ENVIRONMENTAL MANAGEMENT ACCOUNTING – PURPOSE AND PROGRESS

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Environmental Management Accounting – Purpose and Progress

Edited by

Martin Bennett
University of Gloucestershire Business School,
Cheltenham, U.K.

Pall M. Rikhardsson
The Aarhus School of Business,
Aarhus, Denmark

and

Stefan Schaltegger
Centre for Sustainability Management (CSM),
University of Lüneburg, Germany

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Preface

This is the second volume in the EMAN-Europe[1] series of selected refereed papers on environmental management accounting drawn primarily from papers presented at EMAN-Europe's annual conferences[2]. Most of the papers in this volume were first presented at the 5^{th} EMAN-Europe Annual Conference at the University of Gloucestershire, United Kingdom, on 11-12 February 2002.

As several of the papers show, environmental management accounting (EMA) has continued to become increasingly established in both private-sector companies and in the public sector. As a network of researchers, business people, consultants and policy advisers interested in environmental management accounting as a tool of corporate environmental management, EMAN has continued to play an important role in this development by providing a medium through which those interested can contact others with similar interests, and by organising regular events for the dissemination and exchange of news and ideas. EMAN aims to provide a forum in which academics and practitioners can meet to exchange and share ideas and experiences, and this has guided the selection of these papers which include both academic papers, grounded in the relevant literature and with reference to theory as appropriate, and practitioners' reports on their own experiences in their workplaces.

EMA is based on two twin premises. The first is that as environmental issues become increasingly important, then good environmental manage-

[1]Environmental Management Accounting Network - Europe

[2]The first book in this series, including papers selected from those presented at the previous two EMAN-Europe conferences, is:
Bennett, M., Bouma, J.J., Wolters, T. (eds.) (2002). *Environmental Management Accounting: Informational and Institutional Developments,* Dordrecht, Netherlands: Kluwer Academic Publishers. ISBN 1-4020-0552-0 (hardbound) and 1-4020-0553-9 (paperback)

ment by business and other organisations will correspondingly also become increasingly important. The second is that accounting and financial management techniques can help to support this, to the mutual benefit of both the organisation's environmental management function and its accounting and finance function. EMA is understood here as environmental accounting which is specifically addressed to supporting the information needs of the organisation's own management.

Evidence of increasing interest in EMA can be seen not only in the several examples and case studies which are reported in this volume, but also in programmes undertaken in order to promote EMA such as that by the United Nations Division for Sustainable Development, whose Experts Working Group on EMA has published three workbooks on EMA metrics and policy as well as on Sustainable Finance and has initiated various adoption projects in Europe, Asia and the Americas. It is also evidenced globally by the continuing success of EMAN-Asia Pacific[3], which has now held two very successful annual conferences, in September 2001 in Kobe, Japan[4], and in September 2002 in Seoul, Korea; and by the developing plans to set up an EMAN-Americas section which are being coordinated by the recently-established Environmental Management Accounting Research and Information Centre (EMARIC)[5]. Interest has also been expressed by some EMA researchers in Africa in the possibility of setting up a further EMAN section there[6].

Continuing and increasing interest in Europe is evidenced by the support for the 2002 EMAN-Europe Conference, which was attended for the first time by over 100 presenters and participants. We would like to thank the various organisations whose generous financial support has helped to ensure its success:

- the European Commission, Research DG, who have supported the conference as a High-Level Scientific Conference under the EC's Human Potential Programme[7],

[3]http://www.eman-ap.net
[4]Proceedings of the first EMAN-Asia/Pacific conference at Kobe, Japan, 27 September 2001, have been published by the Institute for Global Environmental Strategies (IGES) Kansai Research Centre, Kobe, Japan and are available from Professor Kokubu of Kobe University and IGES at kokubu@iges.or.jp
[5]http://www.emawebsite.org/
[6]Please contact Martin Bennett at mbennett@glos.ac.uk for further details
[7]Contract No. HPCF-CT-1999-00102

- the Association of Chartered Certified Accountants, UK
- the Environment Agency in England and Wales
- the University of Gloucestershire

In particular, the editors of this volume and the Steering Committee of EMAN-Europe would like to thank all those participants who, by joining EMAN and presenting to our Conferences, have been part of the continuing development of the subject.

We would also like to take this opportunity to invite anyone interested to join the EMAN network. Further information can be obtained from the Chairperson Martin Bennett (mbennett@glos.ac.uk), or directly from the EMAN-Europe website (http://www.eman-eu.net).

The editors:
Martin Bennett
Pall Rikhardsson
Stefan Schaltegger

1. Adopting Environmental Management Accounting: EMA as a Value-adding Activity

Martin Bennett

University of Gloucestershire, UK

mbennett@glos.ac.uk

Pall Rikhardsson

Århus School of Business, Denmark

par@asb.dk

Stefan Schaltegger

Centre for Sustainability Management (CSM), University of Lüneburg, Germany

schaltegger@uni-lueneburg.de

1.1 The Value Added by Environmental Management Accounting

Environmental management accounting (EMA) can be defined as "the generation, analysis and use of financial and non-financial information in order to optimise corporate environmental and economic performance and to achieve sustainable business" (Bennett *et al.* 2002: 1). EMA thus both includes monetary and physical accounting which is internal to an organisation and also deals with the integration of ecological and monetary issues (Burritt *et al.* 2002), and as such is a management activity that is relevant for both private-sector and public-sector organisations.

Since all organisations face various resource and capacity constraints, all activities which they perform have to be justified by clearly adding value. Most organisations of any significant size have a management accounting function, management accountants and management accounting tools. Developers of EMA tools therefore have to answer the following crucial questions:

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 1-14.

- What value does EMA create for the organisation, and how?
- Why does it make sense to distinguish between mainstream management accounting and EMA?
- Which EMA tools can support management in a given situation in increasing organisational value?

Some forms of resource constraints bind most organisations, both private-sector and public-sector. Private-sector organisations such as profit-seeking companies sell their products and services on markets in competition with other companies which are simultaneously offering similar value propositions to customers. Companies therefore cannot sell an unlimited amount of their products or services, much as they might wish to. However, they must generate profits in the long-run in order to survive given their competitive situation and restrictions imposed by their access to human and material production capacity. This applies to all businesses, from the smallest mom 'n pop operation to global companies like Shell and CNN.

Public-sector organisations on the other hand are restricted by budget constraints if they are publicly funded, or by market and public household conditions if they are selling a public service. An additional variable for these organisations is the political aims and climate that often influence their existence and operating conditions, an example of which is the liberalisation of the energy market in Europe and the impacts that this is expected to have on different energy companies. In order to survive and to achieve their aims, both private-sector companies and public-sector organisations have to develop and apply EMA in the light of their constituencies, their shareholders or the general public.

This task of managing resources means that managers in both the public sector and the private sector have to make decisions regarding the utilisation, allocation, co-ordination, acquisitions and divestments of resources at all levels of the organisation. This decision-making process itself generally revolves around both planning for the future (i.e. planning and budgeting) and following up on past decisions and plans (i.e. control). Senior managers are required to make strategic decisions such as on the acquisition of increased production capacity in the form of new sites, or mergers with other similar organisations. Managers at operational levels make tactical and operational decisions such as how best to utilise and co-ordinate the use of material and human resources in functions such as production, marketing and distribution.

This is at the core of conventional management accounting. In order to make decisions such as these, managers need information, and conventional management accounting supplies this information to a large extent, through recording, processing and reporting physical and monetary data. Atkinson *et al.* (2002: p. 5) define management accounting as:

> " . . . a value-adding continuous improvement process of planning, designing, measuring and operating non-financial and financial information systems that guides management action, motivates behaviour, and supports and creates the cultural values necessary to achieve an organization's strategic, tactical and operating objectives . . . Effective management accounting systems can create considerable value for today's organisations by providing timely and accurate information about the activities required for their success".

Mainstream management accounting is therefore about supplying decision makers with information - not just any information, but also *effective* information - the right information, supplied to the right person, at the right time, and in the right format. In this case management accounting adds value by reducing the costs of co-ordination and internal transactions – in short, by increasing efficiency – thus improving the quality of management decision-making and providing the organisation with a vocabulary and framework that increases organisational cohesion and enhances communication (Mia and Chenhall 1994).

So far there has been no significant difference between the definitions of EMA and conventional management accounting respectively. Both define a type of information system for managers, revolving around some form of performance measurement. The distinction, and the answers to the questions posed above, emerge when we consider the focus and purpose of the two systems as well as the behavioural implications of management accounting and EMA.

Firstly, management accounting can be seen as a **language** in which an organisation's actions and relationships can be expressed. In doing this, management accounting defines the form of communication and how it is to be decoded and used (Weick 1995). Traditionally, management accounting has revolved around monetary measurements and generally accepted definitions of concepts such as the economic entity, the annual reporting cycle, and the role of accounting in organisations and society. The users of management accounting information often implicitly accept these definitions without question, which means that accounting as such has a significant influence on organisational reality (Tinker 1991).

Secondly, by measuring only certain aspects of organisational, managerial and employee performance, managers **influence organisational behaviour** by defining what constitutes sufficient importance to justify measurement and what does not (Emmanuel *et al.* 1995), so that in this context management accounting might be compared to a flashlight. The decision on where to point the flashlight clearly determines what the beam illuminates - for example if an organisation focuses its measurement system on its processes, then outcome measurements could be cast into shadow. A specific instance might be a company which chooses to measure and reward the performance of its customer complaints department on the basis of how many calls it handles each day. Although in itself this may clearly be a valid and useful indicator, excessive concentration on this indicator alone could reduce focus on other important aspects of its performance such as how customer complaints are resolved, and whether the customer is ultimately satisfied with the quality of service experienced.

This illustrates why EMA is often treated separately from mainstream management accounting. Since this has traditionally revolved around monetary measurements and information, accounting departments often see environmental issues as solely the responsibility of the environmental department (Bartolomeo *et al.* 1999). However this increasingly seems to be based more on tradition than on practical necessity, as the appearance of EMA issues in mainstream management accounting course literature seems to illustrate (see for example Atkinson *et al.* 2002). However, until now most mainstream management accounting literature has not contained any reference to EMA, and most accounting departments have not addressed EMA to any significant extent (Bartolomeo *et al.* 1999).

However although they may not be addressed separately, environmental aspects are inevitably being included at least indirectly in conventional cost calculations, effectiveness and efficiency calculations, investment evaluations and performance assessments. Issues such as the full cost of waste, materials efficiency, energy efficiency, and evaluations of new technology are to a large extent included in traditional calculations but remain "hidden" within other numbers and information. An underlying theme in the EMA debate is that this lack of focus results in inefficiency, waste and inferior environmental performance, since environmental issues are important for businesses and other organisations, both immediately in operational terms and for future performance. Distinguishing EMA from mainstream management accounting thus provides managers with a language, terminology and communications format for defining, measuring and expressing the environmental performance of the organisation. The value proposition of EMA is thus to improve decision-making by drawing management's attention to issues and problems that otherwise would have remained "hidden" within the conventional management accounting framework. By doing this EMA, like mainstream management accounting, adds value by improving the quality of decisions and by providing decision-makers with the vocabulary to communicate about environmental management issues and performance measurement.

But there is also a second value proposition of EMA, even if this is often only implicit, which is another reason for EMA often being separated from mainstream management accounting. This is the issue of improving the quality of the environment itself. EMA should contribute not only to organisational goals of increased efficiency and better decisions but also to **reducing the environmental impacts** of the organisation. This can be achieved firstly by increasing efficiency and improving the quality of decisions, providing that these reduce environmental impacts, and secondly by "pointing the flashlight" towards environmental issues and thus increasing the motivation of managers and employees to incorporate environmental concerns into their decisions and activities. Thus the political and practical importance of the environment and of sustainability legitimises the distinction between EMA and mainstream management accounting.

Thirdly, EMA addresses the issue of **integration**, which is often raised but also only rarely resolved. Environmental issues can have a significant adverse impact on an organization if it is not informed and prepared, so that no form of financial management can afford to leave environmental issues outside its scope. In turn, no environmental programme or environmental officer will be successful if they do not explicitly provide a link to the financial consequences. EMA offers an answer to the challenge of integration by providing a practical set of tools for monetary and physical information management and for the integration of the two. In addition to the contextual integration of environmental issues with financial issues, EMA faces the challenge of methodological and organizational integration in bringing together specific EMA tools with conventional management and management accounting approaches. Furthermore, questions have to be answered such as how environmental cost accounting can best be integrated into existing conventional management accounting systems, and how the process of calculating environmental life cycle costs can be integrated into the product development process.

EMA therefore has three value propositions:

- The first is **internal** to the company, by "pointing the flashlight" for management's attention towards the environmental issues of effectiveness and efficiency and by increasing the quality of management decision-making.
- The second value proposition is **external** to the conventional organisational and accounting boundaries, and addresses the potential for environmental impact reduction as a result of increased efficiency, effectiveness and better decisions.
- The third is that EMA supports the **integration** of monetary and environmental information and issues into decision-making. It supports both financial management by helping to recognize those environmental issues which are most economically crucial, and also environmental management by helping to focus on those measures which are economically preferable when designing the company's environmental programme.

There are important implications of these value propositions for each of the environmental management function, the accounting function, and the organisation as a whole. The accounting function can use EMA as an additional "flashlight" to illuminate an aspect of corporate performance that can influence overall organisational performance and which is relevant for the decision-making processes of many stakeholders, both internal and external. The environmental management function can identify the organisation's reasons for adopting EMA in terms of how this can support and help to measure both improvements in environmental performance and achievement of the business goals of the company. A clear statement of the value propositions of EMA can demonstrate to senior management how environmental performance measurement can be incorporated into the organisation's day-to-day operational routines. Finally, the value propositions illustrate how the organisation takes its responsibilities to the environment into account and how EMA can be an important part of the quest for sustainable development.

1.2 Adopting Environmental Management Accounting: an Overview

A perception of EMA as a value-adding activity for both the organisation and the environment in which it operates is at the core of any management decision to adopt EMA. In order to create value, the relevant EMA tools must be selected and developed in order to provide good practical support for management. In order for the potential of EMA to be widely known and adopted, support in dissemination and promotion by government and international organizations is valuable, as are case studies which illustrate the application of EMA in practice. Further support for a management decision on whether to introduce EMA and how to design the most appropriate EMA approach may be provided by a knowledge and understanding of the effects of EMA applications in practice.

The papers included in this book are structured in order to reflect these themes, as follows:

- conceptual developments and tools of EMA
- policies and initiatives for the promotion of EMA
- developments in EMA adoption in practice
- effects of EMA

1.2.1 Conceptual Developments and Tools of EMA

As an information management approach, EMA focuses mainly on operational issues such as environmental costs and revenues. Many environmental issues, such as whether to introduce green products or when to change production technology to a more eco-efficient type, can however be of far-reaching strategic importance for a company. An important question for the relevance of EMA is therefore how it can be linked with corporate environmental strategy. The contribution by **Figge, Hahn, Schaltegger** and **Wagner** provides a discussion of the different possible forms of a Sustainability Balanced Scorecard, and takes a closer look at the process and steps of formulating such a Scorecard for a business unit. The balanced scorecard has emerged and been discussed as a modern approach to translate strategy into action and thus to link strategy with the operational level of management activities, which is the stimulus for this discussion of how the development by profit-oriented companies of a Sustainability Balanced Scorecard can be helpful as a management tool.

Loew's paper describes a choice of different approaches to environmental cost accounting from Germany, USA and Japan and classifies these into four general application categories: approaches to environmental protection cost accounting, approaches to materials and energy flow-orientated accounting, approaches to environment-orientated investment accounting, and approaches which calculate a company's external costs and include these in calculations within the company. The author goes on to examine how the different contributions of bodies such as standard-setting organisations and environmental protection agencies fall into these categories, and what the differences and potential application areas of these categories might be. The paper is helpful in making sense of the many different initiatives, frameworks and tools which are available for EMA.

In a somewhat polemic paper, **James** criticises the foundations of the recent development of environmental and social reporting for having been unduly influenced by conventional accounting practices that are themselves coming under increasing criticism. The central features of this development have been the annual financial report, voluntarism on the part of organisations in deciding whether and how to report, and attempting to ensure information quality through third party auditing and verification. James highlights the weaknesses of this development as failing to provide stakeholders with the information that they need, and proposes an alternative model in which companies should report a more carefully defined but smaller number of indicators, with a greater regulatory involvement in ensuring information quality and a greater emphasis on third party assessment of actual performance rather than of internal processes.

1.2.2 Policies and Initiatives for the Promotion of EMA

This section includes papers on different initiatives regarding the promotion of EMA as well as on various initiatives which aim to provide EMA practitioners with frameworks for implementing EMA. The first paper, by **Jasch,** focuses on this issue in the context of the recent UN guidelines on EMA. The author, who has contributed extensively to the guidelines and has been involved in testing them in several companies, describes the guidelines and the main assumptions behind them, such as how EMA is defined and how the financial implications of different environmental performance areas such as waste and energy can be measured. The paper then presents an example from an actual company to illustrate how the guidelines can be applied.

Two different ministries of the Japanese government have recently taken separate but related initiatives on environmental accounting to produce guidelines for companies, which have enjoyed a rapid and widespread adoption within Japanese industry. Using a questionnaire survey, **Kokubu, Nashioka, Saio** and **Imai** examine how these initiatives have influenced

Japanese corporate environmental accounting practices. The paper concludes that, at least to date, the guidelines on environmental accounting for external reporting (by the Ministry of Environment) appear to have had a more significant effect than have the guidelines on the internal function of environmental accounting (by the Ministry of Economy, Trade and Industry); however, it may be premature to attempt to draw any final conclusions since the former set of guidelines were published earlier than the latter, and so have had a longer period in which to influence companies.

Thy, who is employed by the Danish Environmental Protection Agency and involved in the administration of the Danish Green Accounts regulation, contributes the next paper in this section. Her paper examines the often-ignored link between an obligatory requirement for external environmental reporting and EMA issues. The paper is based primarily on an evaluation of the Green Accounts legislation that also focuses on how the Act has influenced corporate environmental and financial performance. It seems that the Danish Green Accounts Act has had significant influence on environmental management as well as on how environmental performance is measured in Danish companies. A number of Danish companies state for example that the Act has had an effect on their financial performance through, for example, energy savings and reductions in waste.

Schram's paper combines an analysis of public environmental policies and their political implementation deficiencies with corporate monitoring and reporting of environmental impacts. The author argues that environmental regulation can be designed to become more effective and efficient if it integrates information-based instruments, and advocates mandatory (published) eco-efficiency profiles as an effective approach to spur environmental improvement in companies. Based on the experience of Costa Rican coffee mills, the paper concludes that this option is more feasible than a proposal to implement EMA that would require a full materials and energy balance.

1.2.3 Developments in EMA Adoption in Practice

Burritt, Schaltegger, Kokubu and **Wagner** analyse the potential of EMA information to be used for individual performance appraisal. Their paper examines the results of a survey of the styles of environmental information gathered and of EMA practices followed by companies listed on stock exchanges in Australia, Germany and Japan. The focus of the survey is on an exploratory study of the comparative link between EMA information and its potential use in the assessment of the environmental performance of staff. Similarities and differences in practices between the respondent groups in the three countries are discussed in the contexts of national cultural differences and of respondents' perceptions of the relative importance in each country of a number of different environmental issues.

Collison's paper discusses the results from an empirical study of the integration of environmental performance measurement into mainstream management accounting and financial information systems. The survey is based on a questionnaire which was sent to the Finance Directors of the top 200 companies in the UK and of the top 500 companies in Scotland. Issues are covered such as the importance of environmental issues for the companies, and whether they quantified environmental costs or benefits; whether environmental issues were considered in capital investment appraisals and in other purchasing (and marketing) decisions; and practices in the allocation of environmental costs, and estimates of their current and likely future significance. The results show an association between the separate identification and quantification of environmental issues, and the size and the degree of environmental sensitivity of companies.

Companies wishing to offer to their customers products which have been produced in an environmentally responsible manner need procedures and tools with which they can assess performance not only within their own organisations but also along their supply chains. **Seuring** examines the links between EMA and the use of life-cycle costing as a tool used by companies to assess the environmental performance of their suppliers as part of an overall approach of supply chain management. It uses two case studies of German textiles companies to study the application of this, analysing the costs incurred along the supply chains in terms of their drivers, between direct costs, activity-based costs, and transaction costs. It concludes that there are close links but that there remains a need for further research to study the conceptual bases of each technique and to explore the scope for their further integration.

The question of how EMA is influenced by changes in its institutional setting often does not receive as much attention by researchers as it might justify. **Bouma** and **Correlje**'s paper explores how EMA practices are being influenced by societal and institutional change, and in particular how the trend in many countries towards the decentralisation of decision-making and towards liberalization in many (now often formerly) public sectors can influence the evolution of EMA systems. The paper concludes that the institutional changes in the public sectors examined have had a significant effect on environmental accounting and reporting in general and on EMA practices in particular.

Understandably, much of the early work on EMA has been carried out by larger companies. However small and medium-sized enterprises (SMEs) are generally recognised as, in aggregate, a source of substantial environmental impacts, which raises the question of how they can be encouraged to adopt positive environmental management policies such as EMA, and the three remaining papers in this section address this. **Pilisi** and **Venturelli** report on how the Industry Association of Brescia, Italy, has started a programme to promote the diffusion of environment management systems and safety management systems among SMEs. The core concept behind this programme is to link the improvement of quality and safety management with EMA. The paper describes how an initiative with sixty companies has been launched to collect the data and to gain the experience necessary to overcome the obstacles which the SMEs face. The analysis of operational costs played a vital role in convincing the pilot companies to implement an EMA system and to improve their accounting system in general.

In a further paper based on this programme, **Venturelli** and **Pilisi** discuss the efforts being made to promote environment and safety management systems among member companies of the Industry Association of Brescia. This paper addresses the issues of the initial difficulties experienced with the implementation of EMA on operational costs in pilot SMEs, the need to adapt companies' accounting systems and their frequent reluctance to collect data, and how technical assistance was provided. On the basis of the evaluation of the quality management system costs, project schemes to adopt EMA have been developed with the companies. The paper presents these schemes, together with the results of their application in ten local SMEs of different sizes and operating in a number of different industrial sectors.

The fact that the costs of materials and energy consumption in the manufacturing industry of Germany account for 50 to 70% of its total costs should motivate management to improve the transparency of these costs. However, SME's in particular often have difficulties in introducing process-based environmental cost accounting and management. The contribution of **Heupel** and **Wendisch** summarizes the first results of a research project on the integration by SMEs of environmental cost accounting into their environmental management systems. Following the analysis of different concepts of environmental cost accounting, the process of implementation is demonstrated, using two selected companies as examples.

1.2.4 Effects of EMA

The final section of the book examines the different effects that the adoption of EMA and applications of environmental management techniques could have. The first paper, by **Wagner**, examines the link between company performance and the adoption of formal environmental management systems certified to ISO 14001 or EMAS standard. It concludes from a rigorous analysis of data on both environmental and economic performance that no statistically significant link can be established between environmental management systems and either environmental or economic performance, or on the nature of the relationship between environmental and economic performance.

The calculation of external costs, or economic valuation, in order to inform decisions has been of long-standing interest to environmental economists, but concerns over the validity and credibility of estimates of their amounts have been a barrier to its widespread adoption as a popular technique. **Schuijt** adopts an institutional theory perspective to analyse the reasons for this in terms of the several various stakeholders, with competing interests, who may be involved in any single calculation of external costs. The paper studies this in the context of a particular ministry of the Dutch Government, as one specific environmental stakeholder, and concludes by proposing certain changes to the process by which such economic valuation exercises are carried out in order to limit the extent of inconsistencies in the results produced by economic valuation studies.

1.3 Conclusion

The papers in this volume are an edited selection from a population that is itself self-selected, and so cannot necessarily be claimed to be fully representative of current EMA practice generally. However since they reflect the activities of many of the leading researchers and practitioners in the field, from both Europe and more widely, they can be interpreted as indicative of much leading thinking.

As might be expected in a field which is still relatively new and developing, the papers included here continue to reflect a preponderance of case studies and reports on practice, much of which is of an experimental nature. These examples of existing practice can offer ideas and guidance to other companies who are themselves considering adopting EMA. The variety of these reflects the breadth (and lack of precise definition) of the scope of mainstream management accounting, and in particular the increasing popularity of relatively novel approaches such as the use of non-financial measures of performance to supplement the traditional financial measures, and of strategic management accounting which looks outside the focal organisation. One specific non-traditional management accounting tool which is particularly relevant in EMA is the costing of externalities, in which a resurgence of interest is apparent after some years when the consensus appeared to be that this was too impractical for implementation, and that the focus of attention should be on more pragmatic approaches. As with other further-developed and more pragmatic EMA approaches, integration is a core challenge to any kind of corporate externality accounting if this is to be a value-creating approach for managers.

This is now also being supplemented to an increasing extent by studies which take a broader focus by surveying how EMA has been adopted in practice, the contexts in which EMA is most likely to be successful, and its effects. This may be interpreted as a symptom of a developing - if still early - degree of maturity in EMA, as there is now a substantial literature offering tools and examples. In this situation, companies considering their own adoption of EMA will find these studies of value in selecting, from the array available, those specific EMA tools and approaches to implementation which are likely to be of value in their own circumstances. Governments and similar bodies who are, for their own public policy purposes, keen to support the wider adoption of EMA by industry, will also be better informed on how to promote the wider dissemination of EMA most effectively.

The work done to date on EMA, as evidenced in part by the papers included in this volume, also reinforces the need for further experimentation and research in order to continue to develop and implement EMA, so that the use of appropriate EMA tools becomes a regular and expected feature of the management of every organisation for whom environmental performance is a significant strategic and operational factor.

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I

CONCEPTUAL DEVELOPMENTS AND TOOLS OF EMA

2. The Sustainability Balanced Scorecard as a Framework to Link Environmental Management Accounting with Strategic Management*

Frank Figge, Tobias Hahn, Stefan Schaltegger and Marcus Wagner

Centre for Sustainability Management (CSM), University of Lueneburg, Germany

figge@sustainablevalue.com
thahn@uni-lueneburg.de
schaltegger@uni-lueneburg.de
m.wagner@uni-lueneburg.de

Abstract As an information management approach, environmental management accounting (EMA) focuses mainly on operational issues such as environmental costs and revenues. Many environmental issues (such as, for example, whether to introduce green products, or when to change the production technology to a more eco-efficient process) can, however, be of far-reaching strategic importance for a company. An important question for the relevance of EMA is therefore how it can be linked with corporate environmental strategy.

