (1995), Chenhall (1997), Otley (1997), and Kaplan and Atkinson (1998).

11. See, for example, Berliner and Brimson (1988), Kaplan (1988), McNair et al. (1988), Shillinglaw (1989), Nanni et al. (1992), Bromwich and Bhimani (1994), Ittner et al. (2003), and Kennerley and Neely (2003).

12. See, for example, Murphy and Braund (1990), Cohen and Paquette (1991), Davies and Sweeting (1991a, 1991b), Emore and Ness (1991), Ask and Ax (1992), Bright et al. (1992), Green and Amenkhienan (1992), CIMA (1993), Chenhall and Langfield-Smith (1998a, 1998b), Dugdale et al. (2006), Abdel-Kader and Luther (2006).

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PART II: DATA COLLECTION AND ANALYSIS

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CHAPTER 4

METHODOLOGY AND HYPOTHESES DEVELOPMENT

Ahmed Abdel-Maksoud

INTRODUCTION

It was stated in Chapter 1 that there are three main objectives of this study. These objectives are:

1. To investigate the existence and level of importance of shop-floor non-financial performance measures (SFNFPMs) in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the extent/level of deployment of the contingent variables incorporated in the study.
2. To examine the relationship between the existence and importance of SFNFPMs in five evaluation categories and the specified contingent variables.
3. To develop a theoretical SFNFPMs scorecard that examines the cause-and-effect relationships among the five performance evaluation categories in this study.

The first two objectives are covered in this part, while the third objective is covered in Part III.

To address the objectives of this study, a positivistic paradigm was adopted. The adoption of this particular paradigm is ascribed to the nature

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of the research problem (Creswell, 1994; Hussey & Hussey, 1997) as a large-scale survey was required to address the research topic. Questionnaires were sent to managers of manufacturing firms in the four surveyed countries (UK, Italy, Japan, and Canada).

This chapter presents the research methodology, the formulation of the research hypotheses and the questionnaire design. The remainder of this chapter is organised in six sections. The next section shows the research methodology. The third section discusses issues related to determining the research topic and objectives. Formulation of hypotheses is discussed in the fourth section. Questionnaire design stages are discussed in the fifth section while the variable measurement and final questionnaire design are presented in the sixth section. The final section is the summary.

RESEARCH METHODOLOGY

In the social science context, it is argued that a positivistic paradigm and a phenomenological paradigm are two extremes from which research methodology could be derived (Creswell, 1994, Chapter 1; Hussey & Hussey, 1997, Chapter 3; Robson, 1998, Chapter 2; De Vaus, 2001, Chapter 1; Gilbert, 2001, Chapter 1).

A positivistic study is based on testing an existing theory composed of variables, measured with numbers and analysed with statistical techniques, in order to examine whether the predictive generalisation of that theory holds true (Creswell, 1994; Hussey & Hussey, 1997). On the other hand, a phenomenological study is an enquiry process of understanding a social problem. The positivistic approach seeks the facts or causes of social phenomena, with little regard to the subjective state of the individual and logical reasoning is applied to the research (Hussey & Hussey, 1997). Thus, social and natural worlds are both regarded as being bound by certain fixed laws in a sequence of cause-and-effect. On the other hand, the phenomenological paradigm is concerned with understanding human behaviour from the participant's own frame of reference (Creswell, 1994; Hussey & Hussey, 1997).

Hussey and Hussey (1997) indicate that research methodology encompasses the following issues:

1. Why a researcher collected certain data.
2. What data was collected.

3. How data was collected.
4. From where and when data was collected.
5. How data were analysed.

This chapter discusses the first three issues while Chapters 5–9 discuss the fourth and fifth issues (data analysis).

DETERMINATION OF THE RESEARCH TOPIC AND OBJECTIVES

Kaplan and Norton (1992) were interested in supporting organisations with an effective performance measurement system that could provide on-time reliable information. Eventually, they devised the balanced scorecard to provide a comprehensive framework for translating a company's strategic objectives into a coherent set of performance measures (see, Kaplan & Norton, 1996, 1997, 2000).

The balanced scorecard, though, has been criticised in that it relates to a set of measures for the business as a whole. Drury (1996) argues that measures should be cascaded down the organisation by creating lower level scorecards for the business units that make up the organisations. "Individual measures for the various functions and departments should also be established so that they enhance the visibility of their contribution to higher level scorecard measures" (Drury, 1996, p. 50). Drury advocates a linkage so that employees at lower levels in the organisation have clear targets for actions and decisions that will contribute to the company's overall objectives.

The balanced scorecard draws management attention to overall organisational performance without emphasising shop-floor performance. Companies applying advanced manufacturing technologies (AMTs) and/or innovative managerial practices (IMPs) depend heavily on multi-skilled employees. The actual production process in any organisation takes place at the shop-floor level, hence the emphasis on performance evaluation should be placed at shop-floor level and not solely at middle and top management levels. Indeed, it could be argued that, in the present competitive environment shop-floor performance is particularly important. Accordingly, the focus of the research is on SFNFPMs.

Maskell (1989a, 1989b), CIMA (1993, 1996), Otley (1997), and Ittner and Larcker (1998) report that the following five performance evaluation categories were used in organisations:

1. Product quality.
2. Customer satisfaction.
3. On-time delivery.
4. Employee morale.
5. Efficiency and utilisation.

Each of these evaluation categories comprises both financial and non-financial performance measures.

One of the main research objectives is to investigate whether, in real life, the degree of use and importance of SFNFPMs in each of these five evaluation areas varies from one organisation to another. Then, the intention is to determine the factors that affect the degree of importance of the use of SFNFPMs.

Previous literature (see Chapter 3) indicates that contingent managerial, technological, organisational, and environmental factors influence manufacturing performance measurement. In this research, the following contingent factors are considered:

- IMPs (managerial factor).
- Advanced manufacturing technologies AMTs (technological factor).
- Contemporary management accounting practices (CMAPs) (organisational factor).
- The competitive environment in which it operates (environmental factor).

The objectives of this research can be summarised as follows:

- *First*: investigating the existence and level of importance of SFNFPMs, which are grouped in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the level of deployment (or extent of importance) of a number of contingent variables.
- *Second*: examining the relationship between the existence and level of importance of SFNFPMs in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) and the level of deployment/extent of importance of the specified contingent variables.
- *Third*: developing a theoretical SFNFPMs scorecard that examines the cause-and-effect relationships among the five performance evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation).

The first and second objectives are covered in this part. The third objective is covered in Part III.

FORMULATION OF HYPOTHESES

The research comprises many sets of hypotheses. These are concerned with the associations between the contingent factors and the existence and importance of SFNFPMs of five evaluation categories that are:

1. Product quality.
2. Customer satisfaction.
3. On-time delivery.
4. Employee morale.
5. Efficiency and utilisation.

Fig. 1 presents the hypothesised association between SFNFPMs and the contingent factors incorporated.

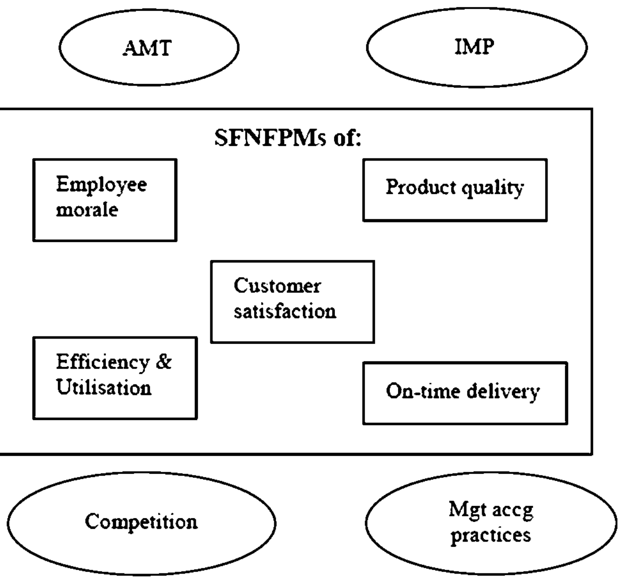

Fig. 1. The Hypothesised Association between SFNFPMs and Contingent Internal and External Factors.

The research hypotheses at the subsidiary level encompass 513 sets, i.e., 19 subsidiary SFNFPMs by 27 subsidiary contingent variables. The 19 measures are grouped in five categories are set out first and these are followed by the 27 contingent variables. Each of the five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) incorporates number of subsidiary SFNFPMs. Also, many of the internal and external contingent factors encompass different subsidiaries. The presentation of these 513 hypotheses, both null and alternative, would take up excessive space, and accordingly, the author has summarised the presentation of these hypotheses into five sets of hypotheses. These hypotheses will be concerned with the association between the five composite contingent factors and the existence and importance of SFNFPMs of five evaluation categories (composites). The selection and development of these measures are explained in fifth section.The SFNFPMs are as follows:

SFNFPMs of product quality (composite)[1]

1. Scrap (% of total production).
2. Defects (% of total production).
3. Reworks (% of total production).
4. Batches (% adjusted).

SFNFPMs of customer satisfaction

5. Number of complaints received from customers.
6. Number of returns.
7. Number of warranty claims.

SFNFPMs of on-time delivery

8. Percentage on-time delivery to customers.
9. Percentage on-time production.
10. Percentage schedule adherence.
11. Manufacturing cycle efficiency (MCE).

SFNFPMs of employee morale

12. Staff turnover.
13. Absenteeism.
14. Lateness.
15. Employee attitude survey.

SFNFPMs of efficiency and utilisation

16. Efficiency.
17. Activity.
18. Capacity utilisation.
19. Proportion of overtime worked.

The above five composites constitute the five main sets of hypotheses where the null hypotheses will state no association between the existence and importance of these five SFNFPMs evaluation categories and the following five composites of the contingent factors:

IMPs (X_1)

1. Level of application of JIT in an organisation;
2. Level of application of TQM;
3. Level of application of TPM;
4. Level of application of MRPI/II;
5. Level of application of ERP;
6. Level of application of OPT.

AMTs (X_2)

7. Level of application of FMS;
8. Level of application of CAD;
9. Level of application of CAM;
10. Level of application of CIM;
11. Level of application of CNC;
12. Level of application of CAE;
13. Level of application of AS/RS;
14. Level of application of AGVS.

Contemporary management accounting practices (X_3)

15. Level of deployment of benchmarking of performance;
16. Level of deployment of activity-based techniques;
17. Level of deployment of balanced scorecard;
18. Level of deployment of economic value added;
19. Level of deployment of throughput accounting;
20. Level of deployment of strategic management accounting;
21. Level of deployment of customer profitability analysis.

Aspects of competition (X_4)

22. Importance of quality in competition;
23. Importance of innovation;
24. Importance of customer service;
25. Importance of price;
26. Importance of delivery;
27. Importance of flexibility.

The five sets of subsidiary hypotheses are as follows:

H_1. There is no association between X_1–X_4 (each stands separately) and the existence and importance of *SFNFPMs of product quality* in manufacturing firms.

H_2. There is no association between X_1–X_4 and the existence and importance of *SFNFPMs of customer satisfaction* in manufacturing firms.

H_3. There is no association between X_1–X_4 and the existence and importance of *SFNFPMs of on-time delivery* in manufacturing firms.

H_4. There is no association between X_1–X_4 and the existence and importance of *SFNFPMs of employee morale* in manufacturing firms.

H_5. There is no association between X_1–X_4 and the existence and importance of *SFNFPMs of efficiency and utilisation* in manufacturing firms.

These hypotheses are statistically examined in Chapters 5–8; each chapter tests the hypotheses in one country.

DATA COLLECTION AND QUESTIONNAIRE DESIGN

Large-scale cross-section surveys of manufacturing firms in the four countries incorporated were applied in this research to gather the required data.

Data were collected through a postal survey. The postal survey was applied for the following reasons (Dillman, 1978; Wallace & Mellor, 1988; Gilbert, 1993; Hussey & Hussey, 1997; Saunders, Lewis, & Thornhill, 1997):

- It is a reasonably inexpensive method.
- Suitable for large samples.

- Postal distribution of questionnaires is easy to administer.
- Respondents are able to fill in questionnaires at a time convenient to them.
- The pre-coding and computerisation of the inputs speeds up the analysis.

However, low response rates can be a major disadvantage of postal questionnaires. Rates can be as low as 10% and this introduces the problem of potential sample bias because those who responded may have a particular interest in the topic and therefore may not be representative of the population (Dillman, 1978; Wallace & Mellor, 1988; Gilbert, 1993; Hussey & Hussey, 1997; Saunders et al., 1997). There are, though, ways to boost response rates. For example, by keeping the questionnaire as short as possible (no longer than two sides of A4), using closed questions of a simple and non-sensitive nature and sending follow-up questionnaires to non-respondents (Dillman, 1978; Wallace & Mellor, 1988; Gilbert, 1993; Hussey & Hussey, 1997; Saunders et al., 1997).

Accordingly, a questionnaire form of two A4 side pages was designed. To achieve a better response rate, personalised, self-addressed envelopes were sent to financial managers, management accountants, directors, or company secretaries of the surveyed firms in both the initial mail and the follow-up. In addition, follow-up letters with blank copies of the questionnaire forms and return-paid, self-addressed envelopes were sent to non-respondents from the initial mail.

As suggested in the literature (Dillman, 1978; Gilbert, 1993; De Vaus, 1996; Hussey & Hussey, 1997) the development of the questionnaire form went through several stages. It is noteworthy to indicate that the design of the questionnaire form that used in data collection from the surveyed manufacturing firms, in the four countries incorporated, was first designed in the UK research study. It then was used in the following studies encountering cultural differences (as will be discussed in country-specific results chapters). Questionnaire design stages are outlined next.

Questionnaire Development (1st Stage): Literature Construction

This was the first stage in developing the questionnaire form. The researcher was interested in incorporating all possible questions regarding SFNFPMs and the proposed internal and external factors that affect the use and importance of these measures. However, the lack of literature covering non-financial performance measures at shop-floor level was a significant problem in the early stage of the questionnaire development.

In order to incorporate valid and related questions regarding the use and importance of SFNFPMs the researcher had to scrutinise all possible non-financial performance measures covered in the literature and previous research at higher management level or even for the business as a whole. The researcher had to choose, from those measures, the most suitable SFNFPMs to be used.

At this stage, the initial performance evaluation categories incorporated in the research were as follows:

1. Product quality.
2. Customer satisfaction.
3. On-time delivery.
4. Product development.

Each of these categories of evaluation contains non-financial performance measures. The non-financial performance measures in each were:

1. Product quality:
   - 1.1. *Customer feedback*: the percentage of quality feedback reports from the customer indicating an error on shipment (CIMA, 1993, p. 25);
   - 1.2. *Monthly average number of faults*: percentage of number of faults found at final test (CIMA, 1993, p. 25);
   - 1.3. *Supplier quality performance*: numbers – parts per million (PPM) – of rejected incoming parts (CIMA, 1993, p. 25);
   - 1.4. Number of complaints received from customers (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   - 1.5. *Cycle time*: time it takes to complete manufacture of a standard batch – month to date (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373; Otley, 1999, p. 368);
   - 1.6. Rework percentage (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   - 1.7. Idle time (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   - 1.8. Percentage of batches adjusted (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   - 1.9. *Batch accuracy*: percentage of batches requiring adjustments – month to date (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   - 1.10. Materials throughput time (Chenhall, 1997, pp. 188, 197);

1.11. Defects free production (Chenhall, 1997, pp. 188, 197; Otley, 1999, p. 368);
1.12. Minimum inventories (Chenhall, 1997, pp. 188, 197);
1.13. Vendor quality and reliability (Chenhall, 1997, pp. 188, 197);
1.14. Reliability and responsiveness of supplier (Chenhall, 1997, pp. 188, 197);
1.15. *Statistical process control*: to track variation from specification at each stage of production process on a statistical chart (Drury, 1996, pp. 501–532);
1.16. *Quality audit programmes*: entail randomly measuring quality at specific points in the manufacturing process to ascertain conformity with specified quality levels (Drury, 1996, pp. 501–532);
1.17. Number of scrap units as percentage of good production (Drury, 1996, pp. 501–532);
1.18. Number of rework units as percentage of good production (Drury, 1996, pp. 501–532);
1.19. Number of defects units as percentage of good production (Drury, 1996, pp. 501–532; Otley, 1999, p. 368);
1.20. Number of warranty claims (Drury, 1996, pp. 501–532);
1.21. Number of return and allowances (Drury, 1996, pp. 501–532);
1.22. Right first-time measures (Drury, Braund, Obsorne, & Tayles, 1993, p. 52);
1.23. Rejects in inspection (Drury et al., 1993, p. 52);
1.24. Set-up reduction (Drury et al., 1993, p. 52).

2. Customer satisfaction:
   2.1. On-time delivery statistics (Otley, 1999, p. 368; CIMA, 1993, p. 25);
   2.2. Customer returns (Drury et al., 1993, p. 52);
   2.3. Number of warranty claims (Drury, 1996, pp. 501–532);
   2.4. Number of complaints received from customers (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   2.5. Quality of final products (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
   2.6. Responses to customer needs (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373).

3. On-time delivery:
   3.1. On-time delivery statistics (Otley, 1999, p. 368; Drury, 1996, pp. 501–532; CIMA, 1993, p. 25);

3.2. *Delivery in full and on-time to the customer* (*DIFT*): percentage of customer orders delivered in full and on-time – month to date (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
3.3. *Made on time*: percentage of batches delivered to warehouse by due time – month to date (Chenhall & Langfield-Smith, 1998a, pp. 368, 372–373);
3.4. *Set-up times*: reducing it enables manufacturing lot size to be reduced, thus leading to shorter manufacture cycles and greater flexibility (Drury, 1996, pp. 501–532);
3.5. *Manufacturing cycle efficiency* (*MCE*): {processing time/[processing time + inspection time + wait time + move time]} (Drury, 1996, pp. 501–532).

4. Product development:
   4.1. Success in introducing new products (Chenhall, 1997, pp. 188, 197);
   4.2. On-line data capture (Drury et al., 1993, p. 52);
   4.3. Number of new products relative to those of competitors (Drury, 1996, pp. 501–532);
   4.4. Number of new products launched (Drury, 1996, pp. 501–532);
   4.5. New products launched time (Drury, 1996, pp. 501–532);
   4.6. Number of returned units of new products (Drury, 1996, pp. 501–532).

It is worth noting that there is no consistency in the categorisation of measures of product quality, customer satisfaction, and on-time delivery. For instance, Drury et al. (1993) classify set-up reduction as a non-financial measure of product quality, while Drury (1996) classifies it as a non-financial measure of on-time delivery. Also, the number of complaints received from customers is classified as a non-financial measure of product quality (Chenhall & Langfield-Smith, 1998a) and customer satisfaction (Drury, 1996; Chenhall & Langfield-Smith, 1998a). Moreover, the same author sometimes classifies a measure under different evaluation areas (Drury et al., 1993; Drury, 1996; Chenhall & Langfield-Smith, 1998a). Accordingly, this research suggests that there are interactive relationships among subsidiary non-financial performance measures in three performance evaluation areas (product quality, customer satisfaction, and on-time delivery). These are presented in Fig. 2.

Table 1 presents the non-financial performance measures in each evaluation area that were used as SFNFPMs at this very early stage.

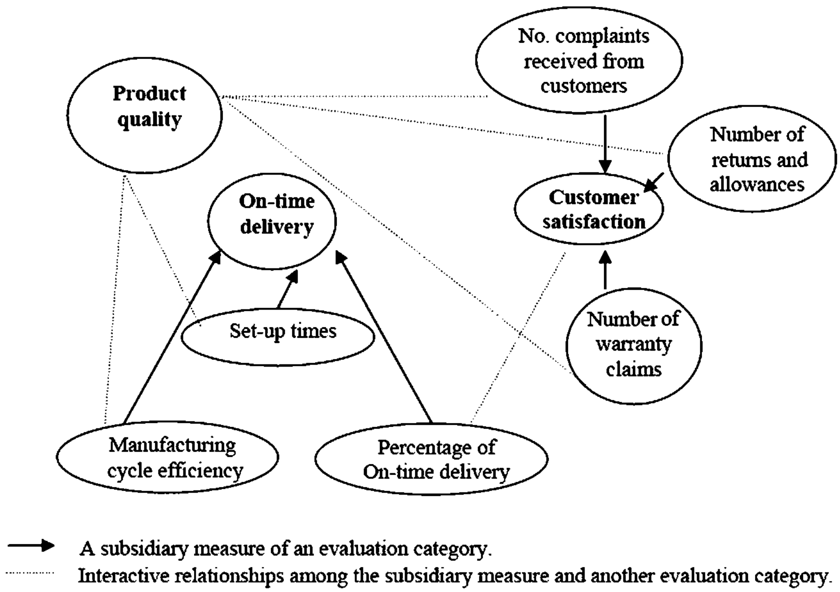

Fig. 2. The Interactive Relationships among Non-Financial Performance Measures in Three Evaluation Categories.

Questions covering the proposed internal and external factors that affect the use and importance of SFNFPMs were also constructed from the literature. These questions are shown in detail in the following sections.

Questionnaire Development (2nd Stage): Factory Visits

At this stage, feedback on how the first questionnaire draft would work among managers in UK manufacturing firms was sought. Accordingly, factory visits took place in March 2000 to two different gas turbines factories located in Newton Abbot and Exeter, respectively. Anonymity was guaranteed to the managers interviewed.

The first draft of the questionnaire was used at this stage. The most important questions covering the use and importance of SFNFPMs[2] were listed at the end of the questionnaire. These primary interviews revealed the need to take out measures of product development from the questionnaire form, as there was no specific logical reasoning behind the use of measures

Table 1. The Shop-Floor Non-Financial Performance Measures at First Stage of Questionnaire Development.

Product Quality	Customer Satisfaction	On-Time Delivery	Product Development
1. Number of scrap units 2. Number of rework units 3. Number of defect units 4. Idle time 5. Number of returns and allowances 6. Rejects in inspection 7. Set-up reduction 8. Batch accuracy 9. Cycle time 10. Supplier quality performance 11. Supplier quality and reliability	1. Number of complaints received from customers 2. Customer return units 3. Number of warranty claims 4. Defects improvements 5. Right first time measures 6. Percentage of number of faults found at final test	1. Percentage of on time delivery 2. Manufacturing cycle efficiency 3. Set-up times	1. Sales percentage from new products 2. Number of new product introduction versus competition 3. Time to launch new products 4. Number of patent application 5. Number of returned units of new products 6. Total cycle time reduction

of product development at shop-floor level. Therefore, the evaluation areas were only product quality, customer satisfaction, and on-time delivery. Some other important changes also took place in the questionnaire form based on these interviews:

- That the final questionnaire form should be administered to management accountants (or persons responsible for management accounting function) in the surveyed firms, as they would be capable of answering incorporated questions.
- The need to list definitions of some AMTs/IMPs, as managers were not aware of the meaning of all of them and sometimes they were applying the techniques listed in the questionnaire but under different names.
- With regard to questions about the level of deployment of IMPs/AMTs, a paragraph was added introducing these questions informing respondents that they could seek the help of production managers in their organisations in answering them.
- Some changes in the layout of the questionnaire form and design took place in order to enhance its effectiveness.

- That other stages of questionnaire development for the amended questionnaire form should take place.

Questionnaire Development (3rd Stage): Academic Consultation

At this stage the second draft of the questionnaire form, as amended in the 2nd stage, was reviewed in May 2000 by four academics, one of whom was a statistician. Participants were asked to evaluate the questionnaire form (from their point of view) listing any suggestions that they felt might improve the questionnaire. Recommendations were as follows:

- Questions relating to two of the tentatively proposed internal factors (the effect of research and development, and the cost of quality on the use and importance of SFNFPMs) were omitted from the list as they were considered irrelevant to the subject under study.
- The questionnaire form should be structured in four parts A, B, C, and D. A and B contain questions about the use and importance of SFNFPMs and the proposed internal and external factors, respectively. Part C seeks some personal information about respondents. Part D investigates whether or not respondents are prepared to co-operate in further analysis.
- Initially each section of questions about the use and importance of SFNFPMs included space for additional SFNFPMs used in the surveyed firms but not listed in the questionnaire.
- SFNFPMs of employee morale were incorporated as an additional evaluation area. Accordingly, performance evaluation areas at this stage were: product quality, customer satisfaction, on-time delivery, and employee morale. SFNFPMs in each area were as follows:
  - *Product quality*: scrap; defects; rework; and batches (percentage adjusted).
  - *On-time delivery*: percentage on-time delivery to customers; percentage on-time production; percentage schedule adherence; and manufacturing cycle efficiency.
  - *Customer satisfaction*: number of complaints from customers; number of returns; and number of warranty claims.
  - *Employee morale*: staff turnover; absenteeism; lateness; and employee attitude survey (Bhimani, 1993; Drury, 1996).
- A covering letter which would be sent to managers of the surveyed companies was drafted so that both the covering letter and the

questionnaire form could be examined in the 4th questionnaire development stage.

Questionnaire Development (4th Stage): Professional/Academic Consultation

This stage took place in July 2000 after applying the recommendations and amendments of the third stage of the questionnaire development. The reviewing group consisted of 11 academics (including professors, senior lecturers, and lecturers) specialising in different fields.

Participants in this stage were different than those in the previous stages. One of the most important characteristics of the participants in this stage was that they had extensive professional, industrial, and consulting experiences. Once again, participants were asked to evaluate the questionnaire form and list any suggestions that might improve the questionnaire. Recommendations were as follows:

- Add a fifth SFNFPMs area of performance evaluation concerned with 'efficiency and utilisation'. It consists of measures of: efficiency (standard hours produced/hours worked); activity (standard hours produced/budgeted standard hours); capacity utilisation (actual hours worked/ budgeted hours); and proportion of overtime worked (overtime hours/total hours) (CIMA, 1996; Drury, 1996).
- In order to capture as many SFNFPMs as possible, it was suggested that a separate sheet be included in the pilot questionnaire asking respondents to list any SFNFPMs that they use but are not listed in the questionnaire.

Questionnaire Development (5th Stage): Questionnaire Piloting

Questionnaire piloting took place in September 2000. Twenty-four professionals of whom 14 were attending a CIMA preparation course and the remainder were attending a Master's course in Management Accounting at a UK university. Members of both groups were professionals in UK firms.

The researcher briefly explained to the participants how the questionnaire should be completed. Participants were given covering letters, questionnaire forms, and self-addressed pre-paid return envelopes and were asked to list their comments – if any – on the questionnaire forms.

After one week only two respondents replied. Three weeks later, eight responses out of 24 were received. Off those, five responses were from management accountants in manufacturing firms and one was from a management accountant in a service firm. Two questionnaires were returned blank from management accountants in service firms.

Subsequent to the piloting, the researcher focused, primarily, on the validity of the questionnaire. Validity is concerned with the extent to which the research findings accurately represent what is happening in the situation, in other words, whether the data collected is a true picture of what is being used (Hussey & Hussey, 1997). It is important that, for a high validity of responses, the questions being asked correspond with the explanation given to respondents regarding the purpose of the study. Otherwise, respondents may lose interest in answering questions as these will appear to be irrelevant (*ibid.*, 1997).

Hussey and Hussey (1997) argue that a quantitative paradigm focuses on the precision of measurement and the ability to be able to repeat the experiment reliably, hence there is always a danger that validity will be very low. In other words, the measure employed may not reflect the phenomena the researcher claims to be investigating.[3]

Carmines and Zeller (1979) argue that there are three most basic types of validity.[4] These are as follows: criterion-related (or predictive) validity (Do scores predict a criterion measure?), content validity (Do the items measure the content they were intended to measure?), and construct validity (Do items measure hypothetical constructs or concepts?) (see, also, Creswell, 1994). Carmines and Zeller (1979) state that both content and criterion-related validity have limited usefulness in assessing the quality of social science measures. In contrast, construct validity has generalised applicability in the social science (also reported in Hussey & Hussey, 1997). The construct validity in social science can be assessed if the measure can be placed in theoretical context (Carmines & Zeller, 1979). Thus, construct validation focused on the extent to which a measure performs in accordance with theoretical expectations (*ibid.*, 1979).

It is important to be aware of the validity problem in research and to try minimising it. One approach is to use a variety of methods of data collection. In particular, observation and in-depth interviewing can give the researcher insight into the meaning of behaviour and attitudes expressed in questionnaires. This can help in more intelligent interpretation of the patterns discovered in the analysis of questionnaires data (De Vaus, 1996).

Following the above, a preliminary analysis of the returned questionnaire forms revealed that the questionnaire form proved to be valid. Also, suggestions listed by the participants were carefully analysed. The questionnaire forms, at the end of this stage, were considered ready for use in a large-scale survey.

VARIABLE MEASUREMENT AND FINAL QUESTIONNAIRE DESIGN

In the final form, the questionnaire is divided into two main parts, A and B (see appendix). Part A covers the SFNFPMs and Part B covers the contingent factors.

Part A: SFNFPMs

The lack of literature covering non-financial performance measures at shop-floor level was a significant problem that the researcher faced in the early stages of the research. In order to list appropriate questions regarding SFNFPMs, the author had to choose from all possible non-financial performance measures covered in the literature including those targeted at higher management or even the business as a whole. An examination of whether these measures are in use in real life was undertaken throughout the pre-testing and pilot stages of the questionnaire development.

The aim was to examine the existence and importance of SFNFPMs in five evaluation categories. This was achieved by asking respondents to specify whether the performance measures listed in each evaluation area were measured in their companies and, if there were, to rank – on a seven-point Likert scale, from 1 (no importance), 4 (moderate importance), up to 7 (critical importance) – the importance of SFNFPMs in five evaluation categories. These are as follows:

- *Product quality*: scrap, defects, and rework (as a percentage of total production) and batches (percentage adjusted) (Bhimani, 1993; CIMA, 1993; Drury, 1996; Chenhall, 1997; Chenhall & Langfield-Smith, 1998a; Otley, 1999).
- *Customer satisfaction*: number of complaints received from customers, number of returns, and number of warranty claims (Bhimani, 1993; CIMA, 1993; Drury et al., 1993; Drury, 1996; Chenhall & Langfield-Smith, 1998a).
- *On-time delivery*: percentage of on-time delivery to customer, on-time production (to finished goods store), schedule adherence (in individual

shop-floor processes), and manufacturing cycle efficiency (CIMA, 1993; Drury, 1996; Chenhall & Langfield-Smith, 1998a; Otley, 1999).

- *Employee morale*: percentage of staff turnover, percentage of absenteeism, percentage of lateness, and employee attitude survey (Bhimani, 1993; Drury, 1996).
- *Efficiency and utilisation*: efficiency, activity, capacity utilisation, and proportion of over-time worked (CIMA, 1996; Drury, 1996).

Part B: Internal and external contingent factors

Consists of a number of questions dealing with the specified contingent factors. The extent of applying IMPs/AMTs was measured by asking respondents to evaluate – on a seven-point Likert scale from (1) not at all, (4) moderately, up to (7) extensively – the extent of deployment of six IMPs (JIT, TQM, TPM, MRPI/II, ERP, and OPT) and eight AMTs (FMS, CAD, CAM, CIM, CNC, CAE, AS/RS, and AGVS) in their companies. Previous studies incorporated some of these techniques and practices (Murphy & Braund, 1990; Drury et al., 1993; Dean & Snell, 1996) but not so comprehensively as in this research.

The extent of deployment of contemporary management accounting practices was measured by asking respondents to indicate whether seven contemporary management accounting practices were (1) not applied, (2) partially applied, or (3) systematically applied in their organisations. These practices were: benchmarking of performance, activity-based techniques (activity-based costing (ABC), management (ABM), and budgeting (ABB)), balanced scorecard, economic value added (EVA®), throughput accounting, strategic management accounting, and customer profitability analysis. The extent of deployment of some of these practices was examined similarly in previous studies (Murphy & Braund, 1990; Drury et al., 1993; Dean & Snell, 1996; Chenhall & Langfield-Smith, 1998b, 1998c; Otley, 1999) but not all had been included in one study.

The effect of the competitive environment on the existence and importance of SFNFPMs was measured by asking respondents to indicate – on a seven-point Likert scale, from 1 (no importance), 4 (moderate importance), up to 7 (critical importance) – the importance of six aspects of competition: quality, innovation, customer service, price, delivery, and flexibility (Gordon & Narayanan, 1984).

Finally, few questions dealing with personal information and the results of the questionnaire are incorporated. At the end of the questionnaire, a list of definitions of some AMTs and IMPs is presented. The final questionnaire form is presented in Chapter Appendix.

One of the important features of this questionnaire is that it is mainly addressed to management accountants, financial managers, or managers who are responsible for the management accounting function in the surveyed manufacturing firms. Part B, however, includes questions that are related to the IMPs and AMTs applied in the surveyed firms. These questions are better answered by production/logistics managers in the surveyed manufacturing firms. Respondents are therefore encouraged – both in the covering letter and in the heading of Part B in the questionnaire form – to consult production/logistics managers in answering Part B.

SUMMARY

There are three main objectives of this research study, these are: first, to highlight the existence and level of importance of SFNFPMs in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the extent/level of deployment of the contingent variables incorporated in the study. Second, to test for associations between the existence and importance of SFNFPMs in the above five evaluation categories and the specified contingent variables. Third, to develop a theoretical SFNFPMs scorecard that examines the cause-and-effect relationships among the five performance evaluation categories in this research study.

The current chapter presented the research study methodology, the formulation of the research hypotheses and the questionnaire design. In order to address the above objectives, a largely positivistic paradigm was adopted. The adoption of this paradigm was ascribed to the nature of the research problem as a large-scale survey, making use of questionnaires sent to managers of manufacturing firms in the surveyed countries, was required to address the research topic. The research study comprises five main sets of hypotheses. These are concerned with the associations between the composite contingent factors and the existence and importance of SFNFPMs of five evaluation categories (composites).

The five composites of the contingent factors are: IMPs (comprises the level of application of JIT, TQM, … etc.); AMTs (FMS, CAD, … etc.); CMAPs (comprises the level of deployment of benchmarking of performance, ABT, … etc.); and aspects of competition (comprises managers' perception of the level of importance of quality, innovation, … etc.). The five composite SFNFPMs evaluation categories are: product quality (comprises level of importance of measures of scrap, defects, … etc.);

customer satisfaction (number of complaints, number of returns, … etc.); on-time delivery (% on-time delivery to customers, % on-time production, … etc.); employee morale (absenteeism, lateness, … etc.), and efficiency and utilisation (activity, efficiency, … etc.). The selection and development of these variables and measures were explained in details in fifth section. The final questionnaire form used in data collection was explained in sixth section.

The next Chapters (5–8) present discussion of the research population and sample, data collection, and data analyses of responses from manufacturing firms surveyed in UK, Italy, Japan, and Canada, respectively.

NOTES

1. By composite we mean the mathematical summation of levels of importance respondents gave to measures of this evaluation category.
2. Listed in Table 1.
3. Contrary, a qualitative paradigm is aimed at capturing the essence of the phenomena and extracting data which are rich in its explanation and analysis. The researcher's aim is to gain full access to the knowledge and meaning of those involved in the phenomenon and consequently validity is high under such a paradigm.
4. Other types of validity include: concurrent validity (Do results correlate with other results?) and face validity (Do items appear to measure what the instrument purports to measure?) (e.g. Creswell, 1994).

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APPENDIX. THE QUESTIONNAIRE FORM USED IN DATA COLLECTION

Part A

1. How important is each of the following shopfloor non-financial performance measures in helping your company to compete effectively? (Please circle the appropriate number on the sevenpoint scale below). **Please note that if you do not use a measure NM (Not Measured) should be circled**.

	Not Measured	1 No importance			4 Moderate importance			7 Critical importance
Shop-Floor Performance Measures of Product Quality:								
Scrap - percentage of total production--------------------	NM	1	2	3	4	5	6	7
Defects - percentage of total production------------------	NM	1	2	3	4	5	6	7
Rework - percentage of total production-----------------	NM	1	2	3	4	5	6	7
Batches - percentage adjusted------------------------------	NM	1	2	3	4	5	6	7
Shop-Floor Performance Measures of Customer Satisfaction*:*								
Number of complaints from customers------------------	NM	1	2	3	4	5	6	7
Number of returns---	NM	1	2	3	4	5	6	7
Number of warranty claims--------------------------------	NM	1	2	3	4	5	6	7
Shop-Floor Performance Measures of On-Time Delivery:								
Percentage on-time delivery to customers---------------	NM	1	2	3	4	5	6	7
Percentage on-time production (to finished goods store)------	NM	1	2	3	4	5	6	7
Percentage schedule adherence (in individual shop floor processes)---	NM	1	2	3	4	5	6	7
Manufacturing cycle efficiency [Processing time / (processing time + inspection time + wait time + move time)]-----------------	NM	1	2	3	4	5	6	7
Shop-Floor Performance Measures of Employee Morale:								
Staff turnover--	NM	1	2	3	4	5	6	7
Absenteeism---	NM	1	2	3	4	5	6	7
Lateness--	NM	1	2	3	4	5	6	7
Employee attitude survey-------------------------------------	NM	1	2	3	4	5	6	7
Shop-Floor Performance Measures of Efficiency and Utilisation:								
Efficiency (e.g. standard hours produced/hours worked)---------	NM	1	2	3	4	5	6	7
Activity (e.g. standard hours produced/budgeted standard hours)---	NM	1	2	3	4	5	6	7
Capacity utilisation (e.g. actual hours worked/budgeted hours)--	NM	1	2	3	4	5	6	7
Proportion of overtime worked (e.g. overtime hours/total hours)---	NM	1	2	3	4	5	6	7

Part B: (In the Following Questions, Please Circle the Appropriate Number)

The following question concerns the application of management accounting practices in your business

2. Please indicate the degree to which the following management accounting practices are applied in your business?

	1 Not applied	2 Partially applied	3 Systematically applied
Benchmarking of performance---	1	2	3
Activity-Based Techniques [Activity-Based Costing (ABC) and/or Activity-based Management (ABM) and/or Activity –Based Budgeting (ABB)]---	1	2	3
Balanced Scorecard [Translates company strategies into a coherent and comprehensive set of performance measures for top management. It emphasises four perspectives - financial, customer, learning and growth, and internal business processes]---	1	2	3
Economic Value Added (EVA) [Financial performance measures focusing on the delivery of shareholder value. Defined as accounting profit less a charge for capital employed]--	1	2	3
Throughput Accounting [Defined as sales less materials (and bought-in services) routinely reported. Throughput per bottleneck minute might be calculated as a decision making aid]---	1	2	3
Strategic Management Accounting [Reporting information relating to a firm's market and competitors] ---	1	2	3
Customer Profitability Analysis [Identifies customers who place numerous small orders (with fixed cost for each order) and/or purchase non-standard production items] ---	1	2	3

3. The following question concerns the monitoring of your competitive environment.

Please indicate the importance of the following aspects of competition:

1 (No Importance) **--------4** (Moderate Importance)**-----------7** (Critical Importance)

Quality -------------------------------------	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Innovation ----------------------------------	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Customer service --------------------------	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Price ---	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Delivery -------------------------------------	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Flexibility ----------------------------------	**1**	**2**	**3**	**4**	**5**	**6**	**7**

4. The following questions concerns the application of technologies and managerial practices within your business.

To what extent are each of the following technologies and managerial practices used in your company? (You may wish to consult the production/logistics manager).

	(1) Not at all--------			(4) Moderately -------------			(7) Extensively
Just-In-Time (JIT)--------------------------------------	1	2	3	4	5	6	7
Total Quality Management (TQM)------------------	1	2	3	4	5	6	7
Total Preventive Maintenance (TPM)*-------------	1	2	3	4	5	6	7
Materials Requirements/Resource Planning MRPI/II*---	1	2	3	4	5	6	7
Enterprise Requirement Planning (ERP)*---------	1	2	3	4	5	6	7
Optimised Production Technology (OPT)* --------	1	2	3	4	5	6	7
Flexible Manufacturing Systems (FMS)*-----------	1	2	3	4	5	6	7
Computer Aided Design (CAD)*------------------	1	2	3	4	5	6	7
Computer Aided Manufacturing (CAM)*----------	1	2	3	4	5	6	7
Computer Integrated Manufacturing (CIM)*-------	1	2	3	4	5	6	7
Computer Numerical Control (CNC)*--------------	1	2	3	4	5	6	7
Computer Aided Engineering (CAE)*-------------	1	2	3	4	5	6	7
Automated Storage and Retrieval System (AS/RS)*---	1	2	3	4	5	6	7
Automated Guided Vehicles Systems (AGVS)*---	1	2	3	4	5	6	7

* Definitions are given at the end of the questionnaire list.

DEFINITIONS

Total Preventive Maintenance (*TPM*): Lists autonomous maintenance schedules, records downtime and minutes of maintenance meetings, monitors maintenance calls, and specifies lubrication and inspection points. In TPM operators maintain their own equipment.

Materials Requirements Planning (*MRPI*): A system that maximises timing efficiency of material orders through to the manufacture and assembly of the final product. It is not used for individual parts where the demand is not related to any other part. Focuses on enhanced production and inventory control.

Manufacturing Resource Planning (*MRPII*): Starts with product demand forecast supplied by marketing staff. Based on the forecast by time period, a manufacturing plan is adopted with other inputs from the various functional areas such as purchasing, production, and accounting. All information regarding product requirements, accounting capacity, inventory, engineering, design, distribution, sales, and marketing is integrated in order to take into account the whole capability and limitations of the entire plant.

Enterprise Requirement Planning (*ERP*): Full integration of business systems, typically based on proprietary software such as that supplied by SAP or ORACLE.

Optimised Production Technology (*OPT*): Based on the theory of constraints, OPT aims to schedule bottleneck facilities first and advocates that non-bottleneck resources should not be utilised to 100% of their capacity. Generally known as finite capacity planning and may be based on proprietary software such as STPOINT, supplied by Scheduling Technology.

Flexible Manufacturing Systems (*FMS*): An integrated production system that is computer controlled to produce a family of parts in a flexible manner. It is a collection of machines that can be reprogrammed to switch from one production run to another.

Computer Aided Design (*CAD*): Computer-based technology allowing interactive design and testing of a manufacturing component on a visual display terminal. Designers can move pieces of design around their drawings, manipulate them to see how the shapes change from various angles, and so forth.

Computer Aid Manufacturing (*CAM*): Computer-based technology to permit the programming and control of production equipment in the manufacturing task.

Computer Integrated Manufacturing (*CIM*): The use of computers and other advanced manufacturing techniques to monitor and perform manufacturing tasks, and to communicate and control. Systems required to operate a manufacturing process are computerised so that information regarding inputs are all automatically available to all subsystems. In a CIM system there is a link between processing materials control, production control, and distribution and financial control. This link enables managers to obtain, interpret, act upon, and update at any time information required.

Computer Numerical Control (*CNC*): In a CNC machine, information necessary for machining products – e.g. the movement of the tool or the work piece specified by successive co-ordinates, cutting speed, depth of the cut, etc—is determined and controlled by a computer according to a set of instructions prepared for the product being processed. Each CNC machine is individually controlled by a single computer dedicated to that machine. An example of a CNC machine is a conventional machine tool, such as a milling machine, or a grinder, controlled by a computer which determines the cutting speed of the machine, the depth of cut, the initial and successive locations of the cutting tool and its movement to achieve the required dimension and geometry.

Computer Aided Engineering (*CAE*): Product designers work on computer terminals, which are linked to central databases and software to find out whether a new product will be feasible to produce with the available machines and how much the cost will be.

Automated Storage and Retrieval System (*AS/RS*): A computer-controlled stocking system in which parts are stored on racks and received and retrieved using computerised robots, cranes, and/or similar devices.

Automated Guided Vehicles Systems (*AGVS*): Provide unmanned transportation of materials in the factory and are equipped with automatic guidance devices programmed to follow certain paths.

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CHAPTER 5

NON-FINANCIAL PERFORMANCE MEASURES IN THE UK MANUFACTURING FIRMS

Ahmed Abdel-Maksoud

INTRODUCTION

The economic slowdown in UK in the 1990s forced manufacturing firms to examine their activities more closely in an attempt to find ways of enhancing operational efficiency and of cutting costs (Bhimani, 1993). Moreover, UK firms began to deploy many of the innovative managerial practices/advanced manufacturing technologies (IMPs/AMTs), and such changes were seen to require quite fundamental alterations in performance measures (Bhimani, 1993, 1994; Bromwich & Bhimani, 1994). Therefore, starting from late 1980s, there was a recognition by UK manufacturers on the importance of performance measures. This appears in many of the Chartered Institute of Management Accountants (CIMA's) studies since late 1980s. A brief discussion of the following salient studies is presented next: Coates and Longden (1989), Littler and Sweeting (1989), Innes and Mitchell (1989), CIMA (1993), Drury, Braund, Obsorne, and Tayles (1993), Dugdale, Jones, and Green (2006), and Abdel-Kader and Luther (2006).

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Coates and Longden (1989) interviewed managers in a group of 20 UK firms and five USA-based firms, belonging to various industries, undertaking technological innovations. The study reports no evidence of associations between the deployment of new technologies and the development of new management accounting techniques. However, the study findings support the view that traditional management accounting practices need to be adapted to provide strategic and relevant information in compliance with the deployment of the new technologies (see, Bromwich & Bhimani, 1994).

Littler and Sweeting (1989) examined the modes of operations of 20 UK and five USA new technology-based firms in various industries. The study shows that "the rationales upon which the suitability of traditional accounting techniques for decision-making purposes are established (e.g. maximising resource allocation and illustration) were not readily identifiable in the firms they studied" (see, Bromwich & Bhimani, 1994, p. 222). In addition, findings show that the surveyed managers tended to rely on both financial and non-financial performance measures rather than financial measures solely.

Innes and Mitchell (1989) interviewed managers of 10 electronics companies in Scotland. Researchers supplemented the study data with reviewing management accounting reports produced within the firms surveyed. The study findings show that management accounting practices have changed and were continuing to change. Findings also highlighted the emphasis on non-financial performance measures in performance measurement techniques in the surveyed firms.

CIMA's study (1993) was commissioned by the Department of Trade and Industry (DTI, Manufacturing and Technology Division), and undertaken by CIMA, Cambridge University, Glasgow University, NIMTECH, and Warwick University. It was a large-scale investigation of UK manufacturing firms where questionnaire forms were administered to 300 CIMA fellows, as well as extensive case studies on performance measurement systems in the surveyed firms. Its remit was to review techniques which have been advocated for measuring performance and to examine the nature and deployment of performance measures as well as the communication of such information to investors and lenders. Findings revealed that:[1]

- Performance measures appear to change as the company is influenced by different factors and that UK manufacturers are keen to gain exposure to novel ideas about performance measures.
- No single set of performance indicators was found in use in all UK surveyed firms or not with a similar degree of importance attached.

- Performance measures useful at one time may become redundant at another and UK manufacturers well understand this and show a ready willingness to adapt.
- Manufacturers ought to take early steps to use performance measures that better link company's strategic mission to operational activities.
- Future research should be on ensuring that manufacturers remain sensitive to the emerging possibilities for using different performance measures to guide their enterprises' activities.

Drury et al. (1993) surveyed 303 UK manufacturing firms with turnover in excess of £10 M. They report details of management accounting practices in UK manufacturing firms and provide a comprehensive description of management accounting systems in the surveyed firms. The survey aimed to compare management accounting practices in UK firms with the theory of management accounting. The results show that a particular emphasis was placed on the use of non-financial performance measures in the surveyed firms.

Dugdale et al. (2006) conducted a document-based interviewing study of 41 UK manufacturing firms operating in various industries. It indicates a diverse use of contemporary reporting practices covering a wide range of traditional as well as contemporary management accounting techniques. Abdel-Kader and Luther (2006) reported a questionnaire-based survey of 245 UK food and drink industries. There was evidence of diverse usage of both traditional and contemporary management accounting techniques. However, Abdel-Kader and Luther concluded that the deployment of contemporary management accounting techniques, in their surveyed firms, is less widely than might be assumed by the reading of textbooks.

The above studies highlight the deployment of new management practices and contemporary management accounting practices, and the importance of the use of non-financial performance measures in UK manufacturing firms. Although, they lack an in-depth coverage of the non-financial performance measures at operational level in UK manufacturing firms. The current study examines, in depth, the deployment of the new management practices and techniques and aspects of competition in relation to the use of non-financial performance measures in UK manufacturing firms.

The remainder of this chapter is organised in four sections. The next section discusses research method and data collection. Third section presents descriptive analyses of responses. Fourth section examines possible correlations among levels of importance of SFNFPMs in use in UK manufacturing firms surveyed and levels of deployment/application of the contingent variables incorporated in this study. A summary is presented in the last section.

RESEARCH METHOD AND DATA COLLECTION

The aim of this study[2] was to obtain a comprehensive view of the shop-floor performance measures used in UK manufacturers; hence a large-scale postal survey was undertaken. Questionnaires relating to 19 shop-floor non-financial performance measures[3] (SFNFPMs) were sent in March 2001 to the management accountants[4] of 2,242 UK manufacturing firms belonging to 21 different industries[5] (UK SIC codes 15-36) having more than 200 employees. Respondents were asked to indicate whether the SFNFPMs listed were used and, if they were, their perceived importance.

A second part of the questionnaire gathered data on the 27 internal and external contingent (independent) variables. For these independent variables[6] respondents were asked to convey the extent of their impact (e.g. for variables relating to the competitive environment) or the extent of their application (e.g. for variables relating to advanced manufacturing technology).

The total number of usable responses to the questionnaire was 313 giving an overall response rate of 14.3 percent. In most cases the questionnaires were fully completed. However, on individual questions wherever there are some missing responses the analysis was based on those that had responded. A summary of the descriptive statistics is presented in the next section.

A stratified sampling technique was used (Gilbert, 1993; De Vaus, 1996; Hussey & Hussey, 1997; Saunders, Lewis, & Thornhill, 1997; Robson, 1998) to select companies included in this survey. So as to ensure that the proportion of various primary industry codes incorporated in the sample was the same as it is in the population, primary SIC UK 1992 industry code was chosen as a relevant stratifying variable.[7] The sample was then arranged into groups according to the stratum of the primary SIC UK 1992 industry codes. Systematic sampling was then applied.

In assessing the reliability of the measurement of questions related to the variables incorporated in this study, Cronbach's alpha was calculated (using SPSS 13) for the independent and dependent variables. Results of reliability test are presented in Table 1.

From Table 1, the lowest alpha value is 0.625. It, thus, can be concluded that the incorporated variables are reliable. In addition, the validity of the incorporated variables was reviewed in the piloting stages.[8]

The vast majority (97 percent) of respondents' companies employ between 200 and 5,000 employees, and 60 percent employ between 200 and 500 employees. The survey responses are summarised in the following section.

Table 1. Results of Reliability Test.

Variables	No. of Items	*N*	Cronbach's Alpha
SFNFPMs	19	313	0.875
Contemporary management accounting practices (CMAPs)	7	313	0.625
Innovative managerial practices (IMPs)	6	313	0.661
Advanced manufacturing technologies (AMTs)	8	313	0.743
Competition	6	312	0.873

DESCRIPTIVE ANALYSES OF RESPONSES

This section examines the use and level of importance of SFNFPMs; the level of deployment of advanced manufacturing technologies (AMTs), innovative managerial practices (IMPs), and contemporary management accounting practices (CMAPs); and the importance of the perceived level of competition in UK manufacturing firms (Research Question 1). Descriptive statistics are presented and discussed in the following subsections.