The Balanced Scorecard has emerged and has been discussed as a modern approach to translate strategy into action and thus to link strategy with the operational level of management activities. This is why the development of a sustainability balanced scorecard is discussed here for profit-oriented companies. The proposed approach has been developed by the Centre for Sustainability Management, Lueneburg, Germany, in a two-year research program in co-operation with partners from the University of St. Gallen, Switzerland, and Insead, Fontainebleau, France, and the approach which is discussed has been tested in practice with six large German and Swiss companies (Schaltegger and Dyllick 2002).

After a brief discussion of the different possible forms of a Sustainability Balanced Scorecard, the paper takes a closer look at the process and steps of formulating a Sustainability Balanced Scorecard for a business unit. Before doing so, the Balanced Scorecard and its suitability for sustainability management will be outlined in brief.

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M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 17-40.

2.1 Introduction

With the growing importance of environmental and social issues, many companies have implemented specific environmental or social management systems during the last decade. These systems have, however, rarely been integrated with the general management system of a firm. As a consequence, even in profit-oriented companies, environmental and social management is mostly not linked to the economic success of the firm, and the economic contribution of environmental and social management therefore remains unclear. Given the desire to achieve simultaneous improvements in the economic, environmental, and social performance of businesses, this lack of integration turns out to be a major obstacle for sustainability management (BMU and BDI 2002). Concerning the relationship between the environmental and social performance of the firm and its economic performance, the literature is based mainly on empirical studies which refer to the correlation but not to the causality between environmental and social measures and the economic success of firms (cf. for example Griffin and Mahon 1997; Pava and Krausz 1996; Schaltegger and Synnestvedt 2002; Wagner 2001; Wagner et al. 2002). To date there is little literature on the relationship between environmental and social measures and the achievement of long-term economic goals (for some exceptions, see Burke and Logsdon 1996; Figge 2001; Schaltegger and Figge 1997; Wagner et al. 2002).

The Balanced Scorecard as a strategic management tool aims to identify the major strategically relevant issues of a business and to describe and depict the causal contribution of those issues that contribute to the successful achievement of a firm's strategy (Kaplan and Norton 1997). Thus, it appears promising to use the Balanced Scorecard methodology to integrate environmental and social management with the general management of a firm. Only recently have the basic approaches and methodology of sustainability management with the Balanced Scorecard been discussed in detail (Figge et al. 2001a, 2001b and 2002; Schaltegger and Dyllick 2002). Sustainability management with the Balanced Scorecard helps to overcome the shortcomings of conventional approaches to environmental and social management systems, by integrating the three pillars of sustainability into a single and overarching management tool. Thus, following a brief discussion of the different possible forms of a Sustainability Balanced Scorecard (SBSC), this text concentrates on the process and steps of formulating a SBSC for a business unit. The process of establishing an SBSC provides an approach to identify the strategically relevant environmental, social and economic performance indicators and to give EMA a clear indication which data and information to provide. First the conventional Balanced Scorecard approach will be outlined in brief.

2.2 The Balanced Scorecard Approach, Economic Success and EMA

2.2.1 The Balanced Scorecard Approach

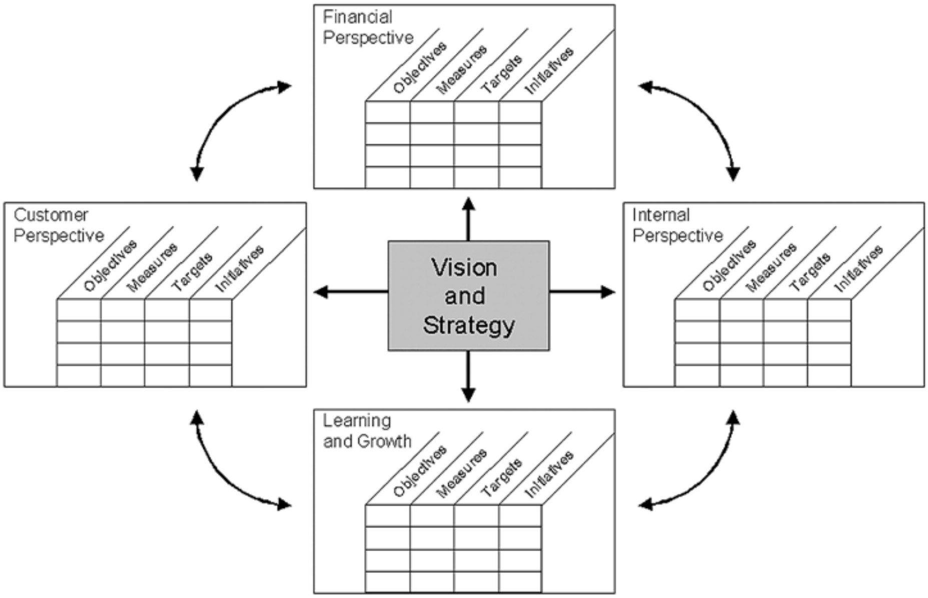
The concept of the Balanced Scorecard (BSC) was developed in the early 1990s as a new approach to performance measurement (Kaplan and Norton 1992) to address the problems of short-termism and past orientation of management accounting (for this critique on management accounting, see Johnson and Kaplan 1987). The concept of the BSC is based on the assumption that the efficient use of investment capital is no longer the sole determinant for competitive advantage, but that soft factors such as intellectual capital, knowledge creation or excellent customer orientation have increasingly become more important. In response to this, Kaplan and Norton suggested a new performance measurement and management approach that focuses on corporate strategy in four perspectives (Kaplan and Norton 1992; Kaplan and Norton 1997; Kaplan and Norton 2001). Figure 2.1 shows a common figure to visualise the BSC and its four perspectives: financial, customer, processes, and learning and growth.

With the BSC, the contribution and achievement of soft factors and intangible assets to long-term financial success can be made explicit and thus controllable. The BSC's four perspectives can be characterised briefly as follows (Weber and Schäffer 2000, pp. 3; Kaplan and Norton 1997, pp. 24; Kaplan and Norton 2001, pp. 23, 76):

- The *financial perspective* indicates whether the transformation of a strategy leads to improved economic success. The financial measures thus assume a double role: on the one hand, they define the financial performance that a strategy is expected to achieve; on the other hand, they are the endpoint of cause-and-effect relationships between the other BSC perspectives.

- The *customer perspective* defines the customer/market segments in which the business competes. By means of appropriate strategic objectives, measures, targets and initiatives, the customer value proposition is represented in the customer perspective through which

Figure 2.1. The four perspectives of the Balanced Scorecard



the firm/business unit aims to achieve a competitive advantage in the envisaged market segments.

- The *internal process perspective* identifies those internal business processes which enable the firm to meet the expectations of customers in the target markets and those of the shareholders.

- Finally, the *learning and growth perspective* describes the infrastructure which is necessary for the achievement of the objectives of the other three perspectives. In this case, the most important areas are the qualifications, motivation and goal orientation of employees, and information systems.

The purpose of a BSC is to formulate a hierarchic system of strategic objectives in the four perspectives, derived from the business strategy and aligned towards the financial perspective. Based on such a causal system of objectives, corresponding measures are formulated in all four perspectives. Kaplan and Norton basically distinguish between *lagging* and *leading indicators* (Kaplan and Norton 1997, pp. 28).

Lagging indicators and long-term strategic objectives are formulated for the strategic core issues of each perspective, which are themselves derived from the strategy of the business unit. Lagging indicators thus indicate whether the strategic objectives in each perspective have been achieved.

In contrast to the lagging indicators, the *leading indicators* are very firm-specific. They express the specific competitive advantages of the firm and represent how the results – reflected by the lagging indicators – should be achieved. Based on the specific strategy of the business unit, the key performance drivers that have the greatest influence on the achievement of the core strategic objectives (measured by lagging indicators) are identified for every perspective.

The integration of the indicators in the four perspectives is achieved by defining goals, appropriate lagging indicators, and leading indicators / performance drivers (Kaplan and Norton 1997, pp. 28, 142) for a specific business strategy. By doing so, BSC translates strategy into terms of objectives, measures and targets in the four perspectives. However, it does not represent strategy as a loose collection of indicators and measures but rather these are linked by cause-and-effect relationships. By formulating and defining the goals and measures, based on the strategy, and starting from the financial perspective in a top-down process throughout the other perspectives, it becomes clear which influencing factors have most impact on the lagging indicators and thus ultimately the achievement of the objectives. These strategy-specific influence patterns are reflected through cause-and-effect chains which directly or indirectly link all the goals, indicators, and measures of the BSC perspectives hierarchically towards the financial perspective with its long-term financial goals.

It is notable that the causal linking of leading and lagging indicators occurs not only within the individual perspectives, but also by constructing effect chains through the four perspectives of the BSC. This means that lagging indicators of a lower-level BSC perspective are drivers for an indicator in a higher-level perspective. Proceeding in this way results in a situation where the lagging (financial) indicators are combined with the leading indicators/performance drivers through the four perspectives (Kaplan and Norton 1997, pp. 8). This strategy-focused hierarchical approach ensures the identification of the major strategic issues of a business and assigns to them their particular strategic relevance, as strategic core issues or performance drivers. This enables an orientation of all business resources and activities towards the conversion of the strategy, and a better communication of the strategy.

The BSC as an instrument for performance measurement was developed further beyond its original concept into a strategic management concept. In this, the BSC is used to communicate and coordinate the translation of the business strategy (Kaplan and Norton 1997, 24, pp. 34): the gap between strategic and operational planning can be bridged, and the long-term achievement of the strategic objectives guaranteed, by means of the consistent application and formulation of a previously defined business strategy in the four perspectives of the BSC (Kaplan and Norton 2001, pp. 65). In particular, Kaplan and Norton subdivide the strategic management system of the BSC into four partial processes: clarifying and translating the vision and strategy; communicating and linking; planning and target-setting; strategic feedback and learning. The central question here is related mainly to the first of the four critical management processes to be described by Kaplan and Norton (Radcliffe 1999, p. 8): clarification and translation of vision and strategy.

The BSC is directed top-down, in both its contents and its development as a management system. Therefore, in order to be able to clarify and translate the strategy, top management must agree on that strategy. The goal is to create a common and comprehensible strategic basis in the form of a formulated BSC (Kaplan and Norton 1997, pp. 11; 186). Because of this, the strategy which has first been verbally formulated should then be translated and causally linked in terms of objectives and measures. In every perspective, the strategic core elements and performance drivers which are pivotal for success are identified. These strategic core elements and performance drivers are then associated causally with each other through the four perspectives, as described above, and oriented towards the financial perspective. The result is a hierarchical cause-effect network which reflects the fundamental assumptions for successful translation of the strategy (Kaplan and Norton 1997, p. 28).

2.2.2 The Balanced Scorecard, Performance Measurement and EMA

In a BSC, all aspects which are crucial for achieving a permanent competitive advantage should be included. The creation and preservation of competitive advantages serves to secure permanently a firm's economic success. In the four perspectives of the BSC, therefore, the critical activities are included and causes are linked to effects. In the formulation of a BSC, the objectives in all perspectives are deduced from the long-term strategic financial goals in a *top-down* process. This hierarchical structure of the BSC guarantees an economic orientation of all business activities. To measure how successfully the causal chains have been managed, *key performance indicators* are formulated for each perspective. This is where *management accounting* can contribute, by providing the respective data for the key performance indicators and the information to measure economic success.

The hierarchical characteristic of the BSC can also be used for the management of environmental and social aspects of performance. The relationship between environmental and social measures on the one hand, and the economic success of the firm on the other, has to be taken explicitly into account. The BSC assists in the identification and management of those environmental and social aspects which contribute to financial business goals. Therefore, a SBSC fulfils the central requirement of the sustainability concept for a permanent improvement in the business's performance in economic, environmental and social terms. The BSC is particularly suitable for the integration of all three sustainability dimensions because of the possibility of considering also those soft factors which cannot be monetised. Environmental and social aspects often show precisely these characteristics, so it is necessary to determine the environmental and social aspects which are relevant for economic success and to include these in the BSC in order to develop a SBSC. As with other strategically relevant aspects, environmental and social issues have to be linked in causal chains to economic aspects. In order to manage the respective causal chains and to measure sustainability performance, indicators have to be defined for those sustainability issues which are strategically relevant. This is where EMA links with the SBSC, by providing the necessary data and information for the key performance indicators and their measurement.

In the following section, the fundamental possibilities of an integration of environmental and social aspects are briefly described.

2.3 Different Possible Approaches of Integrating Environmental and Social Aspects

There are basically three possible ways in which to integrate environmental and social aspects into the BSC. Firstly, environmental and social aspects can be integrated into the existing four standard perspectives. Secondly, an additional perspective can be added in order to take environmental and social aspects into account. Thirdly, a specific environmental and/or social scorecard can be formulated (Epstein 1996, pp. 73; Figge et al. 2001a and 2001b).

2.3.1 Integration of Environmental and Social Aspects into the Four Balanced Scorecard Perspectives

Environmental and social aspects can be integrated into the four existing BSC perspectives, as for all other potential strategically relevant aspects (Epstein 1996, 73; Figge et al. 2001a and 2001b). This would mean that environmental and social aspects are integrated into the four perspectives through respective strategic core elements or performance drivers, for which lagging and leading indicators as well as targets and measures would be formulated (Kaplan and Norton 2001, pp. 90). Through this top-down derivation, those environmental and social aspects are identified which are strategically relevant within the framework of the four standard perspectives of the BSC. Environmental/social aspects consequently become an integral part of the conventional Scorecard, and are automatically integrated into its cause-and-effect links, and hierarchically oriented towards the financial perspective and a successful conversion of a business's strategy.

Within all its four standard perspectives the logic of the BSC remains almost exclusively in the economic sphere. Little consideration is given to exchange processes outside the market mechanism. Therefore, the approach of integrating environmental and social aspects by subsuming them under the four standard perspectives is particularly relevant for strategically relevant environmental and social aspects which are already integrated into the market system. For instance, for a firm that aims at an environmental customer segment, the core measure "market share" in the customer perspective would have an environmentally oriented dimension. The leading indicator "product features" would also have an environmental dimension.

2.3.2 Introduction of an Additional Non-Market Perspective into the Balanced Scorecard

As already noted above, environmental and social aspects and scarcities are not (yet) fully integrated into market exchange processes through assigned market prices. The reason for this is that, fundamentally, environmental and social aspects originate from non-market systems as social constructs. Thus, although some environmental and social aspects have been internalised in the meantime, many environmental and social aspects are still not integrated into the market coordination mechanism and therefore often represent externalities. However, the model of socio-economic rationality according to Hill shows that firms do not operate exclusively in the commercial-economic sphere. As publicly observed, institutions are confronted not only with economic issues but also with other issues, such as socio-cultural or legal issues. As social constructs, environmental and social aspects can emerge in all spheres and can become strategically relevant for firms through other mechanisms as well as the market exchange process.

Given these particular characteristics of environmental and social aspects, it becomes clear that for the integration of strategically relevant environmental and social aspects from outside the market system, the standard BSC structure – which reflects only the market system– might have to be extended by adding a further perspective. Figge et al. (2001a, 2001b and 2002) propose the introduction of an additional, so-called *non-market perspective* in order to integrate environmental and social aspects which are strategically relevant but not market-integrated. Also, Kaplan and Norton (1997, 33) point out that the firm-specific formulation of a BSC may involve a renaming or adding of perspectives. In order to justify the introduction of an additional non-market perspective, environmental and social aspects from outside the market system must explicitly represent strategic core aspects for the successful execution of the strategy of the company considered. Thus, the necessity for an additional non-market perspective arises when environmental or social aspects significantly influence the firm's success from outside the market system, which at the same time cannot be reflected according to their strategic relevance within the four standard BSC perspectives.

Strategically relevant environmental/social aspects from outside the market system can impact a firm's performance in all four perspectives of the conventional scorecard. This means that they can be economically relevant both directly (with regard to the financial perspective) and indirectly (with regard to the other perspectives). Thus, an additional non-market perspective can affect all four conventional perspectives. Analogous to the process of formulating a conventional scorecard, the strategic core aspects and leading indicators of the non-market perspective must also be identified and reproduced through respective measures. These measures are then linked towards the financial perspective by means of hierarchical cause-and-effect chains. Consequently, economically oriented and strategy-linked management is guaranteed for the strategically relevant non-market aspects, too. As will be shown later (see section 3.4), the decision of whether an additional non-market perspective is necessary to formulate a SBSC for a specific business strategy cannot be taken in advance but only during the process of formulation.

2.3.3 Derivation of a Special Environmental and Social Scorecard

The third approach to integrating environmental and social aspects into the BSC is to deduce an environmental and/or social scorecard from the company's core scorecard. At this point, it is very important to note that such a scorecard cannot be developed in parallel with the conventional scorecard. For sustainability management this is possible only in conjunction with one of the two variants of integration discussed in Sections 3.1 and 3.2 above, so that a deduced environmental/social scorecard is not an independent alternative for integration, but only an *extension* of the two variants discussed in the previous sections. A deduced scorecard as discussed in this section develops its contents from the company's existing core BSC system and is thus used predominantly in order to coordinate, organise and further differentiate the environmental and social aspects, once their strategic relevance and position in the cause-and-effect chains have been identified by the two approaches presented above. Deducing such a scorecard can serve to clarify the relationship of an internal service unit such as the environmental management department with the strategic business units and their scorecards (Kaplan and Norton 2001, 48). Thus, this additional variant of a *deduced* environmental/ social scorecard allows coordinated control of all strategically relevant environmental/social aspects which are spread across and integrated into the whole overarching BSC system.

2.3.4 Relationship of the Three Approaches to Build a Sustainability Balanced Scorecard

As discussed in the previous paragraph, a fundamental difference exists between the three approaches to build a SBSC. On the one hand, the first two variants (integration into the four core perspectives, and the addition of a fifth perspective) refer to the structure of the core scorecard for a business unit. On the other hand, the deduced environmental/social scorecard is derived from the core scorecard. In other words, a deduced environmental or social scorecard can be formulated only after at least one of the first two variants has been realised for the core scorecard system. The contents of a deduced scorecard result from the higher-level BSC of the strategic business unit. In the process of building up a SBSC, formulating a deduced environmental/social scorecard thus represents only a possible second step, and the first step always needs to be an integration of the strategically relevant environmental and social aspects into the core BSC with the help of the two variants discussed in Sections 3.1 and 3.2.

After having distinguished the first two approaches from the subsequent possibility of a deduced environmental or social scorecard, it is important to look at the relationship between the two variants concerning the structure of a business unit's core scorecard. It is important to note that certain environmental or social aspects can be integrated into the four conventional BSC perspectives parallel to the introduction of a specific perspective for other strategically relevant environmental or social aspects. In other words, the first two alternative ways in which a SBSC can be structured are not mutually exclusive. Given the characteristics of the two alternatives as outlined in Sections 3.1 and 3.2, it becomes clear that the difference lies mainly in the characteristics of the strategically relevant environmental and social aspects. Those strategically relevant environmental or social aspects which are already integrated into the market system, such as environmental costs, are fairly straightforward to integrate into one of the four conventional perspectives by means of appropriate leading or lagging indicators. In contrast, if environmental and social aspects exert their strategically relevant influence through mechanisms which act in the firm's non-market environment, such as complaints from neighbour groups, then an additional, non-market perspective is necessary. Since there might well exist situations where strategically relevant environmental or social aspects which are already incorporated into the market system occur alongside those which influence the business unit through non-market mechanisms, it is neither necessary nor desirable to make a final decision for or against either of the two variants of integration. Most authors who have dealt with different approaches to integrate environmental and social aspects into the BSC so far have neither considered explicitly the relationship between the different approaches nor discussed the preconditions of their respective appropriateness (Epstein 1996, pp. 73; Radcliffe 1999; Sturm 2000, pp. 374; Fahrbach et al. 2000; Czymmeck and Faßbender-Wynands 2001). Figge et al. (2001a and 2001b) identify two fundamental conditions for the introduction of an additional non-market perspective: in order to justify the addition of a non-market perspective, then (i) environmental and social aspects have to be strategically relevant, i.e. they are either strategic core aspects or performance drivers, *and* (ii) it is not possible to include these aspects appropriately, i.e. according to their strategic relevance, into the four conventional perspectives of the BSC.

Regarding the process of formulating a SBSC, these findings lead to the conclusion that the decision on which structure is appropriate for a specific business unit cannot be taken without further consideration. Rather, this decision depends on the nature of the strategically relevant environmental and social aspects that are identified during the process of formulating a SBSC. The choice of how environmental and social aspects are integrated is therefore taken during, rather than at the start of, this process. The following section describes the process of constructing a SBSC.

2.4 The Process of Formulating a Sustainability Balanced Scorecard

Based on the reasoning of the previous sections, the process of formulating a SBSC should meet a number of basic requirements:

- First, the process must ensure economic management of environmental and social aspects (see 2.2).
- Second, as a consequence of economic orientation of sustainability management, environmental and social aspects must be integrated with the general management system of the firm.
- A SBSC which meets exactly the specific characteristics and requirements of the strategy and the environmental and social aspects of a business unit must not be generic. The process therefore has to ensure, thirdly, that the SBSC which is formulated is specific to the business unit.
- Fourth, the environmental and social aspects of a business unit must be integrated according to their strategic relevance. This includes the question of whether the introduction of an additional non-market perspective is necessary.

On the basis of these requirements, the process of formulating a SBSC can be divided into three major steps. First, the strategic business unit must be chosen. This step presupposes that the business unit does in fact have a strategy. Second, the environmental and social aspects of concern must be identified. And third, the relevance of those aspects for the strategy of the specific business unit must be determined. Figure 2.2 gives an overview of the whole process.

Figure 2.2. Process of formulating a SBSC.

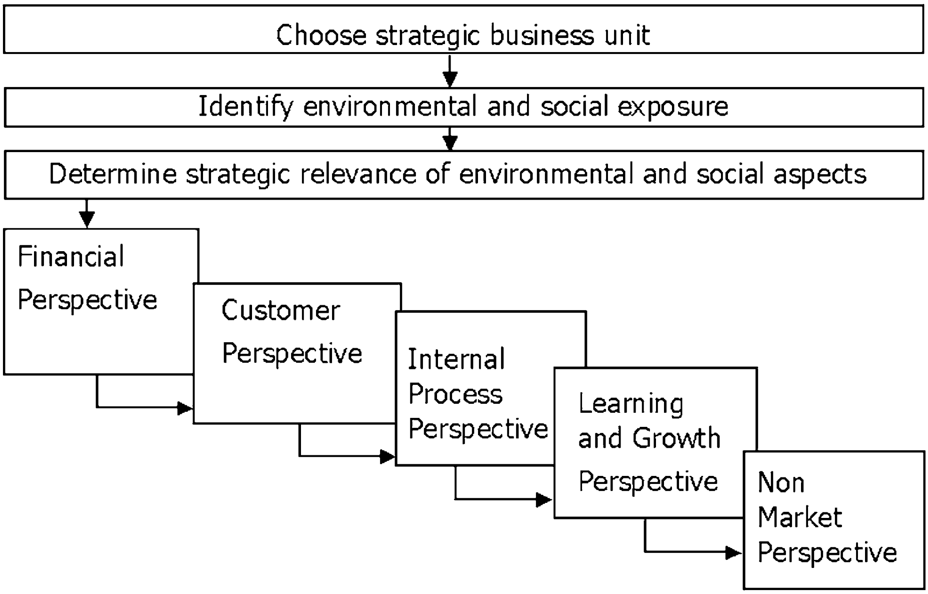


Table 2.1. Framework for the identification of the environmental exposure of a business unit (Figge et al. 2001a, p. 36).

Environmental Exposure of a Business Unit	
Type of Environmental Intervention	Business Unit-Specific Occurrence
Emissions (to Air, Water, and Soil)	...
Waste	...
Materials Input/Materials Intensity	...
Energy Intensity	...
Noise and Vibrations	...
Waste Heat	...
Radiation	...
Direct Interventions on Nature and Landscape	...

2.4.1 Choice of Strategic Business-Unit

The BSC as originally developed by Kaplan and Norton was designed for strategic management at the level of the business unit (Kaplan and Norton 1997, pp. 161). Thus, as a first step, the business unit for which a SBSC shall be formulated has to be chosen. For small and medium-sized enterprises, the business unit level may be identical with the corporate level, whilst in large companies or groups there are often several business units which aim at different customer segments and which are often organised as independent profit centres. The choice of the business unit presupposes that a strategy exists for this business unit. It is important to note that the BSC is not a tool for the formulation of strategies, but rather that the BSC serves to describe and translate an existing strategy consistently in order to enhance the successful execution of that strategy (Kaplan and Norton 1997, 36; Kaplan and Norton 2001, p. 104). The formulation of a BSC is thus not an independent process, but part of a wider framework of competitive positioning and strategy formulation (Kaplan and Norton 2001, p. 40). This is also the case for the formulation of a SBSC: before a SBSC can be formulated, top management has to arrive at a common agreement on what the strategy is, no matter whether this explicitly mentions sustainability issues or not.

2.4.2 Identification of the Environmental and Social Exposure of the Business Unit

In order to ensure that the SBSC is tailored to the specific needs of the chosen business unit, the second step is to identify the environmental and social aspects that affect that business unit. The result is a profile of its environmental and social exposure. The purpose of this step is to identify all the pertinent environmental and social aspects in order to obtain a comprehensive list of all environmental and social aspects which might possibly be strategically relevant. In order to identify the environmental and social exposure of a business unit, two generic frameworks can be used.

The first framework (see Table 2.1) serves to identify the environmental exposure of a business unit. The aim of this framework is to identify all the environmental interventions which originate from a business unit's operations and products. These interventions are eventually responsible for the environmental impacts that a business unit causes, since all environmental problems can finally be traced back to physical and/or chemical interventions (Heijungs et al., 1992). An advantage of this is that the identification of the environmental exposure of a business unit along with the environmental interventions is closely proximate to the operations and products of a firm. In order to obtain the business unit-specific environmental exposure, all activities and products of the business unit must be checked against the categories of the framework as shown in Table 2.1. It is important to consider all pertinent environmental interventions in order to develop a comprehensive and business unit-specific profile of the environmental exposure which does not omit any possibly strategically relevant aspects.

Table 2.2. Framework for the identification of the social exposure of a business unit (Figge et al. 2001a, p. 38).

Social Exposure of a Business Unit							
Direct Stakeholders				**Indirect Stakeholders**			
internal	along the value chain	in the local community	societal	internal	along the value chain	in the local community	societal
particular stake-holder group	*particular stake-holder group*	*particular stake-holder group*	*particular stake-holder group*	*particular stake-holder group*	*particular stake-holder group*	*particular stake-holder group*	*particular stake-holder group*
...	...	...	...	...	...	...	...
claim/issue	*claim/issue*	*claim/issue*	*claim/issue*	*claim/issue*	*claim/issue*	*claim/issue*	*claim/issue*
...	...	...	...	...	...	...	...

Social aspects that are strategically relevant can be identified analogously to the environmental aspects. However, due to the great variety and diversity of social aspects, and the lack of a common foundation in natural sciences as is found for environmental aspects, it is very difficult to achieve a comprehensive classification of social aspects (Clarkson 1995, p. 102). Rather, social aspects depend heavily on the preferences and values of the different actors who are involved (Zadek 1999, pp. 7). It is therefore advisable to classify social aspects not according to their contents, but rather according to the actors involved. The stakeholder approach (Freeman 1984) provides a useful framework in which to classify the actors who are concerned with different social claims (Clarkson 1995). The social issues which concern a business unit can thus be identified by systematically following a comprehensive framework of potentially relevant stakeholder groups (Liebl 1996), which Table 2.2 provides. Potentially relevant stakeholder groups for a business unit can be distinguished between internal stakeholders, stakeholders along the value chain, stakeholders in the local community, and societal stakeholders. As a further, cross-sectional, classification, direct stakeholders can be distinguished from indirect stakeholders (Rowley 1997). Direct stakeholders are those groups which are related to the firm by direct materials resource exchange flows, whilst with indirect stakeholders no such direct materials exchange flows are established. As the first step, all *pertinent stakeholder groups* for a business unit have to be identified. In a second step, the *social claims and issues* brought up by these groups have to be identified. By specifying the framework shown in Table 2.2, a specific profile of the social exposure of the business unit can be obtained.

2.4.3 Determination of the Strategic Relevance of Environmental and Social Aspects

For both the conventional BSC and the SBSC, the core step is the identification and alignment of those aspects which are strategically relevant. The purpose of this step is to translate the strategy which has been verbally formulated for a business unit into causally linked objectives and indicators. As mentioned above (see Section 2.1), the BSC is a tool which can be used to identify the 15 to 25 strategically most relevant aspects and to link these causally and hierarchically towards the long-term financial success which is measured by the financial perspective. For the formulation of a BSC, Kaplan and Norton (1997) propose a top-down process in which the strategically relevant aspects in all perspectives are identified, starting from the financial perspective. In principle, this approach can also be used for the formulation of a SBSC - the only difference is that in addition to conventional aspects, environmental and social aspects have also to be considered. For each perspective, the strategic core issues represented by lagging indicators, and the performance drivers represented by the leading indicators, must be determined for the specific strategy of the business unit chosen. By going through the perspectives in a cascade-like process, starting from the financial perspective as indicated in Figure 2.2, the hierarchical and causal linkage of the strategically relevant aspects is guaranteed. This serves to align all strategically relevant aspects of a business unit towards the successful conversion of its strategy and thus towards its long-term economic success.

As for all other business issues, we can distinguish between three stages of strategic relevance of environmental and social aspects:

- Environmental or social aspects can represent *strategic core issues* for which lagging indicators have to be defined. These lagging indicators measure whether the strategic core requirements in the perspective have been achieved. Kaplan and Norton (1997, p. 4) have proposed generic categories for the formulation of lagging indicators in each perspective (see Table 2.3).

Table 2.3. Generic categories for the formulation of lagging indicators (Figge et al. 2001a, based on Kaplan and Norton 1996).

Financial perspective	Customer perspective	Process perspective	Learning and growth perspective	Non-market perspective
• Revenue growth • Productivity growth • Asset utilisation	• Market share • Customer acquisition • Customer retention • Customer satisfaction • Customer profitability	• Innovation process • Operations process • Post-sale service process	• Employee retention • Employee productivity • Employee satisfaction	• Freedom of action • Legitimacy • Legality

- Performance drivers, as represented by leading indicators, show *how* the results in each perspectives, reflected by the lagging indicators, are to be achieved. Performance drivers are highly business-specific, but there are once again categories to support their identification (see Table 2.4). Leading indicators will reflect environmental or social issues whenever environmental and social aspects act as *performance drivers*.

- Finally, environmental or social issues can also represent *hygiene factors*, reflected by diagnostic indicators. Hygiene factors (Herzberg et al. 1999) are issues which have to be managed sufficiently in order to guarantee successful business operations; however, addressing these factors does not lead to any competitive advantage (Kaplan and Norton 1997, pp. 156). In other words, hygiene factors represent necessary but not sufficient conditions for a successful execution of a firm's strategy, so these factors are not part of the BSC.

Environmental and social aspects have to be classified and integrated into the scorecard system according to their strategic relevance, as for all potentially strategically relevant aspects. In order to determine the strategic relevance of environmental and social aspects for each perspective, a matrix as shown in Table 2.5 can be used. To determine whether environmental and social aspects represent strategic core issues, performance drivers, or

Table 2.4. Generic categories for the formulation of leading indicators (Figge et al. 2001a, based on Kaplan and Norton 1996).

Financial perspective	Customer perspective	Process perspective	Learning and growth perspective	Non-market perspective
Not applicable	• Product attributes • Customer relationship • Image and reputation	• Cost indicators • Quality indicators • Time indicators	• Employee potentials • Technical infrastructure • Climate for action	leading or lagging indicators from all other perspectives

simply hygiene factors, environmental and social exposure are cross-checked against the categories of lagging and leading indicators (see Tables 2.3 and 2.4) in a cascade-like top-down process as shown in Figure 2.2 for every perspective. It is useful to check systematically all pertinent environmental and social aspects by answering the following three questions when going through the four conventional perspectives:

- Does the environmental or social aspect represent a strategic core issue for the business strategy of our business unit (→ an environmental or social lagging indicator)?
- Does the environmental or social aspect contribute significantly to a strategic core issue and therefore represent a performance driver for the business strategy of our business unit (→ an environmental or social leading indicator)?
- What is the substantive contribution of the performance driver to the achievement of a strategic core issue?
- Is the environmental or social aspect simply a hygiene factor which of necessity has to be well managed but which leads to no particular strategic or competitive advantage?

As mentioned above (see Section 3.4), the decision on whether the adoption of an additional non-market perspective is necessary can be taken only during, rather than before, the process of formulating a SBSC. Therefore, after going through the four conventional scorecard perspectives, it must finally be checked whether strategically relevant environmental or social aspects exist which significantly influence the success of the business unit's strategy through mechanisms other than the market system. This can be done by answering the following questions:-

- Are there any environmental or social aspects which influence the business unit's success through non-market mechanisms?
- Do these environmental or social aspects represent strategic core elements at which the business unit has to excel in order to execute its strategy successfully?
- What is the substantive contribution of the performance driver to the achievement of the business unit's strategy?

When going through the perspectives in the described cascade-like manner, it is important to remember that the causal relationships between the strategically relevant aspects which have been identified exist not only between lagging and leading indicators within a single perspective. Rather, all the aspects and indicators have to be directly or indirectly linked towards the financial perspective. The strategic core aspects and value drivers of the lower-level perspectives in the cascade shown in Figure 2.1 serve to achieve the objectives set by the indicators in the upper-level perspectives. Therefore, every time one moves from an upper-level perspective to the next lower-level perspective in the cascade, it must be ensured that the lower-level strategic core aspects and performance drivers contribute to the achievement of the objectives in the higher level perspective(s), and how this is done must be shown explicitly. This serves to establish the hierarchic cause-and-effect chains which link all strategically relevant aspects towards the successful execution of the strategy. As discussed above (see Section 3.2), in contrast to the other scorecard perspectives, the non-market perspective acts as a frame which embeds the other perspectives. However, the strategic aspects of the non-market perspective have also to be linked directly or indirectly to the financial perspective. It is important to note in this context that the core aspects of the non-market perspective can in principle influence objectives in any other perspective. Consequently, as indicated in the final column of Table 2.4, the performance drivers for the non-market perspective can also be found in any other perspective.

As the result of the process described above, all strategically relevant aspects reflected by appropriate lagging or leading indicators are part of a cause-and-effect network which visualises and translates the strategy of the

Table 2.5. Matrix to determine the strategic relevance of environmental and social aspects (according to Figge et al. 2001, p. 42).

		Environmental exposure								**Social exposure**							
										Direct Stakeholders				Indirect Stakeholders			
		Emissions	Waste	Materials input/intensity	Energy intensity	Noise and vibrations	Waste heat	Radiation	Land use	Internal	Along the value chain	In the local community	Societal	Internal	Along the value chain	In the local community	Societal
Strategic core issues	#1																
	#2																
	#3																
Performance drivers	#1																
	#2																
	#3																

business unit. By going systematically through the perspectives in a top-down direction, the strategic relevance of the pertinent environmental and social aspects is determined as for all other, “conventional”, aspects. This ensures the full integration of environmental and social aspects into the general management system.

The process of formulating a SBSC which is described in this paper shows how environmental and social issues can be integrated with the general management of a business unit. The process is designed in such a way that it can be applied whether or not a conventional scorecard already existed prior to integrating environmental and social aspects, so the SBSC provides a strong tool for integrated sustainability management. It helps significantly to overcome the shortcomings of the approach of implementing environmental, social and economic management systems in parallel, which has often been done in the past.

It becomes clear that EMA can play an important role in providing strategically relevant environmental data and information. This holds true for both monetary and physical EMA information (Burritt et al. 2002a and 2002b). However, when it comes to linking EMA information to the SBSC, it is crucial to stick to the logic of the BSC approach. If EMA is to serve strategic sustainability management, the definition of which data is relevant and thus has to be provided by EMA is given by the contents frame of the SBSC. It is therefore crucial to link EMA to the SBSC, instead of yielding to the temptation to feed in any EMA information which is available, no matter whether this fits the strategic goals or not. The core purpose of the SBSC is to link environmental and social issues to the successful implementation of strategies and thus eventually to business success. Consequently EMA, as the most important internal management tool for environmental information, has to be linked to the SBSC and thus also to business success.

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3. Environmental Cost Accounting: Classifying and Comparing Selected Approaches

Thomas Loew

Institut für Ökologische Wirtschaftsforschung (Ecological Economy Research Institute) (IÖW), Berlin

Thomas.Loew@ioew.de

Abstract As a result of 25 years of research and development, a high number of approaches to environmental cost accounting is available. In order to identify those which are most suitable for company practice, it is necessary to identify types with similar concepts and purposes. In a German research project, the most suitable approaches for each type of environmental cost accounting could be identified.

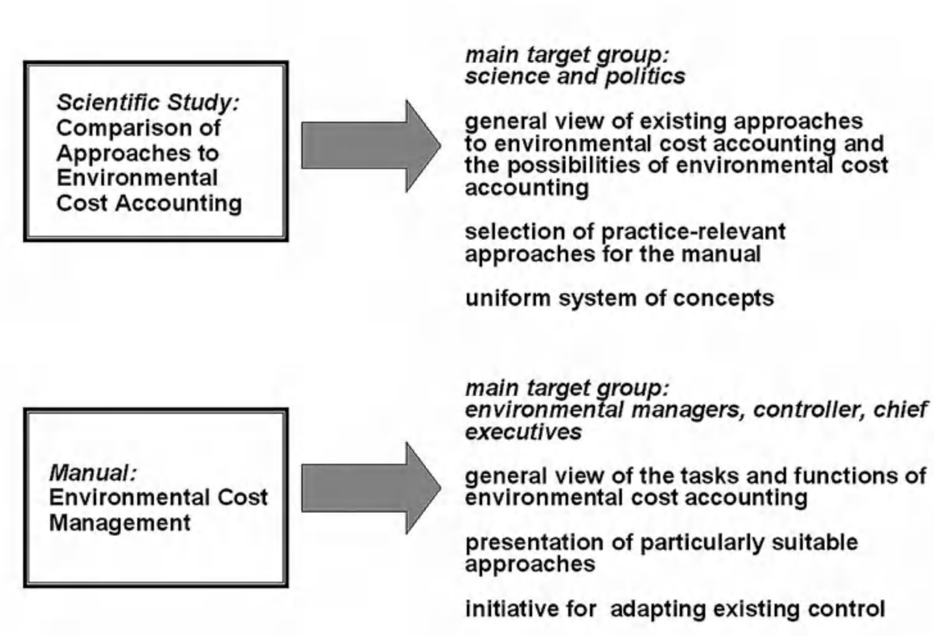
3.1 Background

A multitude of theoretical and practical approaches to environmental cost accounting has been developed in the last 25 years (Bennett and James 1998, Fichter et al. 1997). Until now, diverging opinions have existed both in practice and in science on which approaches are suitable for company practice and the goals of environmental cost management. This discussion comes from various perspectives and is also controversial to some extent.

Recently, various research projects have led to materials and energy flow-orientated accounting approaches, and work on the new version of the VDI Guideline 3800 has led to a new level of development in Germany. Also internationally, for example in the USA and Japan, work is being done on approaches to company cost management (e.g. Environmental Agency Japan 2000, Kokubu 2000, US-EPA 2000). Despite so many activities, there is still no publication which shows which approaches to environmental cost accounting are relevant for practice and how they can be used meaningfully. While some big companies are beginning to develop internal solutions, there is a particular requirement for information for small and medium-sized companies.

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 41-56.

Figure 3.1. Project Design



Against this background, the German Environmental Protection Agency and the German Ministry for the Environment awarded a research project in which a manual on "Operational Environmental Cost Management" was to be compiled[1]. This manual presents those approaches to environmental cost accounting which are particularly suitable for company practice and describes how they can be used.

In preparation for the manual and as a contribution to the international debate on environmental cost accounting, a study (Loew et al. 2001) has been produced which systematically compares the approaches to environmental cost accounting which are known in Germany in terms of their suitability

[1]Research project "Leitfaden betriebliches Umweltkostenmanagement" (Manual Environmental Cost Management), running from April 2000 until Nov. 2001, handled by the Institut für Ökologische Wirtschaftsforschung (Ecological Economy Research Institute) (IÖW), Berlin (project management) and the Institut für Management und Umwelt (Institute for Management and the Environment) (IMU), Augsburg, in co-operation with the Institut für Innovations und Nachhaltigkeitsforschung (Institute for Innovation and Sustainability Research), Berlin and the Deutsches Kompetenzzentrum für Nachhaltiges Wirtschaften (German Centre of Competence for Sustained Economies), Witten-Herdecke.

for practical application[2] (see Figure 3.1). The following is based on the results of this study.

3.2 Classification of the Approaches

The multitude of existing environmental cost accounting approaches appears at first glance to be confusing. In fact, four different types can be distinguished, derived from the following tasks of environmental cost management:

- determination of expenditure for environmental protection measures: environmental protection expenditures are used mainly for external communication. For many German companies, these need to be calculated in order to provide information for the environmental statistics. In addition, this cost block is also regarded as a subject for strategic control. This task is supported by various *approaches to environmental protection cost accounting.*
- support for the discovery of potential savings: much potential for reducing costs lies in reducing the consumption of materials, energy and water, and associated reductions in waste quantities, waste water and emissions. To be able to identify this potential systematically, several *approaches to materials and energy flow-orientated accounting* have now been developed in Germany and the USA.
- support for investment decisions: in the design of products and processes, decisions are made which determine future cost structures and long-term environmental performance. For this reason, the *approaches to environment-orientated investment accounting* have particular significance.
- consideration of external costs: efforts are being made in science and in a few pioneering companies to determine, as well as the internal costs, also the *external costs* which are caused by the company and to include these in managerial calculations.

[2]International approaches were researched only to a limited extent, so a complete general view cannot be given. Nevertheless, it is assumed here that it was possible to take the main approaches into consideration.

Table 3.1 provides a general view of the types of approach and the associated approaches.

Table 3.1. Types of approaches to environmental cost accounting.

Type	Basic concept	Main purpose	Relevant approaches	Further approaches, which may be less relevant
Calculation of environmental protection costs	The systematic identification and calculation of environmental protection costs	a) external communication b) to ensure the cost-efficiency of environmental protection measures	Japanese Environmental Accounting Guideline (Environmental Agency Japan 2000) New VDI Guideline 3800 (VDI 2001)	VDI (1979); Stölzle (1990); Roth (1992); Schreiner (1992); Klook (1993); European Environment Agency (1999)
Materials and energy flow-orientated cost accounting	Eco-efficiency potential is realised by modifying materials flows. Environmental protection costs, materials costs and production costs have to be added together	Improvement of eco-efficiency	Flow cost accounting (Strobel 2001) Residues cost accounting (Fischer 2001) Application of ABC to materials and energy flows (US-EPA 2000)	Pojasek (1998); Spengler (1998); Heller et al. (1995)
Environmental investment appraisal	Consideration of environmental aspects within investment decisions	Improvement of investment decisions in a) products and processes b) environmental measures	VDI Guideline 3800 (for pollution prevention investments) (VDI 2001) Materials and energy flow-orientated budgeting (for conventional investment decisions) (Lethmate 1998)	VDI (1979)
Consideration of external costs	The focus on environmental protection costs neglects the burden on society.	Strategic protection	Examples include Ontario Hydro, BASF, Neumarker Lambsbräu, and BSO Origin.	Roth (1992); Klook (1993); Reitmayr (1994)

3.3 Approaches to Environmental Protection Cost Accounting

3.3.1 Calculation of Environmental Protection Costs

By the end of the 1970s, suggestions had already been developed for the separation of environmental protection costs in order to be able to understand and control this new cost block. Statisticians also found an early interest in expenditure for the protection of the environment. The German statistics on expenditures for environmental protection began in 1975, so these therefore represent the most long-established economic environmental statistics (Becker 2000).

The most relevant approaches to environmental protection cost accounting are:

- the new version of the VDI 3800 – determination of the expenditure on measures for company environmental protection (Germany)
- separation of the environmental protection costs in cost accounting (Germany)
- Japanese manual for the introduction of environmental accounting (Japan)
- application of activity-based accounting (ABC) to environmental protection measures (USA)

The new version of the German VDI[3] Guideline 3800 appeared in December 2001 (VDI 2001). It represents a systematic instruction for the separation of environmental protection costs, taking into consideration the need for separation according to the German Environmental Statistics Law. Whilst environmental statistics are restricted to expenditure for end-of-pipe environmental protection measures, the new VDI Guideline also defines practical separation conventions for production and product-integrated environmental protection measures. The Guideline largely ensures that those

[3] VDI is the Association of German Engineers (Verein Deutscher Ingenieure). Their VDI-Guidelines are similar to the guidelines of national or international standardisation organisations such as ISO. They represent the technical state of the art in Germany and serve as a decision-making aid in the preparatory stages of legislation, and are also used in the application of legal regulations and ordinances.

process innovations which lead to an increase in efficiency in the use of materials which are independent of environmental protection goals are not automatically seen as environmental protection measures.

To enable environmental protection expenditure to be determined efficiently on a continuing basis, it is necessary to install environmental protection cost centres in cost accounting systems. The procedure for this is, however, not described in the Guideline but only in other publications. Due to its compatibility with the Environmental Statistics Law, and to its separation conventions for integrated environmental protection measures, many of which are unique, the approach which is described by the VDI Guideline represents the best approach for the determination and identification of company environmental protection expenditure. The new Guideline was also prepared in order to provide a systematic approach which can be used in discussions about the European Environmental Statistics.

The Japanese Environmental Accounting Guideline (Environmental Agency Japan 2000) goes much further than only the determination of environmental protection costs. This Guideline outlines a comprehensive environmental accounting system in which, among other things, environmental indicators are also to be used. Nevertheless, in the version of March 2000, the main emphasis lies in the determination and identification of environmental protection costs (Kokubu 2001). Whilst the identification of environmental protection costs for end-of-pipe measures has been clarified explicitly, the rules for the separation of costs for integrated environmental protection measures are not clear. This lack of clarity represents a significant weakness in the Japanese approach.

While the intentions of the German VDI Guideline and the Japanese Environmental Accounting Guideline are mainly to provide information for external communication, the application of activity-based accounting (ABC) to environmental protection measures was developed in order to reduce the cost of environmental management and environmental protection measures. Therefore known cases such as Amoco Oil Company, Dow, and Bristol Myers Squibb, are in industry sectors with significant environmental regulations (Bennett and James 1996, Ditz et al. 1995, US-EPA 1995a). The cases show that ABC can be helpful, so that it can be recommended that companies which are familiar with ABC, and who are making significant efforts in environmental management and environmental protection, should apply ABC here. However for those who are not yet familiar with ABC in general, it seems not to be helpful to introduce this approach only with the focus on environmental protection measures.

3.3.2 Materials and Energy Flow-orientated Cost Accounting

In the 1990s it was recognised that the calculation of environmental protection costs does not in itself provide sufficient information to identify the potential for eco-efficiency. It became clear that for this purpose the focus had to be directed to materials and energy flows.

The start of this development in Germany was represented by the "Model Project Environmental Cost Management" at Kunert AG in 1994-95. The approaches "flow cost accounting" and "residues cost accounting" were developed from this project.

The following materials and energy flow-orientated cost accounting approaches are known at present:

- flow cost accounting (Germany)
- residues cost accounting (Germany)
- materials-only costing (USA)
- lean and green supply chain management (USA) [4]

Flow cost accounting and residues cost accounting show clear similarities, in accordance with their common origin. Their basic idea is to gain transparency in materials flows in order to assign to these all the costs that they cause, from procurement up to disposal or sale by the company.

The approach of flow cost accounting (Strobel 2001) is to date the most mature and comprehensive methodical approach to materials and energy flow-orientated cost accounting. It is particularly suitable for companies with a wide variety of raw and auxiliary materials, since these are not considered precisely enough in traditional cost accounting. For smaller companies, for example of under 100 employees, the complete approach to flow cost accounting appears to be too expensive, and residues cost accounting seems to be more helpful here.

Residues cost accounting (Fischer 2001) can be regarded as the "junior" version of flow cost accounting. Whilst flow cost accounting covers all materials and energy flows, residues cost accounting focuses on the flow costs

[4] This is a supply chain management approach rather than a cost accounting approach.

of lost materials in packaging, rejects, waste, waste water and emissions including energy. This focus leads to some disadvantages: firstly, the data consistency and transparency of the materials and value flows are somewhat more restricted since they are limited to only residues-relevant flows; and secondly, the eco-efficiency potential which is available in the design of the product fades into the background. On the contrary, residues cost accounting requires fewer prerequisites and can, as a rule, be carried out with less trouble. It is especially helpful for SME's with limited cost accounting systems, but can also turn out to be effective in larger companies too.

Materials-only costing was developed not as an environmental cost accounting tool but for conventional cost accounting. Materials-only costing focuses on materials costs in monthly reports, and personnel and overhead costs are considered only annually. This approach was part of the study since it has some similarities with flow cost accounting. However, as materials-only costing does not calculate the costs of lost materials, it is not so helpful as flow cost accounting in identifying eco-efficiency potentials.

Within the US-EPA environmental accounting project, the lean and green supply chain management approach was developed (US-EPA 2000). To some extent this is a supply chain management approach rather than a cost accounting approach, but it is still based on similar ideas to flow cost accounting, since both approaches are based on the registration and modelling of materials and energy flows. For this reason this recent American approach is worth consideration.

3.3.3 Approaches to Environment-orientated Investment Accounting

Compared to the numerous suggestions for the consideration of environmental aspects in current cost accounting, there are clearly less studies which cover an environmental orientation in investment accounting. Existing approaches differ in the extent to which they either address only environmental protection investment, or that they contain descriptions for conventional investment situations on how relevant environmental protection aspects should be considered. The following approaches to environment-orientated investment accounting were analysed in depth in the study:

- section C of the VDI Guideline 3800 (Germany)
- investment accounting for environmental protection systems (according to Wicke 1989, Germany)

- materials and energy flow-based investment accounting (according to Lethmate 1998, Germany)

Alongside information for the separation of environmental protection expenditure, the VDI Guideline (VDI 2001), which was mentioned above in respect of its approaches to environmental protection cost accounting, also contains a section C on the "Determination of Expected Expenditure". In this section, the VDI Guideline considers extensively the question of how investment calculations can be carried out for environmental protection systems. For this purpose the guideline provides a list of costs which are to be taken into consideration and how these should be calculated. The VDI-Guideline is suitable primarily for manufacturing companies which are subject to independent and cost-intensive environmental regulations.

Materials and energy flow-based investment calculation is, unlike the VDI Guideline 3800, not limited only to environmental protection investment (Lethmate 1998). It can be applied to all investments in tangible assets which are independent from the objective that they serve. The approach is based on conventional investment accounting and here it integrates ecological aspects. Relevant resource consumption, and emissions during the use phase of the asset in which the investment is being made, are particularly taken into consideration, though to date there have been no case studies of practical application so that there is still room for development here.

3.3.4 Consideration of External Costs

The approaches to environmental cost accounting presented up to now are all concerned with internal costs, i.e. costs which are to be borne by a company and thus have a direct economic impact upon it. However any consequences which have been caused by a company but where the costs arising have to be borne by third parties and/or society ("external costs"), have not yet been addressed.

The few examples that are known from company practice by which external costs have been, or are currently being, accounted for, include:

- in the 1990s, the North American electricity generator Ontario Hydro applied the full cost accounting approach and determined the external costs for its own power generation (US-EPA 1998).

- the Netherlands IT consultants BSO Origin accounted for their external costs in their business reports from 1990 until they were taken over by Philips in 1996 (BSO/Origin 1993).

- in Germany, accounting examples are known from "Neumarkter Lambsbräu" and the bakery "Märkischen Landbrot". Here, the external benefits which had arisen through the use of "ecological" raw materials were calculated in monetary terms and compared with the associated additional internal costs and external damages. This information is now used by "Märkisches Landbrot" in its advertising.

If these examples are examined, it becomes clear that the consideration of external costs in companies can serve a range of different purposes. For Ontario Hydro, the calculation of external costs served to secure their long-term plans and in this way contributed to the minimisation of risk. Marketing and PR goals were the objectives in the cases mentioned here. BSO-Origin indicated that its own external costs were only limited, and "Märkisches Landbrot" even describes positive external effects.

For company practice, it is primarily the consideration of external costs within the framework of investment decisions which would appear to be relevant. It is conceivable that these costs are used for scenario accounting or that they flow as additional information into decision making. Up to now, however, no experience has been published and there is room for more development.

To enable the use of external costs (which need not be restricted only to businesses), data access to existing studies from which appropriate values can be taken should be made easier. One possibility would be a website with a corresponding database. To restrict the width of the range of possible results when calculating external costs, the existing methodological problems should be addressed by a convention on methodology in order to increase the comparability of the results.