Shop-Floor Non-Financial Performance Measures (SFNFPMs)

Respondents were asked to indicate whether certain SFNFPMs were applied in their companies and (if applied) to rank, on a seven-point Likert scale, from 1 (no importance), 4 (moderate importance), up to 7 (critical importance), the importance of these measures. The SFNFPMs were grouped into five evaluation categories:

1. Product quality (scrap, defects, rework, and batches – % adjusted).
2. Customer satisfaction (complaints from customers, number of returns, and number of warranty claims).
3. On-time delivery (percentage on-time delivery to customers, percentage on-time production, percentage schedule adherence, and manufacturing cycle efficiency).
4. Employee morale (staff turnover, absenteeism, lateness, and employee attitude survey).
5. Efficiency and utilisation (efficiency, activity, capacity utilisation, and proportion of overtime worked).

Table 2 presents a summary of the above 19 measures in ranked order of the importance scores.

Table 2 shows that the top three measures (i.e. highest means) are customer-related, while the next four relate to process efficiency where measures of efficiency, defect, and scrap levels and absenteeism in most firms are evaluated as being important (i.e. ranked fourth to seventh with Mean more than 5).

In product quality measures, responses show that 44 percent of respondents do not apply 'batches' and even those that apply it consider it to be of moderate importance (Mean = 4.1).[9]

In on-time delivery, responses show that many UK managers consider '% on-time production', '% scheduling adherence', and 'manufacturing cycle efficiency' measures important (Mean > 5). However, 24 percent, 32 percent, and 38 percent of them do not apply '% on-time production', '% scheduling adherence', and 'manufacturing cycle efficiency' measures, respectively, in their firms.

One can conclude that UK managers do have different evaluations of the use and level of importance attached to SFNFPMs in their firms. For instance, many managers (76 percent) consider '% on-time production' important. However, 24 percent do not apply this measure in their firms. This tendency could be ascribed to a prior cognition of the importance of such measure. For instance, firms that recognise the importance of measuring '% of on-time production' would apply such measure and attach a high level of importance to it, while those firms that do not recognise such importance would not apply it.

Measures of efficiency and utilisation are considered important (Mean more than 5) in over 80 percent of responding firms. One is inclined to conclude that UK manufacturers pay considerable attention to controlling their production costs. Results also show that less importance is attributed to measures of employee morale (Mean less than 5 in three of the measures).

Levels of Application of AMTs

Respondents were asked to evaluate – on a seven-point Likert scale from (1) not at all, (4) moderately, up to (7) extensively – the extent of deploying AMTs in their companies. The AMTs were: flexible manufacturing systems (FMS), computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM), computer numerical control (CNC), computer aided engineering (CAE), automated storage and

Table 2. Shop-Floor Non-Financial Measures ($N = 313$).

Rank by Importance[a]	Measures (Ranked by Mean Value on Scale of 1–7)	Percentage of Firms Using this Measure	Mean Importance for Firms Using the Measure	Median
	Product quality			
5	Defects (% of total production)	87	5.8	6
6	Scrap (% of total production)	90	5.7	6
15	Rework (% of total production)	84	5.2	5
19	Batches (% adjusted)	56	4.1	4
	Customer satisfaction			
2	Number of complaints from customers	95	6.2	7
3	Number of customer returns	91	5.9	6
8	Number of warranty claims	70	5.5	6
	On-time delivery			
1	Percentage of on-time delivery to customers	92	6.4	7
9	Manufacturing cycle efficiency	62	5.3	6
13	Percentage of on-time production	76	5.2	6
14	Percentage of schedule adherence	68	5.2	5
	Employee morale			
7	Absenteeism	97	5.5	6
16	Employee lateness	90	4.9	5
17	Staff turnover	89	4.6	5
18	Employee attitude surveys	63	4.5	5
	Efficiency and utilisation			
4	Efficiency (standard hours produced/hours worked)	90	5.8	6
10	Activity (standard hours produced/budgeted standard hours)	86	5.3	6
11	Capacity utilisation (hours worked/budgeted hours)	84	5.3	6
12	Proportion of overtime worked	92	5.3	5

[a]Ranked by mean value on scale of 1–7.

Table 3. Respondents' Evaluation of the Level of Application of AMTs.

AMTs (Ranked by Mean Value on a Scale of 1–7)	*N*	Mean[a]	Median	Percentage of Firms Applying this Practice[b]
Computer aided design (CAD)	313	4.49	5.0	80.8
Computer aided manufacturing (CAM)	313	3.22	3.0	56.5
Computer numerical control (CNC)	313	2.99	2.0	51.8
Computer aided engineering (CAE)	313	2.51	1.0	44.7
Computer integrated manufacturing (CIM)	313	2.50	1.0	48.2
Flexible manufacturing systems (FMS)	313	2.36	1.0	46.6
Automated storage and retrieval system (AS/RS)	313	1.84	1.0	31.3
Automated guided vehicles systems (AGVS)	313	1.42	1.0	15.0

[a]1 = Not at all, 4 = moderately, and 7 = extensively.
[b]Percentage of respondents who gave (2–7) rank on the scale.

retrieval system (AS/RS), and automated guided vehicles systems (AGVS). Summaries of responses are shown in Table 3.

Table 3 shows that CAD has the highest level of application in UK manufacturing firms (highest mean) with 81 percent of respondents having it in their firms. The high level of application of CAD is followed by the application of CAM and CNC. There is a similar pattern in responses for the level of application of CAM and CNC. Responses show that many firms (43 percent and 48 percent of respondents) do not apply CAM and CNC, respectively, however, there is a discernible tendency for firms that do apply them to do so significantly.[10]

The levels of application of the other AMTs are low. Many respondents (52 percent, 53 percent, 55 percent, and 69 percent) do not apply CIM, FMS, CAE, or 'automated storage and retrieval system' (AS/RS), respectively, and there is a tendency, in firms that apply them, towards a low level of application (Mean < 4).

Responses show that AGVS are not a common advanced manufacturing technology in UK firms. They are not used in 85 percent of respondents' firms.

Levels of Application of IMPs

Respondents were asked to evaluate – on a seven-point Likert scale from (1) not at all, (4) moderately, up to (7) extensively – the extent of deploying.

Table 4. Respondents' Evaluation of the Level of Application of IMPs.

IMPs (Ranked by Mean Value on Scale of 1–7)	*N*	Mean[a]	Median	Percentage of Firms Applying this Practice[b]
MRPI/II	313	4.60	5.0	84
Total quality management (TQM)	313	4.10	4.0	87
Just-in-time production (JIT)	313	3.85	4.0	81
Total preventive maintenance (TPM)	313	3.71	4.0	81
Enterprise requirement planning (ERP)	313	2.86	2.0	54
Optimised production technology (OPT)	313	1.93	1.0	37

[a] 1 = Not at all, 4 = moderately, and 7 = extensively.
[b] Percentage of respondents who gave (2–7) rank on the scale.

These IMPs were: just-in-time (JIT), total quality management (TQM), total preventive maintenance (TPM), materials requirements/manufacturing resource planning (MRPI/II), enterprise requirement planning (ERP), and optimised production technology (OPT).

Table 4 shows that MRPI/II have the highest level of application in UK manufacturing firms (highest mean). The high level of application of MRPI/II is followed by the application of TQM, JIT, and TPM, respectively.

There is a similar pattern in responses for the level of application of TQM, JIT, and TPM. Responses show that some firms do not apply these practices, however, there is a discernible tendency, in firms that apply them, towards a moderate level of application (Mean = 4).

It can be concluded that OPT is not a common innovative managerial practice in UK firms, where 63 percent do not apply it. Responses are striking in relation to the level of application of ERP, they show that generally ERP is partially applied. For instance, many respondents (46 percent) do not apply ERP, but of those who apply it, it is not seen as an important measure (Mean < 3).

Responses are consistent with the findings of previous research in UK firms during the last decade. For instance, Murphy and Braund (1990) report 52 percent implementation rate of FMS, Drury et al. (1993) report 48 percent, and Davies and Sweeting (1991a, 1991b) report 23 percent. An application rate of 70 percent for CAD was reported (Murphy & Braund, 1990). Murphy and Braund (1990), also, report application rates for CAM and CIM as 81 percent and 55 percent, respectively. Davies and Sweeting (1991a, 1991b) report a 43 percent application rate of CIM. Drury et al. (1993) report that 64 percent of their survey respondents used CNC to some extent.

Table 5. A Comparison between Reported Application Rates of IMPs/ AMTs in Surveys of UK Firms.

	Application Rates Reported by Surveys (in %)					
	Present Survey (2001)	Abdel-Kader and Dugdale (1998)	Drury, Braund, Obsorne, and Tayles (1993)	Davies and Sweeting (1991a, 1991b)	Murphy and Braund (1990)	Voss and Robinson (1987)
IMPs						
JIT	58.7		28.0	26.0	23.6	16
TQM	64.6		–	40.0	–	–
MRPI/ II	71.6		–	63.0 (MRPII)	–	–
AMTs						
FMS	26.8	42	48.0	12.0	51.7	–
CAD	68.4	86	–	–	69.2	–
CAM	41.2	55	–	–	80.6	–
CIM	29.5	36	–	18.0	54.75	–
CNC	36.7	63	64.0	–	–	–

Abdel-Kader and Dugdale (1998) reported application rates for CAD, CAM, and FMS as 86 percent, 55 percent and 42 percent respectively.

A comparison between implementation rates for different IMPs and AMTs reported in this survey and other surveys for UK firms is presented in Table 5.

In making this comparison, the figures used in the present survey represent the cumulative percentage of respondents who apply the specified IMPs and AMTs at a 'moderate' (point 4 on the scale) to 'extensive' (point 7) level of application. This is consistent throughout Table 5. It was not fully clear, in previous research, what basis was used to report the proportion of application.

Levels of Application of CMAPs

Respondents were asked to indicate whether seven contemporary management accounting practices were (1) not applied, (2) partially applied, or (3) systematically applied in their organisations. These practices are shown in Table 6 together with the distribution of respondents by level of application. The application of some of these practices has been examined in previous

Table 6. Distribution of Responses Concerning Level of Deployment of Contemporary Management Accounting Practices (CMAPs).

Management Accounting Practice (Ranked by Mean on a Scale of 1–3)	*N*	Mean[a]	Percentage of Respondents		
			1	2	3
Customer profitability analysis (CPA)	313	1.85	36.4	41.9	21.7
Benchmarking of performance (BP)	313	1.84	28.1	59.4	12.5
Strategic management accounting (SMA)	313	1.78	39.0	43.8	17.3
Activity-based techniques (ABT)	313	1.62	50.2	37.7	12.1
Throughput accounting (TA)	313	1.60	56.5	27.5	16.0
Balanced scorecard (BSC)	313	1.56	58.8	26.5	14.7
Economic value added (EVA)	313	1.52	62.0	24.0	14.1

[a] 1 = not applied; 2 = partially applied; 3 = systematically applied.

studies (Murphy & Braund, 1990; Drury et al., 1993; Dean & Snell, 1996; Otley, 1999).

Responses show that 'benchmarking of performance', 'customer profitability analysis', and 'strategic management accounting', respectively, are widely applied in UK manufacturing firms. Benchmarking of performance is partially to systematically applied by 72 percent of respondents, customer profitability analysis by 64 percent, and strategic management accounting by 61 percent. Moreover, responses show a tendency towards a 'systematic application' of customer profitability analysis (22 percent), followed by strategic management accounting (17 percent), and benchmarking of performance (13 percent), respectively.

It was expected, from the literature, that some firms would be applying 'activity-based techniques' (ABT) and balanced scorecard (BSC). However, responses show that more than half of respondents (50 percent for the ABT and 59 percent for BSC) do not apply these practices. Moreover, firms that apply ABT and BSC, tend to apply them at a 'partial' not a 'systematic' level. This accords with Abdel-Kader and Luther study's (2006) which concludes that the deployment of contemporary management accounting techniques in UK firms is less widely than might be assumed by writings in the field.

Table 6 also shows that throughput accounting and economic value added (EVA) are not common management accounting practices in UK firms, with 57 percent and 62 percent of respondents, respectively, not applying them in their firms.

These findings confirm other survey results in UK, for instance, Murphy and Braund's (1990) survey suggests that companies are considering the implementation of more modern management accounting techniques such as activity-based costing (ABC), throughput accounting, and strategic management accounting.

As regards to ABC, results of previous surveys of UK firms in the early 1990s report a 10 percent average adoption rate[11] (Innes & Mitchell, 1991; Nicholls, 1992; Drury et al., 1993). However, adoption rates of ABC increased in the mid-1990s to 20 percent (Innes & Mitchell, 1995), 21 percent (Evans & Ashworth, 1996), and 22 percent (Banerjee & Kane, 1996). In addition, Innes, Mitchell, and Sinclair (2000) report 17.5 percent application rate of ABC and 20.3 percent of respondents who did not adopt ABC were considering implementing it.

However, one important constraint on these comparisons is that, findings of previous surveys were related to activity-based costing (ABC), management (ABM), and budgeting (ABB) separately, whereas, in this survey, they are all listed under one title, activity-based techniques (ABT). The effect of this is that any comparison between the adoption rate of ABC, ABB, and ABT in this survey and the adoption rates in previous surveys may be inaccurate.

Findings reported from previous UK studies, also, reveal different implementation rates of 'strategic management accounting' that ranged from 17.9 percent to 44 percent in the mid-1990s (Murphy & Braund, 1990; Davies & Sweeting, 1991a, 1991b; and Drury et al., 1993). A 40 percent implementation rate of 'throughput accounting' was also reported (Davies & Sweeting, 1991a, 1991b).

A UK study by Innes and Mitchell (1995) reports that 50 percent of respondents use 'customer profitability analysis' and a further 12 percent planned to do so in future. Also, another survey of 187 UK firms by Drury and Tayles (2000) indicates that 74 percent of respondents analyse profits either by customers or customer categories. Tonge, Larsen, and Pepper (2000) report that 16 firms out of 41 FTSE 100 surveyed firms were found to apply balanced scorecard.

Monitoring of Competitive Environment

Respondents were asked to indicate – on a seven-point Likert scale, from 1 (no importance), 4 (moderate importance), up to 7 (critical importance) – the importance of six aspects of competition. These aspects were quality,

Table 7. Respondents' Evaluation of Level of Importance of Competition on Various Characteristics.

Dimensions of Competition (Ranked by Mean Value on Scale of 1–7)	*N*	Percentage of Respondents who Gave Some Degree of Importance[a]	Mean
Customer service	313	99.7	6.16
Quality	312	100.0	6.12
Price	313	99.4	6.10
Delivery	313	100.0	5.97
Flexibility	313	99.0	5.27
Innovation	313	97.8	4.87

Note: 1 = no importance, 4 = moderate importance, and 7 = critical importance.
[a]Percentage of respondents indicating moderate degree of importance (4–7) on the scale.

innovation, customer service, price, delivery, and flexibility. The respondents' evaluation of the levels of importance of these six aspects is presented in Table 7.

A scrutiny of responses in Table 7 shows that customer service is the most important characteristic in competition (highest mean) followed by quality and price, respectively. More than half of respondents consider these three characteristics of competition as of 'critical' importance in any competitive environment.

Most of respondents (89 percent) consider delivery to be of 'above moderate' importance in competition, while many of them (66 percent and 63.3 percent) consider flexibility and innovation to be of 'above moderate' importance.

The next section explores the degree to which the use of non-financial measures might be related to the contingent variables.

RELATIONSHIPS AMONG THE IMPORTANCE OF SFNFPMs AND THE LEVEL/EXTENT OF APPLICATION OF THE CONTINGENT VARIABLES

The second objective of this study is to examine whether the use of SFNFPMs is associated with internal and external contingent variables (Research Question 2). However, examining the associations between the use and importance of the 19 subsidiary SFNFPMs and the extent of the

Table 8. Composite Categories of Shop-Floor Non-Financial Performance Measures (SFNFPMs) and Related Subsidiary Measures.

SFNFPMs Evaluation Category	SFNFPMs
Product Quality (PQ) (Y_1)	Scrap, defects, reworks, and batches
Customer Satisfaction (CS) (Y_2)	No. of complaints from customers, no. of returns, and no. of warranty claims
On-time Delivery (OTD) (Y_3)	Percentage of on-time delivery to customers, Percentage of on-time production, Percentage of schedule adherence, and manufacturing cycle efficiency
Employee Morale (EM) (Y_4)	Staff turnover, absenteeism, lateness, and employee attitude survey
Efficiency and Utilization (EU) (Y_5)	Efficiency, activity, capacity utilization, and proportion of overtime worked

Table 9. Composite Categories of the Contingent Variables Incorporated in this Study.

Contingent Variable	Composite Score for
Innovative managerial practices (IMPs) (X_1)	JIT, TQM, MRPI/II, TPM, ERP, and OPT
Advanced manufacturing technologies (ATMs) (X_2)	FMS, CAD, CAM, CIM, CNC, AS/RS, and AGVS.
Contemporary management accounting practices (CMAPs) (X_3)	BP, ABT, BSC, EVA, CPA, TA, and SMA
Competitive environment (X_4)	Quality, customer service, innovation, price, delivery, and flexibility.

implementation of the 27 contingent variables included in the study is tedious and can yield results that are difficult to interpret. In an attempt to minimize such complications, the associations were tested between composite SFNFPMs and composite contingent variables.

The groups of composite SFNFPMs are presented in Table 8. The composite score of each evaluation category, that is, the sum of the ratings the respondents gave to the subsidiary SFNFPMs comprising an evaluation category, were used as dependent variables. For instance, the ratings given to the 'number of complaints from customers', 'number of returns', and 'number of warranty claims' were added and the sum used as a composite score of the SFNFPM evaluation category named 'customer satisfaction'.

Similarly, four composite variables were constructed for the four categories of contingent variables, listed in fourth section, as in Table 9.

Recalling from Chapter 4, the objective here is to statistically test the following 20 hypotheses:

Product Quality (Y_1)

H_1. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in UK manufacturing firms.

H_2. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in UK manufacturing firms.

H_3. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in UK manufacturing firms.

H_4. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in UK manufacturing firms.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in UK manufacturing firms.

H_6. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in UK manufacturing firms.

H_7. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in UK manufacturing firms.

H_8. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in UK manufacturing firms.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in UK manufacturing firms.

H_{10}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in UK manufacturing firms.

H_{11}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in UK manufacturing firms.

H_{12}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in UK manufacturing firms.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in UK manufacturing firms.

H_{14}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in UK manufacturing firms.

H_{15}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in UK manufacturing firms.

H_{16}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in UK manufacturing firms.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in UK manufacturing firms.

H_{18}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in UK manufacturing firms.

H_{19}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in UK manufacturing firms.

H_{20}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in UK manufacturing firms.

In order to examine the associations among the contingent variables and the use and importance of SFNFPMs, a non-parametric statistical technique was applied. As the data were primarily ordinal, Kendall's

Table 10. Kendall's τ-Correlations Among Levels of Deployment/Application of Contingent Factors (Composites) and Levels of Importance of SFNFPMs of Five Evaluation Categories (Composites) in use in UK Manufacturing Firms.

Composite Independent Variables	Composite Dependent Variables				
	PQ (Y_1)	CS (Y_2)	OTD (Y_3)	EM (Y_4)	EU (Y_5)
X_1: Level of application of IMPs (JIT, TQM, etc.)	0.183**	0.173**	0.297**	0.184**	0.159**
X_2: Level of application of AMTs (FMS, CAD, CAM, etc.)	0.091*	0.150**	0.177**	0.076	0.106**
X_3: Level of deployment of CMAPs (BP, ABC, ABB, etc.)	0.124**	0.060	0.217**	0.220**	0.187**
X_4: Competitive environment (quality, price, etc.)	0.181**	0.211**	0.235**	0.224**	0.210**

*Significant at 95% level of significance ($\alpha = .05$, 2-tailed).
**Significant at 99% level of significance ($\alpha = .01$, 2-tailed).

τ-statistic test was applied (SPSS, 13)[12] (Siegel, 1956; Cramer, 1994; De Vaus, 1996). The correlations among the contingent variables (composites) and the existence and importance of the composite SFNFPMs are shown in Table 10.

Results in Table 10 reveal significant relationships among virtually all contingent factors (composites) and all five categories of the existence and importance of SFNFPMs (composites) included in this study, with the exception of 'customer satisfaction' and 'employee morale'. Comments on the above are presented next.

IMPs

Significant positive correlations are found between this group and the use and importance of SFNFPMs of the five evaluation categories. Results are consistent with CIMA (1993) study on UK manufacturers which shows that, to a large extent, the manufacturing process would play a large part in determining the adopted performance measures. CIMA argues that a company adopting JIT production system is likely to deploy novel measures to police delivery performance. Also, the adoption of a TQM philosophy is matched with an enhanced level of quality tracking (CIMA, 1993; Bhimani, 1994).

The significant correlations found are also consistent with other studies which found positive associations between the emphasis placed on IMPs and the provision of non-financial measures such as defect rates, on-time delivery, and machine utilisation (Daniel & Reitsperger, 1991; Banker, Potter, & Schoreder, 1993; CIMA, 1993; Drury et al., 1993; Abernethy & Lillis, 1995, Chenhall, 1997; Perera, Harrison, & Poole, 1997; Jazayeri & Hopper, 1999). For instance, reduced manufacturing lead time, improved labour productivity, reduced scrap, rework, warranty costs, increased manufacturing flexibility, achieving delivery promises, and improved customer service all are potential benefits of the application of AMTs (Cobb, 1992; Bromwich & Bhimani, 1994). Also, Harrison and Poole (1997) have found empirical evidence, after surveying 200 managers of Australian manufacturing firms, that there is a greater emphasis on non-financial performance measures for firms in which the application of IMPs is high.

The application of TQM and TPM leads organisations to put more importance on the SFNFPMs of all five evaluation categories. This could be because the application of these practices embeds quality concerns, workforce empowerment, and training for workforce (Hackman & Oldham, 1995; McAdams & Bannister, 2001). Many companies are driven by profit and with TQM application, profit comes from customer satisfaction. It is argued that (Hackman & Oldham, 1976; Goodman, Lerch, & Mukhopadhyay, 1998) emphasis on non-financial measures such as attitudes and team working will lead to improved financial performance.

The application of JIT is significantly correlated with the use and importance of 'on-time delivery' and 'product quality'. That could be because JIT task is highly interdependent where each succeeding task depends on the quality and timeliness of the preceding task (Selto, Renner, & Young, 1995). It requires operators to detect and correct process problems and to seek ways to prevent defects spontaneously (Selto et al., 1995).

Moreover, a survey by Jazayeri and Hopper (1999) shows that changes in performance measures in some surveyed companies begin with their adoption of MRPII. Also, Harries (1990) suggests that MRPII is in part based on the assumptions of infinite capacity, fixed lead times, and fixed batch sizes. Hence, one could conclude that firms who apply MRPI/II, ERP, and OPT will be keen to have measures of efficiency, timeliness, and product quality.

AMTs

Many significant positive correlations are found between the levels of application of AMTs and the use and importance of SFNFPMs of 'efficiency and utilisation', 'on-time delivery', 'product quality', and 'customer satisfaction'. One might be driven, by these few significant correlations, to conclude that companies that apply AMTs show interest in monitoring measures of these four categories to ensure a successful application of these techniques. For instance, Bromwich and Bhimani (1994) and Dilts and Russell (1985) argue that organisations can get better product quality and maximise machine utilisation when FMS is implemented. This is consistent with other studies which found positive associations between the emphasis placed on AMTs and the provision of non-financial measures such as defect rates, on-time delivery, and machine utilisation (Daniel & Reitsperger, 1991; Banker et al., 1993; Drury et al., 1993; Abernethy & Lillis, 1995, Chenhall, 1997; Perera et al., 1997).

It is notable that there is no significant correlation between this group and the existence and importance of 'employee morale' measures. Perhaps companies that apply AMTs are less interested in 'employee morale' measurement as computerised machines take over workforce. Lee (1987), for instance, states that the implementation of FMS requires that a firm plans for the resistance from employees who fear the possible loss of their jobs. Also, Mackey and Thomas (1991) argue that in FMS, support labour is required for maintenance only and occasionally to replace tools.

CMAPs

Significant correlations are found between variables in CMAPs group and the existence and importance of SFNFPMs of four evaluation categories: product quality, on-time delivery, employee moral, and efficiency and utilisation. One might conclude that the deployment of CAMPs, benchmarking of performance for instance, requires an adaptation to competitive environment and that will require upgrading workforce skills, efficient use of resources, and delivery timeliness.

The lack of a significant correlation between this group and SFNFPMs of 'customer satisfaction' is striking. One would have expected to find significant correlations between the application, for instance, of BSC or customer profitability analysis and company's tendency to monitor the satisfaction of its customers.

One might be inclined to interpret such results in light of the view that companies introduce technology into 'islands of excellence' rather than comprehensively (Murphy & Braund, 1990).

Competitive Environment

Results shown in Table 10 confirm that competitive environment is an important contingent factor and has high significant positive correlations with all five SFNFPMs evaluation categories. This finding is consistent with the argument that the dynamics of the markets in which a company operates are recognised as important factors that influence the use and importance of performance measures (Khandwalla, 1972; Otley, 1980; Bhimani, 1993; CIMA, 1993; Drury et al., 1993; Bhimani, 1994; Otley, 1999; Hoque, Mia, & Alam, 2001). This finding is also consistent with Chenhall and Morris (1986) who report positive associations between perceived environmental uncertainty and the demand for broad-based performance measurement systems incorporating non-financial indicators. Moreover, Hoque et al. (2001) in surveying 71 New Zealand manufacturers report a significant positive relationship between the intensity of the market competition and the use of non-financial performance measures.

It could be argued that the higher the competition a company faces, the more importance it puts on the use of non-financial performance measures at shop-floor. This may be because such non-financial performance measures enhance competitiveness by clearly monitoring the organisation's competencies.

SUMMARY

This chapter presents summary descriptive statistics of the raw data gathered through a large survey of UK manufacturing firms in 2001. The chapter sheds light on the application and importance of SFNFPMs of five evaluation categories (i.e. product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) in use in UK manufacturing firms and the following factors: the levels of application of IMPs, AMTs, contemporary management accounting practices, and managers' perception of the levels of importance of competitive environment. The aim of this study is to obtain a comprehensive view of the shop-floor performance measures used in UK manufacturers; hence a large-scale postal survey was undertaken. Questionnaires relating to 19 SFNFPMs and 27 contingent variables were sent in March 2001 to the management accountants/financial managers of 2,242 UK manufacturing firms belonging to 21 different industries. The total number of usable responses to the questionnaire was 313 giving an overall response rate of 14.3 percent. A summary of the descriptive statistics is presented in fourth section.

Findings reported in this chapter reveal that SFNFPMs are now extensively employed in the surveyed UK manufacturing firms with most of the measures listed used by more than 80 percent of the responding firms and where measures are used, they are generally considered to be important. The top three measures (out of the 19 SFNFPMs) are customer related, while the next four are related to process efficiency where measures of efficiency, defect, and scrap levels and absenteeism in most firms are evaluated as being important.

One can conclude that UK managers do have different evaluations of the use and level of importance attached to SFNFPMs in their firms and this could be ascribed to a prior cognition of the importance of such measures. For instance, firms that recognise the importance of measuring '% of on-time production' would apply such measure and attach a high level of importance to it, while those firms that do not recognise such importance would not apply it.

Amongst the AMTs applied in the surveyed firms, CAD has the highest level of application followed by the application of CAM and CNC. There is a similar pattern in responses for the level of application of CAM and CNC. The levels of application of the other AMTs incorporated in the study are low, in addition findings show that AGVS are not a common advanced manufacturing technology in the surveyed firms.

Findings show that 'material requirements/manufacturing resource planning' (MRPI/II) have the highest level of application, amongst the other IMPs incorporated in the study, in the surveyed firms, followed by the application of TQM, JIT, and TPM, respectively, and there is a discernible tendency, in firms that apply them, towards a moderate level of application. Optimised production technology (OPT) was found to be an uncommon practice in the surveyed firms. Findings also show that ERP is partially applied (i.e. low mean). Findings reported in this study are consistent with the findings of previous research in UK firms during the last decade (see, Murphy & Braund, 1990; Drury et al., 1993; Davies & Sweeting, 1991a, 1991b; Abdel-Kader & Dugdale, 1998).

Findings, also, show that, amongst the CMAPs incorporated in the study, 'benchmarking of performance', 'customer profitability analysis', and 'strategic management accounting', respectively, are widely applied in the surveyed firms. In accordance with Abdel-kader and Luther (2006), ABT and BSC seem to have low deployment rate in the surveyed firms where more than half of respondents do not apply them. In addition, management accounting practices such as 'throughput accounting' and EVA are found to be uncommon in the surveyed firms. These findings seem consistent with findings from other surveys in UK (see, for instance, Murphy & Braund, 1990; Innes & Mitchell, 1991; Nicholls, 1992; Drury et al., 1993; Evans & Ashworth, 1996; Banerjee & Kane, 1996; Drury & Tayles, 2000; Innes et al., 2000; Tonge et al., 2000).

Customer service is found to be the most important characteristic in competition, as perceived by managers in the surveyed firms, followed by quality and price, respectively. However, respondents do perceive all other characteristics of competition as important.

The chapter, also, examines the associations among the use and levels of importance attached to SFNFPMs of the five evaluation categories (composites) in use in the surveyed UK manufacturing firms and the levels of application/importance of the four contingent factors (composites) incorporated in the study, i.e. IMPs, AMTs, CMAPs, and aspects of competition. Significant positive correlations were reported, in compliance with previous research studies, among the use and levels of importance attached to SFNFPMs of virtually the five evaluation categories and the levels of application/importance of the four contingent factors incorporated (above).

The next chapter, Chapter 6, presents descriptive analyses of responses and examines possible correlations among levels of importance of SFNFPMs and levels of deployment/application of the contingent variables incorporated in this study in Italian manufacturing firms.

NOTES

1. Also reported in Bhimani (1993, 1994).
2. The study was funded by Bristol Business School, University of the West of England, UK.
3. It is worth noting that the 19 individual measures fall into five groups: product quality (scrap, defects, rework, and batches); customer satisfaction (number of complaints received from customers, number of returns, and number of warranty claims); on-time delivery (percentage of on-time delivery to customer, on-time production, schedule adherence, and manufacturing cycle efficiency); employee

morale (percentage of staff turnover, percentage of absenteeism, percentage of lateness and employee attitude survey); and efficiency and utilisation (efficiency, activity, capacity utilisation, and proportion of over-time worked).

4. The questionnaire was sent to management accountants, financial managers, or managers who are responsible for the management accounting function in the surveyed manufacturing firms. This reflected our interest in traditional and contemporary management accounting techniques. However, because of the wide range of data collected, respondents were encouraged, in covering letters and within the questionnaire itself, to consult with other specialist managers where necessary.

5. The industry categories are as follows: manufacturing of food products and beverages; manufacturing of tobacco products; manufacturing of textiles; manufacturing of wearing apparel; dressing and dyeing of fur; tanning and dressing of leather, manufacturing of luggage, handbags, saddlery, harness, and footwear; manufacturing of wood and of products of wood and cork, except furniture; manufacturing of pulp, paper, and paper products, publishing and printing; publishing, printing, and reproduction of recorded media; manufacturing of coke, refined petroleum products, and nuclear fuel; manufacturing of chemicals and chemicals products; manufacturing of rubber and plastic products; manufacturing of non-metallic mineral product; manufacturing of rubber and plastic products; manufacturing of non-metallic mineral product; manufacturing of basic metal; manufacturing of fabricated metal products; manufacturing of machinery and equipment; manufacturing of computers; manufacturing of radio, television, and communication equipment and apparatus; manufacturing of medical, precision, and optical instruments, watches and clocks; manufacturing of motor vehicle, trailers, and semi-trailers; manufacturing of other transport equipment; and manufacturing of furniture.

6. These are, as stated in the previous chapters, six IMPs (JIT, TQM, TPM, MRPI/II, ERP, OPT), eight AMTs (FMS, CAD, CAM, CIM, CNC, CAE, AS/RS, AGVS), seven contemporary management accounting practices (benchmarking, activity-based techniques, balanced scorecard, economic value added, throughput accounting, strategic management accounting, customer profitability analysis), and six aspects of competition (quality, innovation, customer service, price, delivery, and flexibility).

7. A stratifying variable is "the characteristic on which we want to ensure correct representation in the sample" (De Vaus, 1996, pp. 65–66).

8. See Chapter 4 for more details.

9. Responses from 'no importance' (1) to 'moderate importance' (4). That is consistent throughout the interpretation of the responses in Table 2.

10. 30.0–35.1% of responses are between 'above moderate application' (point 5 on the scale) and 'extensive application' (point 7) for CNC and CAM, respectively.

11. However, Davies and Sweeting (1991a, 1991b) report a 32 percent implementation rate of ABC in UK firms. Also, Cobb (1992) and Drury et al. (1993) indicate that 33 percent and 37 percent of their surveyed firms were considering the adoption of ABC, respectively.

12. Two hypotheses are postulated in applying Kendall's τ-statistic test. The first is the null hypothesis (H_0) that the contingent variables are not associated with the use and importance of the composite SFNFPMs in the population, and the second is

the alternative hypothesis (H_1) that they are associated. The null hypothesis H_0 (there is no correlation between the variables) will be rejected in favour of the alternative hypothesis H_1 (there is a correlation between the variables) when, and only when, the probability associated with the occurrence under H_0 of any value (τ) is equal to or less than (0.05) (Siegel, 1956). For brevity, the acceptance or rejection of the null hypotheses will depend on the reported correlations.

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CHAPTER 6

NON-FINANCIAL PERFORMANCE MEASURES IN THE ITALIAN MANUFACTURING FIRMS

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INTRODUCTION

In the last 10 years the competitiveness of Italian industry has deteriorated. According to a recent survey of Bank of Italy (Banca d'Italia, 2005), Italian productive system is behind, if compared with other European ones, in terms of innovation and investments in research and development. Labour productivity has grown less than in other European countries. Italian productive system is fragmented and continues with this trend. The report indicates that the proportion of Italian medium-sized firms[1] has declined from 4.5 percent to 3.9 percent between 1991 and 2001. The report also indicates that many big Italian firms experience difficulties, attributed to incompetent organisation and strategic practices.

The 1990s has been a period of incorporating intensive changes in Italian firms. In the last 10 years the government has intervened with many rules (e.g. labour market) to enhance competitiveness in many sectors. One, thus, would expect that such a governmental support to the industry sector in Italy would have had better results than these reported by Bank of Italy.

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However, there are three factors should be considered when analysing the performance of Italian manufacturing firms in comparison with their European peers. These are: business governance, historical background of the introduction of managerial practices in Italian firms, and industrial relations with unions.

Business Governance

A recent survey (IFERA, 2003) highlights that most of Italian manufacturing firms (93 percent) are family owned. Italian family businesses are not necessarily small and medium enterprises. This could have important consequences, since the tenure of the CEO tends to be longer in such type of businesses (see, Barry, 1989; Cromie, Stephenson, & Monteith, 1995; Reid & Adams, 2001), and that is seen by some commentators as possible obstacle to management accounting change (Burns & Scapens, 2000). Also, the role played by entrepreneurial management is usually relevant here. The entrepreneurial manager is in many cases the founder that remains the most important figure in the firm. The central role of the founder usually produces the adoption of ad hoc planning and control systems, with very basic budgeting practices, an informal structure, and a culture oriented to the family values (Flamholtz, 1986, p. 42). Elements that may promote a change in the design of control systems of family business are related mainly to the perception of an increased level of competition and complexity of the external environment, which is also fostered by the globalization of the economy and IT developments. These elements contribute in fostering the need of vertical and horizontal integration within organisations, which can be achieved also by the use of non-financial performance measurement systems (Amigoni & Miolo Vitali, 2003, p. XI). Moreover, Arena, Azzone, and Caimi (2004) highlight that the increased competition and the IT developments augmented the dissatisfaction with traditional control systems also in Italian organisations.

Historical Background of the Introduction of Managerial Practices in Italian Firms

Commentators have argued that Italian firms are lagging, compared to European and North American firms, in the extent of application of contemporary management techniques (see for instance, Costa, Faccipieri, &

Rullani, 1978; Volpato, 1978; Barbato, Collini, & Quagli, 1996; Kipping, 1999). This has been ascribed to the low level of market competition since the late 1970s. This has partially shifted the attention of Italian managers away from the issue of cost efficiency towards thinking of ways to enhance the design and the use of management accounting techniques in their companies (Barbato et al., 1996). This trend was reinforced by further turbulences in Italian economy (rapid economic growth in the 1980s followed by an economic crisis in early 1990s), as managers struggled to solve many managerial problems in that era (*ibid.*).

However, a recent survey on Italian firms in 1990s (Barbato et al., 1996) has shown evidence of an increasing awareness among Italian managers of the importance of developing their firms' management accounting systems. This was influenced by Italian managers' recognition of the important role of efficiency in facing international competition and the increasing number of university educated managers, in Italian firms, who understand the usefulness of the new management tools (*ibid.*). Moreover, recently the Italian context has been characterised by an increasing awareness of the relevance of customers, employees, and quality in facing competition. This awareness has contributed to a change in the measure and tools that support manager decision-making processes (Arena et al., 2004).

Despite this, in relation to the Italian context, only few studies focus on the level of deployment and importance of management practices and techniques, and on the use and importance of non-financial performance measures (Pitzalis, 2003).

Industrial Relations with Unions

Another factor which has probably played an important role in the use of management techniques and of performance measures is the industrial relation model applied in Italy during the 1970s between firms and unions. In Italy, in fact, industrial relations have been based on a conflict relationship, so that in general performance measures have been seen by unions' representatives as non-impartial instrument in the hands of the firm.

This consideration is particularly true for medium–large organisations in which the presence of unions is more relevant, if compared to medium and small size organisations, and influences the management of the organisations. Therefore, unions can be considered as important stakeholders that, as highlighted by Arena et al. (2004), may affect the degree of deployment of management accounting systems.

In the Italian context a recent study (Arena et al., 2004) has highlighted a growing tendency of Italian firms to deploy 'new' performance dimensions as quality and customer satisfaction in their performance measurement systems. As a response to the increasing competition and the evolution of the economic environment, firms are extending the range of performance dimension that are monitored. Recent research studies on management control systems in manufacturing and service firms permeates the Italian literature (see, for instance, MIP – Politecnico di Milano, 1991; Collini & Stefani, 1994; Catturi & Mussari, 1996; Ostinelli & Toscano, 1996; Arena et al., 2004), however, reports on Italian research studies on the use of shop-floor performance indicators and the level of application of innovative managerial practices (IMPs), advanced manufacturing technologies (AMTs), and the extent of deployment of contemporary management accounting techniques in manufacturing firms are said to be rare. Moreover, these studies, apart from Arena et al. (2004) are mainly based on small samples of small–medium organisations and relate to specific Italian regions.

The reminder of this chapter is organised in four sections. The next section discusses research method and data collection. Third section presents descriptive analyses of responses. Fourth section examines possible correlations among levels of importance of shop-floor non-financial performance measures (SFNFPMs) in use in Italian manufacturing firms surveyed and levels of deployment/application of the contingent variables incorporated in this study. A summary is presented in the last section.

RESEARCH METHOD AND DATA COLLECTION

The sample frame includes all Italian CERVED listed[2] manufacturing firms belonging to 22 different industry sectors[3] and employing more than 200 employees. The total number of firms involved was 1,565. Questionnaires were sent in May 2003 to management accountants/financial controllers in the surveyed firms. We had 142 usable responses (9 percent average response rate).

The questionnaire[4] consisted of two parts. The first part relates to perceived importance and the use of SFNFPMs in helping organisation to compete effectively. The SFNFPMs considered are related to five main performance dimensions: quality, customer satisfaction, on-time delivery, employee morale, efficiency and utilisation. The second part focuses on the analysis of different technological, organisational, and environmental factors (i.e. contingent variables) that influence manufacturers' performance measurement. This part

Table 1. Results of Reliability Test.

Variables	No. of Items	*N*	Cronbach's Alpha
SFNFPMs	19	136	0.873
Contemporary management accounting practices (CMAPs)	7	117	0.740
Innovative managerial practices (IMPs)	6	122	0.715
Advanced manufacturing technologies (AMTs)	8	127	0.784
Aspects of competition	6	138	0.892

contains questions in relation to the deployment of IMPs, AMTs, contemporary management accounting practices (CMAPs), shop-floor related aspects (shop-floor involvement and development of skills and training of shop-floor), size of workforce, type of industry a company belongs to, and last but not least, the competitive environment a company operates in.

In assessing the reliability of the measurement of questions related to the variables incorporated in this study, Cronbach's alpha was calculated (using SPSS 13) for the independent and dependent variables. Results of reliability test are shown in Table 1.

From the above table, the lowest alpha value is 0.715. It, thus, can be concluded that the incorporated variables are reliable. In addition, the validity of the incorporated variables was reviewed in the piloting stages.

The majority of the respondents (97 percent) represent manufacturing firms employing between 1,000 and 10,000 employees while only 3 percent employ less than 1,000 employees.

DESCRIPTIVE ANALYSIS OF RESPONSES

This section examines the use and the level of importance of SFNFPMs; the level of application of AMTs, IMPs, and CMAPs; and the importance of the perceived level of competition in Italian manufacturing companies (Research Question 1). Descriptive statistics are presented and discussed in the following subsections.

Use and Level of Importance of SFNFPMs

Respondents were asked to indicate whether various SFNFPMs were applied in their companies and the importance attributed to each. Importance was signified on a seven-point Likert scale from 1 (no importance) to 7 (critical importance), and the 19 measures are shown in rank order in Table 2.

Table 2 shows that the perceived importance attributed to the SFNFPMs related to product quality, customer satisfaction, and efficiency and utilisation, in use in Italian firms is high (Mean > 5 in most measures). The majority of Italian manufacturing firms measure efficiency, scrap, % on-time delivery to customers and defects and perceive these measures to be *very* important. These are measures of efficiency and utilisation, product quality, and customer satisfaction, respectively.

The first measure in rank is 'efficiency', this is consistent with Barbato et al. (1996) findings that the increasing awareness among Italian managers of the importance of developing their firms' management accounting systems was ascribed, in part, to their recognition of the vital importance of efficiency to face international competition. It can be seen that, in addition to the first measure, the second and fourth of these measures (i.e. scraps and defects) can be used by companies as to monitor the level of non-value adding use of resources.

This perceived importance of efficiency is also consistent with Arena et al. (2004) study where efficiency was the most critical non-financial performance dimension, followed by customer satisfaction and quality. Arena et al.'s (2004) study also shows that on-time delivery was not considered important by respondents, time to market was measured and ranked quite low – ranked eighth out of nine performance dimensions.

Surveys on employees attitudes and, in general, measures related to the employee morale are considered less important if compared to the measures related to the other performance dimensions considered by this study. Also, measures on employee morale are not so in use; this result is not consistent with Arena et al. (2004) which states that there was a growing interest on measures related to employees by Italian firms. The most important employee measure is absenteeism, which, surprisingly, is also the most widely used SFNFPM by the surveyed Italian firms. The high diffusion of performance measures on absenteeism could be explained by the fact that high rates of absenteeism may affect productivity and/or efficiency.

Apart from absenteeism, in relation to the use of SFNFPMs, managers seem to be more consistent. The second, third, and fourth most measured variables are, once again, related to efficiency and are: scraps, defects, and efficiency (measured as standard hours produced/hours worked), respectively. It can also be noticed that measures related to customers (i.e. % on-time delivery, number of complaints from customers, and number of

Table 2. Shop-Floor Non-Financial Measures – in Ranked Order of Importance.

Rank by Importance	Shop-Floor Non-Financial Measures (Ranked by Mean Value on Scale of 1–7)	Mean Importance for Firms Using the Measure	Median	Percentage of Firms Using this Measure
	Product quality			
2	Scrap (% of total production)[a]	5.96	6.00	91.5
4	Defects (% of total production)	5.83	6.00	91.5
12	Rework (% of total production)	5.09	5.50	85.9
15	Batches (% adjusted)	4.76	5.00	60.6
	Customer satisfaction			
5	Number of complaints from customers[a]	5.82	6.00	88.7
7	Number of customer returns	5.77	6.00	86.6
14	Number of warranty claims[a]	4.93	5.00	63.4
	On-time delivery			
3	Percentage of on-time delivery to customers	5.89	6.00	89.4
6	Manufacturing cycle efficiency[a]	5.82	6.00	76.1
11	Percentage of schedule adherence[a]	5.28	6.00	70.4
13	Percentage of on-time production[a]	5.06	5.00	89.4
	Employee morale			
10	Absenteeism	5.31	5.00	93.7
17	Employee lateness	4.41	4.00	82.4
18	Staff turnover	4.25	4.00	67.6
19	Employee attitude surveys[a]	3.75	4.00	57.0
	Efficiency and utilization			
8	Activity (standard hours produced/budgeted standard hours)	5.64	6.00	82.4
9	Capacity utilisation (hours worked/budgeted hours)[a]	5.42	6.00	83.8
1	Efficiency (standard hours produced/hours worked)	6.14	6.00	90.1
16	Proportion of overtime worked[a]	4.71	5.00	85.9

[a] $N = 141$, $N = 142$ in all other SFNFPMs.

returns) are quite extensively used and are considered as relevant. This is consistent with Arena et al.'s (2004) survey of Italian firms where efficiency and quality and customer satisfaction were among the most measured variables in management control systems. Their survey results show efficiency, quality, and customer satisfaction were measured, respectively, by the 98, 94, and 88 percent of the surveyed companies.

One can conclude that Italian manufacturing firms are quite keen on the efficient use of their resources and on quality and delivery as ways to maintain their customers satisfied. It is also noted that measures related to shop-floor staff are not widely used by the surveyed Italian firms, and are considered less relevant.

Level of Application of AMTs

Respondents were asked to rank the level of application of AMTs on seven-point scale, [1 (not at all), 4 (moderately), and 7 (extensively)]. Table 3 shows the distribution of respondents by their evaluation.

Table 3 shows that only computer aided design (CAD) is widely applied in Italian manufacturing firms. One can conclude that the levels of application of the other AMTs are low (Mean < 4).

Level of Application of IMPs

Respondents were asked to rank the level of application of IMPs on seven-point scale, [1 (not at all), 4 (moderately), and 7 (extensively)]. Table 4 shows the distribution of respondents by their evaluation.

Table 4 shows that 'material requirements/manufacturing resource planning' (MRPI/II), 'enterprise requirement planning' (ERP), and 'total

Table 3. Distribution of Respondents' Level of Application of AMTs.

AMTs (Ranked by Mean Value on a Scale of 1–7)	*N*	Mean	Median	Percentage of firms applying this practice[a]
Computer aided design (CAD)	134	4.99	6.0	82.8
Computer aided manufacturing (CAM)	135	3.79	4.0	68.1
Computer numerical control (CNC)	131	3.75	4.0	64.1
Computer integrated manufacturing (CIM)	130	2.70	2.0	52.3
Computer aided engineering (CAE)	130	2.58	1.0	45.4
Flexible manufacturing systems (FMS)	132	2.44	1.0	41.7
Automated storage and retrieval system (AS/RS)	131	2.21	1.0	35.9
Automated guided vehicles systems (AGVS)	130	1.70	1.0	22.3

Note: 1 = not at all, 4 = moderately, and 7 = extensively.
[a]Percentage of respondents who gave (2–7) rank on the scale.

Table 4. Distribution of Respondents' Level of Application of IMPs.

IMPs (Ranked by Mean Value on Scale of 1–7)	*N*	Mean	Median	Percentage of Firms Applying this Practice[a]
MRPI/II	136	4.85	6.0	84.6
Enterprise requirement planning (ERP)	134	4.23	5.0	73.1
Total quality management (TQM)	134	4.15	4.0	83.6
Total preventive maintenance (TPM)	132	3.58	4.0	76.5
Just-in-time production (JIT)	135	3.44	4.0	68.9
Optimised production technology (OPT)	132	2.18	1.0	40.9

Note: 1 = not at all, 4 = moderately, and 7 = extensively.
[a]Percentage of respondents who gave (2–7) rank on the scale.

quality management' (TQM) are employed in Italian manufacturing firms more extensively than the other IMPs considered in this study. Just-in-time production (JIT) and optimised production technology (OPT) are the least important and the least applied practices by the surveyed firms. In relation to JIT, the low rate of adoption is consistent with Arena et al. (2004) even if it has to be noticed that in their study only the 8.3 percent of firms were adopting this IMPs.

Level of Application of CMAPs

Respondents were asked to indicate whether seven CMAPs were (1) not applied, (2) partially applied, or (3) systematically applied in their organisations.

Table 5 shows that over 80 percent of responding firms extensively apply 'customer profitability analysis'. The customer profitability analysis is the only management accounting practice which is applied systematically by almost half of the respondents. This seems consistent with the high importance attached to SFNFPMs of customer satisfaction reported in first section.

The second most applied technique is 'benchmarking of performance' which is applied systematically by the 18 percent of the respondents and applied extensively (i.e. systematically and partially) by the 59 percent of the respondents. The wide use of 'benchmarking of performance' is consistent

Table 5. Distribution of Respondents' Level of Application of Contemporary Management Accounting Practices.

Management Accounting Practice (Ranked by Mean on a Scale of 1–3)	*N*	Mean	Percentage of Respondents		
			1	2	3
Customer profitability analysis	129	2.29	17.1	37.2	45.7
Benchmarking of performance	129	1.77	41.1	41.1	17.8
Activity-based techniques	129	1.70	44.2	41.9	14.0
Economic value added	128	1.69	46.9	37.5	15.6
Balanced scorecard	126	1.56	59.5	25.4	15.1
Strategic management accounting	125	1.55	57.6	29.6	12.8
Throughput accounting	122	1.29	76.2	18.9	4.9

Note: 1 = not applied, 2 = partially applied, 3 = systematically applied.

with Arena et al. (2004). On the other hand, the other management accounting practices (activity-based techniques (ABT), economic value added, strategic management accounting, and balanced scorecard (BSC)) are not extensively applied in Italian manufacturing firms. Most of the responding firms do not apply 'throughput accounting' in their firms.

It was expected, from the literature, that many firms would be applying ABT and BSC, however, results show that many respondents do not apply these practices. Moreover, firms that apply ABT and BSC, tend to apply them at a partial not a systematic level. This could be interpreted, in case of ABT, in light of Barbato et al. (1996) suggestion that the acceptance of the functional principle and the multiple basis approach has made the innovative contribution of ABC more difficult to understand by Italian managers. Another possible explanation for the non-systematic use of these techniques is related to the lack of integrated information systems which may prevent its use within all the companies' functions (Arena et al., 2004).

Regarding the use of BSC in Italy Arena et al. (2004) have develop a multiple case study analysis that highlights a lack of competencies for the effective use of BSC and for updating its structure in order to be consistent with the evolution in the competitive environment.

Managers Perceptions of Competitive Environment

Respondents were asked to indicate the importance of six aspects of competition. These are presented in Table 6.

Table 6 shows that Italian manufacturers take quality and price *very* seriously. Virtually, all the respondents regard all the competitive dimensions

Table 6. Distribution of Respondents' Perceptions to Question about the Importance of Competition Dimensions.

Dimensions of Competition (Ranked by Mean Value on Scale of 1–7)	*N*	Percentage of Respondents who Gave Some Degree of Importance[a]	Mean
Quality	141	94.3	6.11
Price	142	95.1	6.05
Customer service	140	92.1	5.81
Delivery	141	92.2	5.74
Flexibility	141	90.8	5.67
Innovation	141	89.4	5.47

Note: 1 = no importance, 4 = moderate importance, and 7 = critical importance.
[a]Percentage of respondents indicating moderate degree of importance (4–7) on the scale.

as very important. This is consistent with Arena et al. (2004) findings where quality and price were revealed to be very important aspects of competition in Italian firms.

RELATIONSHIPS AMONG THE LEVEL OF IMPORTANCE OF SFNFPMs OF THE FIVE EVALUATION CATEGORIES AND THE LEVEL/ EXTENT OF APPLICATION OF THE CONTINGENT VARIABLES

The second objective of this study is to examine whether the use of SFNFPMs is associated with internal and external contingent variables (Research Question 2). Possible associations were tested between composite SFNFPMs and composite contingent variables. The reader is reminded, from the previous chapter, that the composites SFNFPMs considered are the 19 measures grouped in the five performance dimensions: product quality (PQ), customer satisfaction (CS), on-time delivery (OTD), employee morale (EM), and efficiency and utilisation (EU). The composite contingent variables include: the level of application and perceived importance of IMPs (e.g. just-in-time and total quality management), the level of application and perceived importance of AMTs (e.g. computer aided design and manufacturing), the level of application and perceived importance of CMAPs (e.g. activity-based costing and budgeting) and contingent factors related to the competitive environment (e.g. quality and price).

Recalling from Chapter 4, the objective here is to statistically test the following 20 hypotheses

Product Quality (Y_1)

H_1. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Italian manufacturing firms.

H_2. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Italian manufacturing firms.

H_3. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Italian manufacturing firms.

H_4. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Italian manufacturing firms.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Italian manufacturing firms.

H_6. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Italian manufacturing firms.

H_7. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Italian manufacturing firms.

H_8. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Italian manufacturing firms.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Italian manufacturing firms.

H_{10}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Italian manufacturing firms.

H_{11}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Italian manufacturing firms.

H_{12}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Italian manufacturing firms.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Italian manufacturing firms.

H_{14}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Italian manufacturing firms.

H_{15}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Italian manufacturing firms.

H_{16}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Italian manufacturing firms.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Italian manufacturing firms.

H_{18}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Italian manufacturing firms.

H_{19}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Italian manufacturing firms.

H_{20}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Italian manufacturing firms.

Kendall's τ-statistic test was applied[5] (Seigel, 1956; Cramer, 1994; De Vaus, 1996). The correlations among the contingent variables and the existence and importance of the composite SFNFPMs are shown in Table 7, with significant correlations denoted by asterisks (*5-percent level of significance, and **1-percent level).

Results reveal that almost all the SFNFPMs are significantly and positively correlated with most of the independent variables considered. The only missing correlation is the one between the use of measures related to 'efficiency and utilisation' and the level of application of AMTs (CAD, CAM, etc.).

In general one can observe the low significant correlations associated with the level of deployment of AMTs and the use and importance of SFNFPMs which can be partially explained by the low rate of adoption of AMTs by the Italian firms surveyed.

Of particular interest is the significant correlation between the use and importance of SFNFPMs and the manager's perception of the competitive environment. This is consistent with Arena et al.'s (2004) study that highlights a significant correlation between the perception of some critical competitive factors and the use of SFNFPMs.

Table 7. Kendall's τ-Correlations among Contingent Factors and Five Evaluation Categories of Use and Importance of SFNFPMs.

Composite Independent Variables	Composite Dependent Variables				
	PQ (Y_1)	CS (Y_2)	OTD (Y_3)	EM (Y_4)	EU (Y_5)
X_1: Level of application of IMPs (JIT, TQM, etc.)	0.224**	0.222**	0.273**	0.367**	0.237**
X_2: Level of application of AMTs (FMS, CAD, CAM, etc.)	0.146*	0.200**	0.134*	0.147*	0.093
X_3: Level of deployment of CMAPs (BP, ABC, ABB, etc.)	0.204**	0.226**	0.265**	0.225**	0.296**
X_4: Competitive environment (quality, price, etc.)	0.147*	0.196**	0.164**	0.177**	0.239**

*Significant at 95 percent level of significance ($\alpha = .05$, 2-tailed).
**Significant at 99 percent level of significance ($\alpha = .01$, 2-tailed).

It is surprising that measures related to 'product quality' are the only ones that have a low correlation with the perception of competition. However, bearing in mind the results of this study, reported in the previous section, and those reported by Arena et al. (2004) study, one can conclude that product quality measures are considered important and are utilised by Italian firms; also in both the studies quality represents an important factor for competition. Moreover, one possible explanation could be that the concept of quality as a competitive factor may be considered in broad terms by Italian managers. Small and medium enterprises operating in Italy in the second-half of last century have predominantly operated in mature sectors (e.g. textile, clothes, shoes, mechanics, furniture) by means of incremental innovations and flexible organisational structures (Lorenzoni, 1987) especially via networks; in Italy the unified craft process still dominates and the separation between 'conceiving' and 'making goods' in the production process is very soft. Italian firms, thus, tend to compete on quality and on the aesthetic attributes of the products more than on price.

CONCLUSIONS

This chapter presents a part of the cross-countries comparative studies on the use and importance of SFNFPMs in Italian manufacturing firms. Two objectives were covered, first, to highlight the use and perceived importance of SFNFPMs (the dependent variables) and levels of application of IMPs, AMTs, CAMPs and level of importance of aspects of competition (the independent variables) in the Italian manufacturing firms. Second, is to examine whether the use and levels of importance of SFNFPMs of the five shop-floor non-financial performance measures evaluation categories (the dependent variables) are associated with the levels of deployment/importance of the independent variables.

From the descriptive analysis of responses, one can conclude that Italian manufacturing firms are resource focused (keen on more efficient use of their resources). The majority of Italian manufacturing companies use mainly measures of efficiency and utilisation, product quality, and customer satisfaction, respectively.

Whilst these results give a picture of Italian firms that is quite similar with the one provided by previous studies (in particular with Arena et al., 2004), results seems to be quite different when dealing with SFNFPMs related to staff. In this study there seems to be a low attention to measures related to the employee morale, whilst from the Arena et al.'s (2004) study indicates that firms are sensitive to employees' issues. On the one hand, this could be explained by the fact that this study considers specific measures of employee morale and these may be not the same as those studied by Arena et al. (2004). On the other, it could be also true that in Arena et al.'s (2004) study questions formulated to managers were defined in general terms (e.g. with something like: Do you think that employee satisfaction is relevant for your business?), which might have influenced respondents answers. A possible explanation for the results obtained in this study could be derived from the industrial relationship model actually operating in Italy, which has been historically based on a conflict relationship between property and labourers and which is changing only in these last years. In particular, employee non-financial performance measures may be used as instrument in the conflict relationships between organisations and unions.

'Material requirements/manufacturing resource planning' (MRPI/II), 'enterprise requirement planning' (ERP), and 'total quality management' (TQM) are employed in Italian manufacturing firms more extensively than the other IMPs. Results show low application rate of ABT and BSC in Italian manufacturing firms. In addition, Italian firms that apply ABT and BSC, tend to apply them at a partial not a systematic level.

The partial application of ABT and BSC by Italian manufacturing organisations may be a reason for the acknowledgment of Italian managers about the failure of performance measurement and control systems in contributing to the achievement of objectives that relates to employees and customers (Arena et al., 2004). In addition, results show that Italian manufacturers take quality and price *very* seriously in competition.

The results are consistent with previous surveys that state the increasing awareness among Italian managers of the importance of developing their firms' management accounting systems because of their recognition of the vital importance of efficiency to face international competition and of the increasing turbulence of the competitive environment (Arena et al., 2004).

The current survey results could be partially interpreted in light of understanding the effects of ownership and governance systems of Italian firms (managers' attitude and organisational structure) and, more importantly, the persistent turbulences in the Italian economy in the last decades which led to focusing Italian managers' attention on developing management techniques and practices in their firms.

NOTES

1. In terms of size of workforce.

2. CERVED is an Italian official database that lists all companies operating in Italy.

3. The industry sectors are as follows: manufacturing of food products and beverages; manufacturing of tobacco products; manufacturing of textiles; manufacturing of wearing apparel; dressing and dyeing of fur; tanning and dressing of leather, luggage, handbags, saddlery, harness, and footwear; manufacturing of wood and of products of wood and cork; manufacturing of furniture; manufacturing of pulb, paper, and paper products; publishing, printing, and reproduction of recorded media; manufacturing of coke, refined petroleum products, and nuclear fuel; manufacturing of chemicals and chemical products; manufacturing of rubber and plastic products; manufacturing of non-metallic mineral product; manufacturing of basic metal; manufacturing of fabricated metal products; manufacturing of machinery and computers; manufacturing of electrical machinery and apparatus; manufacturing of radio, television, and communication equipment and apparatus; manufacturing of medical, precision and optical instruments, watches and clocks; manufacturing of motor vehicle, trailers and semi-trailers, and transport equipment.

4. The questionnaires were first translated into Italian by a professional translator and then translated back to English. Any discrepancies or ambiguities were investigated and resolved, as applicable.

5. The reader is reminded that, two hypotheses are postulated in applying Kendall's τ-statistic test. The first is the null hypothesis (H_0) that the contingent variables are not associated with the use and importance of the composite SFNFPMs in the population, and the second is the alternative hypothesis (H_1) that they are associated. The null hypothesis H_0 (there is no correlation between the variables) will be rejected in favour of the alternative hypothesis H_1 (there is a correlation between the variables) when, and only when, the probability associated with the occurrence under H_0 of any value (α) is equal to or less than (0.05) (Seigel, 1956). For brevity, the acceptance or rejection of the null hypotheses will depend on the reported correlations.

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CHAPTER 7

NON-FINANCIAL PERFORMANCE MEASURES IN JAPANESE MANUFACTURING FIRMS

Ahmed Abdel-Maksoud, Takayuki Asada and Masaru Nakagawa

INTRODUCTION AND LITERATURE REVIEW

The Japanese economy has experienced a booming economic cycle in the 1980s where many Japanese firms went for planned expansions in their facilities and, in turn, human capabilities (Iwata & Miyagawa, 2003). This was synchronised with the success of Japanese manufacturers in the global economy which stimulated substantial interest in the sources of their competitive advantage which, in turn, triggered the attention of many Western academics and researchers to discover differences between Japanese and non-Japanese manufacturing firms' management accounting practices and systems (Pascale & Athos, 1981; Pegles, 1984; Abegglen & Stalk, 1985; Shields, Chow, Kato, & Nakagawa, 1991). However, Japanese economy experienced a recession cycle, where land and stock prices sharply declined, in the 1990s (1991–2001), which is known in Japanese economy as the 'lost ten years' (Iwata & Miyagawa, 2003). As a consequence, many Japanese manufacturing firms found themselves in the dilemma of sustaining

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profitability levels that commensurate with their 1980s expansions, especially with the anti-downsizing Japanese management notion (*ibid.*). The same era has witnessed another phenomenon involving Japanese manufacturers, where some leading Japanese firms, in their quest to increase profitability, went for organisational restructuring. For example, Matsushita (Panasonic) was known for its divisional organisation by product. However, its management decided to integrate some of its divisions to minimise and eliminate redundancy in operations. Also, Nissan Motor had to recruit an ex-Renault CEO to revitalise it.

Moreover, many of the Japanese manufacturing firms started to shift their production facilities to cheap neighbouring countries, especially China (Iwata & Miyagawa, 2003; Ministry of Economy, Trade and Industry, 2003). However, some of them altered their choice, after facing problems in operating in China, and either returned back to Japan or shifted their facilities to some other Asian countries (Iwata & Miyagawa, 2003; Ministry of Economy, Trade and Industry, 2003). Moreover, Japanese firms sought the deployment of cost cutting schemes, where cutting product costs and, therefore, prices were inevitable.

Despite Japanese manufacturers' tendency towards cost-cutting schemes though a full utilisation of resources and deployment of contemporary managerial techniques, few Japanese research studies were carried out in the last decade on the deployment of contemporary cost/management accounting practices and performance measurement systems, especially the use of non-financial performance measures, in Japanese manufacturing firms (see for instance, Sato, Sakate, Mueller, & Radenbaugh, 1982; Daley, Jiambalvo, Sundem, & Konodo, 1985; Daniel & Reitsperger, 1991; Shields et al., 1991; Ito, 1996; Sonoda, 1996; Hoshino, 2003; Otomasa, 2003; Takahashi, 2003; Sakurai, 2003; Kawai, 2004).

For instance, Otomasa study (2003) examined the use of non-financial indicators in performance measurement systems in Japanese manufacturing firms. His study, basically, focused on the introduction of balanced scorecard (BSC) in Japanese firms. Otomasa's findings showed that the use of non-financial performance indicators in the surveyed Japanese manufacturing firms was evident. Such findings are found to be consistent with other more recent Japanese studies (e.g. Kawai, 2004). However, it is noteworthy to indicate that, the current research study distinguishes itself from recent Japanese studies in a way that it focuses on shop-floor performance measurement level while the other studies, in general, seem to focus on corporate and higher managerial levels. Such distinction has, in fact, imposed some constraints on comparing results reported in the current study to those reported in other Japanese studies.

This chapter aims to report the survey results of Japanese manufacturing firms. It presents the results of carrying out a survey on 123 Japanese Tokyo Stock Exchange listed manufacturing firms. Research method and hypotheses used in this Japanese study are similar to those used in the previous two countries (i.e. UK and Italy).

The remainder of the chapter is organised in five sections. The next section presents research method and data collection. The third section discusses the descriptive analysis of responses. Association between the use and importance of shop-floor non-financial performance measures (SFNFPMs) of the five evaluation categories and the levels of deployment/extent of importance of the contingent variables incorporated in the study are covered in the fourth section. A summary is presented in the last section.

RESEARCH METHOD AND DATA COLLECTION

The research population was confined to Japanese manufacturing firms that were listed in Tokyo Stock Exchange. The survey[1] covers a total sample frame of 1,155 firms. A postal questionnaire was undertaken to collect primary data in this survey. The survey covered manufacturing firms belonging to 18 different industry codes.[2] Questionnaires[3] and individually addressed cover letters were mailed in May 2003 to management accountants, financial controllers, or vice presidents of the surveyed firms, with a follow-up mailing to non-respondents in four weeks.

A total of 123 usable responses were received[4] comprising an average response rate of 12.3 per cent. Most of the respondents (55.5 per cent) represent manufacturing firms employing between 1,000 and 10,000 employees, while 39.5 per cent employ less than 1,000 employees. Only 5.0 per cent of respondents employ more than 10,000 employees. In assessing the reliability of the measurement of questions related to the variables incorporated in this study, Cronbach's alpha was calculated (using SPSS 13) for the independent and dependent variables. Results of reliability test are presented in Table 1.

From Table 1, the lowest alpha value is 0.687. It, thus, can be concluded that the incorporated variables are reliable. In addition, the validity of the incorporated variables was reviewed in the piloting stage. The analysis of the responses is presented next.

Table 1. Results of Reliability Test.

Variables	No. of Items	*N*	Cronbach's Alpha
SFNFPMs	19	108	0.891
Contemporary management accounting practices (CMAPs)	7	95	0.806
Innovative managerial practices (IMPs)	6	112	0.808
Advanced manufacturing technologies (AMTs)	8	113	0.870
Aspects of competition	6	117	0.687

DESCRIPTIVE ANALYSIS OF RESPONSES

This section examines the use and level of importance of SFNFPMs; the level of deployment of advanced manufacturing technologies (AMTs), innovative managerial practices (IMPs), and contemporary management accounting practices (CMAPs); and the perceived level of importance of competition in Japanese manufacturing firms (Research Question 1).

Importance of SFNFPMs

Respondents were asked to indicate whether 19 various SFNFPMs were applied in their firms and the importance attributed to each. Importance was signified on a seven-point scale from 1 (no importance) to 7 (critical importance), and the 19 measures are shown in rank order in Table 2.

Table 2 shows that the majority of Japanese manufacturing firms measure 'number of complaints from customers' and 'defects' and perceive these two measures to be critically important. These two are measures of customer satisfaction and product quality, respectively. It is noted that the third ranked measure relates to the measurement of quality, also the fourth item, 'percentage on-time delivery to customers', although part of a different group of variables has clear implications for customer satisfaction. One can conclude that Japanese manufacturing firms are customer focused and they are keen on quality and delivery as ways to maintain their customers satisfied.

Results reported in recent research studies on Japanese firms comply with the above findings (see, Katayama & Bennett, 1996; Otomasa, 2003; Kawai, 2004). Kawai (2004), for instance, surveyed 837 Japanese manufacturing firms (where 113 responses were received) to examine the use of financial and non-financial measures in the surveyed firms. Kawai's (2004) findings

Table 2. Shop-Floor Non-Financial Measures – in Ranked Order of Importance.

Rank by Importance[a]	Measures (Ranked by Mean Value on Scale of 1–7)	Percentage of Firms Using this Measure	Mean Importance for Firms Using the Measure	Median
	Product quality			
2	Defects (% of total production) ($N = 121$)	97.5	6.26	6
3	Scrap (% of total production) ($N = 120$)	95.8	5.99	6
14	Rework (% of total production) ($N = 121$)	87.6	5.24	6
19	Batches (% adjusted) ($N = 119$)	82.4	4.34	4
	Customer satisfaction			
1	Number of complaints from customers ($N = 120$)	98.3	6.61	7
10	Number of customer returns ($N = 120$)	98.3	5.63	6
9	Number of warranty claims ($N = 121$)	90.9	5.69	6
	On-time delivery			
4	Percentage of on-time delivery to customers ($N = 120$)	87.5	5.98	6
11	Manufacturing cycle efficiency ($N = 120$)	94.2	5.58	6
8	Percentage of on-time production ($N = 119$)	90.8	5.77	6
6	Percentage of schedule adherence ($N = 118$)	94.9	5.79	6
	Employee morale			
15	Absenteeism ($N = 121$)	95.9	5.17	5

Table 2. (*Continued*)

Rank by Importance[a]	Measures (Ranked by Mean Value on Scale of 1–7)	Percentage of Firms Using this Measure	Mean Importance for Firms Using the Measure	Median
16	Employee lateness ($N=120$)	55.3	4.95	5
18	Staff turnover ($N=121$)	90.1	4.52	4
17	Employee attitude surveys ($N=120$)	72.5	4.84	5
	Efficiency and utilisation			
7	Efficiency (standard hours produced/ hours worked) ($N=121$)	90.9	5.75	6
12	Activity (standard hours produced/ budgeted standard hours) ($N=121$)	85.1	5.52	6
5	Capacity utilisation (hours worked/ budgeted hours) ($N=120$)	92.5	5.91	6
13	Proportion of overtime worked ($N=120$)	93.3	5.29	5

[a]Ranked by mean value on scale of 1–7.

seem to be in line with the above results, as respondents to Kawai's study were, also, keen on non-financial measures of product quality and customer satisfaction rather than financial measures. The same findings were reported in Otomasa's (2003). Otomasa's study was on the use of non-financial performance measurement in firms introducing BSC. Otomasa surveyed 827 manufacturing and service Japanese firms (where responses were received from only 161 firms).

However, results on employee morale measures merit some explanations. Morris and Wilkinson (1995), for instance, argue that Japanese lean working is part of a distinct socio-technological paradigm characterised by high organisational and labour dependency. Hence, a successful operation implies tight control over firm's resources, e.g. production process, mechanical, human (Oliver & Wilkinson, 1988). Ishida (1997) suggest that high-worker morale contributes to guarantee good plant performance in Japanese firms. One, thus, would have expected to see measures of 'employee morale' to rank high. However, the above results show that respondents tend to give 'employee morale' non-financial measures less level of importance (ranked 15–18). One possible explanation could be that respondents view the very dependencies lean working requirement as imposing constraints on autonomy and intensifying Taylorist-based control (Klein, 1991; Garrahan & Stewart, 1992; Witcher & Butterworth, 2001).

Level of Application of AMTs

Respondents were asked to rank the levels of application of eight AMTs on Likert 7-points scale [1 (not at all), 4 (moderately), and 7 (extensively)]. Table 3 presents respondents' evaluation of levels of application of AMTs.

Table 3 shows that 'computer aided design' (CAD) is widely applied in Japanese manufacturing firms followed by 'computer numerical control' (CNC). The levels of application of the other AMTs are low (mean less than 4).

The above results confirm Takahashi (2003) survey findings. Takahashi surveyed 824 Japanese Tokyo Stock Exchange listed manufacturing firms (and received 102 responses) to examine the cost management accounting practices in use in Japanese firms. Takahashi's findings show that CAD and CNC were on the top list of the most popular tools in use in Japanese firms.

Table 3. Respondents' Evaluation of the Levels of Application of AMTs.

AMTs (Ranked by Mean Value on a Scale of 1–7)	*N*	Mean	Median	Percentage of Firms Applying this Practice[a]
Computer aided design (CAD)	120	5.191	6.0	92.5
Computer numerical control (CNC)	116	4.258	5.0	80.2
Computer aided manufacturing (CAM)	117	3.982	4.0	78.4
Flexible manufacturing systems (FMS)	117	3.683	4.0	78.6
Computer integrated manufacturing (CIM)	117	3.675	4.0	75.2
Computer aided engineering (CAE)	118	3.381	3.0	71.2
Automated storage and retrieval system (AS/RS)	118	3.161	3.0	66.1
Automated guided vehicles systems (AGVS)	118	3.016	3.0	66.1

Note: 1 = not at all, 4 = moderately, and 7 = extensively.
[a]Percentage of respondents who gave (2–7) rank on the scale.

Table 4. Respondents' Evaluation of the Levels of Application of IMPs.

IMPs (Ranked by Mean Value on Scale of 1–7)	*N*	Mean	Median	Percentage of Firms Applying this Practice[a]
Total quality management (TQM)	121	5.628	6.0	99.2
Total preventive maintenance (TPM)	120	4.766	5.0	95.8
MRPI/II	116	4.620	5.0	90.5
Just-in-time production (JIT)	121	4.562	5.0	93.4
Enterprise requirement planning (ERP)	120	4.325	5.0	85.0
Optimised production technology (OPT)	115	3.539	4.0	71.3

Note: 1 = not at all, 4 = moderately, and 7 = extensively.
[a]Percentage of respondents who gave (2–7) rank on the scale.

Application of IMPs

Respondents were asked to rank the levels of application of IMPs on 7-point scale, [1 (not at all), 4 (moderately), and 7 (extensively)]. Table 4 presents respondents' evaluation of levels of application of IMPs.

Table 4 shows that 'total quality management' (TQM), 'total preventive maintenance' (TPM), 'material requirements/manufacturing resource planning' (MRPI/II), and 'just-in-time production' (JIT) are employed in most (more than 90 per cent) Japanese manufacturing firms. However, in Japanese firms, TQM is applied more extensively than the other IMPs.

The above findings, again, seem to comply with results of other Japanese studies showing the wide deployment of techniques such as TQM, TPM, and JIT (Ito, 1996; Katayama & Bennett, 1996; Takahashi, 2003).

Application of CMAPs

Respondents were asked to indicate the extent of the use of seven-key CMAPs in their firms, using one of the following three categories: 1 (not applied), 2 (partially applied), and 3 (systematically applied).

Table 5 shows that 'benchmarking of performance' and 'strategic management accounting' are widely applied in Japanese manufacturing firms as over 60 per cent of responding firms apply these techniques either partially or systematically. Activity-based techniques (ABT), economic value added, and BSC seem not to be extensively applied in the surveyed Japanese manufacturing firms.

Table 5. Distribution of Responses Concerning Levels of Deployment of CMAPs.

Management Accounting Practice (Ranked by Mean on a Scale of 1–3)	*N*	Mean	Percentage of Respondents		
			1	2	3
Benchmarking of performance	101	2.118	21.8	48.5	29.7
Strategic management accounting	110	1.772	38.2	46.4	15.5
Economic value added	111	1.765	45	33.3	21.6
Throughput accounting	110	1.727	41.8	43.6	14.5
Activity-based techniques	108	1.592	55.6	29.6	14.8
Customer profitability analysis	110	1.554	51.8	40.9	7.3
Balanced scorecard	109	1.467	59.6	33.9	6.4

Note: 1 = not applied; 2 = partially applied; 3 = systematically applied.

The above results confirm, to a great extent, findings reported in previous Japanese studies, for instance, Takahashi (2003) survey findings show that levels of application of activity-based costing (ABC) and throughput accounting in Japanese firms are low. Otomasa study (2003) shows that almost half of the respondents were not even acquainted with the term BSC.

Monitoring of Competitive Environment

Respondents were asked to indicate the importance of six aspects of competition on 7-point scales, anchored as follows: 1 (no importance), 4 (moderate importance), 7 (critical importance).

Table 6 shows that Japanese manufacturers' take price and quality *very* seriously. Virtually, all the respondents regard all the competitive dimensions as very important. Similar findings were reported by Kawai (2004) where aspects such as quality, product development, and delivery were ranked high as perceived by respondents.

RELATIONSHIPS AMONG THE LEVELS OF IMPORTANCE OF SFNFPMs AND THE CONTINGENT VARIABLES

The second objective of this study is to examine whether the use of SFNFPMs is associated with internal and external contingent variables

Table 6. Respondents' Evaluation of the Levels of Importance of Competition on Various Characteristics.

Dimensions of Competition (Ranked by Mean Value on Scale of 1–7)	*N*	Percentage of Respondents who Gave Some Degree of Importance[a]	Mean
Price	119	99.2	6.60
Quality	120	100	6.50
Customer service	120	100	6.00
Innovation	118	99.2	5.70
Delivery	119	100	5.47
Flexibility	118	100	5.44

Note: 1 = no importance, 4 = moderate importance, and 7 = critical importance.
[a]Percentage of respondents gave some degree of importance (4–7) on the scale.

(Research Question 2). Recalling from Chapter 5, the associations between the use and importance of the 19 subsidiary SFNFPMs and the extent of the implementation of the 27 contingent variables included in the study were tested between composite SFNFPMs and composite contingent variables.

The reader is reminded, again, that the composites SFNFPMs considered are the 19 measures grouped in the five performance dimensions: product quality (PQ), customer satisfaction (CS), on-time delivery (OTD), employee morale (EM), and efficiency and utilisation (EU). The composite contingent variables include: the level of application and perceived importance of IMPs (X_1) (e.g. JIT, TQM, …), the level of application and perceived importance of AMTs (X_2) (e.g. computer aided design and manufacturing …), the level of application and perceived importance of CMAPs (X_3) (e.g. activity-based costing and budgeting, …), and contingent factors related to the competitive environment (X_4) (e.g. quality, price, …).

Recalling from Chapter 5, the objective here is to statistically test the following 20 hypotheses.

Product Quality (Y_1)

H_1. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Japanese manufacturing firms.

H_2. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Japanese manufacturing firms.

H_3. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Japanese manufacturing firms.

H_4. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Japanese manufacturing firms.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Japanese manufacturing firms.

H_6. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Japanese manufacturing firms.

H_7. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Japanese manufacturing firms.

H_8. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Japanese manufacturing firms.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite* *shop-floor non-financial performance measures of on-time delivery* (Y_3) in Japanese manufacturing firms.

H_{10}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Japanese manufacturing firms.

H_{11}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Japanese manufacturing firms.

H_{12}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Japanese manufacturing firms.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Japanese manufacturing firms.

H_{14}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Japanese manufacturing firms.

H_{15}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Japanese manufacturing firms.

H_{16}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Japanese manufacturing firms.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Japanese manufacturing firms.

H_{18}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Japanese manufacturing firms.

H_{19}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop- floor non-financial performance measures of efficiency and utilisation* (Y_5) in Japanese manufacturing firms.

H_{20}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Japanese manufacturing firms.

Kendall's τ-statistic test was applied (SPSS, 13)[5] (Siegel, 1956; Cramer, 1994; De Vaus, 1996). The correlations among the contingent variables and the existence and importance of the composite SFNFPMs are shown in Table 7. The results reveal many significant positive correlations among the contingent factors and the five categories of the existence and importance of SFNFPMs included in this study. The extent of importance of 'competitive environment' and levels of deployment of IMPs are particularly important, being significantly positively associated with all five categories of the existence and importance of SFNFPMs.

Generally speaking, Japanese manufacturing firms seem to be quite keen on the use of non-financial measurement. Therefore, many Japanese managers reaction to the introduction of BSC into Japanese firms, at an early stage, was that 'we have already done it'. They understand BSC just as a performance evaluation tool (see, Sakurai, 2003). Results indicate that competition forces Japanese manufacturing firms to focus on non-financial performance measures such as quality and customer satisfaction, etc. Competitive environment seems, also, to accelerate competition among Japanese firms and their rivals on quality and price. Japanese managers seem to be sensitive on these two aspects. Thus, they tend to be keen on

Table 7. Kendall's τ-Correlations among Contingent Factors and Five Evaluation Categories of Use and Importance of SFNFPMs.

Composite Independent Variables	Composite Dependent Variables				
	PQ (Y_1)	CS (Y_2)	OTD (Y_3)	EM (Y_4)	EU (Y_5)
X_1: Level of application of IMPs (JIT, TQM, etc.)	0.331**	0.247**	0.325**	0.204*	0.312**
X_2: Level of application of AMTs (FMS, CAD, CAM, etc.)	0.173*	0.141	0.156*	0.135	0.177*
X_3: Level of deployment of CMAPs (BP, ABC, ABB, etc.)	0.023	0.100	0.183*	0.211*	0.254**
X_4: Competitive environment (quality, price, etc.)	0.269**	0.396**	0.434**	0.221**	0.369**

*Significant at 95 per cent level of significance ($\alpha = .05$, 2-tailed).
**Significant at 99 per cent level of significance ($\alpha = .01$, 2-tailed).

non-financial performance measures of product quality and cost management related such as on-time delivery measures.

The lack of significant associations between levels of application/ deployment of AMTs and CMAPs and the use of SFNFPMs of 'customer satisfaction' is interesting and need to be seen in synchronisation with Japanese managers tendency to focus on quality and delivery to satisfy their customers.

SUMMARY

The Japanese economy's recession cycle in the 1990s, the 'lost ten years', has forced Japanese manufacturing firms to put more emphasis on cost cutting and full utilisation of their resources (Iwata & Miyagawa, 2003; Ministry of Economy, Trade and Industry, 2003). Japanese literature on research studies carried out in last decade on the deployment of contemporary cost and management accounting practices and performance measurement systems in Japanese manufacturing firms, though, is said to be rare (see for instance, Sato, Sakate, Mueller, & Radenbaugh, 1982; Daley et al., 1985; Daniel & Reitsperger, 1991; Shields et al., 1991; Ito, 1996; Sonoda, 1996; Hoshino, 2003; Otomasa, 2003; Takahashi, 2003; Sakurai, 2003; Kawai, 2004).

This chapter presents the Japanese results of the book's cross-countries comparative study on the use and importance of SFNFPMs in manufacturing firms. The current research study distinguishes itself from recent Japanese studies as it focuses on shop-floor performance measurement level, while the other studies seem to focus on corporate and higher managerial levels. Such distinction has, in fact, imposed some constraints on comparing results reported in the current study to those reported in other Japanese studies.

Two main objectives are covered, first, to highlight the extent of the use of 19 SFNFPMs of five evaluation categories (i.e. product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) and levels of application/importance of 27 contingent variables belonging to four main factors: IMPs, AMTs, CAMPs, and levels of importance of aspects of competition in Japanese manufacturing firms. Second, is to examine whether the use and importance of SFNFPMs of the five evaluation categories are associated with the levels of deployment/importance of the contingent variables incorporated.

The chapter presents some interesting findings on levels of application of the variables above. Results, consistent with previous research studies on Japanese firms (see for instance, Katayama & Bennett, 1996; Otomasa, 2003; Kawai, 2004), show that the surveyed Japanese manufacturing firms are customer focused and they are also keen on quality and delivery. Reported results on the use and levels of importance of 'employee morale' are striking. Results show that respondents tend to rank low the importance of non-financial performance measures of 'employee morale'. It could be that respondents view the Japanese lean-working management style as imposing constraints on autonomy and intensifying Taylorist-based control (see, Klein, 1991; Garrahan & Stewart, 1992; Witcher & Butterworth, 2001).

Techniques such as CAD, TQM, TPM, MRPI/II, and JIT are found to be widely applied in the surveyed Japanese firms. This is consistent with results of other Japanese studies showing wide deployment of such techniques in Japanese firms (see for instance, Ito, 1996; Katayama & Bennett, 1996; Takahashi, 2003).

Findings also show that 'benchmarking of performance' and 'strategic management accounting', amongst the other CMAPs, are found to be partially/systematically applied by over 60 per cent of respondents. Levels of deployment of 'ABT and BSC seems, in line with findings reported in Japanese literature (see, for instance, Otomasa, 2003; Takahashi, 2003) and similar to findings reported on UK and Italian firms in Chapters 5 and 6, to be uncommon in the surveyed Japanese firms. Furthermore, it is evident that Japanese managers perceive the six aspects of competition incorporated in the study as very important, with an emphasis on price and quality.

Kendall's τ-statistical technique was applied to examine the associations between the existence and importance of SFNFPMs of the five evaluation categories and the levels of deployment/importance of the contingent variables. Results show many positive significant correlations among the use and importance of SFNFPMs and the levels of deployment/importance of the four contingent factors captured in this study, particularly the extent of importance of 'competitive environment' and levels of deployment of IMPs.

The next chapter, Chapter 8, presents descriptive analyses of responses and examines possible correlations among levels of importance of SFNFPMs and levels of deployment/application of the contingent variables incorporated in this study in Canadian manufacturing firms.

NOTES

1. This study was funded by University of Osaka, Japan.

2. The industry categories are as follows: manufacturing of food products and beverages; manufacturing of textiles; manufacturing of wearing apparel; dressing and dyeing of fur; manufacturing of pulp, paper, and paper products, publishing and printing; publishing, printing, and reproduction of recorded media; manufacturing of coke, refined petroleum products, and nuclear fuel; manufacturing of chemicals and chemical products; manufacturing of rubber and plastic products; manufacturing of non-metallic mineral product; manufacturing of rubber and plastic products; manufacturing of non-metallic mineral product; manufacturing of basic metal; manufacturing of fabricated metal products; manufacturing of machinery and equipment; manufacturing of computers; manufacturing of medical, precision and optical instruments, watches and clocks; manufacturing of medical, precision and optical instruments, watches and clocks; manufacturing of motor vehicle, trailers and semi-trailers; manufacturing of other transport equipment; and manufacturing of furniture.

3. The questionnaires were first translated into Japanese and then translated back to English and any discrepancies or ambiguities were investigated and resolved, as applicable.

4. In virtually all cases, the questionnaires were comprehensively completed. On individual questions, where one or more respondents failed to indicate an answer, the analysis was based on those that had responded.

5. It is worth noting that two hypotheses are postulated in applying Kendall's τ-statistic test. The first is the null hypothesis (H_0) that the contingent variables are not associated with the use and importance of the composite SFNFPMs in the population, and the second is the alternative hypothesis (H_1) that they are associated. The null hypothesis H_0 (there is no correlation between the variables) will be rejected in favour of the alternative hypothesis H_1 (there is a correlation between the variables)

when, and only when, the probability associated with the occurrence under H_0 of any value (α) is equal to or less than (0.05) (Siegel, 1956). For brevity, the acceptance or rejection of the null hypotheses will depend on the reported correlations.

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CHAPTER 8

NON-FINANCIAL PERFORMANCE MEASURES IN CANADIAN MANUFACTURING FIRMS

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INTRODUCTION

The Canadian manufacturing sector has experienced a significant decrease in size during the past 40 years (Murty, 2004). The manufacturing sector has steadily decreased as a proportion of the total economy, whereas the service sector has significantly increased and the public sector remained fairly constant. As measured by the resource inputs, the manufacturing sector has decreased from 54 percent of the total economy in the 1960s to 42 percent in the 1990s, whereas the service sector has increased from 34 percent to 44 percent. The government sector comprised 12 percent in the 1960s and remained at 14 percent during the next three decades (Murty, 2004). Murty (2004) also observed a similar declining trend for the manufacturing sector using employment statistics.

Another trend in Canadian manufacturing has been a movement towards more capital-intensive and larger companies. The number of small manufacturing companies, and their share of total employment, has increased significantly, but their share of total production output has remained constant in the 1990s (Baldwin, 1996). This means that the bulk of

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manufacturing production comes from a relatively small number of large capital-intensive companies, whereas a relatively large number of manufacturing workers are employed by small companies. Baldwin (1997) found that small Canadian manufacturing companies were less likely to introduce new products and processes, engage in continuous R&D activities, and introduce advanced technologies than large ones. In addition, Baldwin, Gray, and Johnson (1997) associated innovation and technological competence in large companies with high skills requirements and wage levels. Since an increasingly large number of all manufacturing workers are employed by small companies, the average real manufacturing wages in Canada have declined over, at least, the past decade. As small businesses are also riskier, there has also been a relatively high turnover or renewal rate in manufacturing companies in Canada, as measured by job renewal rates, with 40 percent of manufacturing jobs being renewed within a decade and 85 percent within four decades (Baldwin & Brown, 2004).

The Canadian manufacturing industry is also diverse in terms of both products and geography, with different industries located in different regions (Fleming & Rowell, 2000). In the Atlantic Provinces of Newfoundland, New Brunswick, Nova Scotia, and Prince Edward Island, fishing industry and related food processing and equipment manufacturing industries dominate, with forestry-related industries also being prominent. The Central Provinces of Ontario and Quebec are the primary centres of major manufacturing activity in Canada, with Ontario accounting for approximately 50 percent and Quebec approximately 25 percent of all manufacturing activity in Canada. Major textile and aerospace industries are primarily located in Quebec and major transportation equipment and auto industries in Ontario. In the Western Prairie Provinces of Manitoba, Saskatchewan, and Alberta, agriculture and related food processing and equipment manufacturing industries are important, particularly in Saskatchewan. In addition, Alberta also has substantial mining, chemical, and petroleum products sectors, and Manitoba also has significant aerospace and clothing industries. Finally, forestry and forestry products industries dominate in British Columbia, the fourth Western Province.

However, the trends in Canadian manufacturing, which can be cyclical, affect different regions differently (Baldwin & Rafiqussam, 1994). For example, between 1970 and 1990, Quebec experienced the largest decline in employment in labour-intensive sectors, and the Prairie Provinces experienced a large decrease in the natural resources sector, while British Columbia showed dramatic gains in some sectors and losses in others.

At the present time, the gas and oil industry in Alberta is booming again at an unprecedented rate.

This chapter aims to discuss the Canadian results. The remainder of this chapter is organised into five sections. The relevant Canadian literature is discussed first, followed by the research method and data collection procedures. The third section presents descriptive analyses of responses. The fourth section examines correlations among the levels of importance of shop-floor non-financial performance measures (SFNFPMs) in use in the Canadian manufacturing firms surveyed and the levels of deployment/application of the contingent variables incorporated in this study. A summary is presented in the last section.

LITERATURE

Following the main theme of this book, this section discusses academic and practitioner literature dealing with the implementation of SFNFPMs, advanced manufacturing technologies (AMTs), innovative managerial practices (IMPs), and contemporary management accounting practices (CMAPs), as well as, competition, in Canadian manufacturing companies. It becomes immediately evident from the review of this literature that only very few academic studies have been conducted in the Canadian context. Notable examples of such studies are those by Henri (2006a, 2006b), Gosselin (1997, 2004), and Armitage and Nicholson (1993). However, some additional empirical results are available from special studies conducted by Statistics Canada. This category includes studies, for example, by Baldwin (1997), Sabourin and Beckstead (1999), Baldwin, Diverty, and Sabourin (1995), Baldwin, Rama, and Sabourin (1999), and Baldwin and Sabourin (2001). Some key results of these studies are reviewed in this section to provide an overview of relevant developments in the Canadian manufacturing sector.

The Canadian studies in the 1990s were mainly concerned with the adoption of AMTs and technology-led IMPs. Baldwin (1997) found that large Canadian manufacturing companies were more likely to introduce advanced technologies than small ones. Sabourin and Beckstead (1999) discovered that approximately one-half of Canadian companies had adopted at least one of the following groups of technologies: computer aided design and manufacturing (CAD/CAM), computer aided design and engineering (CAD/CAE), simulation technologies, and electronic exchange of CAD files. Baldwin et al. (1995) also found widespread use of technology-led IMPs, especially inspection and communications technologies, in 48 percent of Canadian manufacturing companies, particularly in large companies. Baldwin et al. (1999) described communications technology also as the fastest growing technology in the mid- and late-1990s. In addition, Baldwin et al. (1995) noted fairly widespread use of multiple technologies, and Baldwin and Sabourin (2001) found the use of communications technologies and multiple technologies to be linked to increased relative productivity and market share.

As to CMAPs, activity-based costing (ABC) was the main focus in the 1990s, but attention slowly shifted to performance measurement, particularly non-financial measures and SFNFPMs, after the turn of the century. Armitage and Nicholson (1993) reported an adoption rate of 14 percent for ABC in Canadian manufacturing companies, but Gosselin (1997) reported a higher adoption rate, 48 percent. Gosselin (2004) found that most companies used primarily financial measures, with 11 top-rated measures (of the total of 73) being financial. He concluded that contemporary techniques such as the balanced scorecard (BSC) and integrated performance measurement systems, were not used to a large extent by Canadian manufacturing companies. Henri (2006a) recently reported that approximately 50 percent of Canadian manufacturing companies had moderately well-developed performance measurement systems. Financial measures were still somewhat more important than customer, process, and innovation and learning measures. Interestingly, Henri also discovered that well-performing companies used more performance measures than poorly performing companies. Empirical work on CMAPS in Canada has slowly followed after the development of a series of strategic management accounting guidelines, dealing specifically with performance measurement, by CMA Canada (1994, 1999, 2002).

Although there is no known research findings on the effects of competition on SFNFPMs in Canadian manufacturing companies, Tang (2003) considered a competitive environment to be an important factor affecting innovation, particularly technological innovation. Tang found that, for the Canadian manufacturing sector as a whole, an easy substitution of products and a constant arrival of new competing products were perceived to be significant negative and positive forces, respectively, for technological innovation. Tang proposed that individual differences in perceptions about the competitiveness of environment may explain why companies adopt, or do not adopt, innovative strategies, even for same products, in a given competitive environment. More generally, 45 percent of Canadian manufacturing companies surveyed by BDO Dunwoody/COMPASS (2005) considered competition from Asian countries to pose at least moderate challenges.

Overall, although the development of CMAPs in Canadian manufacturing companies has been slow and somewhat inconsistent, significant progress, often enabled by new technologies, has occurred during the past few years. However, the lack of research on the effects of competition in the Canadian context is surprising, as evidence from the performance measurement literature in general suggests that non-financial performance measures can be critical for providing useful operational information for planning and control purposes in competitive environments (Chenhall & Morris, 1986; CIMA, 1993; Drury, Braund, Osborne, & Tayles, 1993; Bhimani, 1994; Otley, 1999; Hoque, Mia, & Alam, 2001).

RESEARCH METHOD AND DATA COLLECTION

The sampling frame in this study was confined to medium-sized and large manufacturing companies, with at least 150 employees, belonging to 20 Standard Industrial Classification (SIC) categories listed in the 2004 Canadian Key Business Directory (Dun & Bradstreet, 2003).[1] A systematic random sample of 571 companies was selected. A bilingual postal questionnaire survey (English and French) was undertaken to collect primary data. The bilingual questionnaire was necessary, as French is the official language in the Province of Quebec where approximately one quarter of Canadian manufacturing companies operate.[2] Questionnaires and individually addressed cover letters were mailed in January 2004 to management accountants, financial controllers, or vice presidents, whose names were listed in the Directory.

A total of 43 usable responses[3] were received for a response rate of 7.8 percent.[4] The number of responses received was reasonably proportionate to the questionnaires mailed to different Canadian provinces.

In assessing the reliability of the measurement of questions related to the composite variables incorporated in this study, Cronbach's alpha was calculated (using SPSS 13) for the independent and dependent variables. Results of reliability tests are presented in Table 1.

From Table 1, the lowest alpha value is 0.720. It, thus, can be concluded that the incorporated variables are reliable. In addition, the validity of the incorporated variables was reviewed in the piloting stages.

Table 1. Results of Reliability Test.

Variables	No. of Items	*N*	Cronbach's Alpha
SFNFPMs	19	42	0.896
Contemporary management accounting practices (CMAPs)	7	43	0.811
Innovative managerial practices (IMPs)	6	41	0.821
Advanced manufacturing technologies (AMTs)	8	42	0.720
Aspects of competition	6	43	0.776

The majority of the respondents (77 percent) represent manufacturing companies employing between 160 and 1,000 employees, while 19 percent represent companies employing between 1,001 and 6,300 employees.

DESCRIPTIVE ANALYSIS OF RESPONSES

This section examines the use and level of importance of SFNFPMs; the level of deployment of AMTs, IMPs, and CMAPs; and the importance of the perceived level of competition in Canadian manufacturing companies (Research Question 1). Descriptive statistics are presented and discussed in the following subsections.

Importance of SFNFPMs

Respondents were asked to indicate whether various SFNFPMs were applied in their companies and the importance attributed to each measure. Importance was signified on 7-point Likert scales, anchored as follows: 1 (not important), 4 (moderately important), and 7 (critically important). The 'not measured' option was also provided. The 19 measures are shown in Table 2, in the ranked order of the importance scores.

The majority of Canadian manufacturing companies measure the 'percentage of on-time delivery' and the 'number of complaints' from customers and perceive these measures to be of the greatest importance, (Means greater than 6). Both measures are indicators of customer satisfaction and thus reflect the recent increased emphasis on improved customer service in general.

Table 2. Shop-Floor Non-Financial Measures – in Ranked Order of Importance.

Rank by Importance[b]	Measures (Ranked by Mean Value on Scale of 1–7)	Percentage of Firms Using this Measure (1–7 on the Scale)	Mean Importance for Firms Using the Measure	Median
	Product quality			
5	Defects (% of total production)	83.7	5.75	6
6	Rework (% of total production)	79.1	5.73	6
10	Scrap (% of total production)	79.1	5.41	6
17	Batches (% adjusted)	41.9	4.55	4
	Customer satisfaction			
2	Number of complaints from customers	88.4	6.10	7
8	Number of customer returns	74.4	5.50	6
11	Number of warranty claims	74.4	5.40	5
	On-time delivery			
1	Percentage of on-time delivery to customers	93.0	6.22	7
3	Manufacturing cycle efficiency[a]	64.3	5.96	6
12	Percentage of schedule adherence[a]	81.0	5.20	5
13	Percentage of on-time production	60.5	5.19	5
	Employee morale			
14	Employee attitude surveys	69.8	5.06	6
16	Absenteeism	90.7	4.88	5
18	Employee lateness	83.7	4.30	4
19	Staff turnover	86.0	4.29	4
	Efficiency and utilisation			
4	Activity (standard hours produced/budgeted standard hours)	72.1	5.77	6
7	Efficiency (standard hours produced/hours worked)	88.4	5.55	5
9	Capacity utilisation (hours worked/budgeted hours)	76.7	5.45	5
15	Proportion of overtime worked	95.3	5.04	5

Note: Scale (1–7); 1 = not important; 4 = moderately important; 7 = critically important.
[a] $N = 42$; for all other measures, $N = 43$.
[b] Ranked by mean value on scale of 1–7.

In the middle of the spectrum, the third most important measure is 'manufacturing cycle efficiency' (MCE), which can also affect on-time delivery. The fourth measure in importance is 'activity' which reflects efficiency and resource utilisation. These measures are followed by several other measures of product quality and operating efficiency. Although in the middle ranks on importance scores, these measures are used by between 60 and 88 percent of the companies and have means between 5 and 6. These findings demonstrate that these measures are still considered useful.

Surprisingly, measures of employee morale such as 'absenteeism', 'lateness', and 'turnover', are considered among the least important measures, with means lower than 5, although these measures are among the most frequently used, by over 80 percent of the companies. 'Employee attitude surveys', which can yield other measures of employee satisfaction, ranked slightly higher in importance, but they were less frequently used, by about 70 percent of the companies.

Little research on the use of SFNFPMs in Canadian manufacturing companies has been carried out. One recent example is a survey by Gosselin (2004), who included both financial and non-financial measures. He found that most companies still primarily used traditional financial measures, with the top-rated 11 measures, of the total of 73 measures included, being financial measures. The top-ranking non-financial measures were the number and the incidence of worker injuries, which ranked the 11th and 15th, respectively. The two top-rated measures in this study, delivery times and the number of customer complaints ranked the 20th and 17th, respectively in Gosselin's study, among the top five non-financial measures. Similar to the findings of this study, the measures of absenteeism, employee turnover, and customer satisfaction also ranked relatively low in Gosselin's study, with the latter two being in the bottom one-third of all measures. Therefore, some tentative similarities are beginning to emerge on the use of SFNFPMs in Canadian manufacturing companies, although a direct comparison was not possible due to the use of different measures and methods. However, there appears still to be plenty of room for more widespread and effective use of SFNFPMs in the Canadian context.

Application of AMTs

Respondents were asked to rank the extent of the use of AMTs on 7-point scales anchored as follows: 1 (not at all), 4 (moderately), and 7 (extensively). Table 3 shows the distribution, ranked in the order of the extent of usage.

Table 3. Extent of Use of Advanced Manufacturing Technologies (AMTs), Ranked by Mean Values.

AMTs	Mean	Median	Percentage of Companies Using Technology[b]
Computer aided design (CAD)	4.95	6	81.4
Computer numerical control (CNC)	3.81	4	72.1
Computer aided manufacturing (CAM)[a]	3.66	4	71.4
Computer aided engineering (CAE)	3.51	4	60.5
Computer integrated manufacturing (CIM)	3.44	3	62.8
Flexible manufacturing systems (FMS)	2.86	1	48.8
Automated storage and retrieval system (AS/RS)	2.02	1	34.9
Automated guided vehicles systems (AGVS)	1.74	1	23.3

Note: Scale (1–7); 1 = not at all; 4 = moderately; 7 = extensively.
[a]$N = 42$; for all other techniques, $N = 43$.
[b]Percentage of respondents who gave (2–7) rank on the scale.

Table 3 shows that CAD is widely applied in Canadian manufacturing companies. One can conclude that the levels of application of the other AMTs are relatively low, with means lower than 4, although slightly more than 70 percent of the companies also indicated using at least some CNC and CAM techniques.