3.4 System to Develop Terms and Definitions

The studies on environmental cost management are marked by a maze of concepts, terms and definitions which, up to now, are for the most part unstructured. Currently, there are three suggestions which attempt to develop a consistent system of concepts:

- In 1995 the US-EPA published "An Introduction to Environmental Accounting as a Business Tool" with key concepts and terms (US-EPA 1995b).
- Schaltegger et al. (2000) have developed a framework for the instruments of environmental accounting
- In the research project "Manual of Environmental Cost Management", cost concepts have been systematised by combining the various lines of discussion in a model (Loew et al. 2001).

The concept system of the research project "Manual of Environmental Cost Management" shows the relations and the influences on the environment and the various types of environmental costs (see Figure 3.2).

The influences on the environment are caused by emissions, raw materials consumption, etc., which emanate from a company and its products. Many of these influences on the environment can be prevented by means of environmental protection measures. These measures cause environmental protection costs which are, together with emission levies and other payments, internal environment-related costs.

Distinct from internal costs, external costs must be borne by third parties or society due to the environmental damage which is caused. This includes, for example, damage to buildings or health, or a reduction in usefulness such as the loss of recreational areas. One of the objectives of environmental politics is to structure the relationship between external and internal costs in such a way that use for the whole of society is optimised.

Although external costs should always be taken into consideration for company decisions, in cost accounting only the internal costs (environmental protection costs and environmental levies) are currently considered. In practice, these internal environment-related costs are, as a rule, on a level with environmental protection costs. This is incorrect since it means that environmental taxes are added to the environmental protection costs, although these taxes are not then used to pay for environmental protection measures (e.g. as opposed to waste water charges).

In order to identify and subsequently analyse companies' environmental protection costs, a distinction is made between various types of environmental protection measures (production-related, process-integrated, end-of-pipe, etc.). This differentiation and the associated presentation of costs originated from the VDI Guideline 3800. Finally, consideration of the environmental protection costs in flow cost accounting should be considered. In

Figure 3.2. Concept system (Source: Loew et al. 2001)

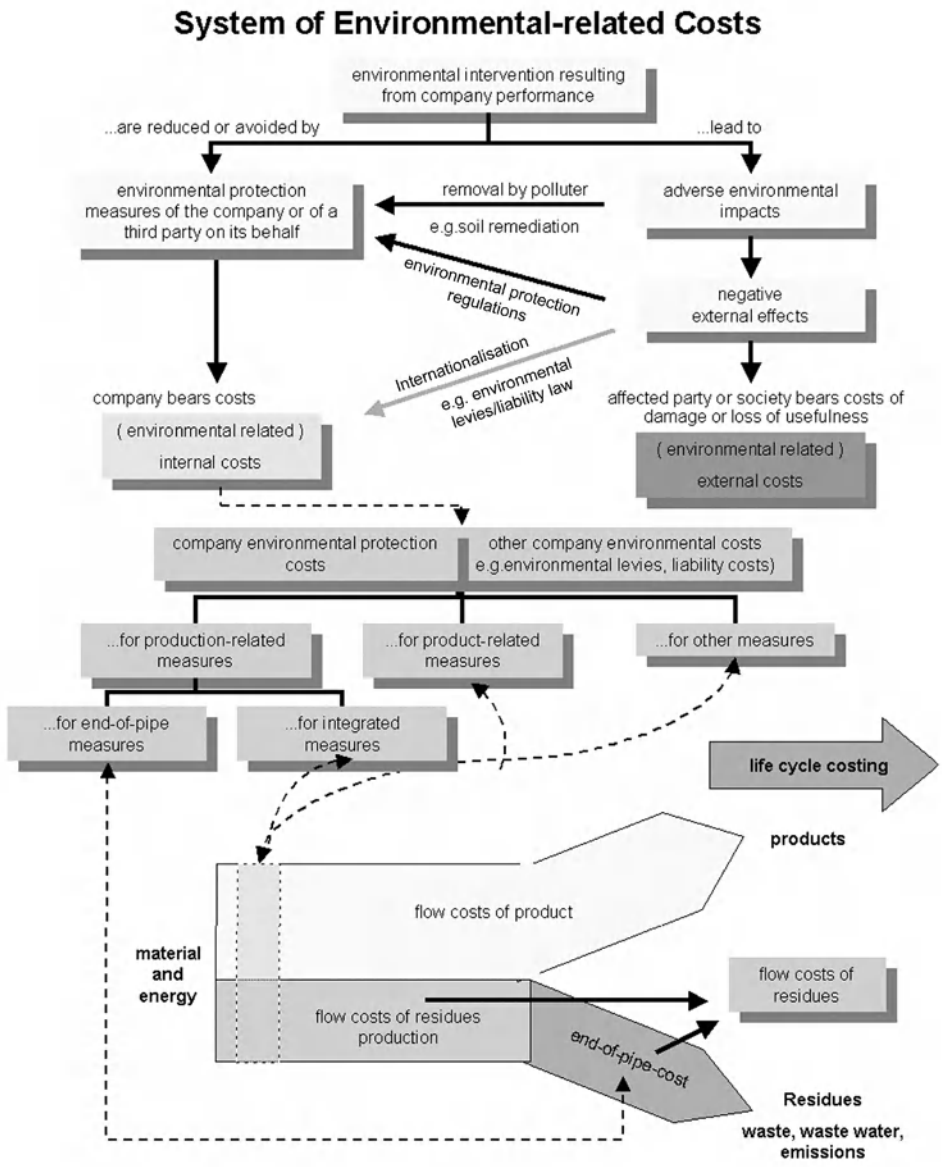


Figure 3.2, the relationships with the flow scheme from flow cost accounting are represented by broken arrows.

3.5 Conclusions

Many companies associate the determination of company environmental protection costs with environmental cost accounting. This information has to be determined partly for statistical enquiry, or it can serve the companies as documentation in their efforts towards environmental protection. It must be made clear to companies, however, that the determination of environmental protection costs is not, as a rule, sufficient for identifying possibilities for cost reduction. Materials and energy flows have to be analysed for this purpose, and flow cost accounting and residues cost accounting are suitable for this. However, flow cost accounting is expensive and would not appear to be ideal for smaller companies (with less than 100 employees). In addition, these materials and energy flow approaches compete with non-monetary instruments such as environmental indicators and materials flow diagrams (Loew and Jürgens 1999, Loew et al. 2002). This is being investigated more deeply in a new research project "INTUS – Operationalisation of Instruments of Environmental Control through the use of Company Environmental Information Systems[5]".

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[5]For further information see www.ioew.de

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4. The Professionalisation of Environmental and Social Reporting - What has it Achieved?

Peter James

Professor of Environmental Management, University of Bradford

peterj@dsl.pipex.com

Abstract The recent development of environmental and social reporting has been dominated by what can be termed a 'professional' model, which has been greatly influenced by accountancy. The central features of this model have been the annual financial report and accounts as exemplar, voluntarism in whether and how to report by organisations, and trying to ensure information quality through third party auditing and verification. However, current debates indicate that this model has a number of weaknesses, and as a generalisation is not providing stakeholders with what they want. The paper suggests an alternative model, based on more carefully defined reporting of a smaller number of indicators, with a greater regulatory involvement in ensuring information quality and a greater emphasis on third party assessment of actual performance rather than internal processes.

4.1 Introduction

Enron, WorldCom and other recent business scandals are raising questions about the role of financial accountants and auditors – and their regulatory bodies - in business (US Senate, 2002). The most fundamental of these questions is whether auditing and reporting processes are meeting their objectives of providing accurate and useful information to investors and other financial stakeholders. The stock market falls of 2002 gave the collective and resounding answer that they are not (Forbes, 2002). One reason is a belief that the combining of auditing and consultancy practices in the large accounting firms creates a conflict of interest which potentially undermines their willingness to conduct rigorous audits and to 'blow the whistle' on financial malpractice. Even if this is not the case in most instances, the perception that it can happen is very destabilising for the users of audit information (Forbes, 2002).

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 57-71.

If these questions are being raised and these answers are being given in the heartland of the financial accounting profession, what are the implications for other areas where it has great influence? This paper argues that they are profound in one such area, which is that of environmental, social and sustainability reporting (for convenience we subsequently use the term ‘environmental and social reporting’ to cover sustainability reporting also).

4.2 The Professionalisation of Environmental and Social Reporting

The first examples of environmental and social reporting were direct, unmediated, responses to political activism. In the social area it was driven particularly by the interest of unions and labour activists in information about employment and related business conditions, which in some cases was enshrined in national law (Bennett and James 1998; Zadek et al. 1997). In the case of environment, post-Bhopal campaigns by NGOs and community groups led to the US ‘Toxic Release Inventory’ (TRI) legislation (OECD 1996). This required publication of data on emissions of specified chemicals by larger companies in specified industries.

A key issue in the debate about these two early forms of environmental and social reporting was the quality of information. In the case of social reporting this was judged negatively because, in the analysis of a leading proponent at the time:

> “It had been used too extensively as a public relations tool and not extensively enough as a way to make fundamental changes in corporate culture... more permanent changes could be achieved only by incorporating social accounting into the internal accounting systems of these organisations... Neither the executives nor their accountants, however, were interested in a significant permanent change in corporate culture and the implementation of corporate social accounting.” (Epstein 1996 p. 12)

TRI-style environmental reporting was more successful. Although information quality was fairly low in its early years because of differences in measurement and interpretation, it nonetheless provided useful if crude information about the approximate magnitudes of emissions and how these varied between companies (Ditz and Ranganathan, 1997; OECD, 1996). The effect of this data on both internal and external perceptions was so great in many companies that it led to considerable action, including the production of broader reports which sought to offset any negative impressions by providing explanation and information on positive environmental actions which were being taken (see, for example, Nash et al 1992). It was also seen by many as a significant cause of the substantial reduction in emissions of targeted chemicals which occurred in following years (ENDS 1993). A key aspect of this success in driving improvement was that the information was required by a focused regulatory body, the Environment Protection Agency, which was itself under the scrutiny of the community and environmental groups who made considerable use of the data.

Over the last 10-15 years this model of the specific reporting of data which is required by a regulator has been superseded by more generic and voluntary approaches. Although NGOs and regulators have to some degree been involved in this development, the real driving force has been the environmental management and accountancy professions, especially the latter. This is because the exemplar of the professional approach has been financial reporting, with its reporting to stakeholders through a comprehensive annual report and accounts. One outcome has therefore been the growing influence of the accountancy profession on environmental and social reporting. Accountancy's professional associations, and the leading accounting firms, have played – and continue to play - a prominent role in developing and defining through a multiplicity of awards, discussion documents and research. This activity has been partly aimed at developing new markets for accounting firms and accountants (see, for example, Schaltegger & Burritt 2000, 205ff.), but it has also been intended as a demonstration that the profession is not just narrowly focused on money but is also engaging with the environmental and social challenges of the modern world.

As a result all the big accountancy practices have units providing consultancy not just on environmental and social reporting and verification but also on other areas of environmental management (Hanneberg, 2002). In 2001, for example, PricewaterhouseCoopers' Global Environmental Services unit employed over 400 advisers worldwide, including 35 in the Netherlands alone. As with its competitors, it was producing a variety of documents designed to influence perceptions of how companies should be reporting (for example, PricewaterhouseCoopers, 2001).

This has also been the aim of a plethora of accountancy-dominated environmental and social reporting awards. At their apex is the European Environmental Reporting Awards, which were in their sixth year of operation in 2002. They were set up by three national accounting bodies, and now involve co-operation between fourteen such bodies (European Environmental Reporting Awards, 2001). They have built on the experience of the UK accountancy institute, the Association of Chartered Certified Accountants (ACCA), in developing first a UK Environmental Reporting Award and then a UK Social Reporting Award. These awards have been extremely influential in shaping expectations of what is 'good' environmental reporting. Many professional accounting bodies have also established working parties, produced publications, and sponsored events on the topic of environmental and social reporting. At European level, for instance, the European Federation of Accountants (FEE) has a Sustainability (previously Environment) Working Party which has published a number of publications, all serving to emphasise the contribution of the accounting profession to environmental reporting and environmental management (for example, FEE, 1996, 2002). The most recent publication at the time of writing also advocates more work for the profession by stressing the need for more independent assurance of sustainability reports (FEE, 2002). Similarly, the ACCA has published a stream of reports on the topic, initially focusing on 'conventional' reporting in the form of an annual, paper-based, report analogous to its professional area of expertise, financial reports and accounts, but more latterly turning to new areas such as internet-based reporting (ACCA, 2001).

The result of these activities is what can be termed a 'professional' model of environmental and social reporting which replicates many of the features of financial reporting. Of course, non-accounting organisations have also contributed to this model and – as with the environmental consultancies who help to prepare and/or verify reports – are happy to apply it in practice (for example, SustainAbility/UNEP, 1996, 1997, 1998, 1999). But it is clear that accountancy ideas and organisations have been at the heart of its development over the last decade.

The attempt to make environmental and social reporting the mirror image of financial reporting has meant an annual, and until recently paper-based, report which attempts to provide a detailed picture of the totality of relevant impacts. The explicit or implicit message from the annual accounting awards and other professional sources has also been that the more comprehensive reports are, then the better, resulting in a continuing increase in their scope and size. The culmination of this trend is the Global Reporting Initiative, with its tens of pages on areas which should be addressed by sustainability reports (Global Reporting Initiative 2002).

Annual financial reports and the data which underpin them are audited, so the professional model also stresses the importance of third party verification of environmental and social data (FEE, 2002). As in the financial area, the aim of this verification is generally not to assess performance in any way, but simply to ensure that information is accurate.

The 'professional' model of environmental and social reporting has spawned an ever growing 'reporting industry'. Its food chain is the amount of money spent on preparing reports – which can run up to $1 million (SustainAbility/UNEP, 1999). As with financial auditing, involvement in environmental and social reporting can also position accounting firms and other environmental consultancies to win other business. And, like any ambitious sector, members of the 'reporting industry' are anxious to develop new markets. Hence, there has been a plethora of schemes aimed at developing reporting schemes for new constituencies such as SMEs or emerging countries (Wah, 2002). In the case of SMEs this includes an initiative by CSR Europe, the SMEKey project (see www.smekey.org).

4.3 Problems with the Professional Model

As the reporting industry has grown, the 'professional model' has certainly moved away from precisely mirroring financial reporting. Environmental consultancies and even the occasional NGO have taken a growing share of the verification and reporting consultancy business, and many reporters are now abandoning the attempt to create exact environmental and social equivalents of the 'annual financial report and accounts' in favour of web-based approaches. According to one survey in 2001, 66% of G100 companies used their web sites as mechanisms for global environmental and social reporting (CSR Network, 2001). A small but growing number of companies do not publish hard copies at all, but rely solely on the Internet. However, in many cases this transition does not result in innovative use of the interactivity and hyperlinking made possible by the internet but simply replicates a paper version in electronic form. As one study has observed:

> "Hardly any companies today take real advantage of the opportunities provided by the web for more transparent reporting. Most are still unsure as to the way forward, while their key stakeholders have already jumped

> on the internet bandwagon... Companies must learn that sustainability reports on the web require a whole new approach to information. Just as companies need to learn how to engage in e-commerce, they need to learn web reporting as a new set of skills. Sustainability reporting on the web has a different agenda from paper-based reporting, and the old tools and styles just aren't good enough." (SustainAbility, 2001, p. 2)

This dissatisfaction with web-based reporting forms part of a broader unease about the current status of environmental and social reporting. Only a minority of even the largest companies produce reports, and many of those do not meet accepted standards of good practice, such as quantitative measures and verification. A survey of the 2000 reports of the top 100 global companies by CSR Network found that about half were reporting on their environmental impacts, and a similar number on social impacts (CSR Network, 2001). However, it concluded that few of these were providing comprehensive data. For example, only 23% of companies reported global data on greenhouse gas emissions, only 19% addressed issues relating to social equity, only 14% addressed the impacts of global distribution and transportation - and only 13% had any formal verification. A UK study by the New Economics Foundation also found that, as at 2001, less than one-third of the FTSE 350 largest companies produced a substantive environmental report, and even fewer a social report (Doane, 2002). The quality of social reporting was also criticised in a survey by the consultancy ERM (2001). This found that whilst 79 of the FTSE 100 were publishing at least some information on social issues:

> "Serious doubts remain over the quality of the reporting being undertaken by these companies. Very few companies, for instance, have begun to move beyond 'corporate gloss' in their policy statements to providing performance information on real issues that impact employees and other key stakeholders.
>
> For example, on the issue of gender balance, hardly any report on the proportion of women in senior management levels in the company. Many declare objectives to forbid child labour in their supply chains, yet none provide data on this issue. And whilst workplace stress is widely reported in the media (in developed countries at least), and corporate social reports often refer to employees' as 'our key stakeholders', none of the FTSE 100 companies report workdays lost through stress." (ERM, 2001)

NGO critics of environmental and social reporting also point to a lack of standardisation, so that organisations are free to report what they want and are therefore able to mislead and/or miss out many of the aspects which of greatest interest to stakeholders. A recent report by the New Economics

Foundation points out that even the best known attempt to achieve such standardisation, the Global Reporting Initiative (GRI):

> "Remains entirely voluntary and the framework is such that companies can pick and choose which of the indicators they would like to report on. This makes it impossible to compare and benchmark corporate environmental and social performance." (Doane, 2002, p. 3)

Or, in the words of a survey of leading UK companies' approaches to stakeholder communications:

> "Many companies prefer to avoid 'fixed' stakeholder solutions, instead opting for an informal approach that enables them to draw together the key parts of the matrix – Corporate Social Responsibility, Reputation Management, Risk Management and Corporate Governance – in their own ways." (Addison, 2002 p. 5)

Doane also highlights the weakness of current verification practices, especially by accountants, stating that:

> "While some companies utilise the accounting sector to provide a statement of verification for the contents of a report, these loose statements do little to provide assurance that the report is adequate. For example, it is common practice for a verification statement to ignore what has not been included in a report." (Doane, 2002, p. 3)

4.4 Towards Mandatory Reporting?

The response of many NGOs to this situation has been to call for mandatory reporting. They argue that this is the only means to ensure that all companies report, and that reports provide the information which is of interest to stakeholders (Doane, 2002).

The call for compulsion has provoked considerable discussion, even amongst strong supporters of environmental and social reporting (for example, Schaltegger, 1997; Emtairah, 2002; Wah, 2002). One concern is the danger of creating a straitjacket which makes it difficult for companies to meet the needs of their particular stakeholders and/or creates disincentives for established reporters to keep making progress. As John Elkington of SustainAbility has observed:

> "Inevitably, mandatory requirements force companies into compliance mode, cramping their creativity .... The biggest risk is that mandatory requirements tend to be tailored to cover diverse sectors, with the result that they

> don't drive competitive thinking in the same way that good old everyday competition can." (quoted in Wah, 2002, p. 2)

Another difficulty with the current position, which is based on action by national governments, is that of a fragmented system of different national requirements which creates considerable costs for organisations (Emtairah, 2002).

These arguments have persuaded the European Commission, whose White Paper on Corporate Social Responsibility rejected a regulatory approach and advocated measures to encourage greater action by business such as demonstrating the business case and sharing best practice. The British government has similar views (DTI, 2002). But, as NGOs argue, if relatively little has happened to date, is it likely that much more will happen in future?

An even more fundamental argument against mandatory reporting as it is being discussed at the moment – i.e. a comprehensive, verified publication analogous to an annual financial report – is that this model of reporting may be unable to provide the transparency, and drive the improvements in environmental and social performance, which are desired by critics. Unsurprisingly, this argument does not figure very much within the publications of the reporting industry, particularly those emanating from its accountancy sections. However, it is important to consider it because the one thing which would be worse than the current position of limited and unreliable reporting would be one of compulsory and unreliable reporting which discredits the entire concept.

Warning signs of this possibility have been sent by the experience of some of the countries which have introduced mandatory reporting. In Denmark, for example, the 1995 Green Accounts Act requires around 1,200 Danish enterprises to publish annually information about their consumption of energy, water and raw materials, pollutant emissions and wastes, as well as other topics (Danish Environmental Protection Agency, 2000). An official analysis of its first years of operation concluded that:

> "Citizens, neighbours and other more remote stakeholders have shown little interest in making use of enterprises' green accounts to obtain information on environmental conditions and performance.
>
> For many enterprises, this lack of active interest has been disappointing. Despite this, many enterprises are convinced that their work on green accounts has borne fruit in the form of environmental improvements and financial results, organisational advantages and similar factors." (Danish Environmental Protection Agency, 2000, p. 12)

The lack of interest was typified by a comment from a representative of one of the leading NGOs, the Danish Society for the Conservation of Nature:

> "I believe that it is a good thing to compel enterprises to prepare green accounts, but I don't know how much energy we have to look through them. It may be that we address them as a theme, but there are many other themes which demand our attention." (Danish Environmental Protection Agency, 2000, p. 12)

One reason for this disinterest may be a lack of trust in the information provided because of poor information quality (Schaltegger, 1997).

Elsewhere too, many organisations which do produce reports typically find that they are read by fewer people than they anticipate or hope. Indeed, one of the unpublicised drivers of the moves to web-based reporting which many established reporters are making is the thousands of undistributed copies of paper environmental reports which are gathering dust in their offices. The problem is typified by the comment of a recent study of mandatory reporting in Denmark, the Netherlands, Norway and Sweden:

> "In a recent conversation with the environmental manager of a Swedish utility company, the manager bitterly complained that the company has decided not to publish a hard-copy environmental report any more because they think that the demand for it is not there. They will switch to Internet-based reporting as an alternative medium and reduce the amount of information published." (Emtairah, 2002, p. 13)

This is exacerbated by the failure of many companies to understand who they are communicating, or trying to achieve a dialogue, with. According to one survey of leading UK organisations, for example, only 25% of those questioned thought that they had a clear picture of their key stakeholders and their needs (Addison, 2002).

This would not matter if reports were at least taken seriously by key stakeholders such as NGOs, the financial community or the media, but there is ample anecdotal evidence that, as a generalisation, they are not. Financial analysts and rating agencies prefer to ask their own questions rather than to rely on the information provided in environmental reports, which generally are used only for background information. NGOs and the media are routinely mistrustful of their content, and many experts also agree with them - for example, all but one of the attendees at the 2002 European Environmental Management Accounting Network (EMAN-Europe) conference agreed that there were fundamental problems with the reliability and therefore credibility of environmental and social reports, when asked during the presentation of an earlier version of this paper.

One obvious reason for this is the feeling that, so long as companies are in control of the reporting agenda and process, no amount of verification or protestations of objectivity will prevent them from putting a positive gloss on their activities. In the words of one commentator:

> "Recent evidence suggests that an alarmingly large number of companies seem to regard even accounting standards as voluntary principles. Accounting scandals such as those surrounding Enron, Andersen, WorldCom and others illustrate the painful truth that a legal requirement to do something simply provides a healthy business in getting round those rules. Legislation on social responsibility would not necessarily change much about companies' response to the world around them." (Janus, 2002)

Simon Zadek too has warned of a general complacency in the field of CSR, with many treating it as a relatively mechanical exercise. He identified two unspoken rules of CSR which apply equally to environmental and social reporting:

> "The first is that you are never meant to say that it is difficult. Whilst indicators and 'how to' guidelines are clearly an important part of CSR's development phase, the growing tool mountain more than anything else symbolises the idea that its really all quite simple, just like fixing a car once you get the hang of it. This view is reinforced by pragmatic and slightly disrespectful appeals to fit answers onto a single sheet of paper for the over-stretched, under-resourced and, apparently, low-attention span business manager. The second rule is that you are never meant to say it's not enough. It is considered almost improper not to celebrate what a company has done, however small is the commitment compared to the company's resources, or indeed however minor is the change on the ground." (Zadek, 2002)

These problems may be worsened rather than improved by the advent of web-based reporting. The very abundance of information on such sites can disorientate and make it difficult, for example, to track performance against prior goals (CSR Network, 2001).

Indeed, the heretical possibility may be that the march towards ever more comprehensive reporting frameworks, containing ever more gargantuan amounts of information, may be as much a part of the problem of as much as the solution to the malaise of environmental and social reporting. Overwhelming amounts of information aimed at every conceivable stakeholder may be inimical to the needs of individual stakeholders for information targeted to their needs. This is especially true if it is the case that almost all stakeholders other than campaigning NGOs ultimately want simple answers to basic questions such as: is this company performing well? and how is it doing compared to relevant benchmarks such as its peers or 'best practice' organisations?

4.5 An Alternative Reporting Model

Bennett and James (1998) have termed the generic frameworks which are favoured by the professional model as a 'light bulb' approach - which illuminate a wide area at varying degrees of intensity, depending on the commitment of the measuring and/or reporting organisation. They and others (for example, Ditz and Ranganathan 1997) have contrasted this with a 'laser' approach, which aims to illuminate a smaller area more intensively through the use of standardised data on specific key aspects - for example, energy, materials and water inputs and outputs, emissions, waste outputs - and have suggested that the latter might be a more effective driver of improvement. The TRI legislation is the exemplar of this approach. Although information quality has not been perfect, with continuing problems of definition and measurement, it has improved with time and was certainly 'good enough' in its early years to meet the needs of users to a substantial degree.

The other key feature of an alternative reporting model is the transformation of third party assessment from a focus on the accuracy of information to a judgement on performance. Aided by the availability of 'laser' information, a third party organisation could provide a view on how an organisation was doing compared to its peers, and compared to expectations of good environmental performance. A wide variety of organisations could play this role, but it is important that those doing it are not open to accusations of conflict of interest by also marketing consultancy services.

Of course, quality of information is a problem in this approach as well as in the professional model. The key is likely to be a sectoral focus to minimise the problems of comparing widely disparate organisations, standardised measurement definitions and protocols, and an incentive to comply through regulatory oversight. Third party verification would still have a role, but it would be much more concerned with ensuring that regulatory requirements are being met than at present.

Of course, any such system of 'laser' reporting does not rule out more comprehensive 'light bulb' approaches. Indeed, just as TRI stimulated the first generation of environmental reports – which were damage limitation exercises to put a gloss on the shocking figures about the volumes of toxic chemicals produced - so a laser system is likely to result in more rather than less generic reporting as companies seek to put figures in the best possible light.

4.6 The Opportunity Costs of the Professional Reporting Model

The argument that the professional approach may have reached its limits is based not only on the failure of its 'environmental and social equivalent of the financial report' approach, which is not delivering what stakeholders want, but also on the alternative activities which might be undertaken by the organisations and groups which are involved in its development. Much more standardisation of information collection and dissemination, for example, would be very helpful to the rating of environmental and social performance for capital markets. At present there is a multiplicity of schemes, resulting in excessive burdens on organisations in supplying information, and in problems for users because of the absence of any widely accepted and authoritative judgements analogous to those of the small number of financial raters. There is even less standardisation, or even use, of product declarations.

The very existence of EMAN also demonstrates that there is another area of accounting practice as well as financial accounting, i.e. management accounting, where accountants can help organisations to identify the costs of poor environmental performance and to make sure that these are taken into account in financial decision-making.

Reconsidering the role of accountancy firms, and accountancy bodies, in environmental and social reporting also highlights opportunities in other areas. Prominent amongst these is surely to raise awareness of environmental issues amongst their general membership. Ask environmental managers what are the greatest barriers to their work, and most will answer that one of the most important is an unsympathetic finance department which fails to understand the medium to long-term financial benefits which can be gained from sensible environmental improvement. Another important 'opportunity cost' of the focus of many accountancy bodies and individuals on reporting has been the neglect of more mundane topics, such as greater emphasis on environment amongst developers of accounting and enterprise resource planning software such as SAP. Indeed the EMAN conference identified the difficulty of gathering basic energy, materials and other data from such systems as perhaps the greatest barrier to the materials flow accounting which would generate the data needed for 'laser' reporting. When the balance sheet is drawn up of what the professional reporting model and the reporting industry that it has spawned has actually achieved over the last decade, the greatest irony may be that, in the endless search for stakeholders, one of those with the greatest capacity to influence environmental improvement has been virtually invisible.

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II

POLICIES AND INITIATIVES FOR THE PROMOTION OF EMA

5. Austrian Pilot Projects on Environmental Management Accounting Following the UN DSD EMA Methodology

Christine Jasch

Institute for Environmental Management and Economics (IÖW), Vienna, Austria

info@ioew.at

Abstract This article reports upon the environmental management accounting (EMA) methodology developed for the UN Division for Sustainable Development (UN DSD) and the resulting toolkit based on 12 case studies in Austria. An example is cited which shows the real cost distribution of SCA Laakirchen, a pulp and paper plant[1].

5.1 Introduction

Part of the background for the strong interest in environmental management accounting (EMA) is the growing demand for integrated consideration of both financial and physical aspects of environmental management. The concept of sustainable development also requires a combined consideration of financial, environmental and social aspects. International rating agencies and award systems for environmental and sustainability reporting also put a strong emphasis on the disclosure of financial aspects in environmental reports.

Within the project which will be described, a series of national pilot projects are being conducted within the Austrian research theme on the "Company of Tomorrow"[2]. This selection of case studies, together with the EMA methodology book (Jasch, 2001)[3], will provide the basis for a national

[1]the project results and publications will be published in print, on CD-Rom and made available for download at the homepage of the IÖW, http://www.ioew.at
[2]For more information, see http://www.fabrkderzukunft.at

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 75-88.

research programme on EMA and will be used for dissemination amongst companies and consultants and for training purposes.

Results for each of the pilot companies will include:

- the calculation of total annual environmental costs for 2001, following the approach developed for the UN DSD
- investment projects calculated by the company and re-calculated by the research team
- improved information for decisions on investment appraisal, for the assessment of the costs of new products, and for the assessment of the costs and benefits of projects
- the identification of potential improvements in the environmental and financial information systems
- improved consistency of the data that is reported within the organisation
- a "best-practice" example that can be published in the environmental report

The focus of the pilot projects is not an in-depth assessment of total environmental cost, but a critical review of existing information systems in order to improve the basis upon which decisions on materials flow management and investment are made. With the methodology which has been developed, a first assessment of total annual environmental costs can be prepared in a workshop of one or two days, and this enables priorities to be set for further investigations. An accountant and a process technician trace the environmental costs and check the environmental and financial information system. The company team consists of at least the environmental

[3] In late 1999, the UN Commission for Sustainable Development (see http://www.un.org/esa/sustdev/estema1 for more information and downloads) established an Experts Working Group on EMA. A book on procedures and metrics for EMA was written for this group, and commissioned by the Austrian Ministry of Transport, Innovation and Technology (BM VIT), the Austrian Ministry of Agriculture, Forestry, Environmental and Water Management (BM LFUW) and the Austrian Chamber of Commerce (BWK). This book can be downloaded in both German and English at http://www.ioew.at The objective of the book was to define principles and procedures for EMA with a focus on techniques for quantifying environmental expenditures or costs, as a basis for the development of national EMA guidelines and frameworks.

manager and the controller/accountant. Often, the production manager and a representative from top management also join the team and for at least the discussion of the results. Most companies already have environmental management systems, and their awareness and the availability of data are high.

All company projects are compiled and described on the basis of existing data records, balance sheets, lists of accounts, cost centre reports, list of assets, etc. Each company is transformed into a neutralised description that allows the re-calculation of costs from scratch. Many toolkits for cost calculation, accounting and the preparation of a balance sheet are structured in this way, but as yet there is no similar publication in the environmental field.

A toolkit for EMA, structured in this way, would allow environmental managers as well as accountants and controllers actually to trace the relevant costs in different records (which is what they would have to do in the company as well), to calculate total annual environmental costs and the costs of an investment example, and to compare their own solution to the solution which is then provided by the research team with some further remarks in the annex.

The following describes in more detail the EMA methodology used in the project, and presents a case study which applies this methodology.

5.2 The UN DSD EMA Methodology

The methodological background of this chapter is consistent with the approach applied in the EMA workbook published by the UN DSD (Jasch, 2001).

The concept of '**waste**' has a double meaning. Waste is a material which has been purchased and paid for but which has not been transformed into a marketable product, so that waste is therefore indicative of production inefficiency. The costs of wasted materials, capital, and labour have therefore to be added together in order to arrive at the company's total environmental costs and provide a sound basis for further calculations and decisions. Waste in this context is used as a general term which includes solid waste, waste water and air emissions, and thus comprises all non-product output. The term "materials" includes water and energy.

The approach developed for UN DSD is based on the underlying assumption that all purchased materials must by physical necessity leave the company

Table 5.1. Total corporate environmental costs (Jasch, 2001)

	Environmental Protection Costs (Emission Treatment and Pollution Prevention)
+	Costs of wasted materials
+	Costs of wasted capital and labour
=	Total corporate environmental costs

as either product or as waste and emission. Waste is thus a sign of inefficient production. When calculating environmental costs, therefore, not only disposal fees are considered but also the purchase value of materials which have been wasted, and the production costs of waste and emissions.

The main problem which is involved in attempting to carry out a systematic identification of the potential for materials efficiency improvements lies in traditional cost accounting systems, which are unable to provide relevant information on the company's physical structure, i.e. on the structure of its materials flows. In particular, non-product output (waste, wastewater, etc.) is not quantified and monetised separately within accounting systems. However, some methods have recently been developed to overcome these shortcomings.

Conventional environmental cost assessment did not consider materials flows but mainly waste treatment and disposal costs and investments in end-of-pipe technologies. For cleaner production projects, and later for the disclosure of environmental performance in environmental reports, *materials flow (input-output) balances* were determined, but that was usually done without systematically integrating the two information systems, aiming for consistency of system boundaries, or assessing the costs of materials flows.

Residual waste accounting, subsequently, measures not only the costs of disposing of waste but also the materials purchase values and pro-rata production costs. The system boundary is the company, as for financial reporting. This approach is also at the core of the UN DSD EMA method, which aims as a first step to provide a comprehensive statement of annual environmental costs.

Activity-based costing improves the calculation of internal costs within a company by allocating those costs which are typically found in overhead costs to the polluting activities and products which originally caused them.

Significant materials flows are traced throughout the company and their costs are allocated back to the polluting cost centres.

Flow cost accounting aims not merely to separate the costs of environmental protection, but to detect all materials flows via the company's cost centres and to reassess production costs and the amounts added in the various phases of production such as estimated scrap percentages, waste rates, etc. Technical process flow charts support this approach. While use of this method in detail assesses the aggregate amounts and costs of materials flows, which results in an improved calculation of production costs, it also avoids the need to separate the environment-related portion and to obtain a complete list of other environmental costs. The system boundaries are the various production processes and cost centres in a company. Also, the input/output-analysis of materials flows can be further subdivided from the company level and the process level down to the level of the product which is produced.

Different companies may adopt different definitions of "environmental costs", and use a variety of different methods for cost assessment. The appropriate distinction between environment, and health and safety and risk management, frequently poses questions. For the purpose of internal management accounting, however, the particular definition which is adopted is not the main concern, so long as all significant and relevant costs are included in decision-making.

Adding the *purchase value of non-materials output* (waste, waste water) to the environmental costs makes the share of "environmental" costs higher, relative to other costs. However, the aim of this approach is not to show that environmental protection is expensive, and it is not a valuable task to spend time attempting to define precisely which costs are environmental or which are not, or what percentage of an item is environmental or not. The destination to which these costs are currently attributed in the present system (such as quality costs, general overhead, etc.) is also irrelevant.

The most important task is to make sure that all relevant, significant costs are considered when making business decisions. In other words, "environmental" costs are only a subset of the larger cost universe that is necessary for good decision-making. "Environmental" costs are part of an integrated system of materials and money flows throughout a company, and not a separate type of cost altogether. To adopt EMA is simply to adopt an improved and more comprehensive management accounting, whilst wearing an "environmental" hat, which attracts attention to previously hidden costs.

The focus of materials flow accounting is therefore no longer on assessing the total "environmental" costs, but on a revised calculation of production costs on the basis of materials flows. All of the wasted materials input percentage from the materials flow balance is added to the "environmental" costs in order to arrive at a full picture of the costs of materials inefficiency and thus the potential for improvement.

The environmental cost categories are distinguished into four blocks:

The first block of environmental costs comprises conventional *waste disposal and emission treatment costs*, including related labour and maintenance materials. Insurance, and provisions for environmental liabilities, also reflect the spirit of treatment rather than of prevention. This block corresponds to the conventional definition of environmental costs, comprising all treatment, disposal and clean-up costs of existing waste and emissions.

The second block is termed *preventive environmental management*, and adds also the costs of labour and external services for good housekeeping as well as the "environmental" share and the additional costs of integrated technologies and green purchases, if significant. The main focus of this second block is on the annual costs of the prevention of waste and emissions without the calculation of cost savings. These include higher pro-rata costs for environment-friendly auxiliary and operating materials, low-emission process technologies and the development of environmentally benign products.

Three production factors are conventionally distinguished: materials, financial capital (investments, related annual depreciation and financing cost) and labour. The next two blocks consider the costs of wasted materials, capital, and labour due to inefficient production and the generation of wastes and emissions.

In the third block, the *wasted materials purchase value* is added. All non-product output is assessed through a materials flow balance, and wasted materials are evaluated in terms of their materials purchase value, or value of materials consumed in the case of stock management.

Finally, the *production costs of non-product output* are added, including with the relevant production costs of labour hours, the depreciation of machinery, and operating materials. In activity-based costing and flow cost accounting, the flows of residual materials are determined more precisely and are allocated to cost centres and cost carriers. Care has to be taken to avoid double counting if maintenance materials and labour cost have already been covered by cost centres, or calculated from the materials flow balance. This depends on the structure and quality of the company's information systems.

Environmental revenues derived from the sales of waste, or grants and subsidies, are accounted for in a separate block.

Costs which are incurred outside the company and borne by the general public (external costs), or that are relevant to suppliers and consumers (life cycle costs), are not dealt with here.

Table 5.2 shows the environmental cost assessment scheme which was developed. The column headings correspond to the Environmental Protection and Resource Management Accounts of the System of Integrated Environmental and Economic Accounting (SEEA) which was developed by the United Nations Statistics Division.

Jasch (2001) provides information on different cost categories, and its annex provides checklists for classification by environmental media. For the case studies, this scheme has been converted into a spreadsheet file that allows data tracing and recording on a line-by-line basis, so that references to all costs are recorded directly in the spreadsheet. The assessment of total annual environmental costs can be done in a workshop of one to two days, and the spreadsheet can then be used in following years to trace costs much more quickly, since the relevant accounts, cost centres and estimates will already have been recorded.

The detailed spreadsheet with all the data records also adds up to a one-page document similar to Table 5.2 which shows all costs on a single page, including their distribution by media and cost categories. This file is also converted into a percent distribution.

5.3 The Case Study of SCA Graphic Laakirchen AG

The history of paper manufacture in Laakirchen dates back to 1874. The Swedish group "Svenska Cellulosa Aktiebolaget" (SCA) is structured into three business segments: "SCA Hygiene Products", "SCA Packaging" and "SCA Forest Products". Within the "Forest Products" group, the Laakirchen factory (SCA Graphic Laakirchen) specialises in the production and development of super-calendered (SC) paper. SCA Graphic Laakirchen currently employs 557 people and operate two paper machines – PM 3 and PM 10 – which together annually produce around 330,000 tonnes of SC natural roto-

Table 5.2. Environmental cost scheme (Jasch, 2001)

Environmental media / **Environmental cost/expenditure categories**	**Air + Climate**	**Waste Water**	**Waste**	**Soil + Ground Water**	**Noise + Vibration**	**Biodiversity + Landscape**	**Radiation**	**Other**	**Total**
1. Waste and Emission treatment									
1.1. Depreciation on related equipment									
1.2. Maintenance and operating materials and services									
1.3. Related personnel									
1.4. Fees, taxes, charges									
1.5. Fines and penalties									
1.6. Insurance for environmental liabilities									
1.7. Provisions for clean up costs and remediation									
2. Prevention and environmental management									
2.1. External services for environmental management									
2.2. Personnel for general environmental management activities									
2.3. Research and development									
2.4. Extra expenditure for cleaner technologies									
2.5. Other environmental management costs									
3. Materials Purchase Value of non-product output									
3.1. Raw materials									
3.2. Packaging									
3.3. Auxiliary materials									
3.4. Operating materials									
3.5. Energy									
3.6. Water									
4. Processing Costs of non-product output									
Σ Environmental Expenditure									
5. Environmental Revenues									
5.1. Subsidies and Awards									
5.2. Other earnings									
Σ Environmental Revenues									

gravure and offset paper. SC paper from Laakirchen is used for magazines, catalogues and advertising materials with around 95% of production being exported, of which 80% goes to EU countries.

In addition to the demands of high quality in terms of printing, the principles of SCA Graphic Laakirchen also cover the need for environmental responsibility. Since 1993 the company has used totally chlorine-free bleached pulp (TCF) exclusively and has consequently adopted a leading role in the production of SC papers. The company was one of the first EMAS sites (registration number 23) and often tests pilot projects which are then implemented throughout the rest of the company. In 2000, the company conducted a major pilot project on EMA, following the UN DSD approach, and has published in its annual environmental statement both the report on the project and its environmental cost distribution over different environmental media[4].

In addition to the plants used directly in the actual paper manufacturing process, such as wood storage, grinding, stock preparation and the paper machines PM 3 and PM 10, SCA Graphic Laakirchen AG also has a variety of technical units which are used to implement the demands of ecological quality. These are the de-inking unit for preparing recovered paper, a multi-level mechanical/biological wastewater treatment plant, and a gas turbine functioning in accordance with the principle of power/heat reaction which guarantees a virtually self-sufficient energy supply for the plant thanks to its high level of efficiency. The annual depreciation of these units is recorded as being wholly an environmental cost.

5.3.1 Wood

The total requirement for wood is around 240,000 m^2 per year, and 10 people work in the wood storeroom. The materials loss of bark waste is 15% of the wood which is purchased. In manufacturing ground wood pulp, SCA Graphic Laakirchen uses approximately 90% wood from thinned trees, primarily from Austrian forests. The materials loss at ground wood pulp production is about 1%. The materials loss percentages as well as the wasted work hours are added to the cost assessment.

[4]for further reference see http://www.sca.at

5.3.2 Recovered Paper

SCA Graphic Laakirchen uses 130,000 tonnes of pre-graded recovered paper each year. About 80% of recovered paper input can be reused for paper production; the rest ends up as waste. Thus, 20% of the purchase price has been added to the cost assessment.

5.3.3 Pulp, Filler

Fillers and totally chlorine-free bleached pulp (TCF) are bought in and dissolved on site as slurry. Production indicators calculated a loss of 0.4% of pulp and 4% for fillers.

5.3.4 Auxiliary Materials

After passing through the production process, all paper chemicals end up in the wastewater treatment plant and are thus recorded as costs. In 1999, a research project for a closed-loop system of paper chemicals started, which was co-funded by the Austrian research fund. The profitability of this is significantly higher if not only end-of-pipe-treatment costs are calculated, but also the savings made on purchases of materials are considered as well. For lubricants, it can be estimated that these end up together with the tissue, in the hazardous waste fraction. For cleaning materials, it is estimated that one-half leaves the company via air emissions, the other half via wastewater.

5.3.5 Gas Turbine

SCA Graphic Laakirchen AG operates a gas and steam plant in co-operation with CMOÖ, an electricity generator[5]. This is used for low-emission generation of electricity and steam from natural gas, and it ensures a largely autonomous energy supply according to the principle of power/heat reaction. It produces about 1460 GWh of electricity and about 1400 GWh of steam annually, and the efficiency loss of natural gas conversion has been estimated at 30%. This cost centre employs 2 blue-collar and 2 white-collar workers, and 30% of their costs have also been added. There are no reliable estimates for the efficiency loss of electricity, so it was decided to calculate only the electricity inputs of environment-related cost centres.

[5]CMOÖ is a subsidiary of Energie AG OÖ and the OMV

5.3.6 Grinding Station

The grinding shop has 14 continuous grinders for grinding the debarked wood. Work is continually being carried out to optimise the energy which is required for the grinding process. In subsequent stages, the wood pulp is graded and stored for further processing. The locations used for wood manipulation (wood transfer, the storeroom and the grinding station) were re-organised last year in order to prepare for a ground-sealing. The costs which are expected in 2002 for re-cultivation have been accounted for.

5.3.7 Environmental Management

In addition to the environmental manager and the personnel costs of the specified cost centres, one technician per year, on average, is working with environment related issues. In addition to the environmental manager, the company has an environmental board of 7 people which spends about 2 weeks per year on environmental issues. The director of the management board is also involved in environmental issues for about one week per year.

For the assessment of environmental costs, not only the output side of the materials flow balance is assessed, with its disposal and treatment costs, etc., but if available the wasted materials input is also calculated with its purchase value and respective production costs.

Table 5.4 shows the percent distribution of the actual environmental costs for SCA Graphic Laakirchen in the year 2000. The rows show the costs by cost categories. The total environmental costs in 2000 came to €23,758,510 which is 30% above the costs in 1999. This substantial increase is attributable to increased prices for raw materials, operating materials and gas.

The distribution by environmental media in Table 5.4 shows that water/waste water is responsible for 44% of all environmental costs. The annual operating costs of the wastewater treatment plant account for 13%, but the price of the paper chemicals which it disposes of down the drain are worth 32%. A reduction in the consumption of paper chemicals would therefore significantly reduce environmental costs.

Wasted materials account for 30% of all environmental costs. Disposal fees are only 3.6%, but the major share is the original cost of the raw materials which are included in the waste fraction (26.6%, including processing costs).

The efficiency losses of gas combustion are assessed under the category of "air and climate". The sharp increase in the price for gas has raised the share of this cost category from 19.9% in 1999 to 24.6% in 2000.

Table 5.3. Average Input-Output Balance of SCA Laakirchen

		Unit	2001	€
Raw Materials	Wood	Kt	123	11,747,000
	Pulp			26,105,000
	Recovered Paper	Kt	126	16,338,000
Packaging Materials	Several packaging materials			2,264,000
Auxiliary materials	Fillers	Kt	107	12,210,000
Operating Materials	Chemicals	Kt	16	8,137,700
	Lubricants			109,100
	Cleaning Materials			32,700
	Water	1000 m^3	6,725	11,600
Energy Provision	In-house hydro power	MWh	16,885	
	Electricity: external	MWh	38,575	
	Natural Gas	1000 m^3	110,970	17,920,000
Energy Consumption	Electrical Energy	MWh	460,509	
	Thermal Energy	MWh	400,003	
Production	Graphic Paper	Kt	323	
Waste Water	Waste Water Flow	1000 m^3	5,706	
	COD	T	453.5	
	Suspended Solids	T	28.5	
	Phosphor	T	2.1	
	Nitrogen	T	7.7	
Air Emissions	NO_x	T	106	
	CO_2	Kt	221	
	CO	T	55	
Waste	Bark	Kt	36.79	
	Fibre Residues	Kt	9.09	
	Flotation Sludge	Kt	43.38	
	Rejects	Kt	1.76	
	Waste for Recycling	Kt	0.5	
	Waste to Landfill	Kt	0.66	
	Hazardous Waste	Kt	0.05	

Analysis of the environmental costs by cost categories makes evident that the highest share is the materials purchase value of non-product output (80.4%), which is calculated from all raw, auxiliary and operating materials in the mass balance that do not leave the company as part of the product.

The earnings in the columns for "waste" and "wastewater" arise from the sale of re-cycled materials and treatment capacity.

The research project on electrochemical wastewater treatment, which is also dealt with under "costs for research and development", was partly funded by the Austrian Fund for Research (FFF). These earnings are also accounted for; though more importantly, this project helped to reduce significantly the costs of paper chemical input.

Assessment of environmental costs following the UN DSD EMA approach has now been carried out for three subsequent years, and has significantly changed awareness of the priority areas for cost savings. The focus is less on technical equipment and personnel hours than on materials efficiency.

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Further references and information on projects can be found at www.EMAwebsite.org; further information on this project can be obtained from Dr. Christine Jasch , Institute for Environmental Management and Economics , Institut für Ökologische Wirtschaftsforschung, IÖW, Wien, 1040 Wien, Rechte Wienzeile 19, tel.: 0043.1.5872189, fax: 0043.1.5876109, http://www.ioew.at, e-mail: info@ioew.at.

Table 5.4. Percent distribution of total environmental costs for 2000 of SCA Laakirchen AG, from the company's Environmental Statement for 2000 (SCA Laakirchen AG, 2001)

Environmental cost categories:	**Air & climate**	**Waste water**	**Waste**	**Soil & ground-water**	**Other**	**Total**
1. Waste and emission treatment						
1.1. Depreciation of related equipment	0,2%	3,2%	0,5%			3,9%
1.2. Maintenance, operating materials and services		5,0%		0,1%		5,1%
1.3. Related personnel	0,8%	1,6%	0,7%			3,1%
1.4. Fees, taxes, charges	0,7%	1,3%	3,6%			5,7%
1.5. Fines and penalties						
1.6. Insurance for environmental liabilities						
1.7. Provisions for clean-up costs and remediation						
2. Prevention and environmental management						
2.1. External services for environmental management					0,1%	0,1%
2.2. Personnel for general environmental management activities	0,1%				0,9%	1,0%
2.3. Research and Development		1,5%				1,5%
2.4. Extra expenditure for cleaner technologies						
2.5. Other environmental management costs						
3. Materials Purchase value of non-product output						
3.1. Raw materials			23,0%			23,0%
3.2. Packaging			0,1%			0,1%
3.3. Auxiliary materials			2,1%			2,1%
3.4. Operating materials	0,1%	32,0%	0,5%			32,5%
3.5. Energy	22,6%					22,6%
3.6. Water		0,1%				0,1%
4. Processing costs of non-product output		0,2%	0,9%			1,0%
Total environmental costs	***24,6%***	***44,9%***	***31,3%***	***0,1%***	***1,0%***	***101,9%***
5. Environmental earnings						
5.1. Subsidies, Awards		- 0,8%				- 0,8%
5.2. Other earnings		- 0,2%	-0,9%			-1,1%
Total environmental earnings		***-1,0%***	***-0,9%***			***-1,9%***
Balance of costs/earnings	***24,6%***	***44,0%***	***30,3%***	***0,0%***	***1,0%***	***100,0%***

* The SEEA categories of noise and vibration, biodiversity, landscaping, and radiation were omitted since no costs arose here.

6. Two Governmental Initiatives on Environmental Management Accounting and Corporate Practices in Japan

Katsuhiko Kokubu

Graduate School of Business Administration, Kobe University

kokubu@rokkodai.kobe-u.ac.jp

Eriko Nashioka, Koichiro Saio and Shinichi Imai

Kansai Research Centre, Institute for Global Environmental Strategies (IGES)

kansai@iges.or.jp

Abstract There are two main governmental initiatives on environmental accounting in Japan, which have been taken by the Ministry of the Environment (MOE) and the Ministry of Economy, Trade and Industry (METI). MOE published the environmental accounting guidelines in 2000 and since then has continued this initiative. METI launched a three-year research-based project on environmental management accounting in 1999, and this was completed in March 2002. This paper will examine the influence of these two governmental initiatives on Japanese corporate environmental accounting practices, with an analysis of environmental accounting disclosure and a questionnaire survey. The examination indicates that the MOE guidelines have had a very strong influence on Japanese companies which in turn shows that Japanese corporate environmental accounting is oriented to external reporting, since the MOE guidelines stress the external disclosure function of environmental accounting more strongly than the internal management function.

The number of companies which disclose environmental accounting information in their environmental reports is increasing (Kokubu and Nashioka, 2001). The Japanese government has recently made considerable efforts to develop environmental accounting with several initiatives, many of which

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are still in progress, having been taken by the Ministry of the Environment (MOE), the Ministry of Economy, Trade and Industry (METI), the Ministry of Agriculture Forestry and Fisheries, and the Ministry of Land, Infrastructure and Transportation. As well as central government ministries, local government bodies such as Iwate Prefecture and Yokosuka City have also been involved in similar initiatives - the environmental accounting statement published by Yokosuka City in 2000 was the first to be published by a Japanese local authority.

Of these initiatives, those of MOE and METI[1] are considered to play a more important role in Japanese companies. Other governmental initiatives have their own particular missions, which are supposed to be confined to their business area[2]. The purpose of this paper is to examine the influence of both MOE and METI environmental accounting initiatives on Japanese corporate practices at large. Li (2001) categorised the policy instruments used by government into: (1) regulatory; (2) voluntary; (3) incentive based; (4) informational; and (5) cooperative instruments. According to this categorisation, both MOE and METI initiatives are voluntary and information-based instruments.

In the following two sections, these two governmental initiatives will be explained briefly. Then Japanese corporate environmental accounting practices will be examined. The analysis will be based on an investigation of environmental accounting disclosures and a questionnaire survey.