In comparison, Sabourin and Beckstead (1999) found that three quarters of Canadian manufacturing companies used at least one of the 26 technologies included in their survey. About one-half of the companies had adopted at least one of the four engineering technologies: CAD/CAM, CAD/CAE, simulation technologies, and electronic exchange of CAD files, with the highest adoption rates for CAD/CAE, 44 percent, and for CAD/CAM, 36 percent. Large companies had higher adoption rates than small companies. The results of this study support this trend and further indicate that the adoption rates for the most popular manufacturing technologies in Canadian manufacturing companies have more than doubled during the past decade.

Application of IMPs

Respondents were asked to rate the extent of the use of IMPs on 7-point scales, anchored as follows: 1 (not at all), 4 (moderately), and 7 (extensively).

Table 4. Extent of Use of Innovative Management Practices (IMPs), Ranked by Mean Values.

IMPs	Mean	Median	Percentage of Companies Using Practice[a]
Material requirements/manufacturing resources planning (MRP I/II)*	4.58	6	76.7
Enterprise requirements planning (ERP)	4.27	5	72.1
Just-in-time production (JIT)	4.16	5	76.7
Total quality management (TQM)	3.88	5	83.7
Total preventive maintenance (TPM)	3.83	4	83.7
Optimised production technology (OPT)	2.85	2	53.7

Note: Scale (1–7); 1 = not at all, 4 = moderately, 7 = extensively; $^{*}N = 42$; for all other techniques, $N = 43$.
[a]Percentage of respondents who gave (2–7) rank on the scale.

Table 4 shows the distribution, ranked in the order of the extent of application.

Table 4 shows that 'material requirements/manufacturing resources planning' (MRP I/II) is employed in Canadian manufacturing companies more extensively than the other IMPs, followed by 'enterprise requirements planning' (ERP) and 'just-in-time production' (JIT). It is, however, notable that although 84 percent of the respondents apply at least some 'total quality management' (TQM) and 'total preventive maintenance' (TPM), the extent of these applications is only moderate, with means lower than 4.

Although not covering every category of practices included in this study, there is some previous evidence on adoption of IMPs by Canadian manufacturing companies. The adoption of such practices has been enabled by technology. Baldwin et al. (1995) found widespread use of technology-led practices in 48 percent of Canadian manufacturing companies, particularly in large firms. Most widespread use occurred for inspection and communications technologies, with manufacturing technologies lagging significantly behind. In addition, Baldwin et al. (1995) noted a fairly widespread use of multiple technologies, and Baldwin and Sabourin (2001) found the use of communications technologies and multiple technologies to be linked to increased relative productivity and market share. It is evident from the results of this study that the Canadian manufacturing companies have continued to adopt, not only major manufacturing technologies, but also several significant innovative management practices during the past few years, as the benefits of such practices have become better understood.

Application of CMAPs

Respondents were asked to indicate the extent of the use of some key CMAPs in their companies, using one of the following three categories: 1 (not applied), 2 (partially applied), and 3 (systematically applied).

Table 5 indicates that more than 80 percent of the companies extensively apply 'benchmarking performance' (BP) and 'strategic management accounting' (SMA). Over 50 percent of the companies also use 'activity-based techniques' (ABTs). On the other hand, other management accounting practices such as BSC, 'economic value added' (EVA), and 'throughput accounting' (TA), are not as extensively used in Canadian manufacturing companies. Significant comparable research exists on the adoption rates of ABTs in different countries, particularly ABC, but relatively little on other techniques.

In the USA, adoption rates of 45 percent, 27 percent, and 53 percent were reported for ABTs by Green and Amenkhienan (1992), Shim and Sudit (1995), and Hrisak (1996), respectively. In Canada, Armitage and Nicholson (1993) reported an adoption rate of 14 percent. On the other hand, Gosselin (1997) reported a much higher adoption rate, 48 percent, in Canadian manufacturing companies. Overall, the adoption rates for ABTs in the early 1990s, with a few exceptions, appear to have been in the 10–20 percent range, increasing to 40–50 percent by the end of the decade. The adoption rate of close to 60 percent of at least some use in this study is consistent with this trend and with recent evidence in Canadian manufacturing companies.

Table 5. Use of Contemporary Management Accounting Practices (CMAPs), Ranked by Mean Values.

CMAPs	Mean	Percentage of Respondents		
		1	2	3
Benchmarking performance (BP)	2.18	18.6	44.2	37.2
Strategic management accounting (SMA)	2.09	18.6	53.5	27.9
Customer profitability analysis (CPA)	1.83	39.5	37.2	23.3
Activity-based techniques (ABT)	1.76	44.2	34.9	20.9
Balanced scorecard (BSC)	1.67	60.5	11.6	27.9
Economic value added (EVA)	1.46	62.8	27.9	9.3
Throughput accounting (TA)	1.46	60.5	32.6	7.0

Note: $N = 43$; Scale: 1 = not applied; 2 = partially applied; 3 = systematically applied.

However, one important constraint on the above comparisons is that findings of previous surveys were related to ABC, activity-based management (ABM), and activity-based budgeting (ABB) separately, whereas, in this study, these concepts were combined into one category, ABT. The effect of this practice is that the adoption rate in this study may be overstated, as compared to the adoption rates in the studies with separate rates for ABC, ABB, and ABM.

As to CMAPs in Canadian manufacturing companies, Gosselin (2004) concluded that contemporary techniques such as the BSC and integrated performance measurement systems, were not used to a large extent. He discovered that the most widely used performance measures were traditional financial measures, and found no evidence indicating that the implementers of contemporary systems used non-financial measures to a greater extent than non-implementers. In comparison, the results of this study are more optimistic regarding the adoption of CMAPs in Canadian manufacturing companies, which could have occurred very recently, consistent with Henri's (2006a) findings. Although the BSC is still not extensively used, the results of this study reveal significant use of other CMAPs, particularly BP and SMA.

Monitoring of Competitive Environment

Respondents were asked to indicate the importance of six dimensions of competitive environment on 7-point scales, anchored as follows: 1 (no importance), 4 (moderate importance), 7 (critical importance).

Table 6 shows that Canadian manufacturers take competition on 'price', 'quality', and 'delivery' very seriously. Virtually all respondents indicated these competitive dimensions to be very important, with means greater than 6. The findings of this study support the importance of competitive environment in implementing product and process strategies, and possibly performance measurement systems, as well as, provide new evidence on various competitive dimensions facing Canadian manufacturing companies.

As previously discussed, there are no comparable research findings with respect to competition in Canadian manufacturing companies along the six dimensions used in this study, although Tang (2003) considered competition to be a potentially important factor affecting technology adoption and innovation strategy.

Table 6. Importance of Various Dimensions of Competitive Environment, Ranked by Mean Values.

Dimension	Percentage of Respondents Indicating at least Moderate Degree of Importance (Scores 4–7)	Mean
Price	97.7	6.27
Quality	100	6.18
Delivery	95.3	6.00
Customer service	90.7	5.81
Innovation	95.3	5.55
Flexibility	83.7	5.55

Note: N = 43; Scale (1–7): 1 = no importance; 4 = moderate importance; 7 = critical importance.

RELATIONSHIPS AMONG THE LEVEL OF IMPORTANCE OF SFNFPMs OF THE FIVE CATEGORIES AND THE LEVEL/EXTENT OF APPLICATION OF THE CONTINGENT VARIABLES

The second objective of this study is to examine whether the use of SFNFPMs is associated with internal and external contingent variables (Research Question 2). The reader is reminded, again, that the composite SFNFPMs considered are the 19 measures grouped into the five performance dimensions: product quality (PQ), customer satisfaction (CS), on-time delivery (OTD), employee morale (EM), and efficiency and utilisation (EU). The composite contingent variables include: the level of application and perceived importance of IMPs (e.g., JIT and TQM), the level of application and perceived importance of AMTs (e.g., CAD/CAM), the level of application and perceived importance of CMAPs (e.g., ABC and ABB) and contingent factors related to the competitive environment (e.g., quality and price).

Recalling from Chapter 4, the objective is to statistically test the following 20 hypotheses:

Product Quality (Y_1)

H_1. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite* *shop-floor non-financial performance measures of product quality* (Y_1) in Canadian manufacturing firms.

H_2. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Canadian manufacturing firms.

H_3. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Canadian manufacturing firms.

H_4. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in Canadian manufacturing firms.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Canadian manufacturing firms.

H_6. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Canadian manufacturing firms.

H_7. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in Canadian manufacturing firms.

H_8. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop floor non-financial performance measures of customer satisfaction* (Y_2) in Canadian manufacturing firms.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Canadian manufacturing firms.

H_{10}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Canadian manufacturing firms.

H_{11}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Canadian manufacturing firms.

H_{12}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in Canadian manufacturing firms.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Canadian manufacturing firms.

H_{14}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Canadian manufacturing firms.

H_{15}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Canadian manufacturing firms.

H_{16}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in Canadian manufacturing firms.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Canadian manufacturing firms.

H_{18}. H_{18}: There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Canadian manufacturing firms.

H_{19}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Canadian manufacturing firms.

H_{20}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in Canadian manufacturing firms.

Again, Kendall's τ-statistic test was applied (SPSS, 13)[5] (Siegel, 1965; Cramer, 1994; De Vaus, 1996). The correlations among the contingent variables and the existence and importance of the composite SFNFPMs are shown in Table 7, with significant correlations denoted by asterisks (* 5-percent level of significance, and ** 1-percent level).

Table 7. Kendall's τ-Correlations among Contingent Factors and Five Evaluation Categories of Use and Importance of SFNFPMs.

Composite Independent Variables	Composite Dependent Variables				
	PQ (Y_1)	CS (Y_2)	OTD (Y_3)	EM (Y_4)	EU (Y_5)
X_1: Level of application of IMPs (JIT, TQM, etc.)	0.521**	0.175	0.323**	0.503**	0.427**
X_2: Level of application of AMTs (FMS, CAD, CAM, etc.)	0.258*	0.123	0.254*	0.407**	0.249*
X_3: Level of deployment of CMAPs (BP, ABC, ABB, etc.)	0.498**	0.139	0.308**	0.436**	0.365**
X_4: Competitive environment (quality, price, etc.)	0.276*	0.235*	0.247*	0.353**	0.459**

*Significant at 95% level of significance ($\alpha = .05$, 2-tailed).
**Significant at 99% level of significance ($\alpha = .01$, 2-tailed).

The correlations among the contingent variables (composites) and the existence and importance of the composite SFNFPMs are shown in Table 7, with significant correlations denoted by asterisks (**1-percent level, and *5-percent level of significance). The results reveal significant relationships among all contingent factors and all five categories of the existence and importance of SFNFPMs included in this study, with the exception of 'customer satisfaction', for which only the relationships with various dimensions of competition is significant.

The contingent factor 'competitive environment' is thus particularly important in that it is significantly positively associated with all five categories of the existence and importance of SFNFPMs. In increasingly competitive business environments, efficient operations and resource utilisation, high-quality products, motivated employees, on-time delivery, and customer satisfaction are key requirements for giving companies a competitive edge, as competitors can easily lure customers away. Given that customers have abundant choices, they are accustomed to expecting the highest quality products and services at the lowest prices, and dissatisfaction with any of these aspects may result in the loss of customer loyalty. Furthermore, employee morale and satisfaction can facilitate the achievement of these objectives by helping align employee and organisational goals, i.e., improve goal congruence. These findings are consistent with evidence in the performance measurement literature, which suggests that non-financial performance measures can be critical for providing useful operational information for planning and control purposes in competitive environments (Chenhall & Morris, 1986; CIMA, 1993; Drury et al., 1993; Bhimani, 1994; Otley, 1999; Hoque et al., 2001).

All internal contingent variables, i.e., IMPs, AMTs, and CMAPs, are significantly positively associated with the use and importance of four categories of SFNFPMs: 'product quality', 'on-time delivery', 'employee morale', and 'efficiency and utilisation'. Such associations were expected. For instance, previous studies have shown that manufacturing processes can play a significant role in determining the adopted performance measures (Banker, Potter, & Schoreder, 1993; CIMA, 1993; Drury et al., 1993; Harrison & Poole, 1997; Chenhall, 1997; Perera, Harrison, & Poole, 1997).

The use of advanced management practices and technologies can improve efficiency and utilisation, product quality, and on-time delivery by providing relevant information and tools for tracking and solving any current or impending problems quickly. In addition, it may convey the message of progressiveness and innovation and boost employee morale, as it may free employees of more routine and mundane tasks. These propositions are also consistent with the three non-financial perspectives of the BSC (Kaplan & Norton, 1992). The measures of efficiency and utilisation fall within the 'internal business process perspective', the measures of employee morale within the 'learning and growth perspective', and the measures of product quality and on-time delivery within the 'customer' perspective.

Therefore, it may appear surprising that the application of IMPs, AMTs, CMAPs is not significantly associated with the use of SFNFPMs of 'customer satisfaction'. This finding may seem to be counterintuitive, as implementing IMPs, AMTs, and CMAPs can reduce defective products (Lee, 1987; Barnett, 1992), which can reasonably be expected to translate into more timely deliveries, higher quality products, and increased customer satisfaction. It could be that Canadian managers think that shop-floor staff can typically more significantly influence activities and processes leading to improved production scheduling, work procedures, and, even their own morale and satisfaction, than customer satisfaction.

Overall, in spite of the apparent anomaly for customer satisfaction, the results of this study provide reasonably strong support for the other associations postulated in this study, as well as, possibly indirectly also for customer satisfaction via improved efficiency and utilisation, product quality, delivery, and employee morale. As such associations have not been previously studied in Canadian manufacturing companies, there are no directly comparable findings. Consequently, the findings of this study make a useful original contribution to the performance measurement literature in the Canadian context.

SUMMARY AND CONCLUSION

This study investigates the use and importance of SFNFPMs, AMTs, IMPs, and CMAPs, as well as, competition, in Canadian manufacturing companies. In addition, relationships among these factors are examined.

As to SFNFPMs, Canadian manufacturing companies consider the most important measures to be 'percentage of on-time delivery' and the 'number of complaints', followed by 'manufacturing cycle efficiency' and 'activity' measures. The first two measures reflect customer satisfaction directly. Canadian companies may also use internal measures of efficient resource utilisation as means to further enhance customer satisfaction more indirectly. However, they place considerably less importance on measures of employee efficiency and satisfaction, although more satisfied employees can be more productive and significantly contribute to better customer service and satisfaction. This pattern is demonstrated by 'absenteeism', 'lateness', and 'turnover' being considered among the least important measures. In comparison, Gosselin (2004) found the number of worker injuries to be the highest-ranking non-financial measure, with on-time delivery and customer complaints ranking lower, but still among the top five non-financial measures. As in this study, the measures of absenteeism and employee turnover also ranked relatively low in Gosselin's study.

'Computer aided design' (CAD) is the most widely applied AMT by Canadian manufacturing companies, followed by CNC and CAM. These findings are consistent with those of Sabourin and Beckstead (1999), who reported significant use of AMTs by about one-half of Canadian companies. As to IMPs, MRP I/II is employed in Canadian manufacturing companies more extensively than other IMPs, followed by ERP and JIT. The adoption of such practices has been enabled by technology. Baldwin et al. (1995) also found widespread use of technology-led practices, particularly inspection and communications technologies, in about one-half of Canadian manufacturing companies.

'Strategic management accounting' (SMA) and 'benchmarking performance' (BP) are used in 80 percent of Canadian manufacturing companies. Over 50 percent of the companies also use ABTs. Gosselin (1997) found a similar adoption rate for ABC, and Henri (2006a) reported that approximately 50 percent of Canadian manufacturing companies had moderately well-developed performance measurement systems. These findings appear to reflect the historical progress in implementing new technologies and strategic management practices. Both SMA and BP are relatively new techniques, which may be currently in various stages of implementation both in European and North American companies. On the other hand, a significant number of Canadian manufacturing companies may have by-passed, or replaced, ABTs and implemented more strategically focused CMAPs such as SMA and BP.

In addition, this study revealed significant positive associations among the use of SFNFPMs, AMTs, IMPs, and CMAPs. AMTs, IMPs, and CMAPs are significantly positively associated with four categories of SFNFPMs: 'product quality', 'on-time delivery', 'employee morale', and 'efficiency and utilisation'. However, significant relationships among such practices and customer satisfaction were not discovered. Furthermore, competition is significantly positively associated with all five categories of SFNFPMs. Although there are no comparable findings in the Canadian literature, the findings of this study suggest that SFNFPMs and CMAPs play important roles in Canadian manufacturing companies, and that competition can have an important impact on their importance and use.

Although the reported findings of this study are consistent in principle with some findings of available Canadian studies, only very few comparable academic research studies have been conducted in the Canadian context (Henri, 2006a, 2006b; Gosselin, 1997, 2004), with most Canadian empirical results cited in this paper being research reports by Statistics Canada. Therefore, the findings of this study provide significant new insight into the use and importance of SFNFPMs in Canadian manufacturing companies, and can form a foundation for further academic research aimed at improving the effectiveness of their performance measurement systems and organisational performance.

NOTES

1. The industry categories are as follows: food and related products; tobacco products; textile mill products; apparel and related products; lumber and wood products; furniture and fixtures; paper and allied products; printing and publishing; chemicals and allied products; petroleum and coal products; rubber and plastics products; leather and leather products; stone, clay, and glass products; primary metal industries; fabricated metal products; machinery (except electrical); electrical equipment; transportation equipment; measuring, analysing, and controlling instruments; and miscellaneous (other) products.

2. The questionnaires were first translated into French by a professional translator and then translated back to English by another professional translator. Any discrepancies or ambiguities were investigated and resolved, as applicable.

3. In virtually all cases, the questionnaires were comprehensively completed. On individual questions, where one or more respondents failed to indicate an answer, the analysis was based on those that had responded.

4. It is notable that similar relatively low response rates have also been reported in several other random surveys of Canadian manufacturing firms (see e.g., MacDonald, 2003; Henri, 2006b).

5. It is worth noting that two hypotheses are postulated in applying Kendall's τ-statistic test. The first is the null hypothesis (H_0) that the contingent variables are not associated with the use and importance of the composite SFNFPMs in the population, and the second is the alternative hypothesis (H_1) that they are associated. The null hypothesis H_0 (there is no correlation between the variables) will be rejected in favour of the alternative hypothesis H_1 (there is a correlation between the variables) when, and only when, the probability associated with the occurrence under H_0 of any value (α) is equal to or less than (0.05) (Siegel, 1965). For brevity, the acceptance or rejection of the null hypotheses will depend on the reported correlations.

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PART III:
INTERNATIONAL COMPARISON

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CHAPTER 9

NON-FINANCIAL PERFORMANCE MEASURES: A CROSS-COUNTRIES COMPARISON

Ahmed Abdel-Maksoud and Magdy Abdel-Kader

INTRODUCTION

This study aims to investigate the usage and level of importance of shop-floor non-financial performance measures (SFNFPMs), which are grouped in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the level of deployment (or extent of importance) of a number of contingent variables. It also aimed to test for associations between the usage and level of importance of SFNFPMs in the five evaluation categories and the level of deployment/extent of importance of the four contingent variables (level of application of innovative managerial practices (IMPs), level of application of advanced manufacturing technologies (AMTs), level of deployment of contemporary management accounting practices (CMAPs), and level of competitive environment a company operates in). These aims are achieved based on an empirical study in four countries; the UK, Italy, Japan, and Canada.

Table 1 summarises the background of each empirical study conducted in the UK, Italy, Japan, and Canada. In each country a questionnaire survey

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Table 1. Background of the Empirical Studies in Four Countries.

	UK	Italy	Japan	Canada
Sample frame	2,242 FAME (UK database) listed manufacturing firms belonging to various UK SIC sectors	1,565 CREVDA (Italian database) listed manufacturing firms belonging to various SIC sectors	1,155 Tokyo Stock Exchange listed manufacturing firms belonging to various SIC sectors	541 Canadian Business Directory listed manufacturing firms belonging various SIC sectors
Responses	313	142	123	43
Response rate (%)	14	9	10.63	7.9
Date of data collection	March 2001	May 2003	May 2003	Early 2004

was sent to the management accountant, financial controller or manager of each firm included in the sample frame. In each country, medium and large manufacturing firms (the minimum number of employees is 150) were included in the sample frame.

In this chapter we compare the results of the four empirical studies (cross-countries comparisons). The remainder of the chapter is divided into five sections. In the next section a summary of descriptive statistics related to each country will be reported. Then, we will compare the four countries in terms of the significant correlations among the levels of implementation/deployment of the composite contingent variables incorporated (i.e. IMPs, AMTs, CMAPs, and competition) and the use and importance of composite SFNFPMs of product quality, customer satisfaction, on-time delivery, efficiency and utilisation, and employee morale. In fourth section, we examine whether there are significant differences in the use of SFNFPMs that could be ascribed to the country type. This is followed by an examination of whether there are significant differences in the use of SFNFPMs that could be ascribed to the industry sector across the four countries. The final section sets out some limitations of the study.

DESCRIPTIVE STATISTICS

In this section we present a cross-countries comparative descriptive statistics related to the level of importance of SFNFPMs, the level of deployment of

AMTs, IMPs, and CMAPs and the importance of perceived level of competition.

Shop-Floor Non-Financial Performance Measures

In each country respondents were asked to indicate whether certain SFNFPMs were applied in their companies and (if applied) to rate the importance of each measure, on a seven-point Likert scale, from 1 (no importance) up to 7 (critical importance). The SFNFPMs were grouped into five evaluation categories:

1. Product quality (scrap, defects, rework, and batches – % adjusted).
2. Customer satisfaction (complaints from customers, number of returns, and number of warranty claims).
3. On-time delivery (percentage on-time delivery to customers, percentage on-time production, percentage schedule adherence, and manufacturing cycle efficiency).
4. Employee morale (staff turnover, absenteeism, lateness, and employee attitude survey).
5. Efficiency and utilisation (efficiency, activity, capacity utilisation, and proportion of overtime worked).

Table 2 presents a summary of the results in each country. The table shows that in the UK study measures of efficiency and utilisation are considered important (Mean is more than 5) in over 80 percent of responding firms. One is inclined to conclude that UK manufacturers pay considerable attention to controlling their production costs. Results also show that less importance is attributed to measures of employee morale (Mean is less than 5 in three of the measures).

In the Italian study, the first measure in rank is 'efficiency', this is consistent with the findings of Bergamin Barbato, Collini, and Quagli (1996) that the increasing awareness among Italian managers of the importance of developing their firms' management accounting systems was ascribed, in part, to their recognition of the vital importance of efficiency to face international competition. It can bee seen that, in addition to the first measure, the second and fourth of these measures (i.e. scraps and defects, respectively) can be used by companies to monitor the level of non-value adding use of resources. Similar to the UK results, measures related to the employee morale are considered less important if compared to the measures

Table 2. The Use and Importance of SFNFPMs of the Five Evaluation Categories.

SFNFPMs Related to: (Scale of 1–7)	UK		Italy		Japan		Canada	
	Percentage of Firms Using the Measure	Mean Importance for Firms Using the Measure	Percentage of Firms Using the Measure	Mean Importance for Firms Using the Measure	Percentage of Firms Using the Measure	Mean Importance for Firms Using the Measure	Percentage of Firms Using the Measure	Mean Importance for Firms Using the Measure
Product quality								
Scrap (% of total production)	90.0	5.7	91.5	5.96	95.8	5.99	79.1	5.41
Defects (% of total production)	87.0	5.8	91.5	5.83	97.5	6.26	83.7	5.75
Rework (% of total production)	84.0	5.2	85.9	5.05	87.6	5.24	79.1	5.73
Batches (% adjusted)	56.0	4.1	60.6	4.76	82.4	4.34	41.9	4.55
Customer satisfaction								
Number of complaints from customers	95.0	6.2	88.7	5.82	98.3	6.61	88.4	6.1
Number of customer returns	91.0	5.9	86.6	5.77	98.3	5.63	74.4	5.5
Number of warranty claims	70.0	5.5	63.4	4.93	90.9	5.69	74.4	5.4
On-time delivery								
On-time delivery to customers	92.0	6.4	89.4	5.89	87.5	5.98	93.0	6.22

Percentage of on-time production	76.0	5.2	89.4	5.06	90.8	5.77	60.5	5.19
Percentage of schedule adherence	68.0	5.2	70.4	5.28	94.9	5.79	81.0	5.2
Manufacturing cycle efficiency	62.0	5.3	76.1	5.82	94.2	5.58	64.3	5.96
Employee morale								
Employee lateness	90.0	4.9	82.4	4.41	88.3	4.95	83.7	4.3
Absenteeism	97.0	5.5	93.7	5.31	95.9	5.17	90.7	4.88
Staff turnover	89.0	4.6	67.6	4.25	90.1	4.52	86.0	4.29
Employee attitude surveys	63.0	4.5	57.0	3.75	72.5	4.84	69.8	5.06
Efficiency and utilisation								
Capacity utilisation (hours worked/ budgeted hours)	84.0	5.3	83.8	5.42	92.5	5.91	76.7	5.45
Efficiency (standard hours produced/ hours worked)	90.0	5.8	90.1	6.14	90.9	5.79	88.4	5.55
Activity (standard hours produced/ budgeted standard hours)	86.0	5.3	82.4	5.64	85.1	5.52	72.1	5.77
Proportion of overtime worked	92.0	5.3	85.9	4.71	93.3	5.29	95.3	5.04

related to the other performance dimensions considered by this study. However, this result is not consistent with Arena, Azzone, and Caimi (2004) who state that there was a growing interest on measures related to employees by Italian firms. The most important employee measure is absenteeism, which, surprisingly, is also the most widely used SFNFPM by the surveyed Italian firms. The high diffusion of performance measures on absenteeism could be explained by the fact that high rates of absenteeism may affect productivity and/or efficiency. One can conclude that Italian manufacturing firms are quite keen on the efficient use of their resources and they are keen on quality and delivery as ways to maintain their customers' satisfaction. It is also noted that measures related to shop-floor staff are not widely used by the surveyed Italian firms, and are considered less relevant.

In the Japanese study, the majority of manufacturing firms perceive measures of 'number of complaints from customers' and 'defects' to be highly important. These two measures are of customer satisfaction and product quality groups, respectively. It is noted that the third important measure relates to the measurement of quality and the fourth measure is 'percentage on-time delivery to customers'. One can conclude that Japanese manufacturing firms are customer focused and they are keen on quality and delivery as ways to maintain their customers' satisfaction. The results regarding employee moral measures also show a similar trend to the UK and Italian studies. These employee morale measures are perceived as the lowest important measures. However, results on employee morale measures merit some explanations. Morris and Wilkinson (1995), for instance, argue that Japanese lean working is part of a distinct socio-technological paradigm characterised by high organisational and labour dependency. Hence, a successful operation implies tight control over firm's resources, e.g. production process and human (Oliver & Wilkinson, 1988). Ishida (1997) suggests that high worker morale contributes to guarantee good plant performance in Japanese firms. One, thus, would have expected to see measures of 'employee morale' to rank high. One possible explanation could be that respondents view the very dependencies lean working requirement as imposing constraints on autonomy and intensifying Taylorist-based control (Klein, 1991; Garrahan & Stewart, 1992; Witcher & Butterworth, 2001).

Finally, as to the Canadian study, the majority of manufacturing companies perceive measures of 'percentage of on-time delivery' and 'number of complaints from customers' to be of the greatest importance (Mean is more than 6). Both measures are indicators of customer satisfaction and thus reflect the recent increased emphasis on improved customer service in general. However, similar to the other three studies, measures of employee morale, such as 'absenteeism', 'lateness', and 'turnover', are considered among the least important measures, with means lower than 5, although these measures are among the most frequently used, by over 80 percent of the companies. 'Employee attitude surveys', which can yield other measures of employee satisfaction, ranked slightly higher in importance, but were less frequently used, by about 70 percent of the companies.

To further investigate the results shown in Table 2, we look at the highest and the least five important measures in each country. This is to find out whether there is a general trend across the four countries' results. The highest five important measures are as follows:

UK companies	Percentage of on-time delivery to customers
	Number of complains from customers
	Number of customers returns
	Efficiency
	Defects
Italian companies	Efficiency
	Scrap
	Percentage of on-time delivery to customers
	Defects
	Number of complaints from customers
Japanese companies	Number of complaints from customers
	Defects
	Scrap
	Percentage of on-time delivery to customers
	Capacity utilisation
Canadian companies	Percentage of on-time delivery to customers
	Number of complaints from customers
	Manufacturing cycle efficiency
	Activity
	Defects

It can be noticed that the measure of 'percentage on-time delivery to customers' is among the highest three important measures in the UK, Italy, and Canada, while it is perceived as the fourth important in Japanese companies. The measure of 'number of complaints from customers' is either perceived as the first or the second important in the UK, Japan, and Canada, while it is perceived as fifth important in the Italian companies. This leads us to consider 'percentage on-time delivery to customers' as the most important non-financial measure across the four countries followed by 'number of complaints from customers'. These two measures are customers related and, hence, we can conclude that companies in the four countries pay particular attention to customers, and shop-floor workers should be committed to customers' requirements.

On the other spectrum we look at the least important measures in the four countries. These are as follows:

UK companies	Batches
	Employee attitude surveys
	Staff turnover
	Employee lateness
	Rework
Italy companies	Employee attitude surveys
	Staff turnover
	Employee lateness
	Proportion of overtime worked
	Batches
Japanese companies	Batches
	Staff turnover
	Employee attitude surveys
	Employee lateness
	Absenteeism
Canadian companies	Staff turnover
	Employee lateness
	Batches
	Absenteeism
	Proportion of overtime worked

The results clearly, though surprisingly, show that, measures of employee morale, such as 'absenteeism', 'lateness', and 'turnover', are considered among the least important measures, with means lower than 5. It is also noticeable that the 'batches' (in the product quality group) is the least important measure in both the UK and Japanese companies and the measure is not considered important in Italian and Canadian companies.

Levels of Application and Extent of Deployment of the Contingent Variables

Summaries of responses in each country are shown in Table 3. An explanation of each variable is presented next.

Application Levels of AMTs

Respondents were asked to rate the level of application of AMTs using a seven-point Likert scale with 1 anchored not at all, 4 anchored moderately, and 7 anchored extensively. Eight types of AMTs were included in the survey – flexible manufacturing systems (FMS), computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM), computer numerical control (CNC), computer aided engineering (CAE), automated storage and retrieval system (AS/RS), and automated guided vehicles systems (AGVS).

Table 3 shows that CAD has the highest level of application in UK manufacturing firms (highest mean), where 81 percent of respondents implemented it in their firms. The Italian firms follow a similar trend towards the implementation of CAD. This is the pattern also in the both Japanese and Canadian firms. This leads us to conclude that CAD is the most popular application of AMTs across the four counties surveyed in this study.

It is also noticeable that AMTs are widely implemented in Japanese firms. More Japanese firms apply different types of AMTs than the other three countries. For every type of AMT included in this survey Japanese firms implement it more than the other three countries. The lowest level of application in Japanese firms (66 percent) was related to the automated guided vehicles systems (AGVS).

Application Levels of IMPs

Respondents were asked to evaluate the extent of deploying five types IMPs using a seven-point Likert scale from 1 anchored not at all to 7 anchored extensively. These IMPs were: just-in-time (JIT), total quality management (TQM), total preventive maintenance (TPM), materials requirements/manufacturing resource planning (MRPI/II), enterprise requirement planning (ERP), and optimised production technology (OPT).

Table 3. Application Levels of AMTs, IMPs, CMAPs, and Competition.

	UK		Italy		Japan		Canada	
	%	Mean	%	Mean	%	Mean	%	Mean
AMTs[a]								
Computer aided design (CAD)	80.8	4.49	82.8	4.99	92.5	5.19	81.4	4.95
Computer aided manufacturing (CAM)	56.5	3.22	68.1	3.79	78.4	3.98	71.4	3.66
Computer numerical control (CNC)	51.8	2.99	64.1	3.75	80.2	4.25	72.1	3.81
Computer aided engineering (CAE)	44.7	2.51	45.4	2.58	71.2	3.38	60.5	3.51
Computer integrated manufacturing (CIM)	48.2	2.50	52.3	2.70	75.2	3.67	62.8	3.44
Flexible manufacturing systems (FMS)	46.6	2.36	41.7	2.44	78.6	3.68	48.8	2.86
Automated storage and retrieval system (AS/RS)	31.3	1.84	35.9	2.21	66.1	3.16	34.9	2.02
Automated guided vehicles systems (AGVS)	15.0	1.42	22.3	1.7	66.1	3.01	23.3	1.74
IMPs[a]								
Total quality management (TQM)	87.0	4.10	83.6	4.15	99.2	5.62	83.7	3.88
Just-in-time production (JIT)	81.0	3.85	68.9	3.44	93.4	4.56	76.7	4.16
Material requirement planning/ manufacturing resource planning (MRPI/II)	84.0	4.60	84.6	4.85	90.5	4.62	76.7	4.58
Total preventive maintenance (TPM)	81.0	3.71	76.5	3.58	95.8	4.76	83.7	3.83
Enterprise requirement planning (ERP)	54.0	2.86	73.1	4.23	85.0	4.32	72.1	4.27
Optimised production technology (OPT)	37.0	1.93	40.9	2.18	71.3	3.53	53.7	2.85
CMAPs[b]								
Customer profitability analysis (CPA)	63.6	1.85	82.9	2.29	48.2	1.55	60.5	1.83
Benchmarking of performance (BP)	71.9	1.84	58.9	1.77	78.2	2.0	81.4	2.18
Strategic management accounting (SMA)	61.1	1.78	42.4	1.55	61.9	2.0	81.4	2.09

Table 3. *(Continued)*

	UK		Italy		Japan		Canada	
	%	Mean	%	Mean	%	Mean	%	Mean
Activity-based techniques (ABT)	49.8	1.62	55.9	1.70	44.4	1.0	55.8	1.76
Throughput accounting (TA)	43.5	1.60	23.8	1.29	58.1	2.0	39.6	1.46
Balanced scorecard (BSC)	41.2	1.56	40.5	1.56	40.3	1.0	39.5	1.67
Economic value added (EVA)	38.1	1.52	53.1	1.69	54.9	2.0	37.2	1.46
Competition[c]								
Customer service	99.7	6.16	92.1	5.81	100	6.0	90.7	5.81
Quality	100.0	6.12	94.3	6.11	100	6.5	100	6.18
Price	99.4	6.10	95.1	6.05	99.2	6.6	97.7	6.27
Delivery	100.0	5.97	92.2	5.74	100	5.47	95.3	6.0
Flexibility	99.0	5.27	90.8	5.67	100	5.44	83.7	5.55
Innovation	97.8	4.87	89.4	5.47	99.2	5.7	95.3	5.55

[a] 1 = not at all, 4 = moderately, and 7 = extensively; percentage of respondents rating 2–7 on the scale are reported.
[b] 1 = not applied, 2 = partially applied, and 3 = systematically applied; percentage of respondents rating 2–3 are reported.
[c] 1 = no importance, 4 = moderate importance, and 7 = critical importance; percentage of respondents rating 4–7 are reported.

Table 3 shows that MRPI/II have the highest level of application in UK manufacturing firms (highest mean). The high level of application of MRPI/II is followed by the application of TQM, JIT, and TPM, respectively. It can be concluded that OPT is not a common innovative managerial practice in UK firms where 63 percent do not apply it. Responses are striking in relation to the level of application of ERP, they show that generally ERP is partially applied. For instance, many respondents (46 percent) do not apply ERP, but of those who apply it, it is not seen as an important measure (Mean less than 3).

The Italian survey shows that MRPI/II, ERP, and TQM are employed more extensively than the other IMPs incorporated in this study. JIT and OPT are the least important and the least applied practices by the surveyed firms.

The Japanese survey shows that TQM, TPM, MRPI/II, and JIT are employed in most Japanese manufacturing firms (more than 90 percent).

However, in Japanese firms, TQM is applied more extensively than the other IMPs.

The MRPI/II is employed in Canadian manufacturing companies more extensively than the other IMPs, followed by ERP and JIT. It is, however, notable that although 84 percent of the respondents apply at least some TQM and TPM, the extent of these applications is only moderate, with means lower than 4.

Across countries comparisons regarding the application level of IMPs reveal that Japanese firms show the highest level of application in each IMPs. TQM ranked first in terms of application in the UK, Japan, and Canada (87 percent, 99 percent, and 84 percent, respectively) and ranked second in the Italian survey (84 percent). The comparison shows also that the least applicable IMP in the four countries is OPT.

Deployment Levels of CMAPs

Respondents were asked to indicate whether seven contemporary management accounting practices were not applied, partially applied, or systematically applied in their firms. The surveyed practices are customer profitability analysis (CPA), benchmarking of performance (BP), strategic management accounting (SMA), activity-based techniques (ABT), throughput accounting (TA), balanced scorecard (BSC), economic value added (EVA). Table 3 shows summaries of the responses from the responding firms in the four countries.

The UK survey shows that BP, CPA, and SMA are widely applied. BP is partially or systematically applied by about 72 percent of respondents, CPA by approximately 64 percent, and SMA by 61 percent. When we distinguish between partial and systematic responses we find a tendency towards a 'systematic application' of CPA (22 percent), followed by SMA (17 percent), and BP (13 percent). The results of UK survey also shows that TA and EVA are not common management accounting practices in UK firms, with 57 percent and 62 percent of respondents, respectively, not applying them in their firms.

The results of the Italian survey show that over 80 percent of responding firms apply CPA. The CPA is the only management accounting practice, which is applied systematically by almost half of the respondents. This is followed by BP, which is applied (partially or systematically) by approximately 59 percent of the respondents and applied systematically by about 18 percent of the respondents. On the other hand, the other management accounting practices – ABT, EVA, SMA, and BSC – are not extensively applied in Italian manufacturing firms. Most of the responding firms do not apply TA in their firms.

In Japanese firms, practices of BP and SMA are widely applied as over 60 percent of responding firms apply these techniques either partially or systematically. ABT, EVA, and BSC seem not to be extensively applied in the surveyed Japanese manufacturing firms.

The Canadian survey shows that more than 80 percent of the responding firms apply BP and SMA either partially or systematically. The results also indicate that over 50 percent of the responding firms use ABT. On the other hand, other management accounting practices, such as BSC, EVA, and TA, are not extensively used in Canadian manufacturing firms.

A cross-countries comparison reveals that BP is widely applied in the four countries. It is ranked either the highest or second highest practice in terms of its application (either partially or systematically) in the four countries. The comparison also shows that CPA is the highest or second highest practice in terms of its application (either partially or systematically) in the three countries – UK, Italy, and Japan – while it comes third in the Canadian survey but with 60 percent of the respondents applying it either partially or systematically. On the other hand, BSC practice seems to be one of the least applied within respondents' firms. It is the least applied practice in Canadian firms and the second least in the other three countries. It is also noticeable that TA is either partially or systematically applied by most firms in Japan (58 percent) but this is not the case in the other three countries with 41 percent, 41 percent, 40 percent in the UK, Italy, and Canada, respectively.

Monitoring of Competitive Environment

Respondents were asked to indicate the importance of six aspects of competition using a seven-point Likert scale, from 1 (no importance) up to 7 (critical importance). These aspects were quality, innovation, customer service, price, delivery, and flexibility. Table 3 shows summary of the results of each survey in the four countries under study.

The survey results in the four countries show that firms take all aspects of competition seriously. The six aspects of competition reported in the survey were considered important (more than 80 percent of respondents considered all aspects as important in the four surveys).

'Quality' is perceived as important by virtue of all respondents in the UK, Japan, and Canada, while it is considered as important by 94 percent of respondents in Italy. 'Customer service' and 'delivery' are considered as important by more than 90 percent in the four countries. On the other hand, 'innovation' can be ranked as the least important aspect of competition in the UK, Italy, and Japan, while 'flexibility' is the least important aspect of competition in Canada.

RELATIONSHIPS BETWEEN SFNFPMS AND THE CONTINGENT VARIABLES

The second objective of this study is to examine whether the use of SFNFPMs is associated with internal and external contingent variables (Research Question 2). However, examining the associations between the use and importance of the 19 subsidiary SFNFPMs and the extent of the implementation of the 27 contingent variables included in the study is not practical. In an attempt to minimise such complications, the associations were tested between composites SFNFPMs and composites contingent variables.

Four composite SFNFPMs are calculated as the sum of the ratings given by respondents to each individual measure included in each group of measures as follows:

Product quality (PQ) (Y_1)	Scrap
	Defects
	Reworks
	Batches
Customer satisfaction (CS) (Y_2)	No. of complaints from customers
	No. of returns
	No. of warranty claims
On-time delivery (OTD) (Y_3)	Percentage of on-time delivery to customers
	Percentage of on-time production
	Percentage of schedule adherence
	Manufacturing cycle efficiency
Employee morale (EM) (Y_4)	Staff turnover
	Absenteeism
	Lateness
	Employee attitude survey

Efficiency and utilisation (EU) (Y_5)	Efficiency Activity Capacity utilisation Proportion of overtime worked

For instance, the ratings given to the 'number of complaints from customers', 'number of returns', and 'number of warranty claims' were added and the sum used as a composite score of the SFNFPM evaluation category named 'customer satisfaction'. Similarly, four composite variables were constructed for the four categories of contingent variables as follows:

Innovative managerial practices (IMPs) (X_1)	JIT, TQM, MRP I/II, TPM, ERP, and OPT
Advanced manufacturing technologies (ATMs) (X_2)	FMS, CAD, CAM, CIM, CNC, CNC, AS/RS, and AGVS
Contemporary management accounting practices (CMAPs) (X_3)	BP, ABT, BSC, EVA, CPA, TA, and SMA
Competitive environment (CE) (X_4)	Quality, customer service, innovation, price, delivery, and flexibility

The objective here is to statistically test the following 20 hypotheses:

Product Quality (Y_1)

H_1. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in manufacturing firms in the four countries.

H_2. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in manufacturing firms in the four countries.

H_3. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of product quality* (Y_1) in manufacturing firms in the four countries.

H_4. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop- floor non-financial performance measures of product quality* (Y_1) in manufacturing firms in the four countries.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in manufacturing firms in the four countries.

H_6. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in manufacturing firms in the four countries.

H_7. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in manufacturing firms in the four countries.

H_8. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of customer satisfaction* (Y_2) in manufacturing firms in the four countries.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in manufacturing firms in the four countries.

H_{10}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in manufacturing firms in the four countries.

H_{11}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop- floor non-financial performance measures of on-time delivery* (Y_3) in UK manufacturing firms.

H_{12}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of on-time delivery* (Y_3) in manufacturing firms in the four countries.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in manufacturing firms in the four countries.

H_{14}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in manufacturing firms in the four countries.

H_{15}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in manufacturing firms in the four countries.

H_{16}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of employee morale* (Y_4) in manufacturing firms in the four countries.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of innovative managerial practices (X_1) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in manufacturing firms in the four countries.

H_{18}. There is no association between the level of application of advanced manufacturing technologies (X_2) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in manufacturing firms in the four countries.

H_{19}. There is no association between the level of application of contemporary management accounting practices (X_3) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in manufacturing firms in the four countries.

H_{20}. There is no association between the extent of importance of aspects of competitive environment (X_4) and the existence and importance of *composite shop-floor non-financial performance measures of efficiency and utilisation* (Y_5) in manufacturing firms in the four countries.

The non-parametric Kendall's τ-statistic test was used (Siegel, 1965; Cramer, 1994; De Vaus, 1996) to examine associations among the contingent variables and the importance of SFNFPMs. Table 4 shows the results of this test.

Results in Table 4 reveal that there are significant positive correlations between SFNFPMs of product quality and each contingent variable in the four countries (rejecting the null hypotheses) except that of Japan where, no significant correlation between product quality measures and CMAPs were reported.

Table 4 shows also that customer satisfaction measures are positively associated (again, rejecting the null hypotheses) with level of application of IMPs in manufacturing firms of the UK, Italy, and Japan. This group of measure is also associated with the application of AMTs in manufacturing firms of the UK and Italy but no such relation exists in Japanese or Canadian manufacturing firms. Furthermore, the table shows that significant correlations exist between customer satisfaction measures and competitive environment in each country. However, this group of measures

Table 4. Associations between the Importance of SFNFPMs and the Contingent Variables.

	UK	Italy	Japan	Canada
Product quality (PQ) (Y_1)				
X_1: Level of application of IMPs	0.183**	0.224**	0.331**	0.521**
X_2: Level of application of AMTs	0.091*	0.146*	0.173*	0.258*
X_3: Level of deployment of CMAPs	0.124**	0.204**	0.023	0.498**
X_4: Competitive environment	0.181**	0.147*	0.269**	0.276*
Customer satisfaction (CS) (Y_2)				
X_1: Level of application of IMPs	0.173**	0.222**	0.247**	0.175
X_2: Level of application of AMTs	0.150**	0.200**	0.141	0.123
X_3: Level of deployment of CMAPs	0.060	0.226**	0.100	0.139
X_4: Competitive environment	0.211**	0.196**	0.396**	0.235*
On-time delivery (OTD) (Y_3)				
X_1: Level of application of IMPs	0.297**	0.273**	0.325**	0.323**
X_2: Level of application of AMTs	0.177**	0.134*	0.156*	.0254*
X_3: Level of deployment of CMAPs	0.127**	0.265**	0.183*	0.308**
X_4: Competitive environment	0.235**	0.164**	0.434**	0.247*
Employee morale (EM) (Y_4)				
X_1: Level of application of IMPs	0.184**	0.367**	0.204*	0.503**
X_2: Level of application of AMTs	0.076	0.147*	0.135	0.407**
X_3: Level of deployment of CMAPs	0.220**	0.225**	0.211*	0.436**
X_4: Competitive environment	0.224**	0.177**	0.221**	0.353**
Efficiency and utilisation (EU) (Y_5)				
X_1: Level of application of IMPs	0.159**	0.237**	0.312**	0.427**
X_2: Level of application of AMTs	0.106**	0.093	0.177*	0.249*
X_3: Level of deployment of CMAPs	0.187**	0.225**	0.254**	0.365**
X_4: Competitive environment	0.210**	0.177**	0.369**	0.459**

*$p < .05$.
**$p < .01$.

is positively associated with the level of application of CMAPs in Italian manufacturing firms only.

The on-time delivery measures are significantly associated with the four contingent variables – level of application of IMPs, level of application of AMTs, level of deployment of CMAPs, and competitive environment – in the four countries. Similar results are shown as to efficiency and utilisation measures in the four countries except that the correlation between efficiency and utilisation and the level of application of AMTs in the Italian manufacturing firms are not significant.

Moreover, Table 4 shows that there are significant correlations between employee morale measures and the four contingent variables in the four countries except the correlation with the level of application of AMTs in the UK and Japanese manufacturing firms.

Finally, it could be concluded, from Table 4, that the majority of the alternate hypotheses in this study were accepted (there is a significant association between a contingent variable and the use and importance of SFNFPMs of one of the five categories) in the surveyed manufacturing firms in the four countries. The above results, though, highlight bivariate associations between the use and importance of SFNFPMs of the five evaluation categories and levels of application/extent of deployment of the contingent variables. To examine the multivariate associations between the contingent variables and each SFNFPM group of measures, a multiple regression analysis[1] was used. The results for each country are shown in Tables 5–8.

In the UK (Table 5) product quality and customer satisfaction measures are explained by IMPs and competition ($R^2 = .12$ and .11, respectively). While on-time delivery, employee morale, and efficiency and utilisation measures are explained by IMPs, CMAPs, and competition ($R^2 = .19$, .14, and .11, respectively). It is surprising that AMTs are not associated with any SFNFPM category.

In the Italian firms (Table 6) product quality, on-time delivery, and employee morale measures are explained by IMPs ($R^2 = .11$, .15, and .26, respectively), while customer satisfaction measures are explained by CMAPs ($R^2 = .14$). The Italian results show also that efficiency and utilisation measures are explained by both CMAPs and competition ($R^2 = .21$). Similar to the UK results the AMTs are not associated with any SFNFPMs category.

Results of the Japanese survey (Table 7) show that product quality and customer satisfaction measures are explained by IMPs and competition ($R^2 = .18$, and .23, respectively), while on-time delivery measures are explained by IMPs only ($R^2 = .30$). The results show also that, unlike in other countries, the application level of AMTs explains the variation in efficiency and utilisation measures ($R^2 = .33$). However, no contingent variable explains the variation in employee morale measures.

In Canadian firms (Table 8) all SFNFPMs categories except employee morale measures are explain by IMPs and competition ($R^2 = .55$, .27, .24, and .56 for product quality, customer satisfaction, on-time delivery, and efficiency and utilisation, respectively). Employee morale measures are explained by IMPs, AMTs, and competition ($R^2 = .73$). The results show

Table 5. Regression Analysis (Stepwise Method) Results – UK Results.

Dependent Variable	Constant	Coefficients (t-Values)				Adjusted R^2	Standard Error	F
		IMPs	AMTs	CMAPs	Competition			
Product quality	4.760	0.255 (4.731)	n.s.	n.s.	0.204 (3.777)	.119	6.43449	22.17
Customer satisfaction	6.304	0.231 (4.254)	n.s.	n.s.	0.203 (3.729)	.106	4.92516	19.40
On-time delivery	−1.766	0.305 (5.589)	n.s.	0.120 (2.220)	0.197 (3.792)	.191	6.95351	25.53
Employee morale	4.360	0.186 (3.303)	n.s.	0.163 (2.919)	0.207 (3.864)	.139	5.05083	17.79
Efficiency and utilisation	5.661	0.174 (3.038)	n.s.	0.167 (2.932)	0.154 (2.824)	.109	6.40210	13.73

Note: All t and F values reported in the table are significant at 99% level.

Table 6. Regression Analysis (Stepwise Method) Results – Italian Results.

Dependent Variable	Constant	Coefficients (t-Values)				Adjusted R^2	Standard Error	F
		IMPs	AMTs	CMAPs	Competition			
Product quality	11.668	0.344 (3.575)	n.s.	n.s.	n.s.	.109	6.66129	12.784
Customer satisfaction	5.327	n.s.	n.s.	0.380 (4.000)	n.s.	.135	5.27113	16.003
On-time delivery	8.568	0.399 (4.236)	n.s.	n.s.	n.s.	.150	7.08081	17.940
Employee morale	5.378	0.514 (5.837)	n.s.	n.s.	n.s.	.256	5.02766	34.074
Efficiency and utilisation	−1.571	n.s.	n.s.	0.380 (4.088)	0.218 (2.339)	.214	6.77408	14.050

Note: All t and F values reported in the table are significant at 99% level.

Table 7. Regression Analysis (Stepwise Method) Results – Japanese Results.

Dependent Variable	Constant	Coefficients (t-Values)				Adjusted R^2	Standard Error	F
		IMPs	AMTs	CMAPs	Competition			
Product quality	2.298	0.349 (3.316)	n.s.	n.s.	0.290 (2.750)	.278	4.12651	16.573
Customer satisfaction	3.137	0.315 (2.910)	n.s.	n.s.	0.271 (2.506)	.230	3.52879	13.271
On-time delivery	10.126	0.558 (6.008)	n.s.	n.s.	n.s.	.302	4.91464	36.092
Employee morale	9.341	n.s.	n.s.	n.s.	n.s.	.184	5.93312	19.050
Efficiency and utilisation	−4.556	n.s.	0.441 (4.365)	n.s.		.330	5.23289	20.708

Note: All t and F values reported in the table are significant at 99% level.