6.2 MOE Initiatives on Environmental Accounting

MOE started its first environmental accounting project in 1997. It formed an environmental accounting committee and in 1999 published a report titled, "Grasping Environmental Cost: Draft Guidelines for Evaluating Environmental Cost and Publicly Disclosing Environmental Accounting Information (Interim Report)" (MOE 1999). Before taking this initiative, MOE annually surveyed the environmental awareness of Japanese corpora-

[1]Both MOE and METI were reformed in January 2001. The former organisations had been named the "Environment Agency" and the "Ministry of International Trade and Industry" respectively. All initiatives before 2001 were taken by the former organisations, but the names MOE and METI have been used in this paper in referring to all initiatives, in order to avoid any confusion.

[2]For example, the Ministry of Agriculture, Forestry and Fisheries completed a project to develop environmental accounting for the food industry, and the Ministry of Land, Infrastructure and Transport has a committee on environmental accounting for the sewage drain business.

tions and recognised that there was considerable need for some instructions on how to calculate environmental costs. MOE revised the interim report and released the environmental accounting guidelines in the following year (MOE 2000). While these guidelines are not mandatory, their main purpose is to establish a standard definition of environmental accounting and to present a format by which to disclose environmental accounting information[3] in a stand-alone environmental report (Kokubu and Kurasaka 2002). Although the guidelines refer to the managerial function of environmental accounting as well as the external reporting function, they place much more importance on external disclosure[4]. In 2002 MOE revised the guidelines (MOE 2002), though this was not a major revision and the basic framework remained unchanged.

MOE also organises a study group on corporate environmental accounting practices, in which more than 60 Japanese companies participate. Any company can become a member of this group if it has introduced, or intends to introduce, an environmental accounting system. Since 2000, MOE has annually published a report on corporate environmental accounting practices based on the activities of this group. In addition to the environmental accounting guidelines, MOE published the voluntary environmental reporting guidelines in 2001 (MOE 2001a).The environmental reporting guidelines detailed the items to be disclosed in an environmental report, and these included environmental accounting information.

The core contents of the environmental accounting guidelines consist of environmental costs and benefits (environmental conservation benefits and economic benefits)[5]. The environmental costs listed in the guidelines are classified into the following seven categories. The environmental costs of the guidelines are limited to environmental conservation costs and do not take into account either the costs of raw materials or social costs.

[3]The MOE guidelines include monetary environmental information as well as physical environmental information.

[4]How to define this type of environmental accounting is a controversial issue. Is it environmental financial accounting or environmental management accounting? Because the MOE guidelines are completely separate from financial accounting, it should not be called environmental financial accounting. In addition, they encourage companies to use environmental accounting for internal management as well as for external reporting, so the guidelines should be recognised as a type of environmental management accounting. In this sense the scope of environmental management accounting should be enlarged to include an external reporting function beyond financial accounting. For a related discussion, see Burritt et al. (2002).

[5]The English version of the guidelines in 2000 uses the word “effect” instead of “benefit”.

1 Business area costs: environmental conservation costs which are incurred in order to control the environmental impacts caused within a business area by its production and service activities.

2 Upstream/Downstream costs: environmental costs for controlling environmental impacts caused upstream or downstream of a business area as a result of its production and service activities.

3 Management activity costs: environmental costs resulting from management activities.

4 Research and development costs: environmental costs resulting from research and development activities.

5 Social activity costs: environmental costs resulting from social activities.

6 Environmental damage costs: environmental costs resulting from environmental damages.

7 Other environmental costs.

Regarding environmental conservation benefits, the guidelines classify these into four categories:

1 environmental conservation benefits concerning input resources,

2 environmental conservation benefits concerning environmental impacts and wastes from main business activities,

3 environmental conservation benefits related to the products and services produced by the company, and

4 other benefits.

These environmental benefits are measured in physical units and are based on the MOE Guidelines on Environmental Performance Index (MOE 2001b). These benefits are, in principle, to be disclosed in order to provide a contrast to environmental costs.

The economic benefits which the guidelines specify are distinguished between "substantive benefits" and "estimated benefits". The substantive benefits are economic benefits which are calculated on a credible basis, and include some savings and revenues from environmental protection activities. The estimated benefits are based on hypothetical calculations, such as of the possible contingent benefits from avoiding any accidents. The guidelines encourage companies to disclose only substantive benefits, and to be careful in calculating estimated benefits in order to avoid misleading readers.

The guidelines provide three alternative formats for the disclosure of an environmental accounting statement from which companies can choose:

- Format A: environmental cost only
- Format B: environmental cost and environmental conservation benefits
- Format C: environmental cost, environmental conservation benefits and economic benefits.

Format C (which is shown in Table 6.1) is the most comprehensive and is highly recommended for use by companies disclosing environmental accounting information in their environmental reports.

The guidelines suggest a new framework of environmental accounting that integrates environmental accounting in monetary units with environmental accounting in physical units. The environmental accounting statement presented in Format C is expected to fulfil a similar role to that of financial statements in a financial report. This is the most important feature of the guidelines, which encourage Japanese companies to disclose environmental accounting information in their environmental reports, and although this practice is not mandatory, it is becoming increasingly popular.

However, the guidelines do not fully discuss how the environmental accounting information which is provided in the environmental report should be interpreted. They present many indices of environmental conservation benefits as well as environmental costs, but do not discuss a ratio such as eco-efficiency. If, as argued in the guidelines, the purpose of environmental accounting is to integrate economic and environmental performance, then the ratio between the two should be shown.

Furthermore it should be noted that the scope of environmental cost in the MOE guidelines is limited to environmental conservation costs. For example, the definition of environmental costs by the United Nations Division for Sustainable Development (UNDSD, 2001) is much broader. The UNDSD definition includes materials and capital costs for waste, which are excluded from the Japanese guidelines because these costs have nothing

Table 6.1. Environmental Accounting Disclosure Format C

Scope: ( )
Target Period:
Units: ¥ ( )

Environmental Conservation Cost				
Category		Key Activity	Investment	Cost
(1) Business Area Cost				
Breakdown	(1)-1 Pollution Prevention Cost			
	(1)-2 Global Environmental Conservation Cost			
	(1)-3 Resource Recycling Cost			
(2) Upstream/Downstream Cost				
(3) Administration Cost				
(4) R&D Cost				
(5) Social Activity Cost				
(6) Environmental Remediation Cost				

Costs that do not fit into categories (1) - (6) above but are related to environmental conservation, should be entered into (7) Other Costs. In this case, status and reasons should be disclosed to specify the scope of such costs.

Item	Content	Yen Value
Total investment in fiscal year under review		
Total R&D cost in fiscal year under review		

Source: MOE (2002)

Environmental Conservation Benefit			
Detail of Benefits*1		Indicators	
		Category	Values*2
(1) Benefit from cost incurred at business site	1) Benefit obtained from the injection of resources into business operations	Energy consumption	
		Water usage	
		Injection of resources	
	2) Benefit associated with environmental impact and waste emissions from business operations	Emission to atmosphere	
		Emission to water bodies and soil	
		Emission of waste	
	Others		
(2) Benefit related to upstream/downstream cost	3) Benefit associated with the goods and services produced by business operations*3		
	Others		
(3) Other environmental conservation benefit	4) Benefit associated with transports and other operations		
	Others		

*1 In the event it is difficult to relate environmental conservation benefit to the cost, environmental conservation benefits should not be classified as shown in the above table Nos. (1) - (3).

*2 For an indicator in terms of physical volume, the total difference between the environmental impact during the base period and the fiscal year under review should be stated. It is also possible to state a comparison of units per sales.

*3 To calculate the environmental conservation benefit during the use of goods or services derived from business activities and at the time of disposal, the results should be made clear from other results.

Economic Benefit Associated with Environmental Conservation Measures - Actual Benefits -		
Benefit		Yen Value
Revenue	Operating revenue generated by the recycling of waste generated by key business operations or the recycling of used product	
Cost Savings	Energy conservation reduces energy costs	
	Resource conservation and recycling reduces waste disposal costs.	

to do with environmental conservation. However, the narrow definition of environmental costs in the MOE guidelines reduces somewhat the importance of the environmental accounting system for the company, because the proportion of environmental conservation costs to total corporate costs is smaller. If the MOE's aim is for companies to use the guidelines not only for external disclosure purposes but also for internal management, this issue would be worthy of consideration.

6.3 METI Initiatives on Environmental Accounting

METI formed an environmental accounting committee in 1999, the secretariat of which is the Japan Environmental Management Association for Industry (JEMAI). This committee conducted a three-year research project which was completed in March 2002, and has published annual reports on its research activities (JEMAI 2000, 2001, 2002). The final report, titled "Environmental Management Accounting Workbook", was published by METI in 2002 (METI 2002)[6]. The purpose of the METI initiatives was to develop environmental management accounting tools appropriate to Japanese companies, and they represent an information-based policy instrument. The MOE initiatives place more emphasis on the external use of environmental accounting, whilst the METI project focused exclusively on internal functions within companies.

The METI committee studied various areas of environmental management accounting. During the first year, the committee studied environmental management accounting practices and governmental initiatives in North America and Europe. Over the next two years, the committee then established the following five working groups:

- Working Group 1: environmental capital investment appraisal
- Working Group 2: environmental cost management (environmental target costing and environmental cost matrix)
- Working Group 3: materials flow cost accounting
- Working Group 4: life-cycle costing

[6]The final report of METI (2002) included most parts of JEMAI (2002) and some parts of JEMAI (2001). The first interim report of JEMAI (2000) was mainly concerned with environmental management accounting in overseas countries, which are not included in METI (2002).

- Working Group 5: environmental corporate performance evaluation.

The final report of each working group was included in METI (2002).

The purpose of Working Group 1 was to develop a method of environmental capital investment appraisal. This group not only introduced conventional appraisal tools into the Japanese context, but tried to add some new functions in order to evaluate the effectiveness of environmental investments. Working Group 2 had two aims: environmental quality costing and environmental target costing. For environmental quality costing, the group developed a new type of environmental costing based on the MOE environmental accounting guidelines, termed an environmental cost matrix. Concerning environmental target costing, the group proposed a framework for constructing methods. The purpose of Working Group 3 was to introduce materials flow cost accounting, as developed by the Institute für Management und Umwelt (IMU) in Germany, into some Japanese companies and to evaluate its effectiveness. Working Group 4 proposed a method of life-cycle costing that integrates cost information on product usage and disposal with life cycle assessment information. Working Group 5 investigated corporate practices which introduced environmental performance indices into their corporate performance evaluation system and completed case studies which included Sony, Ricoh, Canon and Osaka Gas. These companies have already introduced some environmental performance indices into the corporate performance evaluation scheme.

METI (2002) does not provide any strict definitions of environmental costs, and the scope of these is changeable depending on the purpose. For example, the materials flow cost accounting element of the project employed the definition of IMU, in which the materials flow cost contains all production costs (Strobel and Redmann 2001, p.8). The definition of life-cycle cost according to METI initiatives included some types of social costs which are incurred during the usage of the product. The environmental cost matrix which was developed by the METI project as a tool for environmental quality costing employed the cost definition and classification of the MOE guidelines. Therefore, environmental management accounting tools developed by the METI initiatives are very comprehensive.

However, the environmental management tools developed by METI are somewhat theoretical rather than practical and the METI workbook could prove difficult for readers without sufficient prior knowledge of environmental management accounting. For this reason, and to facilitate the introduction of environmental management accounting into companies, JEMAI started a new project to develop manuals for these tools, which will be completed in March 2003.

6.4 Environmental Accounting Practices of Japanese Companies

The number of companies which disclose environmental accounting information in their environmental reports is increasing. According to the MOE survey (MOE 2001c), the proportion of companies disclosing environmental accounting information[7] among the listed companies that responded to the questionnaire showed a steeply-rising trend from 10.4 % in 1998 to 20.9 % in 1999 and 27.0 % in 2000. 17.3 % replied that they had already introduced environmental accounting , while 34.2 % replied that they were considering its introduction.

Although it can be considered that these trends might be influenced by the governmental initiatives mentioned above, they should be thoroughly examined and this is the purpose of the paper. The analysis is divided into two parts. The first part analyses environmental accounting information disclosures in corporate environmental reports. Since the MOE guidelines on environmental accounting emphasise the external disclosure of environmental accounting, it is important to investigate the environmental accounting information which is reported in the environmental reports. The second part is based on a questionnaire survey, in which a questionnaire was sent to those companies which disclosed environmental accounting information in order to analyse how environmental accounting was used within their company.

All companies listed in the first section of the Tokyo Stock Exchange Market (1,430) were asked to send a copy of a stand-alone environmental report, and 257 reports published in 2000 were collected[8]. Environmental accounting information was disclosed by 184 of these companies. In the survey, environmental accounting information is defined as any monetary information on the environment - not only environmental accounting statements, but even a single monetary figure such as the total environmental costs incurred by the company in the year, would be considered to be "environ-

[7] However, "environmental accounting information" was not clearly defined by the survey.
[8] These environmental reports were all annual and at the level of the company as a whole. Of the 257 companies, 10 disclosed their environmental reports only over the Internet.

mental accounting information". This information will be examined first, followed by the questionnaire survey results.

6.4.1 Environmental Accounting Information Disclosure Practices[9]

The number of companies publishing environmental reports among the listed companies in the first section of the Tokyo Stock Exchange Market was 257 (18%). As an absolute number this is high, though not so high as a percentage. However, of these 257 companies, 184 (71%) disclosed environmental accounting information[10]. This result shows that whereas the publication of environmental reports is not yet widespread in Japan, disclosure of environmental accounting information is quite high among those companies which do publish them.

The environmental cost classifications of these 184 companies were analysed initially, and the results of this are shown in Table 6.2. 87 companies based their environmental cost classifications on the environmental accounting guidelines 2000, whilst 19 companies based theirs on the interim report of 1999, so that in fact 106 companies (58%) conformed to one of these two versions of the MOE guidelines. Only 31 companies (17%) used their own standards. It is difficult to ascertain whether or not the remaining 47 companies employed any particular standards or guidelines, since most disclosed only the total amount of their environmental costs or investments without classifying environmental costs. These companies are considered to have been in the very early stages of environmental accounting. Where companies do not follow the guidelines they are not asked to state the reason in their report, because the guidelines are not compulsory.

It is also important to examine the definition of environmental cost. The MOE guidelines recommend that the amounts of "cost" and "investment" should be disclosed separately rather than added together, in accordance with the conventional practice of accrual-based accounting. As shown in Table 6.3, 109 companies (59%) employed this method. The alternative method would be to measure environmental costs on a cash-flow basis, in which cost (excluding costs which do not involve cash outflows) and

[9]This section is based on Kokubu and Nashioka (2001).

[10]The industry sectors of these 184 companies are as follows: construction, 6; food, 6; textiles and paper/pulp, 12; chemicals, 9; glass, cement, iron and steel, 38; non-ferrous metals and machinery, 15; transportation equipment and precision instruments, 17; electrical equipment, 20; miscellaneous manufacturing, 31; commerce, 15; transportation, 5; electricity and gas, 10.

Table 6.2. The Environmental Cost Classification of Japanese Companies

Based on the MOE guidelines of 2000	87	47%
Based on the MOE interim report of 1999	19	10%
Original corporate guidelines	31	17%
No guidelines	47	26%
Total	184	100%

investments are added together as environmental expenditures. Only 10 companies (5%) employed this method[11]. These results demonstrated that the influence of the MOE guidelines was quite strong not only in the environmental cost classification but also in cost definition.

Table 6.3. The Definition of Environmental Cost of Japanese Companies

Cost and investment disclosed separately	109	59%
Environmental expenditures disclosed as cash flow	10	5%
Disclosure of cost only	26	14%
Disclosure of investment only	38	21%
Other	1	1%
Total	184	100%

The MOE guidelines also require that environmental conservation benefits be disclosed in terms of physical units. Of 184 companies, 80 (44%) disclosed environmental conservation benefits in figures of physical quantities and 99 companies (54%) disclosed economic benefits. Before the release of the MOE guidelines, these items were not considered to be a part of environmental accounting, but the guidelines have since required companies to disclose both types of benefit. This is a distinguishing feature of the MOE guidelines, and the finding that the number of companies disclosing these benefits was not insignificant also demonstrates the influence of the guidelines.

[11]Whilst the number of companies which disclose only the amount of all the investment forms the second largest group, most of these companies reported only the total amount, without classifying the investment. This means that these companies did not apply any of the environmental accounting guidelines.

6.4.2 Environmental Accounting Practices in Companies

A questionnaire was sent to those companies which disclosed environmental accounting information in their environmental reports. In addition to 184 companies which had been identified by Kokubu and Nashioka (2001), the authors found an additional 32 companies in the first section of the Tokyo Stock Exchange Market disclosing such information, as at September 2001. Questionnaires were therefore sent to 216 companies in total, of which 159 (73.6%) sent valid answers. The purpose of the survey was to analyse corporate environmental accounting practices within each company. However, it should be noted that the questionnaire survey was carried out before the release of the METI workbook, though the two interim reports of JEMAI in 2000 and 2001 had by then already been published.

Decision-Making Level for Environmental Accounting. In order to analyse the level at which decisions are made about environmental accounting, it is necessary to identify the person who makes the final decision. Question 1 is: "Who proposed the introduction of an environmental accounting system into your company?" The results are shown in Table 6.4. In the majority of the responding companies, the proposer was either the Chief Executive Officer (14.1%) or the director in charge of environmental protection (44.2%). This suggests that environmental accounting was more often introduced from the top down than from the bottom up.

Table 6.4. Who proposed the introduction of an environmental accounting system into your company? (Question 1)*

Chief Executive Officer	22	14.1%
Director in charge of the environment	69	44.2%
Senior management	48	30.8%
Middle management	8	5.1%
Other	9	5.8%
Total	156	100%

* There were three invalid answers to this question.

The next question (Question 2) is concerned with decision-making on external disclosures of environmental accounting information: "Who gave the final permission for the disclosure of environmental accounting information?" The results are shown in Table 6.5. In the majority of the responding companies, it was either the CEO (37.3%) or the board of directors (18.4%) who gave the final permission.

Table 6.5. Who gave the final permission for the external disclosure of environmental accounting information? (Question 2)*

Board of Directors	29	18.4%
Chief Executive Officer	59	37.3%
Director in charge of environmental management	51	32.3%
Senior management	3	1.9%
Other	16	10.1%
Total	158	100%

* There was one invalid answer to this question.

The above results indicate that top management is quite heavily involved in environmental accounting practices, although it is still possible that governmental initiatives might influence them even further. In other words, governmental policies might provide some stimulus for top management to introduce an environmental accounting system into their corporations, which is the subject of the next question.

The Influences of Governmental Initiatives. The influence of the MOE and METI initiatives on corporate environmental accounting was analysed. Table 6.6 shows the results of the answers to Question 3: "When you introduced an environmental accounting system, to what extent did you consult the MOE guidelines?" Whilst almost 70% of the responding companies said that they consulted the guidelines a great deal, only 2 companies (1.2%) did not consult the guidelines to any significant extent.

Table 6.6. When you introduced an environmental accounting system, to what extent did you consult the MOE guidelines? (Question 3)

Very much	110	69.2%
An average amount	34	21.4%
To some extent	13	8.2%
A little	1	0.6%
Very little	1	0.6%
Total	159	100%

In order to clarify this point, a further question was asked (Question 4): "If you have any corporate environmental accounting standards, to what extent are they in accordance with the MOE guidelines?" Table 6.7 shows the results, with almost 70% of the responding companies either employing the MOE guidelines as their corporate standard (21.4%) or preparing a standard based on them (46.5%). Only 3.1 % of the companies employed their own standards. These results emphasise that corporate practices are strongly influenced by the MOE guidelines. The number of companies who based their standards on the MOE guidelines was higher than the results of the analysis on environmental accounting disclosure had shown, as mentioned in the previous section. This means that there were some companies which prepared environmental accounting standards based on the MOE guidelines, but did not disclose full information to the public or measure all the information which is required by the guidelines.

Table 6.7. If you have any corporate environmental accounting standards, to what extent do they follow the MOE guidelines? (Question 4)

Use the MOE guidelines	34	21.4%
Based on the MOE guidelines	74	46.6%
Refer to the MOE guidelines	34	21.4%
Use original standards	5	3.1%
Use no standards	11	6.9%
No answer	1	0.6%
Total	159	100%

The influence of the METI initiatives on corporate practices was then also examined by the question (Question 5): "When you introduced an environmental accounting system, to what extent did you consult the METI reports on environmental accounting published by JEMAI?" When the survey was conducted, two interim reports (JEMAI, 2000 and 2001) had been available. Table 6.8 shows that the rate of dependence on the METI reports was quite low. Less than 7 % of the responding companies consulted the METI report, but more than 70% of companies did not, perhaps largely because the project had not been completed when the questionnaire was sent out, so that it might still be too early to give a final conclusion on the influence of the METI project.

These results suggest that the MOE guidelines have influenced Japanese corporate environmental accounting practices more than have the METI

Table 6.8. When you prepared environmental accounting, to what extent did you consult the METI reports on environmental accounting published by JEMAI? (Question 5)

Very much	3	1.9%
An average amount	7	4.4%
To some extent	28	17.6%
A little	49	30.8%
Very little	72	45.3%
Total	159	100%

initiatives. If this is so, it might be expected that Japanese corporate environmental accounting would be much more oriented to external reporting than to internal management. The next section will examine this topic by investigating the purpose of environmental accounting.

The Purpose of Environmental Accounting. What is the purpose of environmental accounting (Question 6)? In general there are two main objectives: external reporting and internal management. The results of Question 6 are shown in Table 6.9. More than 80 % of companies replied that they pursued both purposes.

Table 6.9. What is the purpose of environmental accounting? (Question 6)

External reporting	16	10.1%
Internal management	5	3.1%
Both	137	86.2%
Other	1	0.6%
Total	159	100%

The above results were investigated further by asking the companies to weight the relative importance of both of these purposes (Question 7). Table 6.10 shows the results. While 35.8% of the companies responded "same", 42.8% considered external reporting purposes to be more important, with only 18.9% placing more emphasis on the importance of internal management objectives. These results suggest that external reporting considerations take precedence over those concerned with internal management in Japanese corporate environmental accounting practices. This is further evidence to support the influence of the MOE guidelines.

Table 6.10. Relative importance of these two purposes (Question 7)

External reporting much more important	13	8.2%
External reporting more important	55	34.6%
Same	57	35.8%
Internal management more important	23	14.5%
Internal management much more important	7	4.4%
Not answered	4	2.5%
Total	159	100%

While Japanese companies tend to emphasise external reporting purposes rather than internal management, it should be noted that they recognised the importance of the latter in environmental accounting practices as well. If they used environmental accounting for internal decision making, what kind of accounting methods were employed (Question 8)? The results are shown in Table 6.11.

Table 6.11. What type of environmental accounting did you employ for internal management?* (Question 8)**

The same as for environmental accounting for external disclosure	67	42.1%
Modification of the environmental accounting used for external disclosure	46	28.9%
A different type of environmental accounting from that used for external disclosure	9	5.7%
Other	12	7.5%
Not answered	35	21.0%

* Multiple answers were accepted to this question.
** The companies that did not use environmental accounting for internal management did not answer the question.

Most of the responding companies used either the same (42.1%) or modified (28.8%) external environmental accounting (environmental accounting for public disclosure) for internal management also. Only 5.7 % of the companies employed different environmental accounting methods for internal use than those they used for external environmental accounting. Considering that most external environmental accounting in Japanese companies is based on the MOE guidelines, it is difficult to apply them to any particular internal decision making such as environmental investment or environment-friendly product development. This is because the guidelines target the whole of corporate activity rather than a specified area within it. In addition, the guidelines' definition of environmental costs is limited to environmental conservation costs only, and this definition may be too narrow for many internal management purposes. Therefore, it can be stated that the environmental management accounting of Japanese companies was not so sophisticated. This will be supported by results from the questions on the benefits of environmental accounting in the following section.

Benefits From the Introduction of an Environmental Accounting System. What benefits can result from the introduction of an environmental accounting system? Question 9 asked this and the results are shown in Table 6.11. It is not surprising that 85.5% of responding companies recognised an improved understanding of the amount of their environmental cost to be a benefit since the MOE guidelines, which most companies adhered to, are oriented towards measuring environmental conservation cost comprehensively. The second largest response (56.0%) indicated that these companies believed that their disclosure of environmental accounting information enhanced their corporate image. This is one of the most distinguishing features of Japanese environmental accounting practices, which are oriented to external reporting. Only 35.8% of the responding companies replied that environmental accounting was useful for internal management, as shown in Table 6.12[12]. Considering that many companies pursue an internal management as well as an external objective, this number was relatively small. An explanation might be that most companies use external environmental accounting for internal management reasons, as mentioned before.

The next question asked if there were any concrete benefits from the internal use of environmental accounting. Table 6.13 shows the results. These figures are generally low, with the highest being only 38.4%. For more than 30% of the responding companies, environmental accounting was considered to be useful in the reduction of both environmental burdens and

[12] The second item of Question 9, "improved understanding of the amount of environmental cost", could be a part of internal management, since cost is to be managed. However, in spite of the multiple answers, the difference between the number of companies responding to the first item "useful for internal environmental management" and those responding to the second item in Table 6.9 was quite large. This indicates that "understanding how much environmental cost incurred" is not always considered by Japanese companies to be a part of internal management, but rather a part of external reporting activities.

Table 6.12. What benefits resulted from the introduction of an environmental accounting system?* (Question 9)

Useful for internal environmental management	57	35.8%
Improved understanding of the amount of environmental cost	136	85.5%
Increased awareness of environmental matters within the company	87	54.7%
Improved budgeting	12	7.5%
Corporate image improved by disclosure	89	56.0%
Status of environmental department raised within the company	11	6.9%
Not known	12	7.5%
Other	4	2.5%

* Multiple answers were accepted to this question.

environmental costs. However, the number of companies that recognised the value of environmental accounting in reducing materials costs or in developing environmentally friendly products was quite small: 10.7% and 18.2% respectively. The percentage of companies that derived benefit from environmental accounting through an improvement in environmental decision making was also relatively small (18.2%). These results suggest that environmental accounting within companies has not been used greatly for these particular management purposes.

Table 6.13. What were the benefits of environmental accounting for internal management?* (Question 10)**

Reduced environmental burden	61	38.4%
Reduced environmental cost	57	35.8%
Reduced materials cost	17	10.7%
Recovered value from waste	18	11.3%
Improved environmental decision making, e.g. environmental investment	29	18.2%
Development of environmentally friendly products	29	18.2%
Performance evaluation	6	3.8%
Other	26	16.4%
Not answered	43	27.0%

* Multiple answers were accepted to this question.
** The companies that did not employ environmental accounting for internal management did not answer the question.