Table 8. Regression Analysis (Stepwise Method) Results – Canadian Results.

Dependent Variable	Constant	Coefficients (t-Values)				Adjusted R^2	Standard Error	F
		IMPs	AMTs	CMAPs	Competition			
Product quality	−17.666	0.651	n.s.	n.s.	0.306	.550	5.49923	24.864
		(6.007)			(2.825)			
Customer satisfaction	−8.445	0.330	n.s.	n.s.	0.404	.272	4.79101	8.273
		(2.394)			(2.925)			
On-time delivery	−3.860	0.394	n.s.	n.s.	0.300	.237	5.52124	6.911
		(2.760)			(2.100)			
Employee morale	−18.210	0.500	.224	n.s.	0.490	.732	3.09544	36.522
		(5.324)	(2.363)		(5.802)			
Efficiency and utilisation	−20.162	0.411	n.s.	n.s.	0.590	.562	4.47375	26.017
		(3.842)			(5.513)			

Note: All t and F values reported in the table are significant at 99% level.

also that the application level of CAMPs in Canadian firms is not associated with any SFNFPM category.

Table 9 presents the coefficient values of independent variables in the regression equations of each country. It shows that levels of application of IMPs are significantly associated with levels of importance of virtually all SFNFPMs of the five categories. This is consistent with the high levels of importance given to the two independent variables by the respondents in each country's survey. On the other hand, levels of deployment of CAMPs have no significant associations with the levels of importance of SFNFPMs of CS, OTD, EU in Japanese and Canadian firms. Contrarily, levels of

Table 9. Coefficients of Independent Variables in the Four Countries.

Dependent Variables/Country	Coefficients			
	IMPs	AMTs	CMAPs	Competition
Product quality (PQ)				
UK	0.255	n.s.	n.s.	0.204
Italy	0.344	n.s.	n.s.	n.s.
Japan	0.349	n.s.	n.s.	0.290
Canada	0.651	n.s.	n.s.	0.306
Customer satisfaction (CS)				
UK	0.231	n.s.	n.s.	0.203
Italy	n.s.	n.s.	n.s.	n.s.
Japan	0.315	n.s.	n.s.	0.271
Canada	0.330	n.s.	n.s.	0.404
On-time delivery (OTD)				
UK	0.305	n.s.	0.120	0.197
Italy	0.399	n.s.	n.s.	n.s.
Japan	0.558	n.s.	n.s.	n.s.
Canada	0.394	n.s.	n.s.	0.300
Employee morale (EM)				
UK	0.186	n.s.	0.163	0.207
Italy	0.514	n.s.	n.s.	n.s.
Japan	n.s.	0.441	n.s.	n.s.
Canada	0.500	0.224	n.s.	0.409
Efficiency and utilisation (EU)				
UK	0.174	n.s.	0.167	0.154
Italy	n.s.	n.s.	0.380	0.218
Japan	0.399	n.s.	n.s.	0.289
Canada	0.411	n.s.	n.s.	0.590

deployment of CMAPs are significantly associated with all SFNFPMs, except those of PQ, in the UK and Italian firms. Surprisingly, the application of AMTs has no significant association with any SFNFPM in the four countries except in case of SFNFPMs of EM in Japanese and Canadian firms.

Product quality and customer satisfaction measures are explained by both IMPs and competition in all surveyed countries except in Italy where product quality measures are explained by IMPs only and no evidence of association can be found between customer satisfaction and the four contingent variables. It is also noticeable that in the four countries on-time delivery measures are explained by the level of IMPs application, while efficiency and utilisation measures are explained by the competition.

The following two sections examine whether the use/level of importance of SFNFPMs of the five evaluation categories used in the surveyed manufacturing firms is country-specific (i.e., Are there significant differences in the use of SFNFPMs amongst the four countries studied?) or more industry-specific? (i.e., Do manufacturing firms, belonging to a specific industry type, give similar level of importance to specific SFNFPMs across the four countries studied?).

THE RELATIONSHIP BETWEEN THE USE OF SFNFPMS AND COUNTRIES

The aim of this section is to examine whether there are significant statistical differences in levels of importance of SFNFPMs of the five evaluation categories used in manufacturing firms across the four countries under study. The One-Way ANOVA Post Hoc multiple comparison for three unrelated variables (Bryman & Cramer, 1990, 2001; Coakes & Steed, 1999) was used to test this relationship. The Scheffe' test was chosen as it is the most conservative in the sense that it is least likely that significant differences between groups are to be found (i.e. it is least likely to make a Type I error). It is also suitable for unequal numbers of participants (Bryman & Cramer, 2001). The Scheffe' test compares mean levels of importance of SFNFPMs of the five evaluation categories in use between all possible pairs of countries. Table 10 shows the results of Scheffe' test. Only significant mean differences are reported.

Table 10 shows that the importance of product quality measures in Japanese manufacturing firms are significantly different than in both UK and Canadian manufacturing firms. The results show that levels of

Table 10. Significant Differences in Means of SFNFPMs Importance within the Four Countries (One-way ANOVA Post Hoc Scheffe' Test).

SFNFPMs	Country (a)	Country (b)	Mean Difference (a−b)	Significance
Product quality ($F = 8.283$, $p = .000$)				
	Japan	UK	3.283	.000
	Japan	Canada	4.215	.006
Customer satisfaction ($F = 11.039$, $p = .000$)				
	Japan	UK	1.851	.010
	Japan	Italy	3.524	.000
	Japan	Canada	3.091	.010
	UK	Italy	1.673	.016
On-time delivery ($F = 13.029$, $p = .000$)				
	Japan	UK	4.831	.000
	Japan	Italy	4.274	.000
	Japan	Canada	4.341	.011
Employee morale ($F = 2.378$, $p = .069$)				
	Italy	UK	−2.999	.000
	Italy	Japan	−3.383	.000
Efficiency and utilization ($F = 9.939$, $p = .000$)				
	n.s.	n.s.	n.s.	n.s.

Note: Only significant mean differences are reported in the table.

importance of these measures are not different in the surveyed firms in the UK, Italy, and Canada.

The importance of customer satisfaction measures is significantly different in Japanese manufacturing firms than in the UK, Italian, and Canadian manufacturing firms. Such differences apply, also, between manufacturing firms in the UK and Italy. The Japanese managers, furthermore, seem to differ, significantly, from their peers in manufacturing firms in the other three countries in their use of on-time delivery measures. Additionally, the importance of employee morale measures in Japanese manufacturing firms significantly differs from the Italian manufacturing firms. It is also noticeable that importance of employee morale measures in Italian manufacturing firms is significantly different than in the UK manufacturing firms.

Finally, the results of the Post Hoc Scheffe' test show that there is no significant difference between manufacturing firms in the four countries in terms of the importance of efficiency and utilisation measures.

THE RELATIONSHIP BETWEEN THE USE OF SFNFPMS AND INDUSTRY SECTORS

This section examines whether the use and levels of importance of SFNFPMs of the five evaluation categories is industry-specific (i.e., manufacturing firms, belonging to a specific industry type, will tend to give same level of importance to specific SFNFPMs across the four countries studies). This incorporates two steps; first, industry types in each country were dichotomised (i.e., if the case belongs to industry sector x, for instance, industry sector x was given a value = 0 and other industry sectors were given a value = 1, etc.) and common industry sectors across the four countries were recapitulated. Tables 11 and 12 present the industry sectors of which the surveyed firms belong to. These will be used in examining those industry sectors that are found to be in common amongst the four countries. Second, Kendall's τ-non-parametric test was applied[2] to examine whether there are significant associations between the use and importance of composite SFNFPMs of the five evaluation categories and the common industry sectors. The significant correlations are reported in Tables 13–17.

Tables 13–17 show that there are few significant associations between the use of SFNFPMs and industry sectors in each country. For example, Table 13 shows that there is a significant association between the importance of product quality measures and the industry sector of 'manufacturing of rubber and plastic products' in the UK and the industry sector of 'manufacturing of electrical machinery and apparatus' in the Italian firms. However, these results are not consistent across the other countries. Similar trend is also observed in the other measures reported in Tables 14–17.

The importance of customer satisfaction measures (Table 14) is negatively associated with the industry sector of 'publishing, printing, and reproduction of recorded media' in Italy and with the industry sector of 'manufacturing of chemicals and chemical products' in the UK. On the other hand, this group of measures is positively associated with the industry sectors of 'manufacturing of machinery and equipment' in the UK and 'manufacturing of motor vehicle, trailers and semi-trailers' in Italy. Again these results are not consistent across the other countries.

Table 15 shows that the importance of the on-time delivery measures is only negatively associated with the industry sector of 'manufacturing of fabricated metal products' in the Canadian manufacturing firms.

Table 16 shows that the importance of efficiency and utilisation measures is only positively associated with the industry sectors of 'manufacturing of

Table 11. Industry Sectors of the Surveyed Firms in the Four Countries.

Industry Code	Industry Sector	UK		Italy		Japan		Canada	
		No.	%	No.	%	No.	%	No.	%
1	Manufacturing of food products and beverages	30	9.6	6	4.5	12	9.8	6	14
2	Manufacturing of tobacco products	1	.3	–	–	–	–	–	–
3	Manufacturing of textiles	12	3.8	7	5.2	7	5.7	–	–
4	Manufacturing of wearing apparel; dressing and dyeing of fur	5	1.6	1	.7	1	.8	2	4.7
5	Tanning and dressing of leather, manufacturing of luggage, handbags, saddlery, harness, and footwear	4	1.3	4	3	–	–	–	–
6	Manufacturing of wood and of products of wood and cork, except furniture,	3	1.0	4	3	–	–	5	11.6
7	Manufacturing of pulp, paper, and paper products	11	3.5	9	2.2	3	2.5	2	4.7
8	Publishing, printing, and reproduction of recorded media	18	5.8	5	3.7	1	.8	2	4.7
9	Manufacturing of coke, refined petroleum products, and nuclear fuel	–	–	–	–	1	.8	–	–
10	Manufacturing of chemicals and chemical products	30	9.6	12	9	25	20.5	–	–
11	Manufacturing of rubber and plastic products	16	5.1	3	2.2	2	1.6	2	4.7
12	Manufacturing of non-metallic mineral product	15	4.8	7	5.2	1	.8	–	–
13	Manufacturing of basic metal	10	3.2	7	5.2	13	9.8	1	2.3
14	Manufacturing of fabricated metal products	35	11.2	19	14.2	3	2.5	5	11.6

Table 11. (*Continued*)

Industry Code	Industry Sector	UK		Italy		Japan		Canada	
		No.	%	No.	%	No.	%	No.	%
15	Manufacturing of machinery and equipment not elsewhere classified	28	8.9	24	17.9	17	13.9	2	4.7
16	Manufacturing of machinery and computers	5	1.6	2	1.5	6	4.9	–	–
17	Manufacturing of electrical machinery and apparatus not elsewhere classified	19	6.1	12	9	13	10.7	–	–
18	Manufacturing of radio, television and communication equipment and apparatus	8	2.6	5	3.7	–	–	–	–
19	Manufacturing of medical, precision and optical instruments, watches and clocks	9	2.9	3	2.2	5	4.1	–	–
20	Manufacturing of motor vehicle, trailers and semi-trailers	14	4.5	4	3	7	5.7	–	–
21	Manufacturing of other transport equipment	8	2.6	3	2.2	1	.8	3	7
22	Manufacturing of furniture, manufacturing not elsewhere classified (others)	32	10.2	3	2.2	5	4.1	4	9.3
23	Manufacturing of stone, clay, and glass products	–	–	–	–	–	–	1	2.2
	Total	313	100	134	100	122	100	43	100

Table 12. Industry Sectors in Common amongst the Surveyed Firms in the Four Countries.

Industry Code	Industry Sector	UK		Italy		Japan		Canada	
		No.	%	No.	%	No.	%	No.	%
1	Manufacturing of food products and beverages	30	9.6	6	4.5	12	9.8	6	14
4	Manufacturing of wearing apparel; dressing and dyeing of fur	5	1.6	1	.7	1	.8	2	4.7
7	Manufacturing of pulp, paper, and paper products	11	3.5	9	2.2	3	2.5	2	4.7
8	Publishing, printing and reproduction of recorded media	18	5.8	5	3.7	1	.8	2	4.7
10	Manufacturing of chemicals and chemical products	30	9.6	12	9	25	20.5	–	–
11	Manufacturing of rubber and plastic products	16	5.1	3	2.2	2	1.6	2	4.7
13	Manufacturing of basic metal	10	3.2	7	5.2	13	9.8	1	2.3
14	Manufacturing of fabricated metal products	35	11.2	19	14.2	3	2.5	5	11.6
15	Manufacturing of machinery and equipment not elsewhere classified	28	8.9	24	17.9	17	13.9	2	4.7
17	Manufacturing of electrical machinery and apparatus not elsewhere classified	19	6.1	12	9	13	10.7	–	–
20	Manufacturing of motor vehicle, trailers and semi-trailers	14	4.5	4	3	7	5.7	–	–
21	Manufacturing of other transport equipment	8	2.6	3	2.2	1	.8	3	7
22	Manufacturing of furniture, manufacturing not elsewhere classified (others)	32	10.2	3	2.2	5	4.1	4	9.3

Table 13. Kendall's τ-Correlations between Industry Sector and the Use of SFNFPMs of Product Quality in the Four Countries.

Industry Sector	UK	Italy	Japan	Canada
1 Manufacturing of food products and beverages	–	–	–	−.291*
4 Manufacturing of wearing apparel; and dyeing of fur	–	–	–	–
7 Manufacturing of pulp, paper, and paper products	–	–	–	–
8 Publishing, printing, and reproduction of recorded media	–	–	–	–
10 Manufacturing of chemicals and chemical products	–	–	–	NA
11 Manufacturing of rubber and plastic products	.098*	–	–	–
13 Manufacturing of basic metal	–	–	–	–
14 Manufacturing of fabricated metal products	–	–	–	–
15 Manufacturing of machinery and equipment	–	–	–	–
17 Manufacturing of electrical machinery and apparatus	–	.159*	–	NA
20 Manufacturing of motor vehicle, trailers and semi-trailers	–	–	–	NA
21 Manufacturing of other transport equipment	–	–	–	–
22 Manufacturing of furniture	–	–	–	–

Note: Only significant Kendall's τ-correlations are reported.
* $p<.05$.

Table 14. Kendall's τ-Correlations between Industry Sector and the Use of SFNFPMs of Customer Satisfaction in the Four Countries.

Industry Sector	UK	Italy	Japan	Canada
1 Manufacturing of food products and beverages	–	–	–	–
4 Manufacturing of wearing apparel, and dyeing of fur	–	–	–	–
7 Manufacturing of pulp, paper, and paper products	–	–	–	–
8 Publishing, printing, and reproduction of recorded media	–	−.181*	–	–
10 Manufacturing of chemicals and chemical products	−.110*	–	–	NA
11 Manufacturing of rubber and plastic products	–	–	–	–
13 Manufacturing of basic metal	–	–	–	–
14 Manufacturing of fabricated metal products	–	–	–	–
15 Manufacturing of machinery and equipment	.114*	–	–	–
17 Manufacturing of electrical machinery and apparatus	–	–	–	NA
20 Manufacturing of motor vehicle, trailers and semi-trailers	–	.208**	–	NA
21 Manufacturing of other transport equipment	–	–	–	–
22 Manufacturing of furniture	–	–	–	–

Note: Only significant Kendall's τ-correlations are reported.
*$p<.05$.
**$p<.01$.

Table 15. Kendall's τ-Correlations between Industry Sector and the Use of SFNFPMs of On-Time Delivery in the Four Countries.

	Industry Sector	UK	Italy	Japan	Canada
1	Manufacturing of food products and beverages	–	–	–	–
4	Manufacturing of wearing apparel, and dyeing of fur	–	–	–	–
7	Manufacturing of pulp, paper, and paper products	–	–	–	–
8	Publishing, printing, and reproduction of recorded media	–	–	–	–
10	Manufacturing of chemicals and chemical products	–	–	–	NA
11	Manufacturing of rubber and plastic products	–	–	–	–
13	Manufacturing of basic metal	–	–	–	–
14	Manufacturing of fabricated metal products	–	–	–	−.294*
15	Manufacturing of machinery and equipment	–	–	–	–
17	Manufacturing of electrical machinery and apparatus	–	–	–	NA
20	Manufacturing of motor vehicle, trailers and semi-trailers	–	–	–	NA
21	Manufacturing of other transport equipment	–	–	–	–
22	Manufacturing of furniture	–	–	–	–

Note: Only significant Kendall's τ-correlations are reported.
*$p < .05$.

Table 16. Kendall's τ-Correlations between Industry Sector and the Use of SFNFPMs of Efficiency and Utilisation in the Four Countries.

	Industry Sector	UK	Italy	Japan	Canada
1	Manufacturing of food products and beverages	–	–	–	–
4	Manufacturing of wearing apparel, and dyeing of fur	–	–	–	–
7	Manufacturing of pulp, paper, and paper products	–	–	–	–
8	Publishing, printing, and reproduction of recorded media	–	–	–	–
10	Manufacturing of chemicals and chemical products	–	–	–	NA
11	Manufacturing of rubber and plastic products	.117*	–	–	–
13	Manufacturing of basic metal	–	–	–	–
14	Manufacturing of fabricated metal products	–	–	–	–
15	Manufacturing of machinery and equipment	–	–	–	–
17	Manufacturing of electrical machinery and apparatus	–	–	.156*	NA
20	Manufacturing of motor vehicle, trailers and semi-trailers	–	–	.163*	NA
21	Manufacturing of other transport equipment	–	–	–	–
22	Manufacturing of furniture	–	–	–	–

Note: Only significant Kendall's τ-correlations are reported.
*$p < .05$.

Table 17. Kendall's τ-Correlations between Industry Sector and the Use of SFNFPMs of Employee Morale in the Four Countries.

	Industry Sector	UK	Italy	Japan	Canada
1	Manufacturing of food products and beverages	–	–	–	–
4	Manufacturing of wearing apparel, and dyeing of fur	–	–	–	–
7	Manufacturing of pulp, paper, and paper products	–	–	–	–
8	Publishing, printing, and reproduction of recorded media	–	–	–	–
10	Manufacturing of chemicals and chemical products	–	–	–	NA
11	Manufacturing of rubber and plastic products	.125**	–	–	–
13	Manufacturing of basic metal	–	–	–	–
14	Manufacturing of fabricated metal products	–	–	–	–
15	Manufacturing of machinery and equipment	–	–	–	–
17	Manufacturing of electrical machinery and apparatus	–	–	–	NA
20	Manufacturing of motor vehicle, trailers and semi-trailers	–	–	–	NA
21	Manufacturing of other transport equipment	–	–	–	−.266*
22	Manufacturing of furniture	–	–	–	–

Note: Only significant Kendall's τ-correlations are reported.
*$p<.05$.
**$p<.01$.

rubber and plastic products' of the UK, and 'manufacturing of electrical machinery and apparatus' and 'manufacturing of motor vehicle, trailers and semi-trailers' of Italy.

Finally, Table 17 shows that the importance of employee morale measures is only positively associated with the industry sectors of 'manufacturing of rubber and plastic products' of the UK, and negatively associated with 'manufacturing of other transport equipment' of Canada.

Overall, it can be concluded that there are significant differences in the use of SFNFPMs of the five evaluation categories amongst manufacturing firms across the four countries surveyed. Such significant differences are country-specific. Also, it can be concluded that there is no consistent pattern of associations between the SFNFPMs and the industry sectors across the four countries. In other words, in each country, firms tend to attach different levels of importance to the use of SFNFPMs of the five categories depending on the industry sector they belong to.

LIMITATIONS OF THE STUDY

The results of this study are limited by typical constraints associated with the survey method, particularly with the variable and sample selection processes and the response rate. Furthermore, in interpreting the results, care should be taken in associating the use of performance measures with performance. The prudent use of sophisticated performance measurement systems can improve performance by allowing the monitoring of key performance criteria and taking timely corrective actions, but the ineffective use of performance measures can result in dysfunctional behaviours and sub-optimal decisions (Waterhouse & Tiessen, 1978; Pollanen, 2005).

NOTES

1. The fulfilment of the assumptions of regression analysis is discussed in Appendix A.
2. See for example, Siegel (1965), Bryman and Cramer (1990), Cramer (1994), and De Vaus (1996).

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APPENDIX A. THE ASSUMPTIONS OF MULTIPLE REGRESSION

It is argued that some important multiple regression assumptions must not be violated in order to infer accurately the true population values from the sample values. Accordingly, the following linear multiple regression assumptions were tested (Lewis-Beck, 1980, p. 26; see also, Bryman & Cramer, 1990; Berry, 1993; Cramer, 1994; Gujarati, 1999; Coakes & Steed, 1999):

1. No specification errors (the relationship between Xi and Yi is linear, no relevant independent variables have been excluded, and no irrelevant independent variables have been included).
2. No measurement error (the variables Xi and Yi are accurately measured).
3. The error term is normally distributed.
4. The absence of perfect multicollinearity. It means that none of the independent variables is perfectly correlated with other independent variables in the original equation. One way of measuring the degree of multicollinearity in an equation is to ascertain the tolerance value for each independent variable in the equation. The tolerance for each independent variable in an equation is equal to $(1–R^2)$ of regressing that particular variable (as being a dependent variable) on the other independent variables in the original equation. The nearer the tolerance value is to zero the greater the possibility of a perfect multicollinearity. A scrutiny of the tolerance values for the independent variables in the regression equations (see Tables 6–9) concludes that the tolerance values are high and one can argue that multicollinearity imposes no threat to the reported regression results.

5. Detecting the presence of residual outliers. Outliers may be defined as residuals with more than three standard deviations from the mean (Coakes & Steed, 1999). The presence of residual outliers affects the standard errors of estimate of a regression model, and thus increases the possibility of prediction error. It also weakens the explanation of the dependent variable in the regression equation (Lewis-Beck, 1980). Residual outliers with greater than 3 standard deviations were detected (Coakes & Steed, 1999).

   It is acceptable to have up to 5 percent of the residuals as outliers (Coakes & Steed, 1999). Accordingly, it can be concluded (from Table A1) that outliers impose no threat to the regression equations in this study.
6. Level of measurement. One of the assumptions of the application of multiple regression is that variables are of interval level of measurement. However, dichotomous variables of nominal and ordinal level of measurement can be included (Lewis-Beck, 1980). Also, the independent variables incorporated in this research are of ordinal level of measurement which may be seen as a violation of the above assumption. However, the use of ordinal variables in regression is a controversial issue. Lewis-Beck (1980) advocates the use of ordinal variables in regression and argues that ordinal variables are candidates for regression even though the distances between the categories are not exactly equal. He states that the conclusions are usually equivalent to those generated by more correct techniques (i.e., the application of dummy variable regression or a non-parametric statistical technique). He also argues that multiple regression is so powerful, compared to non-parametric techniques, as the risk of error is acceptable. Accordingly, all variables of ordinal level of measurement in this research study were used in the linear multiple regression technique.

Table A1. Testing for Residual Outliers in the Regression Equations.

Dependent Variables Existence and Importance of SFNFPMs	Number of Outliers	Percentage of Outliers (No. of Outliers/Total No. of Residuals)
UK (*total number of residuals in each equation=313*)		
Product quality	–	–
Customer satisfaction	2	0.64
On-time delivery	–	–
Employee morale	4	1.28
Efficiency and utilisation	2	0.64

Table A1. *(Continued)*

Dependent Variables Existence and Importance of SFNFPMs	Number of Outliers	Percentage of Outliers (No. of Outliers/Total No. of Residuals)
Italy		
Product quality	–	–
Customer satisfaction	–	–
On-time delivery	–	–
Employee morale	–	–
Efficiency and utilisation	–	–
Japan (total number of residuals in each equation=104)		
Product quality ($N=104$)	1	0.96
Customer satisfaction	–	–
On-time delivery ($N=106$)	2	1.89
Employee morale ($N=110$)	1	0.91
Efficiency and utilisation ($N=104$)	1	0.96
Canada		
Product quality	–	–
Customer satisfaction	–	–
On-time delivery	–	–
Employee morale	–	–
Efficiency and utilisation	–	–

CHAPTER 10

THE DESIGN AND APPLICATION OF SHOP FLOOR NON-FINANCIAL PERFORMANCE MEASURES 'SCORECARDS'

Ahmed Abdel-Maksoud

INTRODUCTION

The current study has three main objectives, *first*, to highlight the existence and level of importance of shop-floor non-financial performance measures (SFNFPMs) in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) and the extent/level of deployment of the contingent variables incorporated in the study. *Second*, to test for associations between the existence and importance of SFNFPMs in the five evaluation categories and the specified contingent variables. *Third*, to develop a theoretical-based SFNFPMs scorecard that examines the cause-and-effect relationships among the five performance evaluation categories in this research study. The first two objectives were covered in previous chapters (Chapters 5–9). The third objective is covered in this chapter.

The comparative analysis of respondents' evaluation of the level of importance of SFNFPMs of the above five evaluation categories indicates

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that, recalling from Chapter 9, SFNFPMs of customer satisfaction are seen as the most important measures by respondents in the surveyed manufacturing firms in the four countries. It is concluded that companies in the four countries pay particular attention to customers and shop-floor workers should be committed to customers' requirements. Many of the SFNFPMs of on-time delivery, product quality, and efficiency and utilisation and employee morale are also seen important by respondents in the four countries. Such results merit further analysis and can be better understood by examining the possible cause-and-effect relationships among the five SFNFPMs evaluation categories. This chapter explores such cause-and-effect relationships where a theoretical-based SFNFPMs scorecard that examines such cause-and-effect relationships is developed and applied in the surveyed manufacturing firms deploying path analysis technique.

The remainder of this chapter consists of four sections. The next section presents a background to path analysis technique. The third and fourth sections present the proposed SFNFPMs scorecard and its application in the surveyed manufacturing firms in the four countries incorporated. Comments and limitations of the proposed 'scorecards' are discussed in the last section.

PATH ANALYSIS TECHNIQUE

In order to develop a SFNFPMs 'scorecard', cause-and-effect relationships among the five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) are examined using path analysis technique. Path analysis is defined as "a procedure for analysing and presenting results" (De Vaus, 1996, p. 225). March (1982) defines it as "the model that stands between the researcher and unbridled empiricism in the attempt to draw causal inferences, for it forces researchers into explicit theory making activity" (p. 72). It is a "method for tracing out the implications of a set of causal assumptions which the researcher is willing to impose upon a system of relationships" (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975, p. 389). However, it is not a procedure for demonstrating causality (Nie et al., 1975). Path analysis is used for testing causal models and requires that a model is to be formulated using a pictorial causal flow graph (Goldberger, 1970; Nie et al., 1975; Johnson, 1977; March, 1982; Davis, 1985; De Vaus, 1996; Bryman & Cramer, 2001).

Bryman and Cramer (2001) argue that path analysis has become a popular technique because it allows the relative impact of variables within a causal network to be estimated. The technique forces researchers to make explicit the causal structures that are believed to underpin the variables of interest (Bryman & Cramer, 2001). However, path analysis cannot confirm the underlying causal structure. It informs researchers what the relative impact of the variables upon each other is, but cannot validate that causal structure (Bryman & Cramer, 2001).

De Vaus (1996) argues that path analysis provides one means of evaluating how well a set of data fits that model. "The key point is that we must develop the model and do it before any fancy statistical analysis. Statistical analysis will not do it for us. Sophisticated statistics and analysis do not substitute for sound careful theoretical reasoning; rather they rely on it" (De Vaus, 1996, p. 226).

The path analysis model must be developed based on sound theoretical reasoning (De Vaus, 1996; Bryman & Cramer, 2001). In path analysis variables are placed in a causal order. The variables included, the order in which they are placed and the causal arrows drawn, are up to the researcher (De Vaus, 1996).

> We are forced to rely on theoretical ideas and our common-sense notions for information about the likely sequence of the variables in the real world. (Bryman & Cramer, 2001, p. 258)

Johnson (1977) argues that "path analysis is a technique for evaluating entire causal models. It utilises multiple-regression techniques" (p. 150). Path analysis makes use of R^2, and thus enables an evaluation of how good the model is. It also uses beta weights (called path coefficients in path analysis), which specify how much effect each variable has. In addition, it pinpoints the extent to which each variable's effect is direct or indirect.

Path analysis application imposes the following requirements on the relationships between the included variables (Johnson, 1977, p. 151; De Vaus, 1996, p. 226; Norreklit, 2000; Luft & Shields, 2003):

- All the causal relationships work in one direction only which is symbolised by a one-way arrow going from the cause to the effect. In other words, all relationships must be asymmetrical or "simple recursive". Causally, prior variables will be placed on the left and we progressively work across to the most recent variable. This is the dependent variable. The arrows specify the assumed direction of causal influence.[1]
- All the variables must have a definite time ordering.

The next section presents the proposed SFNFPMs 'scorecard' with a discussion of the logic followed in building the model and model explanation.

THE PROPOSED SFNFPMs SCORECARD

A causal order of the five SFNFPMs evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation) was developed. The cause-and-effect relationships between the five evaluation categories were proposed and examined through the application of path analysis technique. Stipulating the cause-and-effect relationships between different aspects in the area of management accounting has been advocated by many researchers (see for instance, Fitzgerald, Johnston, Brignall, Silvestro, & Voss, 1991; Lynch & Cross, 1992; Brignall, 2002; Luft & Shields, 2003; Norreklit, 2003; Boom & Wagensveld, 2004; Lau & Sholihin, 2005), and prominently by Kaplan and Norton (2000, 2001a, 2001b) in their balanced scorecard (BSC).

Kaplan and Norton (2001c) argue that

> Over the short term, managers' assessment of strategic impact may have to rest on subjective and qualitative judgements. Eventually, however, as more evidence accumulates, organisations may be able to provide more objectively grounded estimates of cause-and-effect relationships. (p. 197)

Kaplan and Norton (2001c) give an example of one organisation that

> Attempted to validate its hypothesised cause-and-effect relationships in the Balanced Scorecard by measuring the strength of the linkages among measures in the different perspectives. The company found significant correlations between employees' morale, a measure in the learning and growth perspective, and customer satisfaction, an important customer perspective measure. (p. 197)

The BSC integrates four financial and non-financial strategic perspectives (financial, customer, internal, and learning and growth) in a cause-and-effect relationship which assumes the following (Kaplan & Norton, 2001a, 2001b):

$$\text{Learning and growth} \rightarrow \text{Internal business process}$$
$$\rightarrow \text{Customer perspective} \rightarrow \text{Financial perspective}$$

However, these causal relationships claimed in the BSC are being criticised. For instance, Norreklit (2000) argues that the four BSC perspectives are interdependent and that "there are no causal relationship between measures from the four perspectives" (p. 75). Also, Brignall (2002) argues that these causal relationships are "not always linear and one-way, but are commonly a fuzzy mess of interactions and interdependencies that inevitably fail to capture the unintended consequences that many performance improvement initiatives may have" (p. 89).

The logic followed in building the SFNFPMs 'scorecard' and its difference from the BSC is presented next.

The Logic behind the Proposed SFNFPMs 'Scorecard'

In order to propose a model of a SFNFPMs 'scorecard', causal relationships among the five evaluation categories were developed. This model is confined only to the existence and importance of SFNFPMs of the five evaluation categories specified earlier. The logic behind the causal order is as follows:

- Generally, organisations seek to increase sales and market share (as to maximise shareholders wealth). Satisfied customers are considered crucial in achieving such an objective. Accordingly, any organisation will be interested in increasing customer satisfaction. If it is true that "*What you measure is what you get*", organisations will prioritise the measurement of customer satisfaction.
- Customer satisfaction can be achieved through providing products with satisfying quality and delivering them on time. The level of product quality is relative and depends on the targeted market niche. In order to guarantee the required level of quality and timeliness, an organisation will deploy performance measures of product quality and on-time delivery.
- Maintaining on-time delivery requires an efficient use of available resources. Accordingly, an organisation will opt to have some performance measures of efficiency and utilisation.
- Moreover, maintaining both product quality and timeliness as well as the efficient use of available resources must be supported by ensuring a co-operative and enthusiastic workforce. As a consequence, an organisation will be interested in performance measures of human resources (i.e. employee morale).

To fully understand the above proposed causal order, it is crucial to distinguish between two causal paths: first, a causal path among the existence and importance of non-financial performance measures of the five evaluation categories, and second, a causal path among the five evaluation categories (customer satisfaction, quality, timeliness, efficiency and utilisation, and employee morale) as aspects of performance. For instance, Kaplan and Norton (2001a, 2001b) argue that a skilled and co-operative workforce leads to better use of resources, quality, and timeliness which, in turn, leads to satisfied customers. Applying this causal order to the shop-floor, five evaluation categories implies the following causal relationship:

$$\text{Employee morale} \rightarrow \text{Efficiency and utilisation, quality and timeliness} \rightarrow \text{Customer satisfaction.}$$

However, these are aspects of performance. But, when thinking of the causal order of the existence and importance of SFNFPMs of these aspects the direction of the arrows has to be reversed, i.e. a firm will be keen to ensure that it has measures of customer satisfaction (as stated earlier). That will be followed by, for example, measures of quality to ensure the required quality output, and it then will ensure that it has measures of employee morale to ensure a supportive and co-operative workforce (see, Brignall, 2002). In other words, the imperative to attain customer satisfaction leads to (or causes) an imperative to measure quality.

The examination of the causal order between the SFNFPMs evaluation categories in these research studies differs from the BSC in that:

- The BSC is a two-dimensional model that incorporates financial and non-financial aspects, while the SFNFPMs 'scorecard' focuses solely on the non-financial measures.
- The SFNFPMs 'scorecard' is concerned with the causal relationships between the existence and importance of the non-financial performance measures of five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation).
- The BSC is concerned with the organisational or SBU level, while the focal concern in the SFNFPMs 'scorecard' is the shop-floor level.
- The BSC is applicable in both the manufacturing and service industries, while the SFNFPMs 'scorecard' is applicable in manufacturing industries only.
- The BSC is a non-mathematical model (see, Norreklit, 2000) where causal relationships are theoretically hypothesised without being mathematically proven. The SFNFPMs 'scorecard' is a logical and mathematically developed model.

Fig. 1 presents the proposed SFNFPMs 'scorecard' in manufacturing firms.

Key Terms in Understanding the Proposed Path Diagram

This subsection explains some of the technical issues in the application of path analysis technique that help in understanding the diagram in Fig. 1.

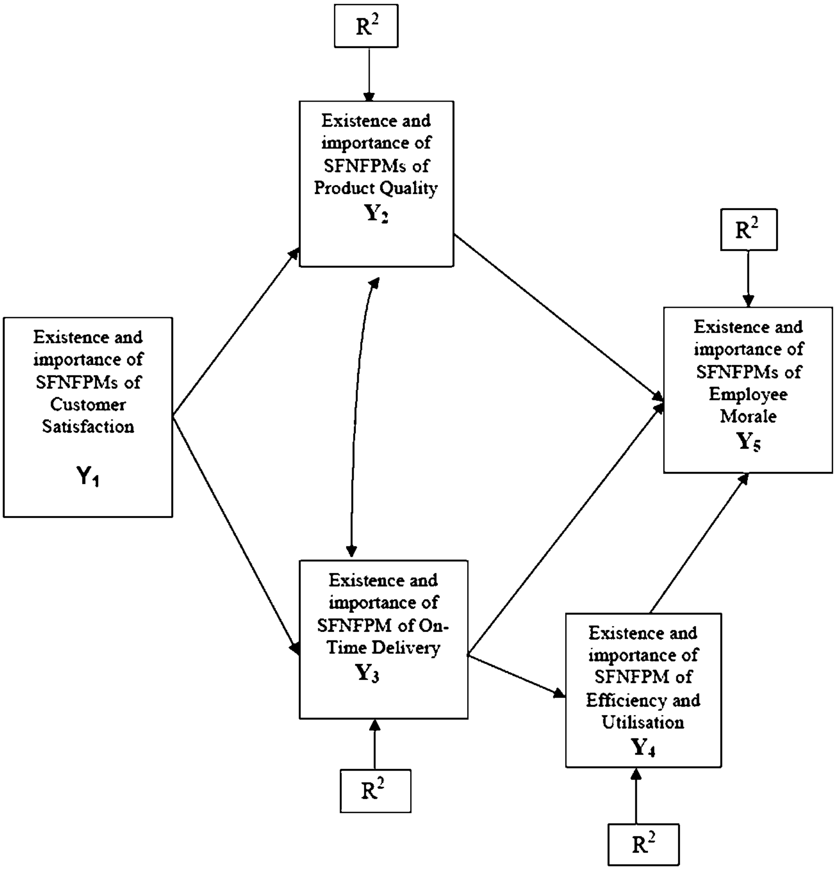

Fig. 1. A Proposed SFNFPMs 'Scorecard' of Five Evaluation Categories.

These are highlighted as follows:[2]

- In a path diagram each path is given a path coefficient. These are beta weights and indicate how much impact variables have on various other variables (De Vaus, 1996, p. 226). The path coefficients are standardised, and thus can be compared directly with one another. A simple and efficient method of estimating a path coefficient (e.g. P_{21}: $X_1 \rightarrow X_2$) is to regress X_2 on X_1 using ordinary regression in which the causal variables assumed to have direct causal effects on a given dependent variable are included as predictors (Nie et al., 1975; Goldberger, 1970; Bryman & Cramer, 2001).

- R^2 indicates how much variance in a variable is explained by the prior variables in the model.
- Y_1–Y_5 are composite measures of the SFNFPMs composing the five evaluation categories. For instance, Y_1 (customer satisfaction) in the 'scorecard' is a composite measure (adding up the scores given by respondents in their evaluation of the importance of SFNFPMs of 'number of complaints to customers', 'number of returns', and 'number of warranty claims'). Y_2 (product quality) is a composite measure of scrap, defects, and reworks as percentage of production, and batches – percentage adjusted. Y_3 (on-time delivery) is a composite measure of '% on-time delivery to customers', '% on-time production', '% schedule adherence', and 'manufacturing cycle efficiency'. Y_4 (efficiency and utilisation) is a composite measure of 'efficiency', 'activity', 'capacity utilisation', 'proportion of overtime worked'. And, finally, Y_5 (employee morale) is a composite measure of 'staff turnover', 'absenteeism', 'lateness', and 'employee attitude survey'.
- The reciprocal interaction between Y_2 and Y_3 infers that the proposed relationship between Y_2 and Y_3 is a non-directional.

An examination of the applicability of the proposed model in manufacturing firms in the four countries under study is presented in the next section.

THE APPLICATION OF THE PROPOSED SFNFPMs SCORECARDS

In order to complete all the paths in the proposed SFNFPMs scorecard path diagrams for the four countries, all the path coefficients are computed deploying multiple regression technique. Multiple regression analysis was carried out on the composite variables in the model using SPSS 13. The stepwise procedure was not selected, as path coefficients of certain variables could not be computed if these variables do not enter the equation due to the programme's default criteria (i.e. inclusion/exclusion criteria) (Bryman & Cramer, 2001). The 'enter' method, thus, was selected where all variables that precede a specific variable in the model and have direct effect on it are forced into the equation (Bryman & Cramer, 2001). For instance, Y_2, Y_3, Y_4 precede and have direct effect on Y_5. This procedure is applied consistently in the SFNFPMs scorecards throughout this chapter.

The next subsections present the SFNFPMs scorecard in UK, Italian, Japanese, and Canadian manufacturing firms, respectively. Comments on the proposed SFNFPMs scorecards and limitations of their application are discussed in the fourth section. The chapter summary is presented in the last section.

The SFNFPMs Scorecard in UK Manufacturing Firms

The mathematical path diagram for the proposed SFNFPMs 'scorecard' in UK manufacturing firms is shown in Fig. 2. An explanation of this mathematical diagram is presented next.

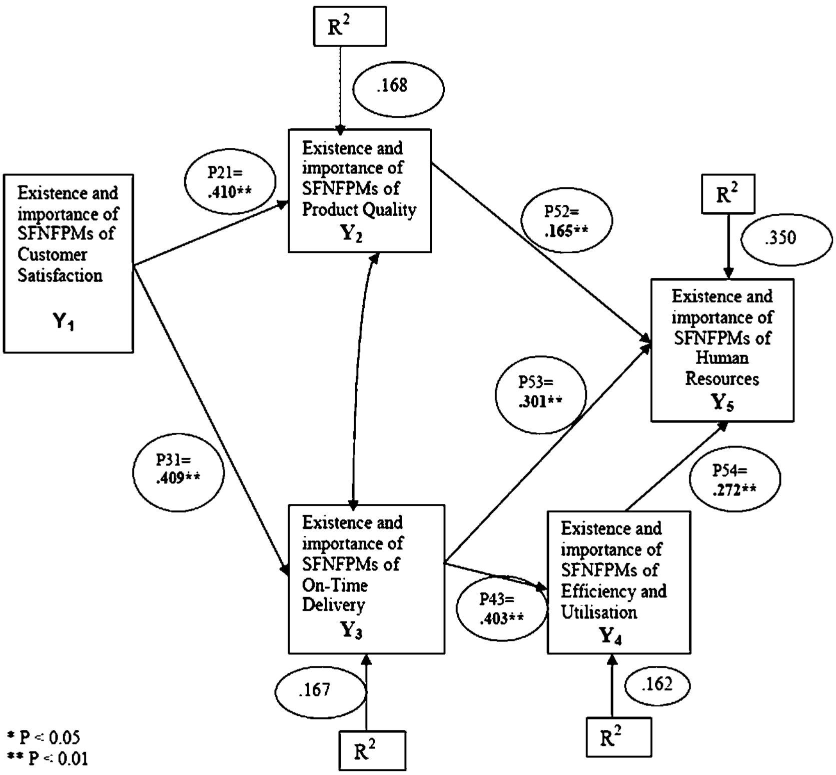

Fig. 2. Proposed Path Diagram for the SFNFPMs 'Scorecard' in UK Manufacturing Firms.

Table 1. Calculations of Total Effects of Y_1–Y_4 on Y_5.

Preceding Variables	Total Direct Effect (1)	Total Indirect Effect (2)	Total Effect (1+2)
Effect of Y_1 on Y_5	–	(P21*P52) = .410*.168 = .069 + (P31*P53) = .409*.301 = .123 + (P31*P43*P54) = .409*.403*.272 = .045	.237
Effect of Y_2 on Y_5	P52 = .165	–	.165
Effect of Y_3 on Y_5	P53 = .301	(P43*P54) = .403*.272 = .110	.411
Effect of Y_4 on Y_5	P54 = .272	–	.272

Table 2. Recapitulation of Total Effects of Y_1–Y_4 on Y_5.

Independent Variables (Y_1–Y_4)	Total Effect on Y_5
Existence and importance of SFNFPMs of customer satisfaction (Y_1)	.237
Existence and importance of SFNFPMs of product quality (Y_2)	.165
Existence and importance of SFNFPMs of on-time delivery (Y_3)	.411
Existence and importance of SFNFPMs of efficiency and utilisation (Y_4)	.272

Model Explanation

In explaining the above SFNFPMs 'scorecard' (presented in Fig. 2), it is crucial to consider the total effect of the antecedent variables in the model, Y_1–Y_4, on existence and importance of SFNFPMs of Y_5 'employee morale' which consists of two components: a direct effect and an indirect effect. Tables 1 and 2 show the total effect incorporating both direct and indirect effects of variables (Y_1–Y_4) on Y_5.

An interpretation of the results in Tables 1 and 2 could be as follows: one unit change in Y_1 leads to 0.239 unit change in Y_5.

The SFNFPMs Scorecard in Italian Manufacturing Firms

The mathematical path diagram for the proposed SFNFPMs 'scorecard' in Italian manufacturing firms is shown in Fig. 3 followed by an explanation of the path diagram.

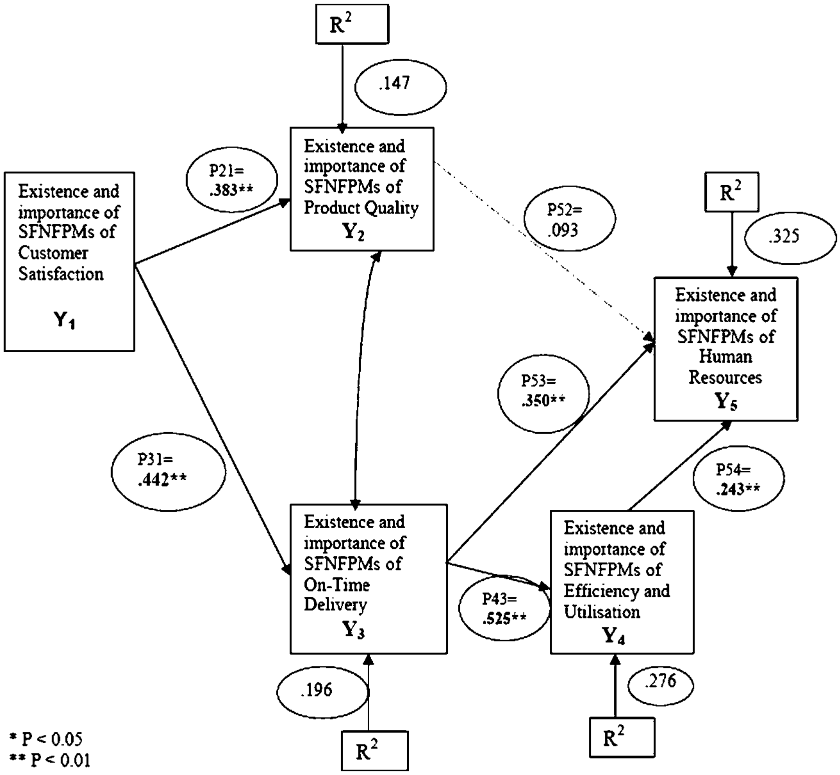

Fig. 3. Proposed Path Diagram for the SFNFPMs 'Scorecard' in Italian Manufacturing Firms.

Model Explanation

Again, the total direct and indirect effect of the antecedent variables in the model, Y_1–Y_4, on existence and importance of SFNFPMs of Y_5 'employee morale' is presented in Tables 3 and 4.

Although there are significant correlations between Y_5 and its preceding variables in the scorecard (i.e. bivariate significant correlations between Y_2, Y_3, and Y_4 and Y_5, see chapter Appendix A), it is, however, noteworthy to indicate that at a multivariate correlations level, the correlation coefficient between Y_2 and Y_5 (i.e. P52 in the scorecard) is insignificant. It, thus, was excluded from the calculations in Tables 3 and 4.

Table 3. Calculations of Total Effects of Y_1–Y_4 on Y_5.

Preceding Variables	Total Direct Effect (1)	Total Indirect Effect (2)	Total Effect (1 + 2)
Effect of Y_1 on Y_5	–	(P21*P52^{INS}) = – + (P31*P53) = .442*.350 = .155 + (P31*P43*P54) = .442*.525*.243 = .056	.211
Effect of Y_2 on Y_5	P52 = .093^{INS}	= –	–
Effect of Y_3 on Y_5	P53 = .350	(P43*P54) = .525	.875
Effect of Y_4 on Y_5	P54 = .243	= –	.243

Note: INS, insignificant.

Table 4. Recapitulation of Total Effects of Y_1–Y_4 on Y_5.

Independent Variables (Y_1–Y_4)	Total Effect on Y_5
Existence and importance of SFNFPMs of customer satisfaction (Y_1)	.211
Existence and importance of SFNFPMs of product quality (Y_2)	–
Existence and importance of SFNFPMs of on-time delivery (Y_3)	.875
Existence and importance of SFNFPMs of efficiency and utilisation (Y_4)	.243

An interpretation of the results in Tables 3 and 4 could be as follows: one unit change in Y_1 leads to .211 unit change in Y_5.

The SFNFPMs Scorecard in Japanese Manufacturing Firms

The mathematical path diagram for the proposed SFNFPMs 'scorecard' in Japanese manufacturing firms is shown in Fig. 4.

Model Explanation

Although there are significant correlations between Y_5 and its preceding variables (i.e. Y_2, Y_3, and Y_4) in the scorecard, the correlation coefficients between Y_2 and Y_5 (i.e. P52) and Y_3 and Y_5 (i.e. P54) are insignificant. They, thus, were excluded from the calculations in the next tables. Tables 5 and 6 show the total effect incorporating both direct and indirect effects of variables (Y_1–Y_4) on Y_5.

An interpretation of the results in Tables 5 and 6 could be as follows: one unit change in Y_1 leads to .160 unit change in Y_5.

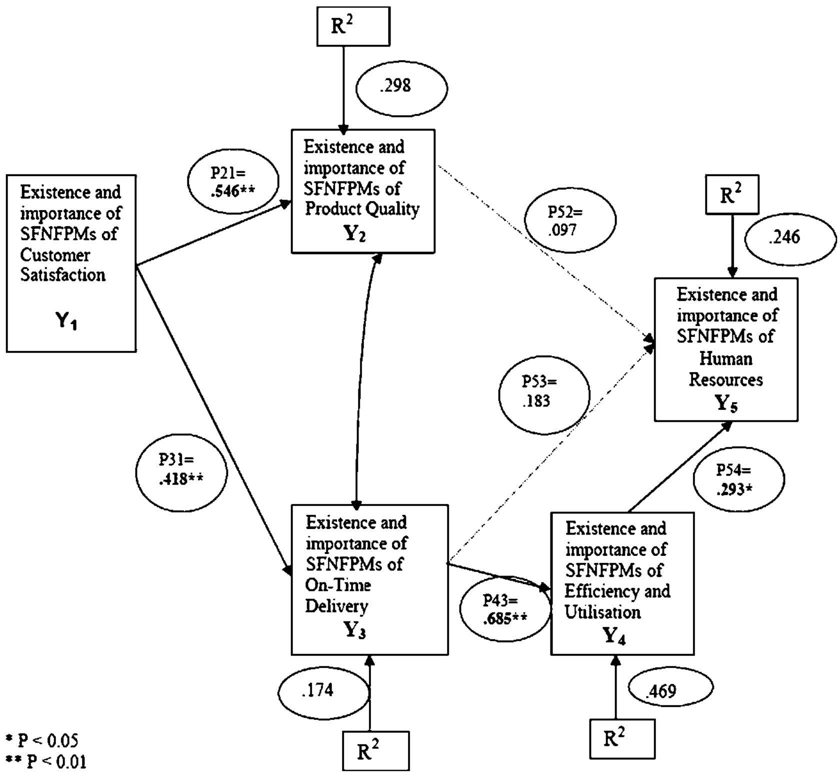

Fig. 4. Proposed Path Diagram for the SFNFPMs 'Scorecard' in Japanese Manufacturing Firms.

Table 5. Calculations of Total Effects of Y_1–Y_4 on Y_5.

Preceding Variables	Total Direct Effect (1)	Total Indirect Effect (2)	Total Effect (1 + 2)
Effect of Y_1 on Y_5	–	(P21*P52^{INS}) = – + (P31*P53) = .418*.183 = .076 + (P31*P43*P54) = .418*.685*.293 = .084	.160
Effect of Y_2 on Y_5	P52 = .097^{INS}	= –	–
Effect of Y_3 on Y_5	P53 = .183^{INS}	(P43*P54) = .685*.293 = .201	.201
Effect of Y_4 on Y_5	P54 = .293	= –	.293

Note: INS, insignificant.

Table 6. Recapitulation of Total Effects of Y_1–Y_4 on Y_5.

Independent Variables (Y_1–Y_4)	Total Effect on Y_5
Existence and importance of SFNFPMs of customer satisfaction (Y_1)	.160
Existence and importance of SFNFPMs of product quality (Y_2)	–
Existence and importance of SFNFPMs of on-time delivery (Y_3)	.201
Existence and importance of SFNFPMs of efficiency and utilisation (Y_4)	.293

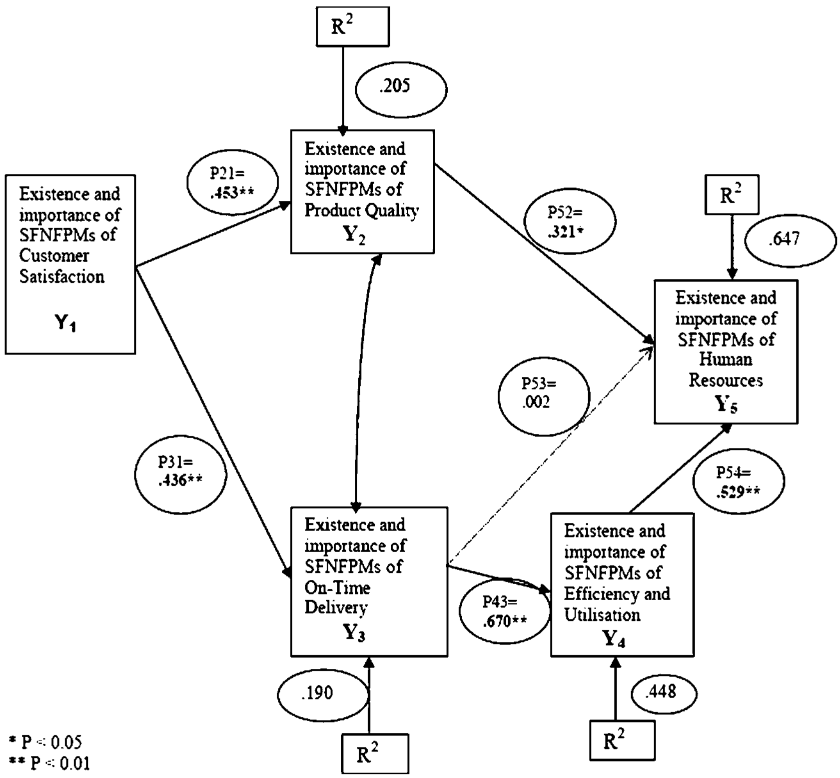

Fig. 5. Proposed Path Diagram for the SFNFPMs 'Scorecard' in Canadian Manufacturing Firms.

The SFNFPMs Scorecard in Canadian Manufacturing Firms

The mathematical path diagram for the proposed SFNFPMs 'scorecard' in Canadian manufacturing firms is shown in Fig. 5.

Table 7. Calculations of Total Effects of Y_1–Y_4 on Y_5.

Preceding Variables	Total Direct Effect (1)	Total Indirect Effect (2)	Total Effect (1+2)
Effect of Y_1 on Y_5	–	(P21*P52) = .453*.321 = .145	
		+ (P31*P53^{INS}) = –	
		+ (P31*P43*P54) = .436*.670*.529 = .155	.300
Effect of Y_2 on Y_5	P52 = .321	= –	.321
Effect of Y_3 on Y_5	P53 = .002^{INS}	(P43*P54^{INS}) = .670*.529 = .354	.354
Effect of Y_4 on Y_5	P54 = .529	= –	.529

Note: INS, insignificant.

Table 8. Recapitulation of Total Effects of Y_1–Y_4 on Y_5.

Independent Variables (Y_1–Y_4)	Total Effect on Y_5
Existence and importance of SFNFPMs of customer satisfaction (Y_1)	.300
Existence and importance of SFNFPMs of product quality (Y_2)	.321
Existence and importance of SFNFPMs of on-time delivery (Y_3)	.354
Existence and importance of SFNFPMs of efficiency and utilisation (Y_4)	.529

Model Explanation

Again, the correlation coefficient between Y_3 and Y_5 (i.e. P53) seems to be insignificant. It, thus, was excluded from the calculations in next tables. Tables 7 and 8 show the total effect incorporating both direct and indirect effects of variables (Y_1–Y_4) on Y_5.

An interpretation of the results in Tables 7 and 8 could be as follows: one unit change in Y_1 leads to 0.300 unit change in Y_5.

Summary

The above subsections present path diagrams for the proposed SFNFPMs scorecards in surveyed manufacturing firms in the four countries under study. Table 9 recapitulates the total effects Y_1–Y_4 have on Y_5 in SFNFPMs scorecards in UK, Italy, Japan, and Canada.

One can conclude, from Table 9, that the preceding variables in the scorecards, in virtually all four countries, do have some effect on the existence and importance of SFNFPMs of employee morale.

Table 9. Recapitulation of Total Effects of Y_1–Y_4 on Y_5.

Independent Variables (Y_1–Y_4): Existence and Importance of	Total Effect on Y_5			
	UK	Italy	Japan	Canada
SFNFPMs of customer satisfaction (Y_1)	.237	.211	.160	.300
SFNFPMs of product quality (Y_2)	.165	_INS	_INS	.321
SFNFPMs of on-time delivery (Y_3)	.411	.875	.201	.354
SFNFPMs of efficiency and utilisation (Y_4)	.272	.243	.293	.529

Note: INS, insignificant.

The proposed scorecards provide some explanations of variation in the existence and level of importance of SFNFPMs of 'employee morale' in association to variations in SFNFPMs of the use and importance of 'product quality', 'on-time delivery', and 'efficiency and utilisation' in the surveyed firms in the four countries (i.e. R^2). The percentage of variation in Y_5 that is explained by variations in preceding variables in the scorecards (i.e. Y_2–Y_4) seems reasonable, except in Japan, bearing in mind the possible effect of other factors that are not incorporated in the scorecard, e.g. other internal or external variables. In Japan, the focus seems to be more on an efficient use of firms' resources, thus we can notice higher R^2 for Y_4 than that for Y_5. This is consistent with the data analysis of Japanese results reported earlier in Chapter 7.

At this stage, concerns about the possibility of spuriousness in correlations among the variables incorporated are raised, i.e. one might argue that the significant relationship between Y_2 and Y_5, for instance, could be due to the effect Y_1 might have on Y_2. Explanations and analyses of the possible spurious relationships in the scorecards are presented in the chapter Appendix A.

SUMMARY AND CONCLUSIONS

In this chapter, a mathematical SFNFPMs 'scorecard' in use, in manufacturing firms, was developed. This model depicts the cause-and-effect relationships among the existence and importance of SFNFPMs of the five evaluation categories specified in this research. The existence and importance of measures of 'customer satisfaction', 'product quality', 'on-time delivery', and 'efficiency and utilisation', are shown to precede the existence and importance of measures of 'employee morale'.

This explanatory model provides a framework for understanding the use of SFNFPMs in the five evaluation categories. Previous research studies (see for instance, CIMA, 1993) show that manufacturers are keen to gain exposure to novel ideas about performance measures. CIMA's report (1993) suggests that the issue of appropriate performance measures has a highly significant effect on firms' commercial success.

It is argued that empirical studies of the interrelationships among different performance perspectives and their measures are in their infancy (Brignall, 2002). De Haas and Kleingeld (1999) and Norreklit (2003) argue that the assumption that there is a cause-and-effect relationship between areas of measurement is crucial because measurement of non-financial areas make the performance measurement system a forward facing control system which mitigates the problem of the historical nature of accounting data (Kaplan & Norton, 1996).

The 'scorecard' developed in this chapter could be used to help achieve internal harmony/integrity of the shop-floor measures applied. Furthermore, the model would, in many instances, make apparent any lack of coordination or completeness (e.g. firms might be measuring customer satisfaction to a disproportionate extent and omitting delivery timeliness). Finally, the 'scorecard' has potential usefulness as a schema for communicating strategy (and the reason for performance measurement) to employees.

The proposed SFNFPMs 'scorecard', though, has its limitations. First, it is argued that there is no single, unique sequence of events (Brignall, 2002; Norreklit, 2003), and the proposed SFNFPMs 'scorecard' can be criticised in that it does not propose more than one path. Scrutinising the theoretical logic behind the model, one could argue that the causal relationship between the SFNFPMs of efficiency and utilisation (Y_4) and of employee morale (Y_5) can be dropped. One might argue that organisation's interest in an efficient use of resources (thus monitoring efficiency and utilisation) does not necessarily imply that measures of efficiency and utilisation precede, causally, employee morale measures. An organisation could be applying 'theory X' management, consequently they would not be using measures of human resources to ensure co-operative workforce. Following this theoretical logic, the 'scorecard' path would differ from the one presented in this chapter in that no arrow will be connecting Y_4 to Y_5.

However, the author dismisses such an argument in that companies applying 'theory X' management will neither be interested in encouraging the involvement of shop-floor nor in receiving shop-floor suggestions on improving quality and reducing costs (upward communication). The analysis of responses, in Part II, shows that most of respondents in the four countries, except in Japan, were keen to have measures of 'employee morale'. Also, the explained variance (R^2), in the current scorecards and when dropping the proposed causal relationship between Y_4 and Y_5, See Table 10, shows that R^2 values for Y_5 are higher when the causal relationship exists. Accordingly, the original scorecard is supported and preferred.

Table 10. Comparison of the Value of R^2 for Y_5 in Current Model and When to Drop Y_4–Y_5 Relationship.

Country	R^2 for Y_5	
	Current Scorecard (1)	Dropping Relationship between Y_4 and Y_5 (2)
UK	.350	.290
Italy	.325	.283
Japan	.246	.195
Canada	.647	.555

Note: The R^2 value for Y_4 remains unchanged when the proposed relationship between Y_4 and Y_5 is dropped.

Second, the SFNFPMs 'scorecard' path is limited to the shop-floor organisational level. It is argued that as one moves upward towards the business unit and firm level, the problems of the aggregation of multiple initiatives make it more difficult to trace chains of cause-and-effect (Brignall, 2002). In other words, the causal order may alter at different organisational levels. For instance, financial aspects (e.g. ROE, ROCE) will dominate in evaluating the top management performance. Accordingly, the proposed cause-and-effect relationships in the 'scorecard' will need to be revised at other organisational levels. This limitation is accepted; with the rejoinder that the scope of these studies is restricted to the shop floor.

Finally, the causal path in this 'scorecard' is built upon the assumption of a corporate objective of maximising the wealth of shareholders. The application of a broader stakeholders' perspective, or an alternative view based on, for instance, labour-process theory might generate different patterns of logic.

NOTES

1. A curved double-headed arrow between two variables in a path diagram represents a relationship that is not considered causal (Johnson, 1977).
2. See Goldberger (1970), Nie et al. (1975), Johnson (1977), March (1982), Davis (1985), De Vaus (1996), and Bryman and Cramer (2001).

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APPENDIX A. EXAMINING FOR SPURIOUS RELATIONSHIPS

A spurious relationship that might exist and affect a relationship between two variables (e.g. Y_2 and Y_5) could be ascribed to the effect that an antecedent variable (e.g. Y_1) has on (Y_2). Certain tests were carried out in order to examine whether the SFNFPMs scorecard relationships were real and not spurious. The following relationships, hence, were examined:

1. Possible effect Y_1 might have on the existing relationship between Y_2/Y_3 and Y_5
   - The relationship between the existence and importance of SFNFPMs of 'product quality' (Y_2) and the existence and importance of SFNFPMs of 'employee morale' (Y_5) when the existence and importance of SFNFPMs of 'customer satisfaction' (Y_1) is controlled for.
   - The relationship between the existence and importance of SFNFPMs of 'on-time delivery' (Y_3) and the existence and importance of SFNFPMs of 'employee morale' (Y_5) when the existence and importance of SFNFPMs of 'customer satisfaction' (Y_1) is controlled for.
2. Possible effect Y_3 might have on the existing relationship between Y_4 and Y_5
   - The relationship between the existence and importance of SFNFPMs of 'efficiency and utilisation' (Y_4) and the existence and importance of SFNFPMs of 'employee morale' (Y_5) when the existence and importance of SFNFPMs of 'on-time delivery' (Y_3) is controlled for.

The above can be summarised as follows:

Relationships between the Following Variables	When Controlling for the Following Variables (Separately)
Y_2 and Y_5	Y_1
Y_3 and Y_5	Y_1
Y_4 and Y_5	Y_3

A partial correlation statistical test (see, De Vaus, 1996; Bryman & Cramer, 2001) was applied to test for spurious relationships among the variables incorporated (see above). Results are shown in Tables A1, A2, and A3.

Table A1. Partial Correlations between Y_2 and Y_5 Controlling for Y_1.

Control Variable (Y_1)	Correlations with SFNFPMs of 'Employee morale' (Composite) (Y_5)
UK	.342**
Italy	.271**
Japan	.188*
Canada	.679**

*Significant at 95% level of significance ($\alpha = .05$, 2-tailed).
**Significant at 99% level of significance ($\alpha = .01$, 2-tailed).

Table A2. Partial Correlations between Y_3 and Y_5 Controlling for Y_1.

Control Variable (Y_1)	Correlations with SFNFPMs of 'Employee Morale' (Composite) (Y_5)
UK	.418**
Italy	.414**
Japan	.312**
Canada	.416**

**Significant at 99% level of significance ($\alpha = .01$, 2-tailed).

Table A3. Partial Correlations between Y_4 and Y_5 Controlling for Y_3.

Control Variable (Y_3)	Correlations with SFNFPMs of 'Employee Morale' (Composite) (Y_5)
UK	.318**
Italy	.265**
Japan	.267**
Canada	.666**

**Significant at 99% level of significance ($\alpha = .01$, 2-tailed).

The results above are confirmatory and provide unequivocal evidence of the trueness of the significant correlations between the antecedent variables in the SFNFPMs scorecards (i.e. Y_1, Y_2, Y_3, and Y_4) and the use of SFNFPMs of 'employee morale' (Y_5).

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PART IV: FURTHER DEVELOPMENTS AND CONCLUSIONS

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CHAPTER 11

ADVANCED MANAGEMENT ACCOUNTING PRACTICES AND COMPETITION IN MANUFACTURING FIRMS

SivaKumar Velayutham and Ahmed Abdel-Maksoud

INTRODUCTION

Structural shifts in the business environment have induced major alterations in the management of enterprises, ranging from manufacturing practices to capital investment policies. To be successful in today's worldwide competitive environment, companies must be capable of manufacturing products of high quality at low cost and providing a first-class customer service (Kaplan, 1983; Drury, 1990). In particular, organizations and their management accountants have been and continue to be, exhorted to develop new accounting approaches that provide more timely and relevant information support (Cooper, 1988; Drucker, 1990; Bromwich, 1990; Drury & Tayless, 1998).

In partial answer to these calls to action, a number of contemporary management accounting practices (CMAPs) have been promoted (e.g. activity-based techniques (ABT), balanced scorecard (BSC), strategic management

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accounting (SMA)). Commentators advocate that the combined deployment of such techniques may offer a potential for unlocking important synergies (Alder, 1999).

This chapter is based on the data collected from the surveyed manufacturing firms (see results reported in Part III). The analysis of data collected provided some interesting findings, from a comparative perspective, which triggered attention and raised challenges to provide some explanations.

The chapter purports to provide, drawing extensively on Porter's (1998) and others' work an inductive framework which attempts to interpret, within the context of the caveats 'national competitive advantage' and 'culture', possible influence that managers' perception of the importance of aspects of competition could exert on their decisions to deploy CMAPs in British, Italian, and Japanese manufacturing firms. The case of Canada was excluded from the analysis for two reasons. First, unlike the three countries identified earlier it was felt that Canada being a migrant society was influenced by different national cultures. Second, Canada was not included in Porter's (1998) analysis and therefore the national competitive advantage was not very clear.

Management accounting literature on possible effects of the perception of competition on the deployment of CMAPs is considered to be rare. This chapter, thus, adopts an inductive approach that is concerned with the detection and explanation of social phenomena (Haig, 1995), where theories are generated from robust data patterns, elaborated through the construction of plausible models, and justified in terms of their explanatory coherence (Haig, 1995). For explanatory coherence, this chapter draws heavily on the work of Michael Porter (1998).

The remainder of this chapter is organized into four sections. The next section highlights the levels of application of CMAPs and the extent of managers' perception of the importance of aspects of competition in UK, Italy, and Japan. Testing for significant differences, among the three countries, in the level of deployment of CMAPs and managers' perception of the extent of importance of aspects of competition is, also, dealt with in the next section. The significance of different perceptions of the importance of different aspects of competition in the three countries within the context of 'national competitive advantage' and 'culture' and the influence such difference exerts on the level of adoption of specific management accounting practices in manufacturing firms in the countries incorporated are discussed in the third and fourth sections, respectively. Concluding remarks are presented in the final section.

SURVEY RESULTS

This section reports results of the survey of the deployment of contemporary management accounting techniques and managers' perception of the importance of different aspects of competition in three countries: United Kingdom, Japan, and Italy. The survey of contemporary management accounting techniques consisted of seven techniques namely: benchmarking of performance, ABT (activity-based costing (ABC), management (ABM), and budgeting (ABB)), BSC, economic value added (EVA®), throughput accounting, SMA, and customer profitability analysis (CPA).

The different aspects of competition surveyed included: quality, innovation, customer service, price, delivery, and flexibility. The three countries surveyed have received considerable attention for their international competitive advantage in different products and services (Porter, 1998). The survey highlights significant differences in deployment of contemporary management accounting techniques and managers' perception of the importance of competition in the three different countries.

Deployment of Contemporary Management Accounting Techniques

The extent of deployment of CMAPs was, recalling from Part II, measured by asking respondents to indicate whether seven CMAPs were (1) not applied, (2) partially applied, or (3) systematically applied in their organizations. These practices were benchmarking of performance, ABT (ABC, ABM, and ABB), BSC, EVA®, throughput accounting, SMA, and CPA.

Differences between the extent of deployment of the CMAPs in manufacturing firms in Italy, Japan, and UK are depicted in Table 1.

The above reported findings were surprising in two major areas. First was the contrasting adoption of different management accounting techniques in the different countries, e.g., the 82.9% of CPA in Italy compared to a 48% in Japan and 58.1% adoption of throughput accounting in Japan compared to 24% in Italy.

The above results raise concerns whether there are significant statistical differences in the levels of deployment of advanced management accounting practices among the three countries. To examine for such difference, The one-way analysis of variance for three unrelated variables (One-Way ANOVA) Post Hoc multiple comparison was applied (Bryman & Cramer, 1990, 2001; Coakes & Steed, 1999). The application of One-Way ANOVA

Table 1. Different Deployment Rates of Contemporary Management Accounting Techniques in Italy, Japan, and UK.

Management Accounting Practice (Ranked in Order of Application in Italian Firms)	Percentage of Respondents[a]		
	Italian Firms (%)	Japanese Firms (%)	UK Firms (%)
CPA	82.9	48.2	63.6
Benchmarking of performance	58.9	78.2	71.9
ABT	55.9	44.4	49.8
EVA®	53.1	54.9	38.1
SMA	42.4	61.9	61.1
BSC	40.5	40.3	41.2
Throughput accounting	23.8	58.1	43.5

[a]Cumulative percentage of firms applying the practice partially/systematically.

Post Hoc multiple comparison test aims at answering the question: Is there a significant difference in the level of deployment of CMAPs between each pair of countries?

The Scheffè test was chosen as it is argued that it is the most conservative, i.e., it is least likely that significant differences between groups are to be found (i.e. it is least likely to make a Type I error). It is also exact for unequal numbers of participants (Bryman & Cramer, 2001). Scheffè test was conducted to compare mean levels of deployment of advanced management accounting practices between every possible pairs of countries. Table 2 shows salient results of applying Scheffè test where only significant mean differences in level of deployment of advanced management accounting practices between pairs of countries are reported.

Table 2 shows that there are significant differences between pairs of the three countries in the level of deployment of five CMAPs: benchmarking of performance, EVA, throughput accounting, SMA, and CPA. Results show no significant differences among the three countries in the level of application of ABT and BSC.

Competition

Respondents were asked to, recalling from Part II, indicate on a seven-point Likert scale, from 1 (no importance), 4 (moderate importance), up to 7

Table 2. Results of One-way ANOVA Post Hoc Scheffè Test for CMAPs[a].

Advanced Management Accounting Practice	Country (I)	Country (J)	Mean Difference (I–J)	Significance
Benchmarking	Japan ($N=101$)	UK ($N=313$)	.2754	.003
	Japan ($N=101$)	Italy ($N=129$)	.3514	.001
EVA	Japan ($N=111$)	UK ($N=313$)	.2450	.012
Throughput accounting	Italy ($N=122$)	UK ($N=313$)	−.3074	.000
	Italy ($N=122$)	Japan ($N=110$)	−.4404	.000
SMA	Italy ($N=125$)	UK ($N=313$)	−.2307	.010
CPA	Italy ($N=129$)	UK ($N=313$)	.4338	.000
	Italy ($N=129$)	Japan ($N=110$)	.7323	.000
	UK	Japan ($N=110$)	.2985	.001

[a]Only significant differences reported in the table.

(critical importance) – the importance of six aspects of competition:[1] quality, innovation, customer service, price, delivery, and flexibility.

Table 3 shows a comparison between managers' evaluation of the importance of the seven aspects of competition in manufacturing firms in Italy, Japan, and UK.

Table 3 shows that Italian manufacturers take quality and price *very* seriously. Virtually, all Italian respondents regard all the competitive dimensions as very important. This is consistent with Arena, Azione, and Caimi's (2004) Italian survey results where quality and price were revealed to be very important aspects of competition. Japanese managers, though being quite keen on all aspects of competition, take price and quality very seriously. Customer service seems to be perceived as the most important aspect of competition followed by quality by UK managers.

It can be concluded, from Table 3, that the most important aspects of competition found in the three countries were quality, price, and customer service. Concerns, again, were raised whether there are significant statistical differences in managers' perceptions of the extent of importance of these six aspects of competition in the three countries. Again, Scheffè test was conducted to compare means of the extent of importance of the six aspects of competition between every possible pairs of countries.

Table 3. Managers Evaluation of the Importance of Aspect of Competition.

Dimensions of Competition	Percentage of Respondents Who Gave Some Degree of Importance (4–7 on the Scale)					
	Italian Firms		Japanese Firms		UK Firms	
	%	Mean	%	Mean	%	Mean
Quality	94.3	*6.11*	100	*6.5*	96.5	*6.12*
Price	95.1	*6.05*	99.2	*6.6*	95.5	6.10
Customer service	92.1	5.81	100	6.0	95.9	*6.16*
Delivery	92.2	5.74	100	5.47	95.3	5.97
Flexibility	90.8	5.67	100	5.44	88.5	5.27
Innovation	89.4	5.47	99.2	5.7	81.8	4.87

Note: $N = 141$ in Italy and 313 in UK; N in Japan was 120 for quality and customer service, 119 for price and delivery, and 118 for innovation and flexibility.

Table 4. Results of One-way ANOVA Post Hoc Scheffè Test for Competition[a].

Importance of the Following Aspects in Competition	Country (I)	Country (J)	Mean Difference (I–J)	Significance
Quality	Japan ($N = 120$)	UK ($N = 312$)	.45321	.005
	Japan ($N = 120$)	Italy ($N = 141$)	.46862	.013
Innovation	UK ($N = 313$)	Italy ($N = 141$)	−.60227	.001
	UK ($N = 313$)	Japan ($N = 118$)	−.86300	.000
Customer service	UK ($N = 313$)	Italy ($N = 140$)	.34865	.046
Price	Japan ($N = 119$)	UK ($N = 313$)	.50600	.002
	Japan ($N = 119$)	Italy ($N = 142$)	.55575	.004
Delivery	UK ($N = 313$)	Japan ($N = 119$)	.50066	.005
Flexibility	UK ($N = 313$)	Italy ($N = 141$)	−.40149	.034

[a]Only significant differences reported in the table.

Table 4 shows salient results of applying Scheffè test on managers' perceptions of the extent of importance of the six aspects of competition. Only significant mean differences between pairs of countries are reported.

Table 4 shows significant differences between pairs of the three countries in managers' perceptions of all aspects of competition.

Our objective is to identify whether diverse managers' perceptions of the importance of aspects of competition reported in the study could influence the level of deployment of CMAPs in the three countries surveyed (i.e. UK, Italy, and Japan). In other words, the aim was to highlight common competitive factors that could, consistently, influence the deployment of CMAPs in manufacturing firms in the three countries. In achieving this pursuit, two other factors were considered: industry type[2] and size of workforce[3] in the surveyed firms.

One might be inclined to expect that different management accounting practices could be dominant in different industries, e.g., Fiat in Italy could adopt the particular management accounting technique used by Toyota in Japan since the particular technique could be considered one of the critical factors in Toyota's success. It could be expected that companies in the same industry probably face similar competitive conditions, i.e., Toyota and Fiat managers would perceive competition in a similar fashion and therefore adopt similar management accounting practices. Moreover, one would expect that the deployment of management accounting techniques could be related to firm size in employee numbers, i.e., contemporary management accounting techniques would be more critical to bigger firm, which probably also have the resources to design and implement them.

Testing for the above, multiple regression statistical technique was applied (Bryman & Cramer, 1990, 2001; Coakes & Steed, 1999), where the three factors referred to above (managers' perceptions of the extent of importance of the six aspects of competition, industry codes, and number of employees) were regressed (as independent variables) on the level of deployment of each of the seven contemporary management accounting techniques incorporated in the study (as dependent variables). Results,[4] whilst indicating many significant correlations between diverse industry types and particular management accounting techniques in individual countries, show no consistent/systematic patterns of correlations between the adoption of CMAPs and industry types, the perception of the importance of aspects of competition, and firm size in number of employees in all the three countries.

Summary

The above results highlight a number of factors concerning the level of adoption of management accounting practices in manufacturing firms and managers' perceptions of competition in the surveyed countries:

1. There are significant differences in the level of deployment of particular advanced management accounting techniques in different countries, i.e.,

different management accounting techniques are more popular in different countries.
2. The adoption of particular advanced management accounting techniques does not appear to be influenced by the industry type to which a company belongs across the three countries although statistical analysis results highlight significant correlations between the adoption of management accounting techniques and various industry types in specific countries.
3. As (2) above there are no consistent/systematic significant correlations between the perception of competition and the adoption of specific CMAPs in the three countries surveyed, but there are significant differences in the perception of competition between the three countries.

In an attempt to interpret the above results, one might draw a conclusion that the adoption of advanced management accounting techniques might be influenced by country-specific factors, i.e., manufactures in the same industry in different countries seem to perceive competition differently.

Such findings are interesting and merit some analysis and interpretation. The next section provides some analytical discussion that is pivotal in reading the above results.

THE PERCEPTION OF COMPETITION IN THE THREE COUNTRIES WITHIN THE CONTEXT OF NATIONAL COMPETITIVE ADVANTAGE AND CULTURE

The findings in the previous section raise a number of questions concerning conventional ideas on competition:

First, the literature highlights that the nature of competition should be more closely related to industry type rather than to specific nations: "Firms, not nations, compete in international markets… . The basic unit of analysis for understanding competition is the industry" (Porter, 1998, p. 33).

Second, the quality movement literature is replete with examples of the Japanese emphasis on quality and their contribution to the emergence of quality as a critical factor in manufacturing success (Evans & Lindsay, 1999), whilst our findings indicate Japanese perceive competition in quality and price to be equally important if not less.

Third, the perception of managers in UK that customer satisfaction is a critical feature of competition.

This section attempts to provide a plausible explanation for the above ideas that challenge conventional ideas of competition.

Michael Porter's (1998) classic *The Competitive Advantage of Nations* provides us with considerable insights into the success and failure of nations in different product and service areas. Porter (1998) identifies particular industries and services that different countries have a competitive advantage, e.g., Germany's high-performance autos and chemical industry, Japan's consumer electronics producers, and Italian footwear and textiles; and relates them to four determinants of national advantage – factor conditions; firm strategy, structure and rivalry; demand conditions; and related supporting industries. Whilst providing a good explanation of the influence of the four determinants on the competitive advantage of specific industries in each country, he does not explain why the particular set of industries thrive in a particular country (what commonality characterizes these industries), e.g., furniture, footwear, and clothing. Yamashita (1998) highlights the influence of national culture on corporate culture and therefore on its competitiveness.

The results of this study indicate that the way managers perceive 'competition', itself, could be, to a great extent, culturally influenced. The core issue, thus, is to understand the focus of each country on different aspects of competition.

Italy and Quality

A review of the quality literature does not rank Italy high on quality or its contribution to the recent emergence of quality as a critical feature of manufacturing. A review of Italian manufacturing however shows Italian consumer goods (including footwear, clothes, and furniture) to be leaders in the fashion world. The above highlights a concern with excellence within Italian industry.

First, Porter (1998) points out that in virtually every consumer goods industry in which Italy has national competitive advantage, Italian buyers are among the, if not the, world's most sophisticated, advanced buyers (this is true in apparel, shoes, jewelry, furniture, lighting, ceramic tiles, food products, wine, and many others):

> Italian consumers are on the cutting edge of taste and style. Some observers attribute this to an unusual interest in design and the arts, a function perhaps of living among masterpieces. (Porter, 1998, p. 440)

Second, Porter (1998) points out that internationally successful industries tend to be characterized by medium- and small-sized firms that compete primarily through export, with only limited foreign direct investment. Moreover, small and medium enterprises operating in Italy in the second-half of last century, have predominantly operated in mature sectors (e.g. textile, clothes, shoes, mechanics, furniture) by means of incremental innovations and flexible organizational structures (Lorenzoni, 1987) especially via networks. Individual firms also tend to specialize in relatively narrow product areas, called districts. Sparke (2001) argues that in Italy the unified craft process still dominates and there is no separation between 'conceiving' and 'making goods' in the production process.

Third, the transmission of industry know-how appears to be transmitted through informal personalized means rather than formal institutionalized ways:

> Highly specialized knowledge and skills are passed within families and from generation to generation … Italian companies provide little formal training, nor do they actively support the universities. … Italy, is also relatively weak in formal research, either in universities, government laboratories, or firms. (Porter, 1998, pp. 437–438)

Furthermore, cognizance of the ownership and governance systems of Italian firms (i.e. family-owned businesses) and, more importantly, the persistent turbulences in the Italian economy in the last decades is vital in any attempts to interpret the research findings on Italian firms. This is evidential by recent research findings in Italy (see, Bergamin Barbato, Collini, & Quagli, 1996) that show:

- An increasing awareness among Italian managers of the important role of efficiency in facing international competition.
- The increasing number of university educated managers in Italian firms who understand the usefulness of the new management tools.

It can be concluded that Italian firms in successful industries, with few exceptions, are focused on niche markets adopting a batch production method rather than mass production. The strength of Italian firms appears to be the aesthetic value of their products rather than individual production synergies and they therefore do not compete on price.

Japan and Price

Whilst Japan manufacturing firms are acknowledged for their contribution to the quality revolution, their principal strength lies in standardization and the mass production process. Their contribution to the quality movement is principally in the view of quality as a precise and measurable variable combining economics with manufacturing and user-based approaches. Garvin (1984) refers to this as "affordable excellence". Porter observes that in many industries Japanese firms gained competitive advantage initially by producing relatively standard models in large volumes. The focus of Japanese manufacturers has been on higher and higher levels of automation.

The above strategy is also reflected in Japanese firms tendency to define their goals in terms of volume and market share. The above strength encapsulates for example Makita's emergence as a leading competitor in power tools. It was the first to employ new, less expensive materials for making tool parts and to produce standardized models in a single plant (Porter, 1998). This is consistent with Hiromoto (1988), Sakurai (1989), and Monden and Sakurai (1990) who maintain that Japanese firms do tie more of their accounting systems to corporate strategy much more than their US peers. Hiromoto and Sakurai, both, give an example that costs of Japanese products are much more market driven than in the West. They explain that further by indicating that rather than relying on engineering standards in the development of costs, Japanese consider the market price vital in determining the so-called 'target cost'.

Porter (1998) observes that Japanese firms have been particularly adept at managing linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. Linkages require activities to be coordinated and the Japanese popularized such practices as overlapping the steps in the new product development process and the just-in-time (JIT) system. The above has been facilitated by the reputation of Japanese workers for discipline, hard work, and willingness to cooperate with the group.

United Kingdom and Customer Service

It is not surprising that managers of UK manufacturing firms perceive customer service to be a more important aspect of competition than quality or price. UK today is more of a service economy than a manufacturing economy. Porter (1998, p. 255) in his analysis of nations with the greatest number of international positions in service industries, found the United Kingdom to be second only to the United States. In contrast to its leading position in the service industry, the United Kingdom has been loosing competitive advantage in manufacturing since well before the Second World War.

Furthermore, there is a general recognition that since the Conservative government elected in 1979 Britain has been experiencing a profound social (McDowell, Sarre, & Hamnett, 1989), economic (Allen & Massey, 1988), and political (Anderson & Cochrane, 1989) restructuring. The above restructuring has frequently been summarized as the emergence of an enterprise culture (Burrows, 1991). The crux of the enterprise culture has been the promotion of entrepreneurs and small businesses not only in manufacturing but in the service domain that includes universities and hospitals competing on service.

Following from the above situation, successful manufacturing firms seem to be those that are close to the service industry such as consumer goods. Porter points out that the largest concentration of British competitive advantage to be in consumer-packaged goods, including alcoholic beverages, food such as confectionary products and biscuits, and personal products. Following from the UK leadership in the service industry it appears that customer service has become a major focus of competition in UK.

Summary

The above discussion highlights how mangers perceive competition to be partly cultural. Italian managers appear to pride themselves on taste and style of their products but not the price or customer service. This is reflected in Italy's high reputation for differentiated products like clothes, shoes, and furniture which customers place a high emphasis on, but poor competitiveness in terms of price and a reputation for poor telephone and other public services. In contrast to Italian managers, Japanese managers seem to pride themselves on organization and efficiency particularly with respect to manufacturing. This is further reflected in Japanese workers reputation for disciplined teamwork. In the UK, the ethos of the "nation of shopkeepers" has transformed it into a major service economy with an emphasis on customer service.

COMPETITION AND THE ADOPTION OF ADVANCE MANAGEMENT ACCOUNTING TECHNIQUES

The previous section highlighted the emergence of different conceptions of competition in different countries. Different perceptions of competition generally lead to the adoption of different strategies by companies. Frequently, companies within a country that attempt to compete based on a different conception of competition than that dominant in the culture are not very successful, e.g., while the Italian car company Ferari which competes on style and excellence has continued to be successful, Fiat's attempt to compete with mass production marketers like Toyota has proven to be unsuccessful.

In this section it is argued that national champions (companies) with a competitive advantage in the global market do develop management accounting techniques to complement their strategy (e.g. the Kanban (JIT) system developed by Toyota) becomes the norm in the country.

Customer Profitability Analysis

Fig. 1 highlights that CPA has the highest adoption rate in Italy (83%) followed by 64% in UK, and a poor 48% adoption rate in Japan.

CPA involves the reporting and analysis of revenues earned from customers, together with the costs required to earn these revenues. CPA has the potential to allow managers a number of alternatives:

- Protecting and expanding business with highly profitable customers.
- Re-pricing expensive services, based on cost to serve.

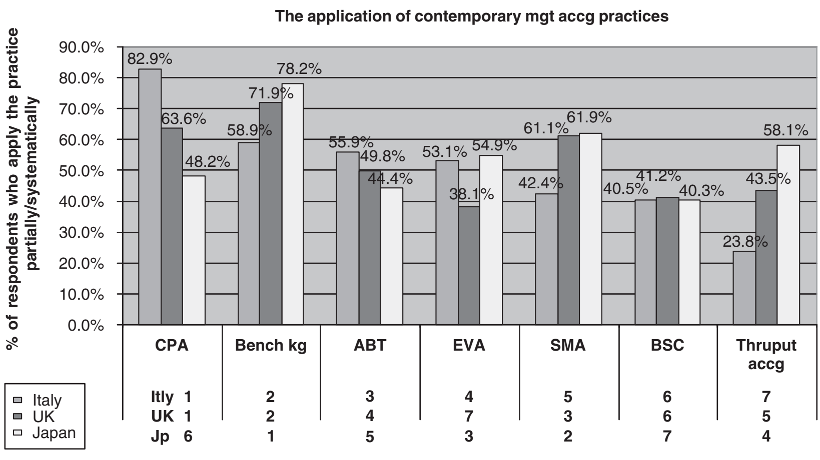

Fig. 1. Levels of Application of Contemporary Management Accounting Practices across the Three Countries Surveyed (Italy, UK, Japan).

- Discounting, if necessary, to gain business with lower cost-to-serve customers.
- Conceding permanent loss customers to competitors.

From the above, CPA appears to be of particular use to medium and small manufacturers of differentiated products focusing on niche products. Manufacturers are generally reliant on a small number of customers and have to closely monitor the profitability of each customer so that they can closely tailor the product or service to the customers ability to pay for it. Manufacturers focusing on volume and market share, however, would not be so focused on CPA because they might not mind cross-subsidizing customers to gain volume and market share.

Benchmarking of Performance

Benchmarking of performance has the highest average adoption rate among the seven advanced management accounting techniques surveyed. The level of adoption is highest in Japan (78%) followed by UK (72%), and Italy (59%).

The objective of benchmarking is to identify best practices in the industry and implement them. The main focus of benchmarking is on improving the efficiency of operations. Benchmarking is therefore critical to all manufacturing companies and is reflected in its high adoption rate in all three countries. It is however a more important tool for product-focused manufacturers rather than a product-differentiation focused ones.

Activity-Based Techniques

Activity-based techniques includes activity-based costing (ABC), activity-based management (ABM), and activity-based budgeting (ABB). ABT, similar to CPA, has the highest adoption rate in Italy (56%) followed by UK (50%), and Japan (44%).

The major purpose of ABC is to assign indirect cost to such cost objects as products, services, and customers. The major benefit is more accurate costing of cost objects compared to prior costing methods. ABM and ABB focus on the use of such information in pricing and product decisions as well as budgeting indirect costs. Theory suggests that the sophistication of the design of product costing systems should be influenced by: (1) the degree of competition faced, (2) diversity of products manufactured, (3) the number of products produced, and (4) the proportion of overheard costs that cannot be directly assigned to costs (Drury & Tayless, 1995).

It can be, therefore, concluded that ABT has a much higher adoption rate in Italy because of the number and diversity of products manufactured and information, hence, is particularly relevant for CPA. The poor rate of ABT adoption in Japan, could be due to the use of other preferred locally developed target costing techniques in Japanese firms.

Economic Value Added

The rate of adoption of 'EVA® is roughly the same in Italy (53%) and Japan (55%) but considerably lower in UK (38%). EVA® is a financial performance method to calculate the true economic profit of a corporation. This method is also known as residual income (RI) and indicates the contribution that an operation makes to overall profitability after allowing for a required return on investment. Since this technique is more concerned with divisional performance it is, probably, not so influenced by managers perception of competition. The low rate of adoption of EVA® in UK could probably be attributed to tendency amongst UK firms to adopt the alternative measure of return on capital employed (ROCE) (see, Drury, Braund, Obsorne, & Tayles, 1993).

Strategic Management Accounting

Strategic management accounting (SMA) has roughly the same rate of adoption in UK (61%) and Japan (62%) but a much lower rate in Italy (42%). Bromwich and Bhimani (1994, p. 127) define SMA as "the provision and analysis of financial information on the firm's product markets and competitors' costs and costs structures and the monitoring of the enterprise's strategies and those of its competitors in these markets over a number of time periods". The defining characteristic of SMA is its external emphasis with a focus on competitors, customers, and its link to the firm's products (Roslender, Hart, & Ghosh, 1998).

The low rate of adoption of SMA in Italy could be attributed to Italy's family-owned companies which probably do not have a formal strategic planning system as opposed to professionally managed companies in Japan and UK with more formal planning systems.

The Balanced Scorecard

The adoption rate of BSC is roughly the same in all three countries, Italy (40.5%), UK (41.2%), and Japan (40.3%). However, although responses show that around 40% of respondents do apply BSC in their firms, a scrutiny of results shows that the majority of firms applying BSC do apply it at a partial rather than systematic level.

One way to interpret such systematic deployment rate, among the three countries surveyed, could be in the BSC's attempt to meet performance measurement needs of any strategy focus a company pursues. On the other hand, the low average adoption rate reported in the three countries (i.e. 40%) could be attributed to companies' cognizance that the BSC does not emphasize measurement of success of their specific strategy.

Throughput Accounting

Throughput accounting has a high level of adoption rate (58%) in Japan followed by the UK (43%), but Italian managers seem to have little interest in it (24%). Throughput accounting is based on Goldratt and Cox (1993) view that it is the rate at which the factory earns money that determines profitability, not the contribution of each product. The goal of a manufacturing firm is to increase plant's throughput which is limited by the plant's bottleneck facilities. Based on the above view net profit equals throughput-operating expenses, where throughput is the rate at which the system generates money through sales.

The above indicates that throughput accounting would have maximum benefits for highly automated plants used in mass production as in the case of Japan. It would probably have little use for medium and small manufacturing firms producing highly differentiated products in small batches as in the case of Italy.

CONCLUSION

A review of the management accounting literature highlights that findings on the adoption of advanced management accounting techniques have been a major source of puzzle for researchers. The surveys results show that there are significant differences in the adoption of different contemporary management accounting techniques in three countries: UK, Italy, and

Japan. The findings further show that whilst there are significant correlations among the use of specific CMAPs and industry type as well as perception of competition in the three countries, there are no consistent/systematic correlations across the three countries, i.e., the car manufacturers in Japan might adopt the same management accounting techniques but this does not extend to car manufacturers in UK and Italy. Results, however, point to significant differences in managers' perceptions of competition in the three countries.

In an attempt to understand the reported findings on managers' perceptions of competition in UK, Italy, and Japan, the cultural effect on managers' perceptions of competition seems to be viable. It is pointed out that consumers' characteristics as well as social values and economic structure do influence managers' perceptions of competition. This follows from the fact that domestic competitors tend to compete in the same segment of the market, i.e., Toyota and Nissan compete in the same segment of the market, and therefore competition between domestic competitors is much stronger than that with international competitors.

The study also shows that (recalling from the third and fourth sections) different management accounting practices would be more relevant to firms pursuing different strategies based on their perception of competition, e.g., benchmarking would be much more critical to a product-efficiency focused firm rather than a market-focused firm.

Finally, the analysis of findings reported in this chapter might draw to the conclusion that national boundaries have far more influence on firms' perception of competition and the diffusion of advanced management accounting techniques than usually expected in that, the adoption of management accounting techniques by an electronics company in Italy would be more strongly influenced by Ferrari than Toshiba of Japan.

NOTES

1. In the original research study, the effect of the competitive environment on the existence and importance of SFNFPMs was measured by asking respondents to indicate the importance of the six aspects of competition incorporated.
2. Information on industry types to which the surveyed firms belong was obtained from databases used in this study.
3. Information on size of workforce in UK and Italian surveyed firms was obtained from country-specific database. In case of Japanese firms, the questionnaire form incorporated a question asking respondents to indicate the size of workforce in their firms.
4. For brevity, results are not reported here.

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CHAPTER 12

PERFORMANCE MEASUREMENT AND ORGANISATIONAL CHANGE MANAGEMENT

Raili Pollanen and Bharat Maheshwari

INTRODUCTION

This chapter examines the nature of organisational change and the relationship between performance measurement and organisational change. It extends the performance measurement systems and models that were presented in Chapter 2 and builds an integrative model of performance measurement for managing organisational change.

Many business leaders would agree with a famous comment made by Michael Dell, Chief Executive Officer of Dell Computers, that, "The only constant [in today's competitive business environment] is change" (cited in Eisenhardt & Sull, 2001, p. 116). Having faced a considerable degree of change in their business environment over the last few years, they realise that their organisations must adapt to the changing environment in order to survive and prosper. However, significant difficulties and challenges commonly exist in managing change in such environments. First, there are different views on how change should be approached, for example, in small increments over a relatively long period of time, or in an accelerated manner during a relatively short period of time. The first approach has been called *incremental* or

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evolutionary change and the second approach *discontinuous* or revolutionary change (Tushman & O'Reilly, 1996). Secondly, implementing and managing change, particularly discontinuous change, can be difficult, because it can impose challenges for performance measurement systems. Managers dealing with change often find that the existing systems lose their effectiveness in the new environment. It can be argued that, if the performance measurement systems do not evolve with organisational change, they can no longer be fully relevant for assessing organisational efficiency and effectiveness and for managing change.

Although discontinuous and incremental change can be interrelated, the main focus of this chapter is on discontinuous change, as it can have major structural, systems, cultural and leadership implications for the organisations implementing it. Discontinuous change has often been influenced or driven by breakthrough technological innovations, although it could also have been triggered by pressures from competitive, economic, regulatory and political environments (Tushman & O'Reilly, 1996; Kotter, 1996). In particular, the role of performance measurement systems in organisations undergoing discontinuous change is examined, with emphasis on the ability of such systems to provide timely clues regarding how efficiently and effectively critical competitive resources are utilised. If an organisation undergoes discontinuous change and the performance measurement systems do not change accordingly, the latter will be at best ineffective or, more likely, counterproductive (Eccles, 1991; Meyer, 1994; Kaplan & Norton, 1996).

However, the interrelated nature of incremental change and discontinuous change requires an ability to effectively manage both types of processes simultaneously (Tushman & O'Reilly, 1996). Their effective management requires performance measurement systems capable of monitoring and evaluating both types of change patterns simultaneously, which, in turn, calls for an integrated approach to performance measurement. The main focus in the performance measurement literature has traditionally been on the measurement of short-term incremental change and related processes, with little attention paid to the measurement of long-term discontinuous change initiatives. In addition, no known efforts exit to integrate measurement approaches for incremental and discontinuous change. This chapter develops a model of performance measurement for discontinuous change that integrates some key principles commonly used to measure incremental change, thus narrowing the gap between the two approaches.

In the remainder of this chapter, change management and performance measurement literatures and tools are reviewed and a model for evaluating discontinuous change developed. The following section examines the relationship between performance measurement and organisational change. In particular, it deals with organisational change management; performance measurement principles and frameworks; implementing performance measures using enterprise resource planning (ERP) systems and implementation challenges. The third section develops a cyclical process model of discontinuous change, examples of performance measures and six propositions for measuring and managing discontinuous change. The final section provides a summary and conclusions. The terms discontinuous change, organisational change and change initiatives are used interchangeably throughout the chapter.

PERFORMANCE MEASUREMENT AND ORGANISATIONAL CHANGE

It has been argued that performance measurement and organisational change can have a bi-directional relationship. Change can influence performance measurement systems and practices, but performance measurement systems can also serve as change agents by providing technical tools and powerful behavioural motivation and incentives. For example, Tushman and O'Reilly (1996) provided examples of several businesses that have been successful in achieving change by implementing decentralised organisational structure, autonomous small responsibility units and vibrant organisational culture. A robust performance measurement system is especially important for organisations facing rapid environmental changes and increased competition, as they have to continuously adapt their strategies and processes to meet such forces. Eccles (1991) argued that improving competitiveness in changing environments depends on the ability to identify the most important strategic performance measures of long-term success and to link them to changing strategic objectives in such environments.

Organisational Change Management

Over the recent years, breakthrough technological innovations have been the main driving force for change. However, failed change initiatives have forced some previously successful companies, which could not adapt to the new environment, into bankruptcy or extinction. For example, Tushman and O'Reilly (1996, pp. 8–9) noted almost a complete turnover of leading companies in the semiconductor industry between 1955 and 1995, and asked the question, "Why are the patterns of success and failure so prevalent across industries and over time?" They attributed some major failures to the "success syndrome", whereby companies are unable to adjust to environmental changes and to evolve successfully as conditions change. The inability to change can result from structural and cultural inertia rooted in established organisational institutions, systems, processes, norms and values. They further argued that, for success in the long term, organisations often need to be able to manage both incremental and discontinuous change simultaneously, for example, to manage existing products by incremental improvements and also to develop new products through proactive technological innovation to meet emerging future market needs. Tushman and O'Reilly (1996, p. 11) stated:

> The real test of leadership, then, is to be able to compete successfully by both increasing alignment or fit among strategy, structure, culture, and processes, while simultaneously preparing for the inevitable revolutions required by discontinuous organizational change. This requires organizational and management skills to compete in a mature market (where cost, efficiency, and incremental innovation are key) *and* to develop new products and services (where radical innovation, speed, and flexibility are critical) [emphasis original].

Christensen (1997) proposed a similar concept, the "innovator's dilemma", to explain why previously successful companies, which apparently do "everything right", can still fail. They argued that technological changes can influence the operational capabilities of organisations, leading to changes in systems, processes, organisational culture and skills required for long-term competitiveness in the new environment. Christensen (1997, p. 7) found that it was difficult for several leading companies facing technological change to retain their leadership position, and he described these difficulties in his "technology mudslide hypothesis" as follows:

> Coping with the relentless onslaught of technological change was akin to trying to climb a mudslide raging hill. You have to scramble with everything you've got to stay on top of it, and if you ever once stop to catch your breadth, you get buried.

Several other authors have also agreed that discontinuous change fundamentally restructures formerly stable organisational characteristics, such as, strategy, structure, systems and culture. The implementations of discontinuous change initiatives are followed by shakedown or adjustment periods until stability is resumed through the establishment of a new structure (Lant & Mezias, 1990; Markus & Tanis, 2000). The relationship or fit between organisational structure and performance can also change as a result of discontinuous change (Lant & Mezias, 1990). Very high levels of ambiguity prevailing during the shakedown call for adjustments to organisational characteristics and can also affect performance. Similarly, Want (1993) argued that many organisations introducing discontinuous change initiatives do not plan for the need to continuously adapt and establish a new fit between organisational characteristics and performance in the new state. These organisations face significant difficulties in managing the implementation and the shakedown period after the implementation. Consequently, they often fail to realise the full potential benefits of their change initiatives.