Finally Question 11 asked if there were any potential benefits which the company wanted to obtain in the future. Table 6.14 shows the results. It should be noted that 71.7 % of the responding companies wanted to improve environmental decision making, such as environmental investment appraisal. This result suggests that the potential need for environmental management accounting is growing in Japanese companies.

Table 6.14. What are the potential benefits that you want to obtain from environmental accounting practices in the future?* (Question 11)

Reduced environmental burden	108	67.9%
Reduced environmental cost	105	66.0%
Reduced materials cost	49	30.8%
Recovered value from waste	31	19.5%
Improved environmental decision making, e.g. environmental investment	114	71.7%
Development of environmentally friendly products	60	37.7%
Performance evaluation	54	34.0%
Other	5	3.1%
Not answered	3	1.9%

* Multiple answers were accepted to this question

On the other hand, the number of companies that wanted the potential benefits of reduced materials costs, the development of environmentally friendly products, and performance evaluation, was relatively small. This is not because Japanese companies made light of these activities, but because they did not recognise that environmental accounting could support these management activities.

6.5 Concluding Remarks

There are two main governmental initiatives on environmental accounting in Japan, which have been taken by MOE and METI respectively. MOE released draft guidelines in 1999 and published the environmental accounting guidelines in 2000, and these were then revised in 2002. A three-year research based project launched by METI in 1999 exclusively focused on the internal function of environmental accounting. It was completed in March 2002 and the final report was published as a workbook in June 2002.

In this paper the influence of these two governmental initiatives on Japanese corporate environmental accounting practices has been examined by an analysis of environmental accounting disclosure and a questionnaire survey. The investigation of environmental accounting information disclosed in environmental reports indicated the strong influence of the MOE guidelines on the classification and definition of environmental costs, which are the main elements of environmental accounting.

The questionnaire was sent to those companies which disclosed environmental accounting information. The decision-making level for environmental accounting, the influence of governmental initiatives, and the purposes and benefits of environmental accounting, were examined. The results suggest that top management was heavily involved in the introduction of an environmental accounting system, and that the MOE guidelines strongly influenced Japanese companies. However, the METI initiatives did not greatly influence Japanese companies, which shows that Japanese corporate environmental accounting is oriented to external reporting, since the MOE guidelines stress the external disclosure function of environmental accounting more strongly than the internal management function. This evidence was supported by the results of an analysis of the purposes and the benefits of environmental accounting. The analysis showed that few Japanese companies received benefits from specific management activities such as environment-friendly product development or environmental investment appraisal, from the introduction of an environmental accounting system.

The examination of this paper shows that environmental accounting which is oriented to external disclosure is not very useful for internal management purposes. The companies employing the MOE guidelines for internal management did not derive many benefits from them, mainly because the definition of the environmental cost of the guidelines is limited to only environmental conservation costs. This narrow definition of environmental costs is insufficient for environmental management purposes such as investment appraisal and target costing. New methods other than external environmental accounting should be developed in order to meet these objectives. This is the aim of the METI initiatives, but they did not appear to have influenced corporate activities at the time of the survey.

However, it should be noted that the MOE guidelines were very effective in stimulating environmental disclosure by Japanese companies. The majority of the companies which disclosed environmental accounting information recognised that their corporate image had been improved by the disclosure, which indicates that the MOE guidelines have been successful in their primary purpose. An environmental accounting statement such as Format C (Table 6.1) is an important part of the environmental report, although the method of interpreting such environmental accounting information remains an unsolved problem which is beyond the scope of this paper.

The analysis showed that the MOE guidelines strongly influence Japanese companies and orient them to external environmental accounting. On the other hand, the METI initiatives for environmental management accounting did not greatly influence Japanese companies. However, as mentioned before, the timing of the survey could make an attempt at reaching a conclusion somewhat premature, since the METI project was still in progress when the questionnaire was sent out. Nevertheless, it can be said that for the internal use of environmental accounting within companies, the MOE guidelines must be complemented with some other type of environmental management accounting such as environmental investment appraisal methods, materials flow cost accounting, and so on. The potential need for environmental management accounting in Japan is increasing. The MOE guidelines have promoted the external disclosure of environmental accounting information very well, and the next task is to develop internal environmental accounting.

Appendix : Survey Questions

Question 1: Who proposed the introduction of an environmental accounting system into your company?

A. Chief Executive Officer

B. Director in charge of environmental management

C. Senior management

D. Middle management

E. Other

Question 2: Who gave the final permission for external disclosure of environmental accounting information?

A. Board of directors

B. Chief Executive Officer

C. Director in charge of environmental management

D. Senior management

E. Other

Question 3: When you introduced an environmental accounting system, to what extent did you consult the MOE guidelines?

A. Very much
B. An average amount
C. To some extent
D. A little
E. Very little

Question 4: If you have any corporate environmental accounting standards, to what extent do they follow the MOE guidelines?

A. Use the MOE guidelines
B. Based on the MOE guidelines
C. Refer to the MOE guidelines
D. Use original standards
E. Use no standards

Question 5: When you prepared environmental accounting, to what extent did you consult the METI reports on environmental accounting published by JEMAI?

A. Very much
B. An average amount
C. To some extent
D. A little
E. Very little

Question 6: What is the purpose of environmental accounting?

A. External reporting
B. Internal management
C. Both
D. Other

Question 7: Please indicate the relative importance of these two objectives:

External reporting Internal management

very high		equal		very high
5	4	3	2	1

Question 8: What type of environmental accounting did you use for internal management? (multiple answers)

A. The same as environmental accounting used for external disclosure
B. Modification of the environmental accounting used for external disclosure
C. A different type of environmental accounting from that used for external disclosure
D. Other

Question 9: What benefits resulted from the introduction of an environmental accounting system? (multiple answers)

A. Useful for internal environmental management
B. Improved understanding of the amount of environmental cost
C. Increased awareness of environmental matters within the company
D. Improved budgeting
E. Corporate image improved by disclosure
F. Status of environmental department raised within the company
G. Not known
H. Other

Question 10: What were the benefits of environmental accounting for internal management? (multiple answers)

A. Reduced environmental burden
B. Reduced environmental cost
C. Reduced materials cost
D. Recovered value from waste
E. Improved environmental decision-making, e.g. environmental investment
F. Development of environmentally friendly products
G. Performance evaluation
H. Other

Question 11: What are the potential benefits that you want to obtain from environmental accounting practices in the future? (multiple answer)

A. Reduced environmental burden
B. Reduced environmental cost
C. Reduced materials cost
D. Recovered value from waste
E. Improved environmental decision-making, e.g. environmental investment
F. Development of environmentally friendly products
G. Performance evaluation
H. Other

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7. The Danish Green Accounts: Experiences and Internal Effects

Charlotte Thy

The Danish Environmental Protection Agency

scandeus@internet.dk

Abstract More than 1,000 Danish companies have published annual Green Accounts since this was made a mandatory requirement in 1995. The legislation regulating the Green Accounts was revised in 2001 and 2002, with new requirements being added and the procedures changed. Green Accounts are mandatory environmental reports which account for physical flows of pollutants and for resource efficiency through information about the use of raw materials and waste generation. The legislation is very flexible, in order to suit the differing communications needs of different companies.

The first objective of Green Accounts is to enhance the public's access to information about the environmental performance of polluting companies in order to promote a democratic and progressive dialogue about environmental issues. Their second objective is to motivate reporting companies to examine their processes and products, and to improve their resource efficiency, as well as to motivate them to work systematically with the environment. As such, this objective can be linked to environmental management accounting.

Experience from the first two years shows that both economic end environmental benefits can be achieved through Green Accounts.

7.1 Introduction

Once a year – for some, even more often – companies publish a story about themselves and the life that they are leading. In annual financial statements you find stories as diverse as the companies themselves. Some are good, some are thrilling, and some are just plain boring, but in any case a lot of effort is always put into the story-telling.

The question of what future prospects a business has can no longer be answered by looking only at the black or red figures presented on the finan-

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 115-127.

cial bottom line. There is an increasing demand from stakeholders to look into how the company is run and the values behind management decisions.

Environmental performance, or the knowledge of non-performance, is one of these aspects. In 1995 Denmark put into effect a new legal instrument: the Green Accounts[1]. In brief, Green Accounts are an annual site-based account of physical materials flows.

The Green Accounts Act came into being because of increasing public concern in the 1980s and 1990s over environmental issues. The general political objective of Green Accounts was to stimulate interest in, and to encourage, active environmental protection among private companies and citizens. The basic idea was that to make annual environmental accounts available to the public would, in itself, motivate companies to make continuous environmental improvements and to improve their use of materials and processes.

More than 1,000 Danish companies are obliged to publish Green Accounts. These companies are already regulated under the Environmental Protection Act as particularly heavy polluters. In addition, 150 companies have decided voluntarily to submit Green Accounts. Over a period of 5-6 years, these companies have together challenged and developed the framework for Green Accounts. In order to take account of developments in green accounting, international developments in the field of reporting, and also general developments in society, the legislation regulating Green Accounts was modernised in 2001 and 2002[2].

New requirements have been added regarding the content, the administrative structure, and the procedures to ensure the comprehensiveness and credibility of the data which is presented. The list of companies which are obliged to report has also been adjusted in order to achieve a better balance between the effort of having to draw up Accounts and the potential benefits for society and for the companies concerned. As a result of this, some activities were added to the list, and all non-IPPC[3] companies with 20 or fewer employees were removed so that they are no longer obliged to publish Green Accounts. In the future it is expected that approximately 800 companies will be obliged to publish Green Accounts.

[1] Law no. 403/1995 and S.O. no. 975/1995

[2] Law no. 258/2001 and S.O. no 594/2002 (This S.O. can be found in English translation at www.mst.dk)

[3] Directive 96/61/EU

7.2 The Framework for the Danish Green Accounts

The philosophy of the Green Accounts has always been that a company should be the master of its own Accounts. In other words, each company should be free to decide how to present its environmental profile, and management should be free to formulate environmental priorities and goals. For this reason, the Act is worded as a framework Act with great freedom, provided that companies comply with a few simple rules. The revisions made in 2001 and 2002 have not changed this approach.

In Denmark, the annual financial report must be received for publication by the Commerce and Companies Agency within 5 months following the end of the fiscal year (4 months for listed companies and state-owned companies), and the Green Accounts must follow the same time schedule.

The Commerce and Companies Agency provides the formal channel for all published Green Accounts[4]. It is not this agency's responsibility actually to distribute these Green Accounts, but merely to ensure that there is an effective distribution system, so individual companies must themselves ensure that their Green Accounts reach the right target groups. With the revision in 2002, the Commerce and Companies Agency is no longer obliged to check the information in the accounts due to the active involvement of the local environmental authorities.

Another fundamental idea behind Green Accounts is that, in common with financial accounts, they should describe the company in general, as well as its future perceptions and objectives regarding environmental issues. In short, they serve as a management tool as well as an external communication medium. Green Accounts should thus be useful in creating a framework for dialogue on the environment with different types of stakeholders. This, however, rests on several fundamental assumptions about the behaviour of selected stakeholder groups regarding environmental issues, which are shown in table 7.1.

The evaluation of the Green Accounts which was carried out in 1999 showed, however, that these assumptions did not always hold true for some stakeholder groups; this will be discussed later.

[4] www.publi-com.dk

Table 7.1. Some assumptions underlying the Green Accounts as a communication tool.

Stakeholder	Assumption
Customers	Customers are demanding increasingly detailed documentation of a company's environmental performance and standards. This trend will continue, and will become even clearer in business-to-business activities and for suppliers and subcontractors to large European manufacturers.
Suppliers	Suppliers are one of a company's most important contributory factors in terms of environmental improvements, irrespective of whether the objective is to devise processes which cause less impact on the environment or to create products with more environmentally friendly life cycles. This is also emphasised through a general trend towards closer relationships with fewer, but more regular, suppliers.
Investors and stock analysts	Investors and stock analysts have begun to look at environmental issues and threats when assessing the long-term potential of a company. They want regular information on environmental initiatives and objectives.
Local communities	Local communities want to know about the environmental impacts and risks from local companies. This includes the companies' resolve to come up with better solutions and to pay greater respect to the countryside, nature and people.
Professionals and the public	This category covers professional environment experts and consultants, major professional and industrial organisations in the labour market, and environment and nature associations, all of which influence a company in different ways. They may act as advisors to a company, investors, loan providers, insurance companies or others who enter into legally binding relationships with a company. For interest groups, this may also take place through influencing the media and lobbying politicians.
Authorities	Authorities – local, regional or governmental – are obviously interested in monitoring environmental work in companies whose production involves risks to the environment.
Employees	Employees – current and potential – want to work for companies that are concerned about the environment. They want to take responsibility themselves to ensure that their employer is producing good environmental initiatives and performance.

The Act includes a clause governing the presentation of information to ensure that the Green Accounts receive an immediate high profile in the dialogue between companies and their stakeholders. Green Accounts should be understandable to anyone with a general education and an interest in reading such Accounts, not just to those with special environmental expertise.

There is a certain amount of mandatory information in the Accounts which must be presented in three successive chapters:- (1) an introduction which identifies the company; (2) a statement by the management; and (3) the actual environmental data. The Accounts must be written in a manner that allows a non-specialist to comprehend the content and, as a new requirement, a statement by the local environmental authority must be published as an integral part of the Accounts.

The following list sets out the most important requirements (all amendments made by the new statutory order in 2002 are indicated in italics).

The introduction to the Accounts must include:

- The primary activity and significant secondary activities of the company
- The name of the supervisory/inspection authority, and the most important environmental permit(s)
- *Recipient of waste water and waste water connection permit*
- *The name of any parent or holding company having the ultimate power of decision*
- A short, qualitative description of the most important resources and environmental parameters which are directly linked to the primary activity and significant secondary activities

Management must make a statement on:

- Why the company concerned considers the information provided to be significant
- Any significant deviations from the previous Green Accounts which were submitted, and the underlying reasons
- How, and to what extent, staff take part in the environmental work of the company
- Aspects of the working environment, such as the use of polluting substances where these present a risk to the safety and health of the staff

- *Information about possible environmental policy and, if relevant, goals and the results thereof (this includes energy, waste and transportation issues)*
- *Information about possible environmental demands placed on suppliers*
- *In cases where the conditions in a permit have not been complied with, there must be a description of the action which has been carried out in order to avoid a repetition*
- *Major complaints (complaints that have led to changes in the company's routines or processes)*

Environmental data must include:

- Any significant consumption of energy, water, and raw materials
- Significant types and volume of pollutants, etc., where they:
  - form part of the production processes
  - are discharged by the company into air, water and soil
  - form part of the company's products
  - form part of the company's waste
- *Dust, noise and odour*
- *Waste production and waste handling*
- *Résumé of self monitoring of compliance with the environmental permit*

Formal requirements in relation to data quality:

- The emission/release data must be published as absolute numbers (e.g. kg/year, kWh/year). Due to confidentiality issues, it is possible to index input data or to group polluting substances in emissions/releases (using the exceptions regarding confidentiality in the Aarhus Convention)
- *Data quality (measured, calculated, or estimated).*
- *Adjustments arising from changes in accounting practices*

- *Historical figures (5 years' data have to be presented)*

If an expert has audited the Green Accounts, the company can elect to provide information on who carried out the audit, whether by an internal or external auditor. If this choice is made, the company must disclose the name of the auditor and include a copy of the auditor's report.

7.3 Company Experience with the Green Accounts

The above changes and amendments to the Green Accounts Act were made following a very exhaustive evaluation of the first two generations, in 1999[5]. The thoroughness stemmed from the nature of this new instrument: there were a great many policy-based questions to address, in addition to looking into what could be learned from the Accounts themselves. The evaluation was based on interviews with managers in more than 500 companies, corresponding to over 60% of the managers responsible for the submitted Green Accounts. Furthermore, 550 Green Accounts were analysed and additional interviews were conducted with 320 selected individuals with a specialised background or a presumed interest in the Green Accounts, and 1900 consumers were also interviewed.

Amongst other things, the evaluation showed that through the reporting requirement itself:

- 41% of companies believed they had achieved environmental improvements; 56% considered they had not achieved improved environmental performance; and 3% were uncertain. Among the companies which had achieved environmental improvements through green accounting, 70% emphasised energy; 50%, water and waste; 40%, consumption of resources; 30%, wastewater and additives; 20%, reduced emissions into the air; and 10%, emissions into the soil
- Greater competitive advantages had been achieved in markets where environmental demands were becoming more dominant
- Companies generally agreed that Green Accounts had created a better overview of their own environmental situation, in particular in respect of materials and energy consumption, and emissions

[5] Rapport om evaluering af de grønne regnskaber, (Report on the evaluation of Green Accounts) Danish EPA 1999

- Companies with Green Accounts were better equipped to answer customers' enquiries about documentation on environmental impact and performance
- Green Accounts had enhanced dialogue with employees

The evaluation showed that, in general, external stakeholders demonstrated relatively little interest in obtaining and using Green Accounts. It became clear that if stakeholders need environmental information about a company, they will usually go directly to the company itself or to the local authorities, even if they are aware of the existence of Green Accounts. The evaluation also showed that the primary target group for Green Accounts – the general public – distrusted the quality of information and used the Accounts on only a very small scale; whereas professional users, such as investors and governmental purchasers, were marginally more trusting of the information presented in the Green Accounts. It is also interesting to note that many Danish industrial companies are subcontractors to German industry, and that quite a number of these companies put especial emphasis on their Green Accounts as part of the documentation that they provide to their customers in order to substantiate their environmental performance[6].

For many companies, this lack of active interest has been disappointing, but despite this many companies are convinced that their work on Green Accounts has borne fruit in the form of environmental improvements and financial results, organisational advantages, and similar benefits.

Companies' lack of ability or willingness to focus on precise target groups may explain why those stakeholders who are removed from routine business operations do not read Green Accounts or use them as a source of information about an enterprise's environmental performance. It may also be due to the fact that Green Accounts compete with a lot of other media and information for the attention of the public.

During the revisions of the Green Accounts Act in 2001 and 2002, the proposed new Act went through an extensive consultation process with different stakeholder groups and organisations. This revealed that, despite the apparent shortcomings which were documented by the 1999 evaluation, the general attitude to Green Accounts has become more positive over the years and these are now generally accepted as a part of Danish corporate reporting practice.

[6] Miljøstyring og miljørevision i danske virksomheder, Danish EPA, October 1997

7.4 Internal use of Environmental Information

One of the objectives of the Green Accounts is to motivate companies to continuously improve their environmental performance by focussing on materials and processes. For some companies, the preparation of Green Accounts has been an introduction to more systematic environmental work, whilst for others it has been a supplement to ongoing environmental efforts.

The evaluation from 1999 shows that a large proportion of companies (between 40 and 60% depending on the question) use the obligation to prepare and publish the required information in order also to support internal decision-making. The main consequence lies in the process of envisaging and planning the actual effort, in addition to more structured and/or detailed data management, especially on the use of resources (in Denmark, emissions from listed enterprises which operate under an environmental permit are monitored by the company). The data is then used for a range of different purposes in the company. In many cases the data requirement in itself has resulted in an improved use of raw and ancillary materials and the minimisation of waste, and in dialogue with employees it has proved useful in providing indicators relating to the use of resources.

Furthermore, different companies have used environmental information collected for the Green Accounts in the following ways: to implement cleaner technologies; to choose between different resource-saving equipment and alternatives; in the substitution of substances; for internal benchmarking between installations within the same company; to focus on waste management; to register and manage the use of chemicals; and to carry through adjustments to the organisation.

Thus, there is a great deal of synergy between external environmental reporting and environmental management accounting when companies fulfil the reporting obligations of the Green Accounts Act.

One of the requirements of the Green Accounts Act is the reporting of the degree of employee involvement in preparing Green Accounts. Not surprisingly, work with Green Accounts has been used to further the involvement of employees in environmental work. Some of the companies surveyed believed that their work with the Green Accounts had an effect on employee performance, as shown in table 7.2.

About half the companies which prepare Green Accounts report that they have gained economic benefits from their work with the Accounts. Most companies taking part in the evaluation could not give actual figures for

Table 7.2. The effect of employee involvement

Decrease in absence due to illness	5%
Less industrial injury	13%
Better communication within the company	49%
Higher commitment	60%
Effectiveness of work procedure	35%
None of these	30%

their savings and revenues, but those (approximately 25%) who had experienced economic benefits and quantified them had on average saved 75,000 DKK (approximately €10,000), and a quarter of these had saved more than 250,000 DKK (approximately €35,000) a year. Table 7.3 provides more details.

Table 7.3. Economic benefits related to the Green Accounts

Increased competitive advantage	6%
Better overview of environmental performance	44%
Reduction of waste	21%
More efficient use of raw and ancillary materials	21%
Reduction in green taxes	15%
Saved resources	27%
Other economic benefits	5%
No economic benefits	48%

7.5 New Reporting Requirements and Amendments

When the first Green Accounts Act came into being, the approach was materials-flow based – what is the input and what are the emissions/releases of polluting substances? This approach remains unchanged, but the Accounts have been expanded with more information requirements concerning waste and waste-handling, and more information reporting on the environmental behaviour of the company. Another important new issue is how well the company complies with its environmental permit.

The new requirements are the result of a political process, and have two objectives. Firstly, that the Accounts present information of interest to the public, for example how well the company complies with regulations; complaints by neighbours and others; behavioural information such as environmental policy, demands on suppliers, and waste generation and handling. Secondly, but no less importantly, the companies themselves should be motivated to work systematically with environmental issues.

The revised Green Accounts Act in 2001 caused a major change in the administrative framework. Until 2001 the central authorities, the Danish Environmental Protection Agency and the Commerce and Companies Agency, played a key role in the process. The Danish Environmental Protection Agency dealt with complaints about content, whilst the Commerce and Companies Agency was the authority responsible for the timely submission by companies of their Accounts and for ensuring that the mandatory information was included.

In order to meet the main criticism raised by the evaluation – distrust of the information and lack of use – the revised Accounts were linked directly to the environmental permit and the conditions therein, a step which resulted automatically in the active involvement of local authorities. Local authorities now have to draw up a statement which is published as an integral part of the Green Accounts, which must reflect whether the environmental data is in line with the knowledge that the authority has about the company through its work in issuing permits and its controls. The statement must register whether the Accounts are acceptable and, if not, state clearly what is wrong. It should be noted, however, that the statement covers only certain parts of the Accounts; for instance, more management-related issues are exempt. In accordance with this change, the role of the central authorities has been reduced.

An improvement in credibility might also have been achieved through mandatory audits. However this could have represented a considerable financial burden on companies, and there was some concern that there would be little added benefit beyond the credibility issue.

An additional benefit from allowing local authorities to make a statement is that dialogue must take place on the Green Accounts. The revised Act prescribes that the company must send its draft Green Accounts to the authority, and that the authority must then send a draft statement as part of a consultation process. The Green Accounts can be altered through dialogue between the company and the authority, and in such cases the statement can also be altered to reflect the changes in the Accounts. The philosophy behind this process is that no company will be interested in having to publish a negative statement which shows differences of opinion between the company and the authorities on the image which the Accounts present.

From an administrative point of view, benefits can be obtained when the local authority uses work with Green Accounts dynamically in order to achieve more targeted and efficient work, ignoring outdated routines in favour of concentrating on the most substantial environmental issues which are relevant to each individual company.

7.6 Conclusions and Future Perspectives

Companies are still experimenting with the results that they can achieve from green accounting. For many, this will primarily be the very sensible philosophy that, "if we consume less resources, or utilise these more effectively, then we will minimise costs and increase profits".

Many companies use Green Accounts to create new and better dynamism in the company, since management and staff have a new and less contentious forum for dialogue. This type of company will also include Green Accounts in its dialogue with co-operating partners and suppliers, so that together they can achieve environmental improvements.

Other companies regard Green Accounts as a means of communicating their values. In Green Accounts it is easy to translate their ideas of responsibility and softer values into goals and actions, which demonstrate the results to those who read the Accounts, thereby creating affinity and understanding. Often, Green Accounts will be a means of communication for environmental management efforts.

In the future we can expect information to become increasingly fragmented on the one hand, while also becoming increasingly targeted on the other. The future of the classic 'pure' environmental report is probably all too predictable. It can be assumed that environmental information, along with other non-financial information, will be incorporated into the annual reports or similar. The information in itself will survive, but the means and the frequency of communication will change. This link with the annual report would also imply more focus on the financial dimension of environmental performance.

The more advanced companies will collect and use the information required by the Green Accounts to cement and enhance their market position. The more product-oriented approach, looking at supply chain and mobility issues, is already under way. In business-to-business markets, more companies will increasingly engage in knowledge-sharing with suppliers, subcontractors and customers.

There is an immense inherent potential for creating product developments through the activity of collecting and presenting the required information. But the real potential only unfolds when the links which have been created between production data and materials flow data are then also complemented with the financial dimension. In this way, companies can access a management tool for evaluating decisions about investments, product mix, product design, etc. As such, this is the main link between the external environmental reporting process and environmental management accounting. Such a tool can furthermore improve the profit margin considerably and, as a side effect, society will profit from the environmental improvements.

Another significant aspect of the future development of Green Accounts, which could become a decisive factor, is the increasing demand for transparent, comprehensive and credible information on a national and international level. This includes, for example, authorities which are engaged in different international, legally-binding reporting requirements. The Danish environmental authorities, for instance, will use the data from the Green Accounts to fulfil reporting requirements to the EU and probably also requirements in the forthcoming pollutant release and transfer register, currently under preparation under the Aarhus Convention as a separate protocol.

In adopting the Green Accounts Act, one of the Danish Parliament's objectives was to create a turning point for communication between companies and the public on the environmental aspects of production and products. In turn, this was to create a new tool for dialogue on the environment between companies and their most important stakeholders, on the road to a sustainable future. The question remains, of whether this objective has been reached. However, the perspectives for environmental information are numerous and there are still many links and possibilities to explore. It can be expected that Green Accounts will continue to develop in tune with changing demands in the future.

8. Environmental Management Accounting, Eco-Efficiency Profiles, and Effluent Charges for Costa Rican Coffee Mills

Albert Schram

Economic Research Institute, University of Costa Rica

aschram@yahoo.com

Abstract The principal aim of this paper is to show how instruments for the environmental regulation of industrial water pollution can be made more effective and efficient by using an information-based instrument such as eco-efficiency profiles. The paper demonstrates how eco-efficiency profiles can be linked to environmental management accounting systems.