In order to help managers navigate such pitfalls successfully, Kotter (1995, 1996) established a set of principles for successful change transformations. These principles emphasise the need for committed visionary leadership with a long-term focus; adjustments to organisational structure, culture and systems; and organisational learning and growth. Kotter (1996, p. 162) considered the creation of a sense of urgency, or "do-it-now" mentality, to be particularly important. Without it, many breakthrough innovations would not have occurred or maintained momentum to become successful commercial applications. The principles can be used as a guiding framework for evaluating and managing discontinuous change initiatives. The eight principles are as follows (adapted from Kotter, 1995, p. 61):

- *Establishing a sense of urgency*: examining market and competitive realities and identifying and discussing crises, potential crises, or major opportunities.
- *Forming a powerful guiding coalition*: assembling a group with enough power to lead the change effort and encouraging the group to work together as a team.
- *Creating a vision*: creating a vision to help direct the change effort and developing strategies for achieving that vision.
- *Communicating the vision*: using every vehicle possible to communicate the new vision and strategies and teaching new behaviours by setting positive examples.
- *Empowering others to act on the vision*: getting rid of obstacles to change, changing systems or structures that seriously undermine the vision, and encouraging risk taking and non-traditional ideas, activities and actions.
- *Planning for and creating short-term wins*: planning for visible performance improvements, creating those improvements and recognising and rewarding employees involved in the improvements.
- *Consolidating improvements and producing still more wins*: using increased credibility to change systems, structures and policies that do not fit with the vision; hiring, promoting and developing employees who can

implement the vision; and reinvigorating processes with new projects, themes and change agents.
- *Institutionalising new approaches*: articulating connections between new behaviours and corporate success and developing means to ensure leadership development and succession.

The widespread adoption of the Internet and the ERP systems provide recent examples of discontinuous change, as do other innovative management practices (IMPs) discussed in Chapter 2. Both technologies have increased the availability of information exponentially and made real-time analysis and communication common practices. For example, after the evolution of ERP systems, many organisations faced much higher competitive penalties for the failure to meet the expectations of customers related to just-in-time production and on-time delivery. These examples of technological development reflect a shift to the "new-age" business environment, where competitive success is associated more with building intangible knowledge assets, or intellectual capital, than with building physical assets, such as railroad, automobile, telephone and electricity that occurred in historical business environments. In all cases, environmental changes necessitated changes to the organisations' operating assumptions, for example, expectations regarding appropriate business practices in the new environment, and corresponding changes to performance measurement systems.

Performance Measurement Principles and Frameworks

Performance measurement is concerned with the achievement of business strategy by monitoring progress and comparing actual results against goals and objectives (Simons, 2000). However, the concept of performance is not well defined or understood. For example, Lebas and Euske (2002) established eight performance propositions and argued that performance is a socially constructed relative concept, subject to different interpretations by different individuals. In spite of such complexity, they proposed that performance can be managed through a set of balanced, complementary performance measures with causal linkages to desired outcomes in specific decision-making contexts. The crux of the eight propositions is as follows (adapted from Lebas & Euske, 2002, pp. 71–75):

- Performance can only be expressed as a set of complementary, and sometimes contradictory, indicators that describe the processes through which various outcomes and results are achieved.

- Understanding performance relies on the identification of a causal model that describes how actions today can influence results in the future.
- Performance is a social construct with no objective description and is defined differently by each user of descriptive signals (i.e., measures) of performance.
- Performance does not have the same meaning if the evaluator is inside or outside the organisation.
- Performance is connected to a domain of responsibility.
- Performance only exists if outcomes and results can be described or measured.
- The relevance of the causal model needs to be continually validated both within and outside the organisation.
- Performance measures should not be confused with what they only partially describe.

An effective performance measurement system requires a set of balanced performance measures (Kaplan & Norton, 1996). A common adage, "what gets measured, gets done", demonstrates a generally acknowledged measurement principle, particularly if appropriate rewards are tied to the measures (Eccles, 1991; Otley, 1994). If a measurement system includes appropriate measures, linked to an organisation's strategy, it can provide guidance for managerial actions and decisions. Performance measures have also been argued to improve organisational efficiency and effectiveness simply by increasing the visibility of consequences of managerial actions (Waterhouse & Tiessen, 1978). As such, they can serve as a mechanism for improving managerial and organisational performance and accountability.

It has been widely recognised that effective performance measurement requires performance measures beyond traditional financial metrics. This perspective has been advocated in both change management and performance measurement literatures (Kaplan & Norton, 1992; Eccles, 1991; Otley, 1994; Otley, Broadbent, & Berry, 1995; Kotter, 1996; Kennerley & Neely, 2002a, 2002b). Kaplan and Norton's (1992) balanced scorecard framework, which emphasises non-financial measures related to internal process, innovation, and customer perspectives, in addition to traditional financial performance measures, is by far the most widely cited performance measurement framework in recent literature (Neely, 2005).[1] The internal focus of the balanced scorecard necessitates tailoring performance measures to the circumstances faced by specific industries, organisations, and processes. These requirements demonstrate that effective performance measurement systems are complex and dynamic and contingent on their environmental context. They demand continuous scanning and monitoring of the environment, in order to provide early warning signals of impending significant environmental changes. The use of critical environmental measures as warning signals in performance measurement systems allows organisations to adapt to environmental changes in a timely and effective manner.

The organisations that are implementing discontinuous change, particularly in changing environments, require dynamic performance measurement systems. Bititci, Turner, and Begemann (2000, p. 696) considered the critical components of dynamic performance measurement systems to be the following:

- an external monitoring system, to continuously monitor developments and changes in the external environment;
- an internal monitoring system, to continuously monitor developments and changes in the internal environment and to raise warning and action signals when certain performance limits and thresholds are reached;
- a review system, which uses the information provided by the external and internal monitors and the objectives and priorities set by higher level systems, to decide internal objectives and priorities and
- an internal deployment system, to deploy the revised objectives and priorities to the critical parts of the system.

However, as Neely (2005, p. 1273) pointed out, one of the key unanswered questions in performance measurement research still is, ‘‘How to develop dynamic rather than static measurement systems?’’ In order to help understand the scope of this task, it is useful to consider the process model of performance measurement, implementing performance measures using ERP systems, and implementation challenges. These issues are discussed in the following three subsections.

Process Model of Performance Measurement

A common pragmatic approach to performance measurement uses a process-oriented model, in which performance measures are categorised into input, process, output and outcome measures. Input measures quantify resources used in providing services; output measures indicate the amount of work completed; process measures reflect the relationships between inputs and outputs, or efficiency in the use of resources; and outcome measures relate to the intended outcomes or effects of services provided, or effectiveness. The notions of *efficiency* and *effectiveness* are at the heart of performance measurement, as they allow the "delineation of managerial responsibilities and accountability for the achievement of interim and ultimate organisational objectives at different stages of operations" (Pollanen, 2005, p. 6). In accordance with Anthony and Govindarajan (1998, p. 131), efficiency is defined as "the ratio of outputs to inputs, or the amount of output per unit of input" and effectiveness as "the relationship between a responsibility centre's outputs and its objectives". The ultimate objective of comprehensive performance measurement systems is the development, use and reporting of effectiveness measures (Pollanen, 2005). However, a trade-off exists between the objectivity of efficiency measures and the relevance of effectiveness measures, making it necessary to balance the two types of measures carefully (Mayne & Zapico-Goni, 1997).

A typical input-process-output-outcome model is shown in Fig. 1. In addition to assessing past performance, it can be used to establish output standards and to compare actual performance against the standards. An output standard is "a formal representation of performance expectations", which can be established in advance for any measurable data using efficiency and effectiveness criteria (Simons, 2000, p. 61). Actual outputs can then be compared with the standards and any significant variations investigated and acted upon based on the feedback, as necessary. Adjustments to standards may sometimes also be necessary. Such ongoing feedback and adjustments can contribute to more positive long-term outcomes and to alignment with

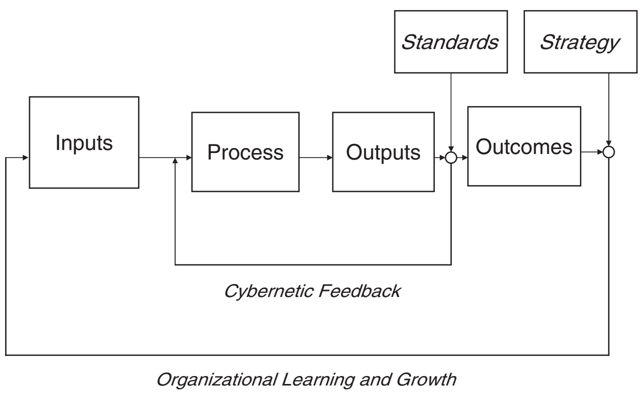

Fig. 1. Input-Process-Output-Outcome Model. *Source:* Adapted from Simons (2000, p. 61), with permission.

long-term strategic directions. In some cases, they may also result in adjustments to strategy, as organisational learning occurs. These characteristics of the model are consistent with the requirements for managing organisational change and thus constitute an element of a comprehensive framework for measuring and managing organisational change.

At each major stage of the model, performance measures can be used to monitor performance against performance expectations for that stage and overall progress towards ultimate outcomes. Performance measures are quantitative indicators of the extent to which an objective has been achieved. Hansen, Mowen, Senkow, and Pollanen (2004, p. 812) characterised performance measures as, "'measuring sticks' of success in achieving an organisation's strategies and objectives and, ultimately, of success in assessing an organisation's contribution to the well-being of its wider community". They can be financial, for example, total or unit cost, or non-financial, for example, number, percentage, or ratio. Furthermore, they can be measures of ultimate outcomes or interim measures towards ultimate outcomes. Interim measures are particularly important for long-term change initiatives, for which ultimate outcomes may occur or become known only several years after initial implementation. They are also equally important for change initiatives that take a long period of time to implement, for example, several months or years. Either financial or non-financial measures can be used to measure inputs, outputs, processes, or outcomes at either interim stages or at the completion of the project. Table 1 demonstrates some examples of input, output, process and outcome measures and classifies them as financial or non-financial. For the purposes of this illustration, measures expressed in monetary units are classified as financial, and measures expressed as number, percentage and ratio as non-financial. The examples provide an idea of possible types of measures in each category but by no means represent an exhaustive list.

Implementing Performance Measures Using ERP Systems

Effective performance measures cannot be developed and used in isolation, but they constitute a part of broader performance measurement and control systems. Simons (2000, pp. 4–5) described performance measurement and control systems as "…formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities". Broadly speaking, they also include accounting systems, internal control systems and planning and budgeting systems, in addition to performance

Table 1. Examples of Types of Performance Measures.

Type	Examples	Financial	Non-Financial
Input	• Number of employees		√
	• Total wages	√	
	• Cost of equipment rental	√	
	• Cost of energy used	√	
	• Quantity of raw materials used		√
Output	• Number of units produced		√
	• Number of customers served		√
	• Total value of sales	√	
	• Number of transactions processed		√
	• Net income	√	
Process (efficiency)	• Cost per unit of product	√	
	• Staff-customer ratio		√
	• Cost per invoice issued	√	
	• Percentage of defective products		√
	• Cost per customer served	√	
	• Manufacturing cycle efficiency ratio		√
	• Capacity utilisation ratio		√
Outcome (effectiveness)	• Number of customer complaints		√
	• Warranty costs	√	
	• Market share percentage		√
	• Customer satisfaction rating		√
	• Environmental pollution rating		√
	• Cost of product liability award	√	

measurement systems. As to performance measurement systems, Simons (2000, p. 7) defined them and their objectives as follows:

> Performance measurement systems assist managers in tracking the implementation of business strategy by comparing actual results against strategic goals and objectives. A performance measurement system typically comprises systematic methods of setting business goals together with periodic feedback reports that indicate progress against those goals.

ERP systems represent one of the most significant recent IMPs in contemporary companies discussed in Chapter 2. They play a critical role in implementing and maintaining effective performance measurement systems. ERP systems are comprehensive packaged software applications that automate and integrate organisational business processes across functional areas. Recognised as one of the most significant and widely adopted innovations in management information systems (Al-Mashari, 2002), ERP systems mark a major shift from the proprietary made-to-order or homegrown legacy systems to generic off-the-shelf and vendor-developed applications (Davenport, 2000). ERP systems provide organisations with an environment for process remodelling and introducing best practices. Organisations, however, cannot just depend on advanced information technologies to produce competitive advantage and business benefits (Powell & Dent-Micallef, 1997). The implementation of information technology (IT) to support business processes in innovative ways, and the development of complementary business and human resources to exploit these new capabilities, are critical for deriving sustainable long-term business benefits.

Effective performance measurement systems may require significant reconfiguration and additional design, evaluation, and reporting features in the ERP systems of most organisations. The systems requirements are similar to those discussed by Kumar, Pollanen, and Maheshwari (2007) in the context of internal control implementations. ERP systems should be able to effectively record accounting transactions, track key performance measures, report them to individuals responsible, flag any violations for investigation and provide a platform for benchmarking such information, for example, using balanced scorecards (Kaplan & Norton, 1996) or other performance measurement frameworks. ERP systems thus enable organisations to provide more frequent, timely and integrated financial and non-financial performance reports to management, regulators, auditors and other interested stakeholders (Matolcsy, Booth, & Wieder, 2005). The key technical features of ERP systems, which heavily rely on advanced IT, include scalable client server software architecture, supported by a common relational database and a single development environment. Such features are capable of facilitating real-time integrated processing and management of information across all functional areas, as well as, supply chain and customer relationships management (Kumar, Maheshwari, & Kumar, 2003; Davenport, 2000). Integrated real-time information, in turn, is necessary for developing effective performance measurement systems (Markus & Tanis, 2000; Kumar et al., 2003).

Davenport (2000) refers to ERP adoption, particularly in large global organisations, as a challenge of portfolio assembly, in which the organisation pulls together a wide variety of process changes with ERP modules as the core or backbone to meet their business requirements. Enterprise integration is the key reason for the development and popularity of ERP systems. It involves using IT to achieve a capability to plan and integrate enterprise-wide resources by assimilating the applications and processes of various functions of the organisation, for example, production, purchasing, marketing, finance, etc. The understanding of the way business processes and enterprise policies are structured, and how the business processes are related to one another, is important for achieving enterprise integration (Kumar, Maheshwari, & Kumar, 2002). To ensure the understanding of business processes, organisations must first ascertain that organisation-specific knowledge is effectively used and documented while configuring ERP systems. Second, for business continuity and ongoing use, the new information and knowledge created in the organisation must be assimilated in the systems on an ongoing basis.

Competitive global organisations facing rapid change need centralised systems to document controls, processes, performance measures and control environments. Documentation on the development, implementation, maintenance and effectiveness of controls and measures should be accessible to relevant employees across the organisation through a secure and auditable system. Management and process owners may need access to such documentation anytime and anywhere. Advanced IT solutions can help them collaboratively create and manage digital documentation allowing world-wide access via corporate intranets with a single authentication and access security system. Similarly, monitoring performance requires IT features capable of verifying and evaluating controls and measures within performance measurement systems, flagging control violations and deviations from performance standards, and documenting remedial actions and justifications for them. These objectives can be achieved by building internal control and data integrity checkpoints in the ERP systems, or by integrating an external monitoring system with specific event-based controls. Advanced application programming interfaces offered by ERP systems vendors, or middle-wares offered by IT companies, are some key technologies, which can enable the effective integration of external monitoring systems.

Implementation Challenges

Significant implementation challenges can occur on the ERP systems side, the performance measurement systems side, or both. For example, Brown and Nasuti (2005) and Kumar et al. (2007) examined ERP systems effectiveness in implementing internal controls. They cited problems with incompatible data structures and systems architecture, difficulties in ensuring adequate security and business continuity, and variations in infrastructure between business units as major obstacles. Such problems were attributed, at least partly, to independent ad hoc systems development in different business units, instead of systematic systems development. Nonetheless, a survey by Deloitte and Touche (cited in Brown & Nasuti, 2005) indicated that "people problems" accounted for almost two-thirds of obstacles to successful ERP implementation. Examples of "people problems" included lack of discipline, teamwork problems, resistance to change and inadequate staff and ongoing support. They also included some issues, such as, poor prioritisation of resources, poor reporting processes, lack of process engineering and ownership and inadequate training, which are more related to finances, processes, or context than people per se. In another study, Sohal, Moss, and Ng (2001) found that economic factors, lack of top management support and difficulty in justifying costs were main impediments to implementing IT. They also noted that manufacturing companies still tended to implement systems to improve operational efficiency and to decrease costs, rather than to improve long-term strategic performance.

Similar challenges are also evident in implementing performance measurement systems and measures. For example, Mills, Platts, and Gregory (1995) identified organisational culture as one of the key organisational constraints in implementing manufacturing strategy and processes. Beliefs, values and expectations embedded in organisational culture evolve slowly and are difficult to change quickly, resulting in reluctance to change (Kotter, 1996). Kennerley and Neely (2002a) identified the most important barriers to facilitating PMS evolution to be the lack of effective processes, necessary skills and human resources; inflexibility of ERP systems and inappropriate culture. These barriers were manifested in ad hoc systems, resistance to change and the lack of appropriate measures and rewards. Bourne, Neely, Platts, and Mills (2002) described the four most important barriers to be difficulties with data access and IT; time and effort required to set up systems, collect data, analyse data, and report results; difficulties concerned with developing appropriate measures and personal consequences, for example, reluctance to implement measures and to report problems. Bititci et al. (2000) found the three most pervasive challenges to be the lack of structured frameworks, the absence of a flexible platform and the inability to quantify relationships between measures. On the positive side, Kennerley and Neely (2002a) and Bourne et al. (2002) also examined drivers of successful performance measurement systems implementations and provided examples of how successful companies have been able to overcome some of the major challenges.

Table 2 provides examples of the main implementation challenges, classified as technical, cultural, financial and contextual. Although some

Table 2. Implementation Challenges.

Challenge	Examples
Technical	• Incompatible data structures • Inflexibility of existing systems • Lack of technical skills • Ad hoc systems • Difficulties with ensuring systems security • Lack of appropriate measures • Lack of cause-and-effect relationships for measures
Cultural	• Resistance to change • Lack of top management support • Reluctance to implement performance measures • Reluctance to report problems • Lack of appropriate incentives and rewards
Financial	• Time and effort required • Lack of resources • Difficulty in justifying costs • Benefits may not exceed costs
Contextual	• Difficulties with data availability • Lack of effective processes • Variations in structure across organisational units • Variations in systems across organisational units • Measures not linked to strategy and objectives • Lack of structured frameworks

examples may be interrelated and other categorisations may also be possible, these examples demonstrate that the implementation of performance measurement systems and performance measures is not an easy and straightforward process. It is subject to many pitfalls and complexities stemming from ambiguities associated with performance measures and performance measurement systems and processes, as well as, from the underlying technical systems necessary for implementing them. Such complexities can be particularly prevalent in establishing effective performance measures for discontinuous change initiatives due to the long-term and non-routine nature of many such initiatives. However, it is encouraging that some prominent companies have been able to overcome some major challenges successfully (Kennerley & Neely, 2002a; Bourne et al., 2002). The experiences of these companies can provide examples of best practices for other companies to follow in their efforts to implement and improve their performance measurement systems.

CYCLICAL PROCESS MODEL AND ORGANISATIONAL CHANGE

The input-process-output-outcome model presented in the previous section is most appropriate for monitoring and measurement of routine operational processes and activities in the short run. It alone is less effective for evaluating long-term effectiveness or contributions of various operational processes and activities to strategic outcomes, which are often difficult to measure and attribute to certain processes and activities. An example of these types of activities is research and development activities. In addition, many change initiatives occur during a long period of time, and it is not desirable to wait for them to be completed before obtaining any feedback on performance. Major construction and systems implementation projects are examples of such initiatives. Both types of examples represent discontinuous change, for which interim performance measures at different stages are useful. A cyclical process model that is developed in this section contributes to this objective. Theoretical foundations for the proposed model are examined first, followed by the description of the model. Finally, six performance measurement propositions are presented.

Theoretical Foundation

Two theoretical approaches have commonly been used to study organisational change: variance theory and process theory (Mohr, 1982). In the variance theory approach, efforts are made to identify organisational and environmental characteristics leading to the adoption of change initiatives. While variance theory explains variations in the magnitude of certain outcomes, it does not consider adequately the uncertainty of outcomes usually associated with discontinuous change. In contrast, process theory can provide powerful explanations even when strong causal relationships cannot be demonstrated between possible change factors and outcomes. In particular, a strand of process theory, called emergent process theory, is relevant for the objectives of this chapter, as it recognises the unpredictability of outcomes of managerial actions resulting from uncontrollable external forces and chance (Markus & Tanis, 2000). These attributes make emergent process theory useful to practitioners interested in implementing effective change and to researchers in developing comprehensive models of the determinants and consequences of discontinuous change in complex organisations and environments.

A common practice in studies using emergent process theory is to inductively develop models that identify a set of sequential stages, through which organisations pass when implementing change. For example, Soh and Markus (1995) developed a model to explain how investments in IT, an example of discontinuous change, create business value. The model includes three stages: development, implementation and ongoing operation. The outcomes of the first stage become the starting conditions for the second stage, and the outcomes of the second stage become the basis for the third stage. Performance in each successive stage is contingent, at least to a degree, on the actions taken in the preceding stage, as well as, on the environmental conditions prevailing at the time. Markus and Tanis (2000) extended the Soh and Markus (1995) model by adding the fourth stage dealing with pre-development activities and by broadening the definition of performance to encompass multiple performance dimensions. They proposed a measurement approach, similar to Kaplan and Norton's (1992) balanced scorecard, for measuring short- and long-term performance (both efficiency and effectiveness) on multiple dimensions in different stages and at different times. The Markus and Tanis (2000) model is illustrated in Fig. 2.

The following is a brief summary of each of the four phases of the model and the related key activities (Markus & Tanis, 2000, pp. 190, 195):

- *Chartering phase*: The chartering phase comprises decisions and activities leading up to the funding of the system, including building a business case

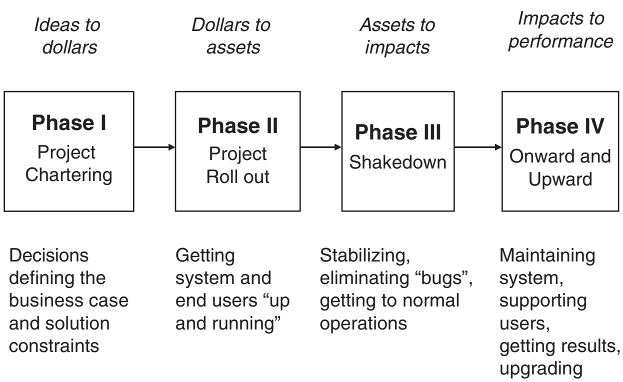

Fig. 2. Stage Model for Implementing Discontinuous Change. *Source:* Adapted from Markus and Tanis (2000, p. 189) and Zmud, R. W. (Ed.) (2000). Framing the domains of IT management: Projecting the future through the past, Pineflex Educational Resources. Permission granted.

for the investment, selecting a software package, appointing a project manager and approving a budget and schedule.

- *Project phase*: The project phase comprises activities intended to get the system running in one or more organisational units, including software configuration, system integration, testing, data conversion, training and roll out.
- *Shakedown phase*: The shakedown phase is the organisation's coming to grips with the system, including "bug" fixing and rework, system performance tuning and retraining.
- *Onward and upward phase*: The onward and upward phase continues from normal operation until the system is replaced with an upgrade or a different system, including continuous business improvement, additional user skill building and post-implementation benefit assessment.

The Markus and Tanis (2000) model is consistent with the process-oriented approach to performance measurement discussed previously in that it allows interim performance measurement and evaluation in different phases. Regardless of this important contribution, the model does not explicitly incorporate feedback, adjustment and learning as part of the model. This chapter attempts to remedy this shortcoming by developing a cyclical process model.

Cyclical Process Model

An effective model for measuring and managing change should reflect the sequential step-by-step nature of change processes and the multi-dimensional nature of performance, as well as, allow feedback, adjustment and learning. To understand this objective, it is useful to examine the cyclical nature of many change initiatives and the concept of organisational learning. Tushman and O'Reilly (1996) argued that change occurs in repetitious cycles of discontinuous change, intervened by cycles of incremental change, in which learning and fine-tuning can occur. Series of incremental cycles can be appropriate in relatively stable environments, in which organisations need to make only minor improvements to a previously implemented major project. Such stability can be interrupted again by another discontinuous change necessitated by new environmental conditions and result in the repetition of the cycle. The principles of the Tushman and O'Reilly (1996) model, using new product technology adoption as an example, are shown in Fig. 3.

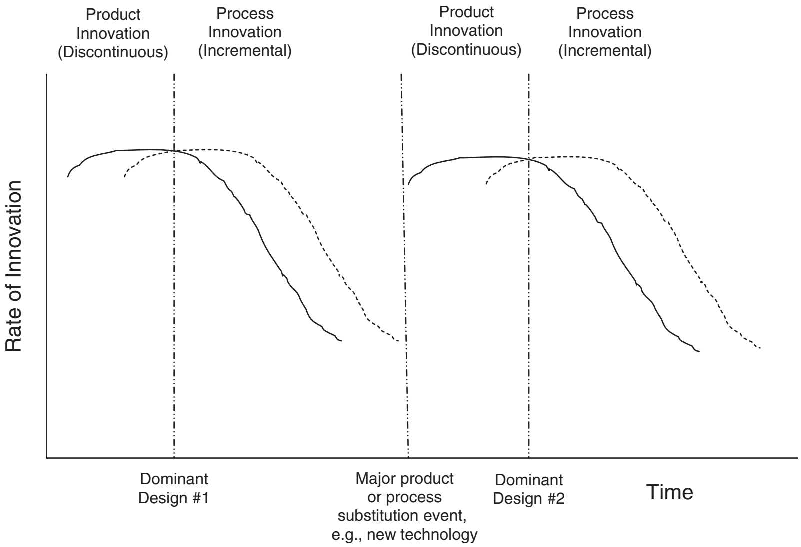

Fig. 3. Interrelatedness of Discontinuous and Incremental Change. *Source:* Adapted from Tushman and O'Reilly (1996, p. 16), permission granted.

The Tushman and O'Reilly (1996) model demonstrates the interrelated nature of incremental and discontinuous change as previously discussed, as well as, the fact that companies may not be able to successfully manage the transition from the existing technology to new technologies. One reason for such failure can be the lack of appropriate performance measurement and feedback systems. Although this model does not explicitly include a feedback loop either, it implicitly recognises the need for feedback and double-loop learning promoted by organisational theorists, for example, Argyris (1977). Building on the models of Tushman and O'Reilly (1996) and Markus and Tanis (2000), discontinuous change can be depicted as a spiral pattern resembling a corkscrew, as proposed by Pollanen and Maheshwari (2004). A cyclical process model based on such change pattern is depicted in Fig. 4.

The first sphere of the corkscrew represents Phase I of the implementation stage for a discontinuous change initiative. Moving along the sphere, different steps of Phase I can be tracked sequentially and performance measured upon the completion of each key step, as well as, Phase I. Performance can also be monitored continuously, if warranted and feasible. The end point of the sphere, although vertically aligned with the starting point, is at a higher level than the starting point, representing a "leap" that has occurred in terms of

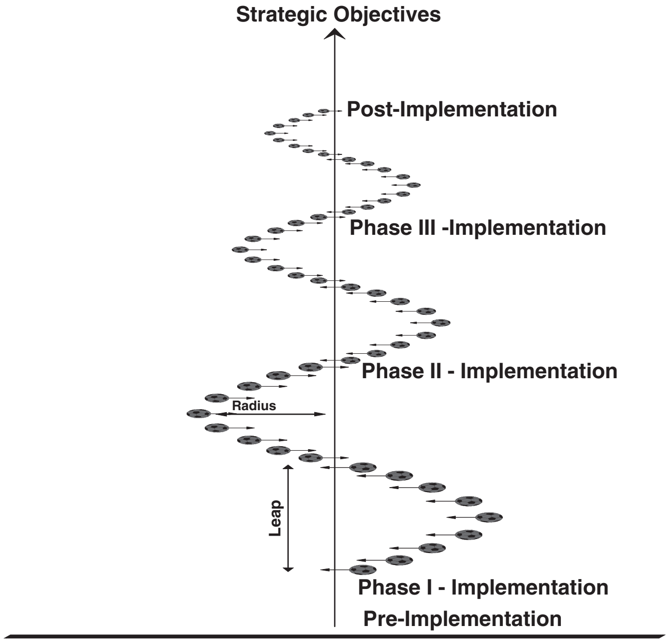

Fig. 4. Cyclical Process Model for Implementing Change. *Source:* Adapted from Pollanen and Maheshwari (2004), permission granted.

progress and time. After the completion of Phase I, other phases may be necessary, resulting in an upward cyclical movement along the other spheres and tapering off at the tip of the corkscrew when completed. The radius of each successive sphere decreases, as the scope and the number of steps are expected to decrease in response to progress and learning that has occurred in previous phases. The length of the radius for Phase I, and the subsequent learning curve, depends on the technical and environmental complexity of the initiative, as well as, on the expertise and resources available at the time. Upon the completion of each successive phase, the outcomes of the entire project become more visible and measurable. The model demonstrates that the path to the achievement of project objectives, and their contribution to the strategic vision, is not a linear straight line, but rather a curvilinear pattern, consisting of a winding series of steps and adjustments towards the strategic objectives. The corkscrew model presents a single discontinuous change initiative. Another discontinuous change initiative would be represented by starting the process again with another corkscrew.

Cyclical Process Model and Performance Measurement

Performance measures can serve different purposes at different stages of implementing discontinuous change. For demonstration purposes, a major systems implementation is used as an example in this section, and the entire project is assumed to have three main stages: pre-implementation, actual implementation (consisting of three implementation phases) and post-implementation. Schematically, the input-process-output-outcome model can be superimposed on the three stages of implementation in Fig. 4 to provide an integrated dynamic model of measurement of discontinuous change. The resultant performance measurement model is presented in Fig. 5.

In establishing appropriate performance measures for discontinuous change, some relevant concepts can be found in the change management literature. This literature has traditionally been concerned with performance on three performance dimensions: time, budget and quality. These criteria suggest that the change initiative is considered successful, if it has been

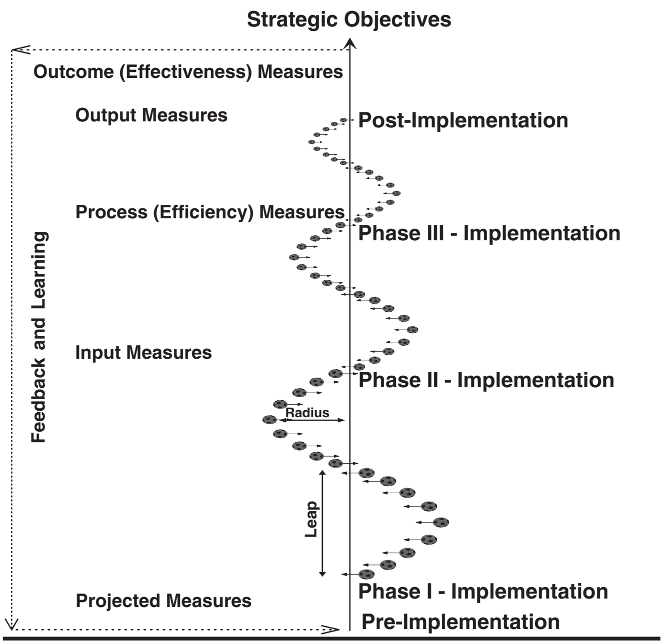

Fig. 5. Performance Measurement Model for Discontinuous Change. *Source:* Adapted from Pollanen and Maheshwari (2004), permission granted.

completed on time and within the set budget, and it meets the pre-determined technical specifications. More recently, customer acceptance and satisfaction have also been considered important (Kerzner, 1998). Icmeli Tukel and Rom (2001, p. 415) empirically examined the importance of the following five performance objectives in change project evaluation:

- minimising project cost;
- minimising project duration;
- meeting technical specifications;
- meeting customer needs and
- reducing rework of non-conforming tasks.

Icmeli Tukel and Rom (2001) found that customer focus was the most important of the five categories, and it remained constant regardless of the project stage. The other categories tended to increase in importance from the conceptualisation stage to the implementation stage, but decline somewhat as the projects neared completion. They were rated less important than the customer needs in all stages. The addition of the customer perspective is a significant improvement to the project evaluation literature, as it represents effectiveness. The other three dimensions are concerned only with efficiency. Taskinen and Smeds (1999, p. 1173) conceptualised a measurement framework with two main components: change project measures and operational excellence (outcome) measures. For each component, they suggested three categories of measures: human measures, process measures and technology measures. Furthermore, they recommended both efficiency and effectiveness measures for each category. Although strong on its emphasis on efficiency and effectiveness, this framework does not explicitly consider the customer perspective, and it unduly separates the measurement of project processes and project outcomes, which are interrelated. Irrespective of its claim, that study does not provide examples of performance measures per se, but rather examples of dimensions of performance that should be measured, for example, innovation, social skills, strategy alignment, timetables, education and selection of right technology, to mention a few.

As previously discussed, quantifiable performance measures, such as, a number, amount, percentage and ratio, are necessary to measure broad performance attributes or dimensions. In addition, the measures should include measures relating to all four levels of the input-process-output-outcome model. Some examples of possible performance measures, including input, process, output and outcome measures, in different stages of implementation are provided in Table 3. For simplicity, it is assumed that

Table 3. Examples of Performance Measures in Different Implementation Stages.

Stage	Type	Examples
Pre-implementation	Input	• Total budgeted project costs \$ • No. of budgeted person hours • No. of budgeted facility usage hours
	Output	• Budgeted no. of project components to be completed • Budgeted no. of clients to be served • Budgeted total completion time
	Process	• Budgeted cost per component completed \$ • Budgeted cost per major step or activity completed \$ • Budgeted cost per client \$ • Budgeted staff utilisation % • Budgeted facility usage %
	Outcome	• Estimated % reduction in errors • Estimated % reduction in time to generate reports • Estimated increase in client satisfaction rating % • Estimated increase in net income \$ • Estimated increase in market share %
Phases I, II, III – implementation	Input	• Total to date project costs \$ • No. of to date person hours • No. of to date facility usage hours • % variances for all of the above from to date budgets
	Output	• No. of components completed to date • No. of clients served to date • Total completion time to date • % variances for all of the above from to date budgets
	Process	• % of major activities completed to date • Cost per component completed to date \$ • Cost per major activity completed to date \$ • Cost per client to date \$ • Staff utilisation % to date • Facility usage % to date • % of major activities completed on time to date • % of non-confirming activities of total completed to date • % variances for all of the above from to date budgets

Table 3. (*Continued*)

Stage	Type	Examples
	Outcome	• % of components completed on time to date • % of non-confirming components of total completed to date • No. of client complaints to date • Cost savings to date \$ • % variances for all of the above from to date budgets
Post-implementation	Input	• Total actual project costs \$ • No. of actual person hours • No. of actual facility usage hours • % variances for all of the above from total budgets
	Output	• Total no. of project components completed • Total no. of clients served • Total actual completion time • % variances for all of the above from total budgets
	Process	• Average actual unit cost per component completed \$ • Average actual cost per major activity completed \$ • Average actual cost per client \$ • Actual staff utilisation % • Actual facility usage % • % variances for all of the above from total budgets
	Outcome	• Actual % reduction in errors • Actual % reduction in time to generate reports • Actual increase in client satisfaction rating % • Actual increase in net income \$ • Actual increase in market share % • % variances for all of the above from total estimates

the processes in the three implementation phases are similar, so that the progress measures can be repeated in each phase. If the project implementation consists of distinct phases with different objectives, processes, resource requirements, and responsibility arrangements, some unique measures may also be needed in each implementation phase. The examples are intended to demonstrate possible types of performance measures corresponding to each major implementation stage, but they do not necessarily constitute an exhaustive list. Other classifications of the measures may also be possible.

In the pre-implementation stage, performance measures can serve as drivers of and justification for change. Before an approval for a project is granted, the pre-implementation assessment in the project proposal should show estimated financial and technical viability, measured using a combination of financial and operational performance measures, such as cost savings, positive net cash flows, improved reliability and timeliness of information and enhanced systems security. For accepted projects, these criteria subsequently provide projected targets, against which actual performance can be compared at different stages of completion. In different implementation phases, actual input measures and process measures become available. Input measures measure resources used on the project, for example, the number of labour hours, total wages and the cost of materials used. Process measures measure relationships between inputs and interim or final outputs, or efficiency, in the use of resources, for example, cost per labour hour, on-time completion percentage and staff and capacity utilisation ratios. Such measures indicate whether the project is progressing as expected, for example, whether it is expected to meet the scheduled completion times and budgeted expenditures. At each implementation phase, the measurement processes are repeated to obtain up-to-date measures and variances from budgets. It is also desirable to include any relevant unique measures for each implementation phase, as warranted. The interim measures used in different implementation phases serve as indicators of progress towards the accomplishment of the ultimate planned outcomes and can reveal significant actual or potential problems.

Upon the completion of the last implementation phase, the final output measures become available. They measure the quantity and quality of work completed, for example, the number of new reports available, the number of clients or departments served and the increased processing capacity and speed. They can be compared with pre-implementation budgets and targets to reveal whether the planned outputs were achieved at the expected level of quality and cost. Finally, in the post-implementation stage, some outcome or effect measures become available. They indicate the effectiveness of implementation, that is, whether the short- and long-term intended outcomes, such as improved client service, increased market share and long-term profitability, have been realised. However, it should be noted that in many cases outcomes are the most difficult to measure, as they are often long-term in their nature and may also be influenced by several environmental factors. Therefore, the measurement of outcomes often requires the collection of relevant external information over a long period of time and the assessment of long-term consequences at several points of time.

As the project progresses through different stages, higher level performance measures become available, and performance measures, and the mix of measures, may need to be changed accordingly. A progression from input and process measures to output and outcome measures becomes possible, and an appropriate mix of measures should include fewer input and process measures and an increasing number of output and outcome measures. Even the same measures become more reliable and valid, as expected outcomes become closer and more information becomes available. In general, the feedback obtained on the efficiency and effectiveness of processes allows adjustment and organisational learning, as demonstrated by a feedback loop in the model. Such feedback is valuable for demonstrating accountability for the project and for implementing similar projects in the future.

Performance Measurement Propositions for Discontinuous Change

The models for measuring and managing discontinuous change in the change management literature do not appear to fully integrate some important principles found in the performance measurement literature. Based on the arguments presented in this chapter, a more integrative approach would be beneficial. As a conclusion to the arguments presented in this chapter, six performance measurement propositions, suitable for empirical testing in future research, are presented in this section. The propositions (modified based on Pollanen & Maheshwari, 2004, p. 832), and the rationale for them, are as follows:

1. An effective "basket" of performance measures at each stage of implementation of discontinuous change includes a mix of financial and non-financial input, process (efficiency), output, and outcome (effectiveness) measures, as performance is a multi-dimensional construct. A different mix of performance measures is appropriate in different stages of implementation of discontinuous change, that is, pre-implementation, different phases of implementation and post-implementation, as objectives, information and conditions change.
2. A different mix of performance measures is appropriate in different stages of implementation of discontinuous change, that is, pre-implementation, different phases of implementation and post-implementation, as objectives, information and conditions change.
3. Increasingly more sophisticated and higher level output and outcome measures become available and important in each successive phase of

implementation of discontinuous change, as the entire initiative nears completion.

4. Actual performance in different phases of implementation of discontinuous change is compared with the original projected performance targets, as well as, with any revised targets set at the time of previous evaluation, and performance targets are revised again, as necessary, in response to further learning that has occurred.
5. The effectiveness of the "basket" of performance measures is evaluated at key stages of implementation of discontinuous change, as environmental conditions change and organisational learning occurs, possibly warranting a change to the mix of measures.
6. The performance measurement systems for discontinuous change and incremental change are integrated to the maximum feasible degree, as the two types of change processes are interrelated.

SUMMARY AND CONCLUSIONS

Based on the review of change management and performance management literatures, this chapter examines the role of performance measurement systems in effective management of organisational change, particularly discontinuous change. Founded on emergent process theory, an analytical framework depicting the cyclical nature of discontinuous change and appropriate performance measures for different stages of such change is developed. It emphasises the need for continuous development of dynamic and responsive performance measurement systems that reflect changes in an organisation's environment. From the managerial perspective, it can provide managers effective early warning signals of impending environmental changes. Due to high costs and risks associated with typical discontinuous change initiatives, proper monitoring and measurement practices are particularly important for organisations undergoing discontinuous change in unstable, complex and competitive business environments. Under such circumstances, the success of change initiatives, long-term organisational prosperity and even organisational survival, can depend, to a large extent, on the managers' ability to correctly diagnose, analyse and react to environmental forces. Effective performance measurement systems are crucial in helping managers effectively manage these forces.

The chapter concludes with six propositions for effective measurement of discontinuous change. These propositions are based on both performance measurement and change management literature. They incorporate some traditional performance measurement principles developed for measuring short-term operational performance or incremental change to the measurement and management of long-term project performance or discontinuous change. As such, they attempt to integrate the two types of performance measurement objectives. However, as the main focus of this book is on operational performance measurement and empirically testing the shop-floor non-financial performance measurement model introduced in Chapter 2, the cyclical process model and the performance measurement propositions developed in this chapter remain to be empirically tested in future research studies.

NOTE

1. Other frameworks also exist, for example, the following: strategic measurement analysis technique (Cross & Lynch, 1988–1989), performance measurement matrix (Keegan, Eiler, & Jones, 1989), performance measurement questionnaire (Dixon, Nanni, & Vollman, 1990), performance pyramid (Lynch & Cross, 1991), results-determinant framework (Fitzgerald, Johnston, Brignall, Sylvestro, & Voss, 1991), performance measurement for world class manufacturers (Maskel, 1992), performance measurement design process (Neely, Gregory, & Platts, 1995), integrated performance measurement reference model (Bititci, Carrie, McDevitt, & Turner, 1998), and performance prism (Kennerley & Neely, 2002b).

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CHAPTER 13

WHERE TO GO: AN INSTITUTIONAL THEORY FRAMEWORK FOR THE ROLE OF PERFORMANCE MEASUREMENT SYSTEMS IN MANUFACTURING FIRMS

Mostafa K. Hassan

INTRODUCTION

The last few years have witnessed increasing calls to improve the financial accountability, the efficiency, and the effectiveness of organizations. In response, organizations tend to implement numerous forms of innovative managerial practices (IMP) to improve their performance in line with other worldwide organizations. The changes in the business environment have led managers to manage different organizational activities such as the production activities, material handling, recycling, marketing, and quality. The problem is that those activities interact together and become more complex in manufacturing organizations that adopt a high level of technology. In today's Advanced Manufacturing Technology (AMTs)

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environment, measuring the performance requires a performance measurement system (PMS) that depicts which performance measures ought to be employed and how they should be deployed. Such a PMS is not only to reward organizational members but also to hold them accountable and responsible for tasks under their control.

The quest of supporting organizations' strategic goals makes the role of PMS centers on supplying better information in order to bring 'better' decision-making. However, the role of the PMS is not only to supply information, but also to play an institutional role to legitimate the organization activities and functions to the wider social, political, and institutional context in which the PMS operates. In this regard, the chapter aims at discovering, or as Vaivio (1999) calls 'exploring', the role(s) of the PMS and performance measures in business organizations' social context. The chapter goes beyond the PMS technical role and presents an institutional framework that can be used in order to understand the role such a system and its measures can play within an organization. It presents a complementary perspective that can be utilized to analyze the data incorporated in Part III. It also highlights other possible explanations and interpretations underlying the adoption of a multidimensional PMS in manufacturing firms.

The chapter reviews the evolution of a multidimensional PMS and the use of various performance measures as explained earlier in Part I. Although it shares Part I's underlying themes for the need of financial and non-financial performance measures, it concludes that the use of the institutional theory gives broader explanations and interpretations of the evolution of such a multidimensional system and the use of its measures. Building on institutional theory notions of competitive, coercive, mimic, normative and rationalized myth, the author proposes an institutional theory framework to understand the role of performance measures in organizational context. Accordingly, Second section reviews the evolution and the role of a multidimensional PMS and its measures from two perspectives: "relevance lost" and "stakeholders' theory". Third section discusses the proposed institutional framework. The last section presents the conclusion and directions for further research.

LITERATURE REVIEW

This section reviews two streams of research that discuss the evolution and the role(s) of PMS. The first presents the role of the PMS in the context of

Johnson and Kaplan (1987) 'relevance lost'. The second discusses the role of PMS in the context of stakeholder theory (Atkinson, Waterhouse, & Wels, 1997; Atkinson, 1998). Finally, the section draws a comparison between the PMS-based relevance lost and the PMS-based stakeholders' perspective.

PMS in the Context of 'Relevance Lost'

Johnson and Kaplan (1987) argue that management accounting has a major 'crisis'. They add that management accounting information is driven by the procedures and cycles of organizations' financial reporting systems, the matter that makes such information too late, too aggregated and distorted to be relevant in managerial planning and controlling decisions. They claim that firms use accounting systems and techniques for internal planning and control, not because they support the firm's strategy, but because they have been chosen through an external political process set by regulators at Financial Accounting Standard Board (FASB) and Security Exchange Commission (SEC) (Kaplan, 1984). The domination of the financial reporting mentality on managerial accounting, they claim, results in too little IMPs and innovative management accounting procedures.

In addition, Kaplan's (1984) historical review observes that management accounting techniques were developed in the late nineteenth and early twentieth centuries and have not been changed despite the changes in business competition and technology in the 1980s. For example, Frederick Taylor's work on scientific management engineers developed techniques for measuring physical and cost standards that are later formed the basis of a standard costing system. Similarly, in the early twentieth century the Dupont Power Company developed the return on investment (ROI) as a measure of the commercial success of operating divisions, yet such a measure still being used despite the massive changes in business environment. Johnson and Kaplan (1987) emphasize that techniques, such as ROI and standards costing, are in place since 1925, yet still being widely used by management accountants in today's AMTs. They add that the prevalence of these techniques suggests that there have been few apparent changes in management accounting practices despite the major changes, which have taken place in manufacturing operations due to advances in technology and competition.

The publication of Johnson and Kaplan's (1987) 'Relevance Lost' altered the PMS agenda. Johnson and Kaplan (1987) recognized that traditional financial performance measures are not only too late and too aggregated, but also poor measures for aspects that matter to customers, such as quality and delivery speed. The growing awareness among academics that ROI and financial measures are no longer sufficient for planning and controlling purposes has led them to develop better PMSs (Fitzgerald, Johnston, Brignall, Sivesttro, & Voss, 1991; Kaplan & Norton, 1992, 1996; Atkinson & McCrindell, 1997; Atkinson, 1998). Johnson and Kaplan (1987) urge decision-makers to look beyond financial measures and reporting a wider perspective of the businesses' total performance. They also encourage and recommend the use of various other possible non-financial measures.

Accordingly, Fitzgerald et al. (1991) investigated performance measures in the UK profit seeking organizations. They discovered that performance measures fell into two categories: end-results and means or determinants. The end-results were subdivided into 'competitiveness' and 'financial measures'. The means or determinants were subdivided into four main categories. These were: quality of service, flexibility, resource utilization, and innovation. They established a map that links these measures together under the banner of an overall PMS. They emphasized that the choice of different measures will depend on some organizational contingent factors such as level of technology, level of competition, level of IMP, and level of investments in intangible assets (see, Hendricks, Menor, & Weidman, 2004; Abdel-Maksoud, Dugdale, & Luther, 2005).

In the same vein, Kaplan and Norton (1992, 1996) suggest a PMS that, they argue, help managers to examine the accomplishment of the organization from four different perspectives: financial perspective, customers' perspective, internal business perspective, and innovation and learning perspective. The authors argue that by combining these four perspectives, a comprehensive understanding of the organization operations could be located and developed. They add that these four perspectives include financial and non-financial measures that help in evaluating business performance and linking the organization strategy to such a performance. Kaplan and Norton (1996, p. 75) state that their PMS '… *addresses a deficiency in traditional management systems: their inability to link a company's long-term strategy with its short-term actions*'.

Despite the similarities between Fitzgerald et al.'s (1991) and Kaplan and Norton's (1992, 1996), each presents a different structure of a better PMS. Nevertheless, their common theme is that organizations can keep moving forward on their strengths through incorporating non-financial performance measures. They add that their proposed PMSs were not to replace financial measures but to add complementing measures deemed necessary to enhance organizations' performance now and in the future.

The general validity of Johnson and Kaplan's (1987) claim of "management accounting crisis" has been empirically questioned (see, Hopper, Kirkham, Scapens, & Turely, 1992; Johnson, 1994; Ezzamel, 1994; Joseph et al., 1996; Porter & Akers, 1987; Rosenzweig, 1985; Scapens et al., 1996). Some empirical studies did not support the fairly bold statements that FASB and SEC requirements affect the internal accounting procedures. Porter and Akers (1987) survey shows that organizations either do not use external reporting conventions for internal purposes or they primarily use them, when they do, because of cost–benefit relationship whereby *there is no reason to maintain an accounting system for internal purposes that is inconsistent with external one unless its benefit out weight its cost*. In the same vein, Hopper et al. (1992) found no clear evidence of a belief that external reporting requirements dominate management accounting procedures, even though most of the studied firms had a single system of data capture. Joseph et al. (1996) surveyed UK management accountants and found little evidence of a generally held belief that external reporting dominates internal accounting (see Dugdale, Jones, & Green, 2005).

In the same vein, despite various calls to develop and use a better PMS that integrates financial and non-financial measures, evidence on the use of non-financial measures still puzzling (Vaivio, 1999). Against surveys that show a growing use of non-financial measures alongside the financial ones (e.g. Abdel-Maksoud, et al., 2005; Bhimani, 1994; Chendall & Langfield-Smith, 1998; Stivers, Covin, Hall, & Smalt, 1998; Silk, 1998), Epstein and Manzoni (1997) found that in practice there is often much more emphasis on the traditional financial measures than the non-financial measures. Other scholars report fragmented observations in different business settings (e.g. Turney & Anderson, 1989; Coates, Davis, Emmanuel, Longden, & Stacey, 1992; Euske, Lebas, & McNair, 1993; McKinnon & Bruns 1993) leading Mooraj, Oyon, and Hostettler, (1999) to question whether the adoption of a multidimensional PMS is 'a necessary good or unnecessary evil?' Accordingly, the questions that worth investigation are: *why organizations adopt a multidimensional PMS?* and *is cost-benefit analysis a sufficient explanation to adopt such a multidimensional PMS?*

PMS in the Context of Stakeholders

Although Atkinson et al. (1997) have no basic quarrel with a PMS-based relevance lost thesis, they felt that it is incomplete. Atkinson et al. (1997) believe that Fitzgerald et al. (1991) and Kaplan and Norton (1992, 1996)

PMS suffers from two pitfalls. First, it does not identify the role of the wider community in defining the environment within which the business operates. Second, it does not identify *performance measurement* as a two-way process, which enables management to assess *stakeholders'* contributions to the business's primary and secondary objectives and enables *stakeholders* to assess whether the business is capable of fulfilling its obligations to them now and in the future.

Therefore, Atkinson et al. (1997) and Atkinson (1998) propose a better PMS from stakeholders' perspective. Based on that perspective, Atkinson et al. (1997) differentiate between business's primary and secondary objectives. They argue that primary objectives are externally oriented and concerned with what could be delivered to the community surrounding the organization while secondary objectives are internally oriented and concerned with how services/products will be delivered.

Atkinson et al. (1997) also argue that a stakeholder approach would help in developing a strategic PMS that enables the business to achieve its primary and secondary targets. They divide business's stakeholders into two groups: environmental and process. The environmental stakeholders are customers, owners, and the community. This group comprises the business's external environment that, in turn, defines the critical elements of its competitive strategy. The process stakeholders are employees and suppliers. This group works within the environment defined by the external stakeholders to plan, design, implement, and operate the processes that make and deliver the business's products/services to its customers. For Atkinson et al. (1997) performance measures provide a platform for organizational members' actions through communicating organizational social and strategic objectives to each organizational member. This communication process permits each organizational member to understand his/her position and how he/she would contribute to the improvement required. This communication process establishes a sound basis for accountability and developing compensation plans-based PMS.

From stakeholders perspective, a PMS plays a significant role to hold organizational members' accountable for their actions while, at the same time, translating organizational wider accountability systems to those members' behavior. It is a two-way process in which performance measures are to be embedded in the organization's control systems and mechanisms. The PMS links employees' performance to their remuneration, their organizations' strategic goals and, at the same time, attempts to link employees' actions to the social and institutional environment wherein the PMS operates. Nevertheless, critics of stakeholders perspective (e.g.

Wisniewski & Stewart, 2004) argue that the attempt to fulfill various stakeholders' desires either through a ''one size fits all'' PMS, or having a single performance indicator that is seen as relevant by all stakeholders is unlikely to be possible.

A more feasible approach would be to develop a PMS that attempts to accommodate the needs of various stakeholders while taking into consideration the importance each stakeholder group assigns to each performance measure and the robustness of the chosen measures. In this regard, Quinlivan (2000) stresses that care must be taken against the corruption of data or developing a culture of doing what gets measured while excluding what is not measured. Schmenner and Vollmann (1994) add that care also must be given in choosing the performance measures. They differentiated between choosing *wrong* measures and failing to use the *right* measures. They labeled the former error, following Dixson, Nanni, and Vollmann (1990), a *false* alarm as managers might spent so much time improving something that has few positive and perhaps harmful consequences. Whereas the latter error is seen as performance *gaps* in which something important for the organization stays neglected.

From stakeholders' perspective, the choice of particular measures should be derived from the systems of accountability that are embedded in the economic, social, and political context of the PMS. The same measures should be linked to organizational members' actions in order to translate accountability systems into day-to-day actions. Such emphasis raises questions such as *is this the only role of the PMS?* and/or *do organizations adopt a better multi-dimensional PMS to support their accountability systems only?*

The PMS-based Relevance Lost/Stakeholders: A Comparison

Although both the PMS-based relevance lost and the PMS-based stakeholders' perspectives aim at developing a better and a more strategic PMS, a comparison between both show that the latter expands the role of the PMS and its performance measures. Table 1 presents the main differences between a PMS-based relevance lost and a PMS-based stakeholders while, at the same time clarifying how the stakeholders' perspective expands the role of the PMS.

Despite the differences shown in Table 1, both approaches are inspired by neo-classical economic theory and the transaction cost economics. The economic-based theories conceptualize the evolution in PMSs as a direct result of gains obtained from implementing such systems in order to

Table 1. Differences between PMS-based Relevance Lost and PMS-based Stakeholders.

Dimension	PMS-based Relevance Lost	PMS-based Stakeholders
Objectives	The external driving force to enhance the organization performance is, only, *customers'* point of view	The external driving force to enhance the organization performance is the *community* point of view
Focus	Emphasis on the organization internal processes in relation to customers requirements	Emphasis on both the internal and external processes in relation stakeholders (internal/external) requirements
Accountability	Stress on holing organizational members accountable to the organization strategic goals	Stress on holing organizational members accountable to the society social goals as well as the organization strategic goals
Communication	Single-way communication in which management assesses the contribution to the society (mainly customers)	Two-way communications in which management assesses the contribution to the society (suppliers, employees, customers, … etc.) while, at the same time, the society assess the organization ability to fulfill its targets

accurately evaluate internal operations, to reward employees, to hold organizational members accountable, and to compete in intensive competitive markets. Accordingly, the role of a PMS is evaluated from the perspective of the functions that the system can serve.

In the light of economic-based theories, PMS has a *technical role* whereby the design of a better PMS is promoted in terms of bringing 'better' decision-making process and/or 'driving' better performance (see Broadbent & Guthrie, 1992). PMS and its measures become a tool to effectively and efficiently achieve certain purposes. Effectiveness refers to the degree of fitness between the information supplied by the PMS and the information required by the users, while efficiency refers to the cost–benefits relationship of implementing the PMS. Therefore, the adoption, the development, and the implementation of a better and a strategic PMS is justified in light of the perceived benefits that outweigh costs associated with such an adoption, development, and implementation.

The PMS *technical* role has been an underlying theme of various explanations that require integration between financial and non-financial measures. For example, Total Quality Management (TQM) programs urged the deployment of a multidimensional PMS in order to achieve continuous performance improvement (Hoque, 2003). Likewise, arguments for implementing non-financial measures together with financial ones have been made in order to attain concepts such as World Class Manufacturing and Customer Satisfaction (e.g. Hiromoto, 1988; Maskell, 1989; McNair, Lynch, & Cross, 1990; Smith, 1990; Eccles, 1991; Jazayeri & Hopper, 1999). One can argue that the explanation behind the adoption of a multidimensional PMS or certain performance measures rests on a simple cost–benefit relationship. This explanation perceives the *social* and *institutional* context wherein the PMS operates as unimportant (see Broadbent & Guthrie, 1992; Puxty, 1993; Laughlin, 1995). However, other explanations could be recognized through exploring the social, political, and institutional context wherein the PMS operates. The economic-based theories ignore these explanations or, at best, do not underscore (Jones, 1995; Hassan, 2005). To this, the chapter proposes an institutional theory framework to find out other possible explanations behind the adoption of a multidimensional PMS. The proposed framework suggests various propositions aiming at highlighting broader explanations behind the adoption of such a PMS while, at the same time, explaining the role(s) of that system.

THE PROPOSED INSTITUTIONAL FRAMEWORK

Vaivio (1999) argues that although the subject of PMS has been the focus of various studies, most authors seem to support the PMS *technical role* while explaining little about the organizational *social* and institutional context in relation to the performance systems and measures. He adds that there is a need to balance both technical and institutional arguments, while going further exploring in sufficient depth the reasons behind the evolution of a PMS and the role that system can play to support organizations' growth and change. In the same vein, Burns and Vaivio (2001) urge to understand how wider social and institutional context can be mediated into management accounting practices, such as a PMS and its measures, within micro organizational level (e.g. Hassan, 2002, 2003, 2005). They encourage scholars to explore the role(s) of management accounting practices, such as a multidimensional PMS, while exploring how forms of performance measures emerge as a consequence of extra-organizational influences and how those measures become interlinked with these organizations' internal circumstances (see Miller & O'Leary, 1987; Bhimani, 1993; Hassan, 2003, 2005).

In response to the above calls, the author proposes an institutional framework in order to understand the role of the PMS and performance measures in manufacturing firms. The framework interlinks a more macro social and institutional context to micro organizational practices such as the PMS and its measures (e.g. Hassan, 2003, 2005). The framework emphasizes the importance of macro institutional arrangements to micro organizational activities and processes. Although Burns and Scapens (2000) underscore this macro dimension, they do not show how micro organizational processes and activities are linked to the organization wider social, political, and economic environment. Nevertheless, Burns and Scapens (2000, p. 22) stress that:

> Such broader dimensions form part of cumulative institutional context in which the intra-organisational process of change operate. To understand the latter it is necessary to recognise the institutional context, both within the organisation (i.e. organisation specific milieu of rules, routines and institutions) and outside (i.e. the broader social, economic and political institutions of the organisational field and also the society in which the organisation is located.

The proposed framework (see Fig. 1) extends Granlund and Lukka (1998) and Hussain and Hoque (2002) frameworks by taking into consideration the role of management accounting, such as the PMS, as a rationalized myth and/or its possible hidden political role. Accordingly, it provides an account of various forces that lie behind the adoption of new management accounting practices and to the expected role of these practices. Fig. 1 presents the proposed institutional framework. The framework relies on notions drawn from the institutional theory. These notions are isomorphic mechanisms, social legitimacy, and institutionalization.

Isomorphism

The *isomorphic mechanisms* are the central macro forces or mechanisms explaining why organizations, over time, have a tendency to move from diversity to similarity (see also Scott, 1987, 1995). DiMaggio and Powell (1983, p. 149) define isomorphism as:

> ... a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions.

DiMaggio and Powell (1983) distinguish between *competitive* and *institutional* types of isomorphic mechanisms, and within the latter category, between *coercive*, *mimetic*, and *normative* isomorphism. The *competitive* isomorphism underscores efficiency as a major cause to adopt a new procedure like PMS, specially, when that procedure is the best, cheapest, or most efficient way for doing things. In other words, this isomorphic force

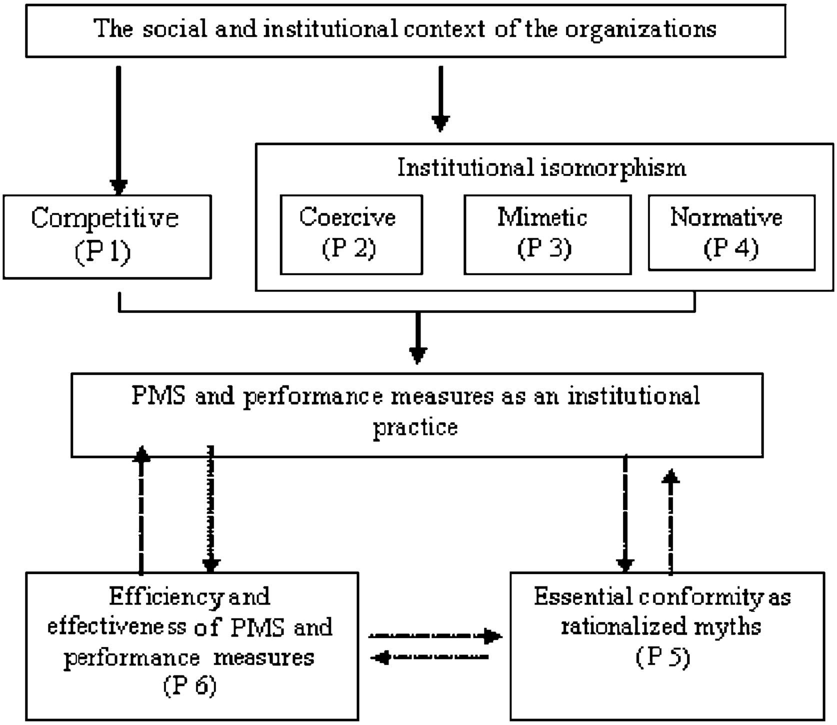

Fig. 1. An Institutional Theory Framework – PMS and Performance Measures as an Institutional and Rationalized Practice.

accepts the economic rationality as a motive that encourages organizations to adopt that one best or cost efficient procedure (Carruthers, 1995; Greenwood & Hinings, 1996; Granlund & Lukka, 1998). Based on that isomorphic force, the framework proposes the following proposition.

P1. Organizations adopt a certain PMS and/or certain measures because of the expected benefits in terms of enhancing organizations' efficiency and effectiveness.

However, efficiency is not the only motive behind the adoption of a certain PMS because of the existence of other forces that DiMaggio and Powell (1983) call institutional isomorphic mechanisms. These *institutional* isomorphic mechanisms are characterized by elaboration of rules, practices, symbols, and beliefs to which individual organization must conform to gain *social legitimacy*. These institutional forces may stem from regulatory agencies, from professional or trade unions, and from generalized belief systems (Meyer & Rowan, 1977). They are elaborated into coercive, mimetic, and normative isomorphic.

Coercive Isomorphism

This isomorphic mechanism results from pressures exerted on organizations by other organizations (DiMaggio & Powell, 1983). Coercive isomorphism is illustrated by the influence on the organizations' activities through the enactment of legislations. Based on that isomorphic force, the framework proposes the following proposition.

P2. Organizations adopt a certain PMS and/or certain measures because of internal and/or external regulatory framework such as executive regulations, bylaws, and laws.

Mimetic Isomorphism

This isomorphic mechanism is driven by an anthropological desire not to be too far away from what is deemed to be "normal", particularly where there is great uncertainty about what is the correct way to behave (Scott, 1995). It is the mechanism of imitation, or "mimetic processes" as defined by DiMaggio and Powell (1983), in which organizations tend to model themselves after similar organizations in their field that they perceive to be more "successful". Uncertainty is the driving force behind mimetic isomorphism. In situations where organizations are not sure what to do, they usually look to a successful reference group and imitate what they do in the same situations. Based on that isomorphic force, the framework proposes the following proposition.

P3. Due to uncertainty and ambiguity that exist in organizations environment, organizations adopt a certain PMS and performance measures imitating other successful organizations that use a multi-dimensional PMS.

Normative Isomorphism

Organizational members, who are at the same time members in professional groups, are subject to pressure to conform to a set of rules and norms developed by their professional groups. These norms and rules come about as a result of professional associations' education, training programs, and "rule of conduct". This normative isomorphic exerts institutional pressure to normalize social practices (like accounting) among different organizations working in the same context. For example, the professions influence on the education of potential entrants, who, eventually become organizational members. Based on that isomorphic force, the framework proposes the following proposition.

> **P4.** Organizations may adopt certain performance measures because of professional norms upon which organizational members drew to achieve their organizations' targets.

Social Legitimacy and Rationalized Myth

One of the underlying themes of the institutional theory is the question of social legitimacy and/or survival. Meyer and Rowan (1977) and DiMaggio and Powell (1983) argue that organizations respond to macro institutional mechanisms (P2, P3, and P4) through adopting some practices (like a multidimensional PMS and its measures) that are socially accepted as being appropriate, even thought those practices might be inefficient. They add that the adoption of new practices is not justified based on cost–benefit relationship or what DiMaggio and Powell (1983) call "efficiency" (P1) but the desire for social legitimacy, whereby organizations are recognized by society as good, valuable, and worthwhile, is the key.

Recent accounting studies that examine accounting as a symbol of social legitimacy argue that accounting systems are developed under the influence of societal expectations of *economic rationality* and *myth* whereby accounting systems serve the social legitimacy of the organization as being a "modern" organization. They also add these systems are rarely acted upon in decision-making processes because they do not enhance organization efficiency (e.g. Abernethy & Chua, 1996; Carpenter & Feroz, 1992, 2001; Etherington & Richardson, 1994; Lapsley 1994; Pettersen, 1995; Brignall & Modell, 2000; Lapsley & Pallot, 2000; Modell, 2001; Hassan, 2005). Meyers (1983, p. 235) argues that:

> ... Accounting structures are myths ... (which) describe organization as bounded and unified, as rational in technology, as well-controlled and as attaining clear purpose. The myths are important: they help to hold the organization together with their justification ... they legitimate the organization with the controlling external environment.

Likewise, although several scholars discuss the benefits of adopting certain management accounting and control systems (Evans III, 1998; Comerford & Aberbethy, 1999), others doubt whether these systems are adequately improving the organization's efficiency and effectiveness (Lapsley, 1994;

Pettersen, 1995; Lapsley & Pallot, 2000). In the same vein, there are some calls that urge to develop a better PMS and to integrate non-financial measures together with financial ones (see Second section), others doubt whether the PMS and the incorporation of various measures are adequately improving the competitiveness, the efficiency, and the effectiveness of organizations (e.g. Mooraj, et al., 1999; Vaivio, 1999; Brignall & Modell, 2000; Modell, 2001). In order to capture the complexity of these two conflict results, DiMaggio and Powell's (1983) notion of isomorphism and Meyer and Rowan's (1977) notion of rationalized myths can be utilized to explore the multiple inter-linkages between an organization's performance measures and the wider social and institutional forces that surround the organization (Burns & Vaivio, 2001).

On the one hand, DiMaggio and Powell (1983) describe the social legitimacy as an end result of institutional isomorphic mechanisms. They argue that those mechanisms are rules (like PMS) that organizations incorporate in order to gain social legitimacy and thus survive. On the other hand, Meyer and Rowan (1977) argues that the incorporation of those institutional rules is a sign of wise action or, as they describe 'sagacious conformity', in which organizations reflect the institutional mechanisms' pressures in its procedures (like accounting) but not necessarily use those procedures in decision-making processes (see Oliver, 1991; Abernethy & Chua, 1996). Meyer and Rowan (1977) refer to the contrast between the apparent adoption of certain procedures (like accounting) and their actual use as "*mythical use*" (see Carruthers, 1995; Hassan, 2005). They argue that sometimes organizations comply with institutional mechanisms to convey the *myth*, or the *imagery*, of efficiency, rationality, and being 'modern' (e.g. Lapsley, 1994; Hassan, 2003, 2005).

According to the proposed framework (Fig. 1), the consequence of the competitive and institutional pressures, namely, competitive (P1), coercive (P2), mimetic (P3), and normative (P4) is the creation of environmental rules that are adopted by organizations to obtain social legitimacy. Organizations internalize these rules into their lives through various practices such the PMS and performance measures. However, organizations can use the PMS as a rationalized myth that evolves from the previously mentioned competitive and isomorphic pressures (see Fig. 1). The PMS and performance measures are techniques that supply financial as well as non-financial information helping in decision-making processes. The multidimensional PMS is understood as a 'better' technique in providing information that helps in evaluating organizations' efficiency and effectiveness. If that system fails to fulfill its technical functions in terms of enhancing organizations' efficiency, it still serves the social legitimacy function in which organizations can claim they use the state-of-the-art management accounting technique in compliance with other organizations working in the same field. This coincides with what Pollitt (2001) calls 'playing it safe' in which if the new systems are not used in decision-making process because those systems are inefficient, they still define the adopting organization as a modern and a successful one. Based on social legitimacy and rationalized myth notions, the framework proposes the following proposition.

> **P5.** If a PMS and/or certain measures have been adopted without proven benefits and mainly because the belief that the system is a rational and appropriate technique, then they are rationalized myths that serve organizations social legitimacy (see Fig. 1), but not to be used in decision-making process within the adopting organizations.

Institutionalization

Another underlying theme of the institutional theory is the *institutionalization* processes whereby organizations change and incorporate new procedures (like the PMS) as a consequence of seeking social legitimacy and isomorphism (Barley & Tolbert, 1997). In their attempt to change, organizations *institutionalize* or infuse new rules or procedures such as the PMS. '*To institutionalize is to infuse beyond the technical requirement of the task on hand*' (Scott, 1995) and the PMS and its measures are no exception. Although the PMS is a technique that helps in decision-making processes, it also helps in building a new reality, or as Meyer and Rowan (1977) call *myth* or *imagery*, for organizations. Several studies investigated management accounting change and institutionalization processes at micro organizational level. They aimed at understanding how organizations templates, or "institutions", such as coalitions, competing values along with power and informal accountability systems influence the process of adopting new accounting systems (Scapens, 1994; Hoque & Alam, 1999; Burns, 2000; Burns & Scapens, 2000; Hassan, 2005). Their underlying theme is that organizations interact with their wider social and institutional environment (P1–P4) whereby they adopt new accounting systems as tools supporting decision-making or as myth for seeking *social legitimacy*.

The proposed framework extends their explanations of *either* the *mythical adoption or* the actual use of the new accounting systems. The framework proposes that there is a possibility that the new systems are *myths* but effectively used to attain other social and, probably hidden political, objectives. In this regard, Carruthers (1995) argues that the adoption of particular procedures (like a PMS) for mythical purpose counts, mainly, on the cultural and political motives rather than on economic efficiency motives. He also adds that both types of motives are interchangeable as cultural and political ones get hidden under the promoted economic benefits of adopting a particular procedure such as the PMS. It is the case that cultural and political motives are implicitly promoted rather than explicitly introduced and thus being resisted (see Chua & Degeling, 1993; Covaleski, Dirsmith, & Michelman, 1993; Covaleski, Dirsmith, & Samuel, 1996; Mouristen, 1994).

P6. If the PMS and/or certain measures are adopted as rationalized myths and without proven benefits, this does not mean that the system and its measures have no use. It is the case that in the name of improving efficiency and effectiveness, the PMS and/or measures are adopted in an attempt to play a political hidden role within the organization.

CONCLUSION

In light of results obtained from the current surveys (see Part II), the adoption of certain measures may count on one, or more, of the driving isomorphic pressures that are mentioned in the proposed framework (see Fig. 1). Therefore, further investigations are required aiming at exploring the reasons behind the adoption of certain performance measures. These investigations go beyond the PMS and performance measures technical role and should aim at finding how they play other role(s) within organizations.

The proposed framework suggests the following research agenda, first, interpreting the surveys' results in light of the social and institutional contexts. For example, results show that certain measures are being adopted by different countries (the four countries incorporated) then there is a need to find out the underlying social and institutional forces behind the use of such measures in each county. Second, the proposed framework also spots light on the way in which PMSs are shaped by organizational social and institutional context. For example, if surveys' results highlight a certain type of a multidimensional PMS is in use, then deeper investigations are required to understand *how/why* such a multidimensional system is/has evolved.

Inevitably, in order to understand how/why a multidimensional PMS and/or certain measures are evolved, there is a need to understand the role(s) of that system and its measures. To this, further micro organizational case studies are required whereby scholars find out whether the system is a rationalized myth or otherwise. If the system is proven to be a myth, then further investigation is required aiming at exploring such a myth. The statistical results reported in Part II can be considered in light of competitive pressure (P1) to adopt certain performance measures, however, the remaining propositions offer another research focus that requires more in depth investigations.

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CHAPTER 14

SUMMARY AND CONCLUSIONS

Ahmed Abdel-Maksoud

RESEARCH SUMMARY

Performance measurement is said to be a key part of any organisational infrastructure and an integral part of all management processes. Commentators advocate that performance, in its traditional role of control feedback, needs to be assessed in determining the adequacy of the strategies for achieving organisational objectives, revising and communicating strategies, and developing tactical objectives. It is recommended that performance measurement process begins with strategy establishment, determining how these strategic objectives would be related to the products and services that customers need. The author proposed a multi-level illustration of the role of performance measurement in achieving organisational strategies and objectives (see Chapter 2). The proposed illustration suggests that a separation among different management levels (top management, middle management, and shop-floor level) needs to be precisely drawn when considering the role of performance measurement in organisations. An organisation's strategies and objectives will be achieved through every management level in the organisation (from the top management level down to the shop-floor level). Everyone in the organisation should understand the organisation's strategy, be motivated to help to achieve it, align his/her day-to-day activities to accomplish strategic objectives, and to find new and innovative opportunities for contributing to organisational objectives.

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Performance evaluation differs across the three different management levels. Performance measurement of each management level comprises financial and non-financial performance measures. It is argued that senior managers are well trained and adapted with financial measures and that the use of financial measures at middle and top management levels is linked to compensation. Shop-floor staffs are the ones who will be implementing the strategy and that non-financial performance measures are preferred to financial measures in evaluating performance at shop-floor level.

Leading manufacturers in Europe, Japan, and USA have been found to focus on certain broad categories of performance measures. These categories formed the framework that guided this research study and, given the importance of the role played by shop-floor, operational performance is central to this research study. The focus of this book is confined only to the shop-floor non-financial performance measures (SFNFPMs) in each of the following five evaluation categories: on-time delivery, product quality, customer satisfaction, employee morale, and efficiency and utilisation.

Effective implementation of advanced manufacturing technologies (AMTs) and innovative managerial practices (IMPs) requires major changes in organisational infrastructure. Commentators recommend that the nature of manufacturing performance measures appropriate for different elements of AMTs/IMPs is a useful area for further research. It has been suggested that elements such as the nature of competition and the extent of AMTs/IMPs are important in understanding the type of performance measures best suited to the development of AMTs/IMPs within organisations. Literature shows that there are different contingent managerial, technological, organisational, and environmental factors that influence manufacturers' performance measurement. Further, literature concludes that there are associations between the levels of application of IMPs/AMTs and the use of non-financial performance measures in organisations. However, the effect of IMPs/AMTs on performance measures at shop-floor level has not yet been examined in depth. Literature, also, advocates the role management accounting techniques have in providing information to develop performance measures, also evidence permeates the literature on positive associations between perceived environmental uncertainty and the demand for broad-based performance measurement systems (PMSs) incorporating non-financial indicators.

In this research the following contingent aspects are incorporated:

1. IMPs and AMTs.
2. Contemporary management accounting practices (CMAPs).
3. The competitive environment a company operates in.

A contingency-based approach was adopted in this research study as a pragmatic device to explore this specialist field with a view to a theoretical development. However, this study differs from the formal contingency-based studies in that some of its 'contingent variables', e.g., management accounting practices or IMPs, would normally be outcomes rather than inputs.

This study aimed to investigate the existence and levels of importance of SFNFPMs, which are grouped in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the levels of deployment (or extent of importance) of a number of contingent variables. It also aimed to test for associations between the existence and levels of importance of SFNFPMs of the five evaluation categories and the levels of deployment/extent of importance of the specified contingent variables (levels of application of IMPs, levels of application of AMTs, levels of deployment of CMAPs, and extent of importance of the competitive environment a company operates in). These aims were achieved based on empirical cross-countries comparative study on manufacturing firms conducted in four countries: the UK, Italy, Japan, and Canada.

Two main questions were addressed in this research. First, whether the use and importance of SFNFPMs in manufacturing firms in the four countries (UK, Italy, Japan, and Canada) are associated with the levels of deployment/extent of importance of the above contingent factors. Second, whether there could be cause-and-effect relationships among five specified evaluation categories of SFNFPMs.

To address these research questions, the objectives of this across-countries comparative study can be summarised as follows:

First: Investigating *the existence and levels of importance of SFNFPMs, which are grouped* in five evaluation categories (product quality, customer satisfaction, on-time delivery, employee morale, and efficiency and utilisation), and the levels of deployment (or extent of importance) of the following *managerial, technological, organisational, and environmental variables*:

1) Levels of application of IMPs.
2) Levels of application of AMTs.
3) Levels of deployment of CMAPs.
4) Extent of importance of aspects of competition.

Second: Testing for associations between *the existence and levels of importance of SFNFPMs* of the five evaluation categories and the level of deployment/extent of importance of the specified contingent variables.

Third: Developing a theoretical-based SFNFPMs scorecards that examine the cause-and-effect relationships among the five performance evaluation categories in use in manufacturing firms in the four countries studied.

Achieving the three objectives of this research study should assist in a better understanding of non-financial performance measures at shop-floor in manufacturing firms in the four countries studied. It will enhance organisations' knowledge about the use of non-financial measures in PMSs. The investment of time, effort, and economic resources in developing better performance measurement tools, and training managers to use them, could contribute to a more effective management of manufacturing firms.

A largely positivistic paradigm was adopted as the nature of the research problem required a large-scale survey. Questionnaires were sent to managers of the sampled manufacturing firms in the four countries under study. The inclusion of manufacturing firms from different countries was purposive as to broaden the study across the boarders of a specific country. The purpose was to cover manufacturing firms belonging to industrial countries in various continents. However, the specific choice of the four industrial countries incorporated was largely based on availability of funding and access to data.

Table 1 summarises the background of each empirical study conducted in the UK, Italy, Japan, and Canada. In each country questionnaires were sent to the management accountant, financial controller, or manager of each sampled firm. In each country medium and large manufacturing firms (the minimum number of employees is 150) were included in the sample frame. A number of conclusions can be drawn from the interpretation of the survey responses. These are briefly presented in the next section.

Table 1. Background of the Empirical Studies in the Four Countries Studied.

	UK	Italy	Japan	Canada
Sample frame	2,242 FAME (UK database) listed manufacturing firms belonging to various industry sectors	1,565 CREVDA (Italian database) listed manufacturing firms belonging to various industry sectors	1,155 Tokyo Stock Exchange listed manufacturing firms belonging to various industry sectors	541 Canadian Business Directory listed manufacturing firms belonging various industry sectors
Responses	313	142	123	43
Response rate	14%	9%	11%	8%
Date of data collection	March 2001	May 2003	May 2003	January 2004

LEVELS OF IMPORTANCE OF SFNFPMs AND APPLICATION OF THE CONTINGENT VARIABLES IN THE FOUR COUNTRIES (RESEARCH OBJECTIVE 1)

This section reflects on the first objective of the study where perceived importance and extent of the use of SFNFPMs and levels of application of IMPs, AMTs, CMAPs, and level of importance of competition in the surveyed manufacturing firms in the four countries are highlighted.

UK Survey Results

The following conclusions are based on 313 responses from the UK manufacturing firms:

- SFNFPMs are extensively employed in the surveyed UK manufacturing firms with most of the measures listed are used by more than 80 percent of the responding firms and where measures are used, they are generally considered to be important. The top three measures (out of the 19 SFNFPMs) are customer related, while the next four are related to process efficiency where measures of efficiency, defect and scrap levels, and absenteeism in most firms are evaluated as being important.
- Among the AMTs applied in the surveyed firms, computer aided design (CAD) has the highest level of application followed by the application of computer aided manufacturing (CAM), and computer numerical control (CNC). There is a similar pattern in responses for the level of application of CAM and CNC. The levels of application of the other AMTs incorporated in the study are low, in addition findings show that automated guided vehicles systems (AGVS) are not a common AMT in the surveyed firms.
- Material requirements/manufacturing resource planning (MRPI/II) have the highest level of application, among the other IMPs incorporated in the study, in the surveyed firms, followed by the application of total quality management (TQM), just-in-time (JIT) and total preventive maintenance (TPM) respectively and there is a discernible tendency, in firms that apply them, toward a moderate level of application. Optimised production technology (OPT) was found to be an uncommon practice in the surveyed firms. Findings also show that enterprise requirement planning (ERP) is partially applied (i.e., low mean). Findings reported in this study are consistent with the findings of previous research in UK firms during the last decade.

- Among the CMAPs incorporated in the study, benchmarking of performance (BP), customer profitability analysis (CPA), and strategic management accounting (SMA) respectively are widely applied in the surveyed firms. Activity-based techniques (ABT) and Balanced Scorecard (BSC), seem to have low deployment rate in the surveyed firms where more than half of respondents do not apply them. In addition, management accounting practices such as throughput accounting (TA) and economic value added (EVA) are found to be uncommon in the surveyed firms. These findings seem consistent with findings from other surveys in UK.
- Customer service is found to be the most important characteristic in competition, as perceived by managers in the surveyed firms, followed by quality and price respectively. However, respondents do perceive all other characteristics of competition as important.

Italian Survey Results

The following conclusions are based on 142 responses from Italian manufacturing firms:

- Italian manufacturing firms are found to be resource focused (keen on more efficient use of their resources). The majority of the surveyed firms is keen on measures of efficiency, scrap, percent on-time delivery to customers and defects and perceives these measures to be very important. These are measures of efficiency and utilisation, product quality, on-time delivery, and customer satisfaction respectively.
- There is a low attention to measures related to the employee morale. A possible explanation for this result could be derived from the industrial relationship model actually operating in Italy, which has been historically based on a conflict relationship between property and labourers and which is changing only in these last years. In particular, employee non-financial performance measures may be used as instrument in the conflict relationships between organisations and unions.
- MRPI/II, ERP, and TQM are employed in Italian manufacturing firms more extensively than the other IMPs.
- There is a low application rate of ABTs and BSC in Italian manufacturing firms. In addition, Italian firms that apply ABT and BSC, tend to apply them at a 'partial' not a 'systematic' level. In addition, results show that Italian manufacturers take quality and price very seriously in competition.
- Results reported in this study are consistent with previous surveys that state the increasing awareness among Italian managers of the importance of

developing their firms' management accounting systems because of their recognition of the vital importance of efficiency to face international competition and of the increasing turbulence of the competitive environment.
- The results could be partially interpreted in light of understanding the effects of ownership and governance systems of Italian firms (managers' attitude and organisational structure) and, more importantly, the persistent turbulences in the Italian economy in the last decades which led to focusing Italian managers' attention on developing management techniques and practices in their firms.

Japanese Survey Results

The following conclusions are based on 123 responses from Tokyo Stock Exchange-listed from Japanese manufacturing firms:

- Japanese manufacturing firms are customer focused and they are also keen on quality and delivery. Reported results on the use and levels of importance of 'employee morale' are striking. Results show that respondents tend to rank low the importance of non-financial performance measures of 'employee morale'. It could be that respondents view the Japanese very dependencies lean-working management style as imposing constraints on autonomy and intensifying Taylorist-based control.
- Techniques such as CAD, TQM, TPM, MRP I/II, and JIT are found to be widely applied in the surveyed Japanese firms. This is consistent with results of other Japanese studies showing wide deployment of such techniques in Japanese firms.
- Findings also show that BP and SMA, among the other CMAPs, are found to be partially/systematically applied by over 60 percent of respondents. The deployment of ABTs and BSC seems, in line with findings reported in Japanese literature, to be uncommon in the surveyed Japanese firms. Furthermore, it is evident that Japanese managers perceive the six aspects of competition incorporated in the study as very important, with an emphasis on price and quality.

Canadian Survey Results

The following conclusions are based on 43 responses from Canadian manufacturing firms:

- Companies consider the most important measures to be 'percentage of on-time delivery' and the 'number of complaints', followed by 'manufacturing cycle efficiency' and 'activity' measures. The first two measures reflect customer satisfaction directly. Canadian companies may also use internal measures of efficient resource utilisation as means to further enhance customer satisfaction more indirectly. However, they place considerably less level of importance on measures of employee efficiency and satisfaction, although more satisfied employees can be more productive and significantly contribute to better customer service and satisfaction. This pattern is demonstrated by 'absenteeism', 'lateness', and 'turnover' being considered among the least important measures.

- CAD is the most widely applied ATM in Canadian manufacturing companies, followed by CNC and CAM. As to IMPs, MRP I/II is employed in Canadian manufacturing companies more extensively than other IMPs, followed by ERP and JIT. These findings are consistent with earlier Canadian studies.
- SMA and BP are used in 80 percent of Canadian manufacturing companies. Over 50 percent of the companies also use ABTs. Both SMA and BP are relatively new techniques, which may be currently in various stages of implementation both in European and North American companies. On the other hand, a significant number of Canadian manufacturing companies may have by-passed, or replaced, ABTs and implemented more strategically focused CMAPs, such as SMA and BP.
- Although the reported findings of this study are consistent in principle with some findings of available Canadian studies, only very few comparable academic research studies have been conducted in the Canadian context. Therefore, findings of this study provide significant new insight into the use and importance of SFNFPMs in Canadian manufacturing companies, and can form a foundation for further academic research aimed at improving the effectiveness of their PMSs and organisational performance.

Cross-Countries Comparisons

The cross-countries comparisons reveal the following:

- 'Percentage on-time delivery to customers' is considered the most important non-financial measure in use, followed by 'number of complaints from customers' measure, in the surveyed manufacturing firms across the four countries. These two measures are customers related and one can conclude that companies in the four countries pay particular attention to customers and shop-floor workers should be committed to customers' requirements.

- Measures of employee morale, such as 'absenteeism', 'lateness', and 'turnover', are considered among the least important measures, with means lower than 5. It is also noticeable that the 'batches' (in the product quality group) is the least important measure in both the UK and Japanese companies and the measure is not considered important in Italian and Canadian companies.
- CAD is found to be the most popular application of AMTs across the four counties surveyed. It is also noticeable that AMTs are widely implemented in Japanese firms. More Japanese firms apply different types of AMTs compared to the other three countries.
- With regard to the application levels of IMPs, results reveal that Japanese firms show the highest levels of application in each IMPs. TQM ranked first in terms of application in the UK, Japan, and Canada (87 percent, 99 percent, and 84 percent respectively) and ranked second in Italian survey (84 percent). The comparison also shows that the least applicable IMP in the four countries is OPT.
- Across countries comparisons reveal that BP is widely applied in the four countries. It is ranked either the highest or second highest practice in terms of its application (either partially or systematically) in the four countries. The comparisons also show that CPA is the highest or second highest practice in terms of its application (either partially or systematically) in three countries – UK, Italy, and Japan – while it comes third in the Canadian survey but with 60 percent of the respondents applying it either partially or systematically. On the other hand, BSC practice seems to be one of the least applied within respondents' firms. It is the least applied practice in Canadian firms and the second least in the other three countries.
- With regard to competitive environment aspects, 'quality' is perceived as important by virtue all respondents in the UK, Japan, and Canada while it is considered as important by 94 percent of respondents in Italy. 'Customer service' and 'delivery' are considered as important by more than 90 percent in the four countries. On the other hand, 'innovation' can be ranked as the least important aspect of competition in the UK, Italy, and Japan while 'flexibility' is the least important aspect of competition in Canada.

TESTING FOR ASSOCIATIONS BETWEEN THE USE OF SFNFPMs AND THE CONTINGENT VARIABLES (RESEARCH OBJECTIVE 2)

The second objective of this cross-countries comparative study was to examine whether the use of SFNFPMs is associated with the incorporated contingent variables. The objective was to statistically test the following 20 hypotheses:

Product Quality (Y_1)

H_1. There is no association between the level of application of IMPs (X_1) and the existence and importance of *composite SFNFPMs of product quality* (Y_1) in manufacturing firms.

H_2. There is no association between the level of application of AMTs (X_2) and the existence and importance of *composite SFNFPMs of product quality* (Y_1) in manufacturing firms.

H_3. There is no association between the level of application of CMAPs (X_3) and the existence and importance of *composite SFNFPMs of product quality* (Y_1) in manufacturing firms.

H_4. There is no association between the extent of importance of Aspects of Competitive Environment (X_4) and the existence and importance of *composite SFNFPMs of product quality* (Y_1) in manufacturing firms.

Customer Satisfaction (Y_2)

H_5. There is no association between the level of application of IMPs (X_1) and the existence and importance of *composite SFNFPMs of customer satisfaction* (Y_2) in manufacturing firms.

H_6. There is no association between the level of application of AMTs (X_2) and the existence and importance of *composite SFNFPMs of customer satisfaction* (Y_2) in manufacturing firms.

H_7. There is no association between the level of application of CMAPs (X_3) and the existence and importance of *composite SFNFPMs of customer satisfaction* (Y_2) in manufacturing firms.

H_8. There is no association between the extent of importance of Aspects of Competitive Environment (X_4) and the existence and importance of *composite SFNFPMs of customer satisfaction* (Y_2) in manufacturing firms.

On-time Delivery (Y_3)

H_9. There is no association between the level of application of IMPs (X_1) and the existence and importance of *composite SFNFPMs of on-time delivery* (Y_3) in manufacturing firms.

H_{10}. There is no association between the level of application of AMTs (X_2) and the existence and importance of *composite SFNFPMs of on-time delivery* (Y_3) in manufacturing firms.

H_{11}. There is no association between the level of application of CMAPs (X_3) and the existence and importance of *composite SFNFPMs of on-time delivery* (Y_3) in manufacturing firms.

H_{12}. There is no association between the extent of importance of Aspects of Competitive Environment (X_4) and the existence and importance of *composite SFNFPMs of on-time delivery* (Y_3) in manufacturing firms.

Employee Morale (Y_4)

H_{13}. There is no association between the level of application of IMPs (X_1) and the existence and importance of *composite SFNFPMs of employee morale* (Y_4) in manufacturing firms.

H_{14}. There is no association between the level of application of AMTs (X_2) and the existence and importance of *composite SFNFPMs of employee morale* (Y_4) in manufacturing firms.

H_{15}. There is no association between the level of application of CMAPs (X_3) and the existence and importance of *composite SFNFPMs of employee morale* (Y_4) in manufacturing firms.

H_{16}. There is no association between the extent of importance of Aspects of Competitive Environment (X_4) and the existence and importance of *composite SFNFPMs of employee morale* (Y_4) in manufacturing firms.

Efficiency and Utilisation (Y_5)

H_{17}. There is no association between the level of application of IMPs (X_1) and the existence and importance of *composite SFNFPMs of efficiency and utilisation* (Y_5) in manufacturing firms.

H_{18}. There is no association between the level of application of AMTs (X_2) and the existence and importance of *composite SFNFPMs of efficiency and utilisation* (Y_5) in manufacturing firms.

H_{19}. There is no association between the level of application of CMAPs (X_3) and the existence and importance of *composite SFNFPMs of efficiency and utilisation* (Y_5) in manufacturing firms.

H_{20}. There is no association between the extent of importance of Aspects of Competitive Environment (X_4) and the existence and importance of *composite SFNFPMs of efficiency and utilisation* (Y_5) in manufacturing firms.

To test for the above hypotheses, the non-parametric Kendall's τ statistic test was applied using SPSS (13). Table 2 summarises the results of each hypothesis based on the reported correlations.

Table 2 shows that the majority of the alternate hypotheses in this study are accepted (there are significant associations between levels of application/ extent of importance of the contingent variables and the use and levels of importance of SFNFPMs of the five evaluation categories) in the surveyed manufacturing firms in the four countries.

The use of SFNFPMs in the surveyed firms was further investigated. Two further questions on whether the use and level of importance of SFNFPMs of the five evaluation categories used in the surveyed manufacturing firms is

Table 2. Summary of Hypotheses Testing.

Hypotheses	Country			
	UK	Italy	Japan	Canada
H_1				
H_2				
H_3			Not significant	
H_4				
H_5				Not significant
H_6			Not significant	Not significant
H_7	Not significant		Not significant	Not significant
H_8				
H_9				
H_{10}				
H_{11}				
H_{12}				
H_{13}				
H_{14}	Not significant		Not significant	
H_{15}				
H_{16}				
H_{17}				
H_{18}		Not significant		
H_{19}				
H_{20}				

Notes: Not significant: The null hypothesis H_0 is accepted (there is no significant correlation). An empty cell: The null hypothesis H_0 is rejected in favour of accepting the alternate hypothesis H_1 (there is a significant correlation).

country-specific (i.e., there are significant differences in the use of SFNFPMs among the four countries studied) or/and industry-specific (i.e., manufacturing firms, belonging to a specific industry type, will tend to give the same level of importance to specific SFNFPMs across the four countries studied) were examined. One-way analysis of variance for three unrelated variables (One-way ANOVA) Post Hoc multiple comparison – Scheffe's test – was applied (using SPSS 13) to test for the former question and Kendall's τ statistic test was applied (using SPSS 13) to test for the latter.

Results revealed that there were significant differences in the use of SFNFPMs of the five evaluations categories among manufacturing firms across the four countries and such differences were country-specific. However, results show that respondents in manufacturing firms belonging to a specific industry, across the four countries, did not give the same level of importance to SFNFPMs in use in their firms. In other words, there were no consistent patterns of significant associations between industry type and the level of importance respondents gave to SFNFPMs in use in their firms (see Chapter 9).

THE DEVELOPMENT OF SFNFPMs SCORECARDS IN MANUFACTURING FIRMS IN THE FOUR COUNTRIES (RESEARCH OBJECTIVE 3)

It is argued that empirical studies of the interrelationships among different performance perspectives and their measures are in their infancy and that the assumption that there is a cause-and-effect relationship between areas of measurement is crucial because measurement of non-financial areas make the PMS a forward facing control system which mitigates the problem of the historical nature of accounting data. Accordingly the third objective of this cross-countries comparative study was to develop theoretical-based SFNFPMs scorecards that examine the cause-and-effect relationships among the five performance evaluation categories in use in manufacturing firms in the four countries.

A mathematical SFNFPMs model that tests the cause-and-effect relationships among the existence and importance of the five evaluation categories was developed. The existence and importance of measures of 'customer satisfaction', 'product quality', 'on-time delivery', 'efficiency and utilisation' appear to precede the existence and importance of measures of 'employee morale' (see Chapter 10). The SFNFPMs 'scorecard' is a logical and mathematically proven cause-and-effect model at shop-floor level. This explanatory model provides better understanding of the use of measures in the five evaluation categories. It could be used to help achieve internal harmony/integrity of the shop-floor measures applied and makes apparent any lack of coordination and completeness. It also could be useful in making the shop-floor PMS a 'forward facing' control system thereby mitigating the problem of the historical nature of accounting data.

The 'scorecard' developed in this book could assist in achieving internal harmony/integrity of the shop-floor measures applied. Furthermore, the model would, in many instances, make apparent any lack of coordination or completeness (e.g., firms might be measuring customer satisfaction to a disproportionate extent and omitting delivery timeliness). Finally the 'scorecard' has potential usefulness as a schema for communicating strategy (and the reason for performance measurement) to employees.

However, the applicability of the SFNFPMs 'scorecard' is constrained. The 'scorecard' provides a single causal path for five shop-floor non-financial evaluation categories – there could be others. Secondly, the 'scorecard' is not intended to be appropriate as one goes up toward higher organisational levels (SBU, firms level, etc.). Indeed, the indication that a single cause-and-effect model cannot apply up and down the whole organisation may be a significant contribution of this study. Another constraint on the applicability of the 'scorecard' is that the theoretical basis of the 'scorecard' is the assumption of a corporate objective of maximising the wealth of shareholders; an alternative perspective, e.g., a stakeholder view, might generate different patterns of logic.

FURTHER DEVELOPMENTS AND SUGGESTIONS FOR FUTURE RESEARCH

The book, also, incorporates a part on further developments and suggestions for future research studies in this field (see Chapters 11, 12, and 13). Three different areas are covered: first, the possible influence that managers' perception of the importance of aspects of competition could exert on their decisions to deploy CMAPs in manufacturing firms (Chapter 11). Second, an examination of the role of PMSs in the effective management of organisational change, particularly discontinuous change was included in Chapter 12. Third, the role of a PMS and performance measures in business organisations' social context has been explored in Chapter 13. Each of the above three areas sheds light, and invites further research studies, on diverse interpretational aspects of the book theme. A brief discussion of each area is presented next.

Possible Influence of Aspects of Competition on the Deployment of CMAPs in Manufacturing Firms

Chapter 11 purports to provide, drawing extensively on Porter's (1998) and others' work, an inductive framework which attempts to interpret, within the context of the caveats 'national competitive advantage' and 'culture', possible influence that managers' perception of the importance of aspects of competition could exert on their decisions to deploy CMAPs in UK, Italian, and Japanese manufacturing firms[1].

The survey results (Part III) show that there are significant differences in the adoption of different contemporary management accounting techniques in three countries: UK, Italy, and Japan. The findings further show that while there are significant correlations among the use of specific CMAPs and industry type as well as perception of competition in the three countries there are no consistent/systematic correlations across the three countries, i.e., the car manufacturers in Japan might adopt the same management accounting techniques but this does not extend to car manufacturers in UK and Italy. Results, however, point to significant differences in managers' perceptions of competition in the three countries.

In an attempt to understand the reported findings on managers' perceptions of competition in UK, Italy, and Japan, the cultural effect on managers' perceptions of competition seems to be viable. It is pointed out that consumers' characteristics as well as social values and economic structures do influence managers' perceptions of competition. This follows from the fact that domestic competitors tend to compete in the same segment of the market, i.e., Toyota and Nissan compete in the same segment of the market, and therefore competition between domestic competitors is much stronger than that with international competitors. The chapter showed that different management accounting practices would be more relevant to firms pursuing different strategies based on their perception of competition, e.g., benchmarking would be much more critical to a product-efficiency focused firm rather than a market-focused firm.

Chapter 11 draws a conclusion that national boundaries have far more influence on firms' perception of competition and the diffusion of advanced management accounting techniques than usually expected in that, the adoption of management accounting techniques by an electronics company in Italy would be more strongly influenced by Ferrari than Toshiba of Japan.

Examining the Role of PMSs in the Effective Management of Organisational Change, Particularly Discontinuous Change

Chapter 12 examines, based on the review of change management and performance management literatures, the role of PMSs in the effective management of organisational change, particularly discontinuous change. Founded on emergent process theory, an analytical framework depicting the cyclical nature of discontinuous change and appropriate performance measures for different stages of such change was developed. It emphasises the need for the continuous development of dynamic and responsive PMSs that reflect changes in an organisation's environment. From the managerial perspective, it can provide managers effective early warning signals of impending environmental changes. Due to high costs and risks associated with typical discontinuous change initiatives, proper monitoring, and measurement practices are particularly important for organisations undergoing discontinuous change in unstable, complex, and competitive business environments. Under such circumstances, the success of change initiatives, long-term organisational prosperity, and even organisational survival, can depend, to a large extent, on the managers' ability to correctly diagnose, analyse, and react to environmental forces. Effective PMSs are crucial in helping managers effectively manage these forces.

Chapter 12 concludes with six propositions for effective measurement of discontinuous change. These propositions are based on both performance measurement and change management literature, and they incorporate some traditional performance measurement principles developed for measuring short-term operational performance or incremental change to the measurement and management of long-term project performance or discontinuous change. As such they attempt to integrate the two types of performance measurement objectives. However, the cyclical process model and the performance measurement propositions developed in this chapter remain to be empirically tested in future research studies.

Exploring the Role of a Performance Measurement System (PMS) and Performance Measures in Business Organisations' Social Context

The quest of supporting organisations' strategic goals makes the role of PMS centres on supplying better information in order to bring 'better' decision-making. However, the role of the PMS is not only to supply information, but also plays an institutional role in which it legitimates the organisation activities and functions to the wider social, political, and institutional context wherein the PMS operates. With this regard, Chapter 13 aimed at exploring the role(s) of the PMS and performance measures in business organisations' social context. The chapter went beyond the PMS technical role and presents an institutional framework that can be used to understand the role such a system and its measures can play within an organisation. The chapter presented a complementary perspective that can be utilised in order to analyse the data incorporated in this book. It also highlighted other possible explanations and interpretations underlying the adoption of a multidimensional PMS in manufacturing firms.

In light of results obtained from the current cross-countries comparative study (Part III), the adoption of certain measures may count on one, or more, of the driving isomorphic pressures that are mentioned in the proposed framework. Therefore, further investigations are required aiming at exploring the reasons behind the adoption of certain performance measures. These investigations go beyond the PMS and performance measures technical role and should aim at finding how they play other roles within organisations.

The proposed framework suggests the following research agenda:

First, interpreting the surveys' results in light of the social and institutional contexts. For example, results show that certain measures are being adopted by different countries (the four countries under study) then there is a need to find out the underlying social and institutional forces behind the use of such measures in each county.

Second, the proposed framework sheds light on the way in which PMSs are shaped by organisational social and institutional context. For example, if surveys' results highlight a certain type of a multidimensional PMS in use, then deeper investigation is required to understand how/why such a multidimensional system is/has evolved. Inevitably, in order to understand how/why a multidimensional PMS and/or certain measures were evolved; there is a need to understand the roles of that system and its measures. To this, further micro organisational case studies are required whereby scholars find out whether the system is a rationalised myth or otherwise. If the system is proven to be a myth, then further investigation is required to explore such a myth. The statistical results reported in Part III of this book can be considered in light of competitive pressure to adopt certain performance measures, however, the remaining propositions offer another research focus that requires more in depth investigations.

RESEARCH LIMITATIONS

The results of this cross-countries comparative study are limited by typical constraints associated with the survey method, particularly with the variables and samples selection processes and the response rates. Furthermore, in interpreting the results, care should be taken in associating the use of performance measures with performance. The prudent use of sophisticated PMSs can improve performance by allowing the monitoring of key performance criteria and taking timely corrective actions. Contrarily, the ineffective use of performance measures can result in dysfunctional behaviours and sub-optimal decisions.

NOTE

1. The case of Canada was excluded from the analysis for two reasons. First, unlike the three countries identified it was felt that Canada being a migrant society was influenced by different national cultures. Second, Canada was not included in Porter's (1998) analysis and therefore the national competitive advantage was not very clear.

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