A sector-specific profile is created for coffee mills, and the paper goes on to argue that a compulsory eco-efficiency profile program, coupled with a pollution charge, might promote a better integration of environmental management at the level of the firm and improve environmental performance. It is shown that eco-efficiency profiles can be created even from the information which is presently available, generated by existing regulation.

8.1 Introduction

For several reasons, economists prefer market-based instruments (MBIs) to traditional environmental permits and standards as instruments of environmental regulation for industry. MBIs consist of measures such as subsidies for cleaner technology, effluent charges, or tradable emission permits. The principal reason for this preference is that MBIs offer more flexibility to those who are being regulated, and therefore lead to substantial savings in compliance costs. In practice, however, MBIs are seldom implemented independently of other direct regulation. Depending on the characteristics of a country's legal system and other institutions, in all OECD countries a "policy mix" is used in which conventional, direct, or command-and-control (C&C) measures still predominate (Barde, 2000: 157159). In practice, concrete proposals for the specific design and parameters of market-based regulatory instruments are more difficult to formulate than economic theory would lead one to believe. Consequently, applied research should focus on

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methods to develop such instruments and to measure their impact under difference circumstances.

The response of private companies to these MBI instruments has been studied in industrialised countries. For developing countries, by contrast, the incipient environmental regulation is still quite partial and ineffective, so that insufficient data are available for similar analyses. In these countries, the problems which are caused by water pollution are considerable, and urgently need to be addressed in an efficient and effective way. Water pollution by industry and households is a public health problem, since a large part of the population depends directly on surface water. Although municipal wastewater treatment is beyond the scope of this paper, both issues need to be addressed simultaneously by the regulator, otherwise failure to act with regard to municipal wastewater can become an excuse for industry not to co-operate.

Given the differing context in developing countries, this paper addresses topics on which discussion has become trite in the OECD countries, as well as issues that have never surfaced in developed countries. Firstly, in section 2, the advantages and disadvantages of three types of environmental regulation - C&C, MBIs, and information-based instruments (IBIs) - are briefly discussed from the perspective of economic theory. In particular, the application of IBIs in a developing country setting, and the consequences and wider implications of this, are evaluated. In section 3, a method for assessing the impact of IBIs, such as a mandatory eco-efficiency profile and an effluent charge, is then described. An environmental management accounting (EMA) system would provide the information for the IBI. Finally, in section 4, a proposal for mandatory eco-efficiency profiles is presented for coffee mills.

Before implementing a similar scheme, we suggest that a systematic series of economic experiments should be carried out in order to determine the impact of eco-efficiency profiles on the effectiveness of an effluent charge system and to outline the essential elements of a basic EMA system. These experiments would build on earlier experiments performed in 2001 (Alpízar et al., 2001).

8.2 The Impact of Information-Based Instruments on Compliance with Environmental Regulation in Developing Countries

There are several differences in context between developed and developing countries that need to be taken into account when addressing issues regarding environmental regulation and its consequences for EMA. A working definition of an EMA system could be "any cost accounting system that generates a public statement about an organisation's use of, interaction with and impact upon the natural environment" (Gray, 2001). In developing countries (though not exclusively only there), financial accounting standards are often inconsistent and confusing. In addition, confusion over environmental indicators compounds the problem: "even when companies do report environmental information, the value of that information is diminished by the absence of a common and recognised set of definitions and concepts with regard to environmental issues and their associated costs" (Lindroos, 2001: 18). Industrial pollution issues are different, and generally the sphere of action of the state is significantly more limited than it is in industrialised countries. Furthermore, the legacy of protectionism and state involvement has not been eliminated, so that often competition is weak and monopolies are deeply ingrained.

Among the regulation of economic activity in developing countries, environmental regulation is unsurprisingly often the weakest of all. Often the institutions which are responsible for environmental regulation have only recently been created and are relatively powerless. The enforcement of environmental regulation is also weak since other institutions fail - for instance, the legal system frequently does not define property rights well, and at the same time does not provide for an adequate way of transferring property rights. The court system can also make it difficult or extremely costly to enforce any claim (Porter and Esty, 2001).

The enforcement of environmental regulation has little political weight, because public support for environmental policy is weak. The political power of well-connected local business groups is many times greater than their economic importance, and their lobbying activities are often effective in obstructing any effort on the part of the state to regulate or tax, particularly with regard to environmental regulation. Engrained monopolies and regulatory capture are particularly intense in smaller countries with less than 7 million inhabitants, which compose the majority of developing countries. Despite all this, the scope of environmental regulation is expanding quickly, and for countries like Costa Rica it is to be expected that during the next decade environmental policies will become more effective.

Economists have written of a "second-best world" where one condition for reaching a Pareto-optimal efficient outcome is violated. For instance, in the case of the supposed double dividend of "green taxes", the existence of other distorting taxes needs to be taken into account. In the context of a developing country, property right regimes are both ill-defined and incomplete, as well as too rigid and over-protected (De Soto, 2002). Moreover, corruption is rife and the actual operation of state institutions is far removed from what they were designed to do. We could call this the "third-best world", where systemic failure often makes a mockery of any efforts to implement environmental policy.

In the developing world, C&C instruments have been introduced during the last decade, particularly regarding surface water pollution by industry. Given the seriousness of the pollution problems and the ease with which industries could be targeted, it is no surprise that this has been the first area for environmental regulation. C&C instruments require firms to generate a limited amount of specific information for the regulating agency that monitors compliance. The task of collecting and compiling this information is often outsourced to small, specialised consulting firms. If a firm is found to be out of compliance, fines or other penalties can and should be applied. In addition, in recent decades approaches that differ from this traditional type of instruments of direct environmental regulation have been implemented more widely in an increasing number of countries.

The first type of non-conventional instruments for environmental regulation are commonly called "market-based instruments" (MBIs). These instruments require the provision of more, and more detailed, information from firms, as well as more monitoring and control activity on part of the regulatory agency. A second type of non-conventional instruments is called "information-based instruments" (IBIs). Until recently these instruments were not taken very seriously by policy makers and academics, but they are now becoming increasingly popular.

Since IBIs require firms to generate information on a variety of topics and in different forms, they can potentially be a important driving force for introducing EMA on a wider scale and stimulate a more integrated environmental management system (EMS). An EMS is that part of the overall management system which includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy (ISO 14001:1996). IBIs are the most interesting instruments to examine in the light of EMA systems. Ideally, an EMA system would feed information seamlessly into the IBI.

IBIs are not always used as mandatory regulatory instruments, and sometimes consist of voluntary programmes for a specific sector or for a limited group of firms. Examples of IBIs are environmental covenants between industry and the state, such as in the Netherlands with the chemicals industry; the compulsory Toxic Release Inventory (TRI) programme of the US Environmental Protection Agency (EPA); voluntary product or process certification schemes, such as ISO14001 certification, Green Seal in the USA, and the Nordic Swan programmes in the Nordic Countries in Europe; and environmental prizes, such as "Bandéra Ecológica" in Costa Rica. These examples show that there is a wide range of IBIs. Once experience has been acquired by the parties working within a voluntary IBI framework, these schemes can then acquire compulsory elements or be combined with existing regulation, for instance, by making participation in a covenant a condition for accessing simplified permitting or other benefits. With their flexibility, low costs for the regulator, and opportunities for firms to improve their competitive position, IBIs offer many attractive features, particularly for developing countries that have difficulties in implementing other types of regulatory instruments (OECD, 1997).

Standard economic theory can teach several lessons about environmental regulation. In the first place, by focusing on the incentives to comply or to free-ride, it can shed light on the reasons for the failure of direct, C&C-type regulation, particularly in developing countries. This has led some to idealise MBIs, although of course these are no panacea. Most market-based and information-based instruments require independent audits, monitoring and control by a regulator, and a functioning legal system, or else they will inevitably fail.

A second lesson from economic theory is that there should be a balance between, on the one hand, maintaining the competitiveness of the majority of firms in a sector, and on the other hand exerting pressure on industry to improve its environmental performance. Current regulation is of a binary type (compliance or non-compliance) which does not allow for realistic gradualism. More flexible regulation would stop this all-or-nothing situation, and allow companies to undertake a more sophisticated balancing act (Hanley et al., 1997).

In addition to mere economic trade-offs, problems of a technical and political nature also need to be considered. The devil is in the detail - the level of an effluent charge, for example, must be set so that a political balance is struck. It is key that a balance be made between industry's tendency to avoid paying charges and to free-ride on the one hand, and the opposition sparked if industry is able to pass the bill for environmental damage to society at large.

IBIs use a different mechanism than do the other instruments of environmental regulation. They stimulate direct or indirect (through political organisations) negotiation between victims and polluters, and also negotiations within each of these two groups. Their effects on actual behaviour are not easily predictable, so they are often seen as complementary instruments that should be combined with MBIs. The principal idea with regard to EMA is that with improved information, MBI will work more effectively and the design of regulation can be improved.

Finally, economic theory suggests that IBIs can potentially be very cost-effective, but unfortunately it does not yet provide a method of determining precisely their effects. The effects of IBIs work through product markets, capital markets, labour markets, the judicial system, the creation of new legislation, constitutional principles and private enforcement actions, but none of the mechanisms have been thoroughly analysed (Tietenberg, 1997). Since IBIs work indirectly and create complicated interactions, the normal optimalisation framework is not appropriate for the study of their effects. We recommend therefore the use of controlled experiments or simulations in order to investigate the effects of IBIs on regulated industries, based on methods developed in experimental and behavioural economics.

For all these reasons, environmental regulation is required in developing countries which is budget-neutral, easy to implement for the regulator, and offers sufficient flexibility for the regulated firms. Measures that combine conventional direct regulation with MBIs such as revenue-generating environmental charges and with IBIs are therefore to be recommended.

8.3 Effluent Charges with Information-Based Instruments: An Application for Costa Rica

Most economists advocate effluent charges (also called Pigouvian taxes) in order to "make the polluter pay", since these are the most straightforward solution to eliminate a problem of negative externalities. A negative externality is an uncompensated third party effect which leads to a welfare loss, and arises when the costs of pollution are not born by those who produce that pollution, who thus do not take them into account in their production decisions. Consequently, pollution is over-produced (Baumol and Oates, 1988).

For the regulator, effluent charges provide a source of revenue which, if "earmarking" is a legal possibility, may finance the costs of effective monitoring and control. "Earmarking" means that the revenues from an environmental charge can be dedicated to a specific purpose, such as, for instance, building and operating water treatment plants. For the regulated industry, by contrast, it implies an increase in production cost, so that some resistance from industry to the introduction of pollution charges is to be expected. There are, however, long-term positive effects on competitiveness from an environmental charge, since this provides a double incentive for innovation. By improving its treatment and production technology a firm will lower its marginal abatement cost curve, and thus save on both its tax bill and its total abatement costs.

The success of an effluent charge system will depend critically on two factors: that the charges are set at an appropriate level, and that there are strong disincentives to free-ride. If charges are set too low, the environmental policy goals will not be reached. If they are set too high, on the other hand, free-riding and evasion will become uncontrollable.

In the following sections it is suggested that simulations can help to determine the level of the charge that the market will bear, and that mandatory eco-efficiency profiles can be used to reduce the scope for free-riding. As a consequence, higher revenue can be obtained from an environmental charge by using eco-efficiency profiles. To reduce the risk of free-riding, an IBI can be used. An IBI in combination with an environmental charge can reduce the temptation to free-ride, and thus enhance the degree of compliance.

For over a century, coffee milling has caused substantial river pollution in Costa Rica, a country with around four million inhabitants. Since this is a relatively consolidated industrial sector and one of the main causes of industrial water pollution in the country, it became the first industry to be subject to environmental regulation. In 1990, less than 100 coffee mills processed the entire coffee harvest and caused significant pollution to the country's rivers. These mills produced the equivalent of the untreated wastewater of approximately eight million people.

The coffee bean is hidden inside a coffee berry, which turns red when ripe. The remains of this berry produce most of the organic waste. Removing the berry from the bean is done with water, which causes the high organic content of the effluent. Traditionally, the coffee beans are exported in 46-kilo bags of "green beans", and are toasted and packed upon arrival. Many coffee-millers in Costa Rica are part of vertically integrated corporations which also export coffee directly to the New York market. There is thus considerable experience with market mechanisms in the coffee mill sector.

In 1994, the government and the coffee millers association (ICAFE) agreed to reduce water use gradually, to invest heavily in water treatment technology, and to apply concentration standards to their wastewater. In addition, in 1998 around 8 or 10 coffee mills decided to participate in a voluntary environmental certification scheme called "Bandéra Ecológica" which was set up by the Costa Rican Ministry of Environment. Subsequently, some of these mills have dropped out of this programme in order to progress instead to ISO14001 certification, whilst others have left the programme for lack of interest or commitment by management.

Unfortunately, since 1994 progress has been slow and today only a meagre 30%40% of coffee mills are in compliance[1]. Moreover, coffee prices are currently heavily depressed and production is expected to fall substantially in coming years. In consequence, it is unlikely that the coffee mills' compliance record will improve under current regulations. A series of proposals have been launched for pollution charges or tradable permit schemes, though unfortunately these proposals have never gone beyond the debating stage (Adamson, 1996 and 2001; López and Méndez, 2002). In part this is due to the limited understanding by all parties of the advantages of these schemes. It is also due to a lack of interest from the industry, which is currently facing low coffee prices and has no desire to "wake the sleeping dog" of environmental regulation. Its past efforts at cleaning up have not produced any tangible benefits, and as a first step, voluntary eco-efficiency profiles could be a way out of the gridlock. Once an appropriate regulatory framework has been negotiated, these profiles could be made mandatory and a condition for obtaining some of market benefits which associated with certified EMSs such as ISO14001.

[1]This estimate is based on the author's own research in the archives of the Ministry of Health and on results presented by Marcos Adamson, who studied a sample.

This type of regulation is insufficient to reduce pollution sufficiently or to prevent substantial public health damage. Experience with the coffee milling industry in Costa Rica suggests that when state institutions are weak, this type of regulation will achieve compliance by less than 40% of industries (Schram, 2000). Creative methods which suggest how best to proceed from here need to be devised. Possibly, IBIs should play a more important complementary role in developing countries than in industrialised countries.

Policy makers have realised the power of IBIs, but have been deterred by their potential ramifications. In 1995, for instance, a young environment minister in Costa Rica had a meeting with business leaders. When he said he was going to increase fines for environmental misdemeanours, nobody stirred. Even when he mentioned the introduction of an effluent charge on industrial wastewater, nobody moved, since business leaders have heard this repeatedly and have developed their own ways of dealing with these nuisances. Only when the minister mentioned that he was considering the publication of a list of the highest-polluting industries, did he get the business leaders' undivided attention. Nevertheless, nothing ever came of this idea, since blacklisting of companies can seriously harm a firm's competitive position. It seems that the future challenge lies in combining the strengths of a mandatory disclosure instrument with the benefits of voluntary environmental agreements, certification, and reporting.

For regulated industries, the cost of generating information for eco-efficiency profiles can be offset by the strategic advantage of having a common baseline for negotiation and discussion with the regulator and among industry members themselves. It also protects businesses against false claims by extreme environmentalists. In a community setting, moreover, it can help in defining properly who are true members of the community, and who are infiltrators with different agendas. More importantly, competitive advantages can be achieved through the use of eco-efficiency profiles for marketing purposes. These profiles should combine the generally applicable indicators from the organisational, value and environmental profile from the World Business Council for Sustainable Development (WBCSD) with more business-specific performance indicators based on ISO14031. In this sense, EMA can generate management performance indicators, which are an organisation's environmental performance indicators that provide information about management's efforts to influence the organisation's environmental performance (ISO14031: 1999). From the choice of an organisation's specific environmental performance indicators, implications for environmental accounting systems can be drawn (Wolters and Danse, 2002).

The proposed system for public disclosure of eco-efficiency profiles is generally applicable and can be constructed with existing data, even in developing countries. It must be stressed that no new data collection effort was undertaken, and these profiles were created by organising existing data. It is based essentially on the ISO14031 norms for environmental performance, combined with the value and environmental profile as proposed by the eco-efficiency framework of the WBCSD. Some of the lessons learned in developing countries can also be applied *mutatis mutandis* to small and medium-sized firms in Europe and the USA.

8.4 Environmental Management Accounting and Eco-Efficiency Profiles for Costa Rican Coffee Mills

Eco-efficiency profiles can stimulate firms to implement EMA in response to the need to monitor and reduce compliance cost for present or future environmental regulation. During the development of these profiles, the need to implement EMA should be taken explicitly into account. This strategy to promote EMA would appear to be more feasible than the alternative proposal of promoting EMA standards independently, which requires a full materials and energy balance and is therefore more suited to industrialised countries.

Eco-efficiency profiles would thus provide an intermediate layer of information that enhances the effectiveness of existing environmental regulation and also stimulates firms to improve their EMA systems, in support of the environmental performance goals which are implicit in the eco-efficiency profiles. For the usual reasons, it would be highly desirable to move from the current direct regulation approach of effluent standards for waste water to a MBI such as an effluent charge.

More research will be needed in order to develop an integrated eco-efficiency profile and EMA system. We suggest a procedure that uses eco-efficiency profiles to improve and fine-tune MBIs, building on earlier economic experiments. The main hypothesis is that the full benefits of improved environmental regulation can be achieved only when the three levels of information sets - those generated by environmental accounting systems, eco-efficiency profiles, and environmental regulation - are harmonised and well integrated.

EMA will then create a process that leads to higher eco-efficiency and an integration of the three bottom lines.

Coffee milling is a fairly typical activity for developing countries, as part of the primary processing of agricultural products. The type of regulation - effluent standards and some technical standards - is also fairly representative of the kind of regulation that has been implemented in developing countries. Given the history of environmental regulation of this industry, mandatory eco-efficiency profiles in combination with a pollution charge system would enhance compliance by alerting the regulator to who are the most likely non-compliers. An example of a simple eco-efficiency profile is that proposed by the WBCSD (see http://www.wbcsd.org), which consists of three elements: an organisational profile, a value profile, and an environmental profile. This paper will concentrate on the latter. Possibly in the future, due to the increasing risk of becoming a victim of boycotts as a consequence of inadequate social performance, it would make sense for companies to add a social profile as well. A sample eco-efficiency profile was created for the 25 largest coffee mills in Costa Rica, based on existing data.

The fact that these profiles could be created easily by using data which is already available shows how cost-effective an eco-efficiency profile can be as a regulatory instrument. Firstly, simplicity is essential for effective communication. Regulatory agencies tend to produce incomprehensible and unusable information, maybe to protect their monopoly on power or to hide failures. Here, a scale from 1 (low, bad) to 5 (high good) is proposed for each dimension. There are of course data limitations for this exercise, since existing regulation provides the basic data. Experience with small and medium-sized companies in Italy suggests that, with some subsidised consulting, companies can find their own way in creating EMA, without necessarily first creating a full materials and energy balance, or an EMS (Pilisi and Venturelli, 2002).

Secondly, the principal idea is to provide clear rules on how to generate information, but the objective is to create more rather than less flexibility for the regulated industry. Finally, the total points for each coffee mill can give an indication of progress for the entire sector. The simplicity of a single index system is thus combined with a multi-dimensional profile. Eco-efficiency profiles have an additional advantage, because they can be used to promote internationally the unique achievements of the Costa Rican coffee mills in environmental management. These profiles could also be used as a signalling instrument to generate inter-industry pressure to comply.

Since this is a heavily regulated industry, coffee mills already provide data about the operational costs of water treatment facilities, which when combined with other data help to create an eco-efficiency profile. The profile ranks the following dimensions per production quantity, i.e. per 46 kilo export coffee bag, on a scale from 1 to 5: materials efficiency or yield; energy efficiency; investment in treatment technology; treatment costs; and water effluent levels and compliance. The average value for the entire industry is also shown.

Table 8.1.

Name	Rank in production 1997-1998	Yield	Energy Costs	Emissions Level	Investment treatment technology	Treatment Costs	Eco-Efficiency Points
Coope Agri	1	3	5	2	5	1	13
Coope Naranjo	2	5	4	5	4	4	17
Coope Victoria	3	3	4	3	2	5	14
Coope Libertad	4	4	4	5	5	4	18
Coope Tarrazú	5	4	3	1	5	4	13

From table 8.1 it can be seen that the five largest coffee mills have rather similar profiles, and on the whole score above average with regard to eco-efficiency points. This suggests that there is a correlation between production volume and eco-efficiency.

Table 8.2 shows however that for the smaller coffee mills the eco-efficiency profiles differ quite remarkably. For the whole set, there is no significant rank correlation between eco-efficiency points and production (Pearson's ñ). The graphs in Appendix B show the same data in spiderweb diagrams.

The first two dimensions in the profile are linked to materials and energy efficiency, and are of obvious importance for the firms' environmental performance. The third dimension is the legal compliance status, which was selected for the benefit of the regulator. The fourth dimension is the investment cost of the treatment technology, and the fifth dimension is the direct treatment costs, which indicate the level of effort undertaken by the firm. For a more extensive description of how the profiles were generated, see Appendix A.

The issues arising from the eco-efficiency profiles with regard to EMA are firstly, the inclusion of the financial consequences of low materials and energy efficiency, and secondly, how to include more costs in the dimensions of

Table 8.2.

Name	Rank in production 1997-1998	Yield	Energy Costs	Emissions Level	Labour costs	Treatment Costs	Eco-Efficiency Points
Ben. S. Antonio	6	4	1	5	1	1	8
Ben. El General	7	1	3	2	3	1	9
Coope Jorco	8	2	4	5	4	3	16
La Meseta (S. Isidro)	9	1	1	4	1	2	8
Coope San Vito	10	2	2	3	4	5	14
Cafetalera Pilas	11	4	5	5	4	3	17
La Meseta (S. Luis)	12	3	1	3	1	2	7
La Meseta (Los Santos)	13	5	2	2	3	2	9
La Meseta (Santa Barbara)	14	1	2	3	2	2	9
La Meseta (Palmares)	15	3	1	3	2	2	8
Coope Ramonenses	16	5	1	1	3	5	10
Coope Atenas	17	4	5	2	3	3	13
La Meseta (Coto Brus)	18	2	2	3	2	1	8
Ben. Sarchí	19	1	5	2	5	5	17
Coope Palmares	20	5	3	2	2	3	10
Coope Sabailto	21	2	5	3	5	4	17
Ben. Santo Domingo	22	3	3	3	3	1	10
Ben. San Diego	23	2	5	3	4	3	15
Ben. Santa Eduviges	24	5	3	1	1	4	9
Ben. Monte Redondo	25	1	2	3	1	5	11

investment level and treatment costs. Currently, the yield is reported only in physical terms. It would be desirable to include also the costs of processing non-product materials, i.e. waste. With regard to energy use too, the energy costs of processing non-product materials should be included. With current accounting practices and available data, this was impossible to do.

The second issue about the inclusion of more costs in the fourth and fifth dimensions of the eco-efficiency profiles arises when, for instance, investment in installing and operating wastewater treatment technology is sponsored. In the past, the German and Dutch International Co-operation Agencies, for instance, have provided soft loans and subsidised consulting services for waste water treatment in coffee mills. This has stimulated the adoption of these technologies, but has also generated an expectation that all these costs would continue to be subsidised in the future. In this sense, international co-operation has had a "crowding-out" effect on private investment.

A related issue is whether to use a market discount rate or a social discount rate. In developing countries, the market interest rate can be more than 20% due to inefficient banking systems and unstable macro-economic environments. Once similar eco-efficiency profiles are made compulsory, it will become more likely that these issues with regard to EMA will be properly addressed.

To answer the question of exactly how effective an eco-efficiency profile instrument can be in terms of enhancing a regulator's ability to ensure compliance and produce higher revenues, a series of economic experiments would need to be developed in which contextual variables are carefully and systematically changed (Ledyard, 1995). It is hoped that this will be an improvement on earlier simple economic experiments, where results were compared for situations with full information and with no information respectively (Friedman and Sunder, 1994)[2].

Lessons learned from earlier set of experiments done with a group of Costa Rican coffee mill of managers and a reference group of students should be taken into account (Alpizar et al., 2001). The objective in these experiments was to compare two budget-neutral systems of fines for non-compliance. It was found that for both systems, managers and students show different behaviours, and that contextual and subject-pool differences matter. Experiments with students are therefore unlikely to generate valid results, and experiments with actual decision-makers should be carried out in order to test a proposal for IBIs or MBIs.

A substantial learning effect was also observed during all these experiments. Since control and monitoring is imperfect, pollution by coffee mills was treated as a non-point pollution problem. This is realistic, since several coffee mills typically share the same river basin. When ambient pollution levels reach a certain level, the regulator may feel pressured by politicians and the population to investigate. Effective control is thus initiated only when coffee mills jointly produce an unacceptable level of pollution.

The series of experiments that we envisage here will show the players a pay-off matrix for an effluent charge system. There is a substantial literature on economic experiments for public goods and for pollution control mechanisms, and some interesting ongoing research was recently presen-

[2]Unfortunately, to date it has not yet been possible to carry out these experiments, due to lack of financial support, so that their potential usefulness for answering policy-related questions cannot yet be demonstrated.

ted at the World Conference of the American Environmental and Resource Economist Association. (Friedman and Sunder, 1994; Kagel and Rother, 1995).

The objective of the experiments is to determine by how much the maximum acceptable level of the effluent charge can be increased by using eco-efficiency profiles. In each round, a player decides on an effluent level. In combination with the decision of the other player, the pay-off is determined. Each player should try to maximise its revenue during the whole simulation. The interaction of the players can be modelled by changing the probability of being fined, or by changing the amount of information that they have over each other's actions.

Two different sets of experiments could be carried out, one with eco-efficiency profiles and one without, respectively. It would probably be most practical to conduct these experiments with internet-based software. Players could be present on-site in the laboratory, but could also participate off-site. In each set of experiments, players will progressively be shown more information about their partners. The hypothesis is that eco-efficiency profiles will signal to coffee mill managers the probability that the other coffee mill will try to evade paying the tax by under-reporting and over-polluting. If this assumption is correct, a different game equilibrium might be reached, and probably in less rounds. The adaptation times to new regulation will thus be reduced.

The experiment with the eco-efficiency profiles will again match two players randomly, but provide real information about coffee mills' materials and energy efficiency, past effluent performance, investment level in treatment technology, and treatment costs. The scale of production and average levels for all coffee mills will also be mentioned. The amount of pollution that has to be reduced in each round will be based on average values for the whole population of coffee mills. The hypothesis that can be tested in this experiment is how much higher the charge can be, with eco-efficiency profiles, before compliance breaks down. This will generate some quantitative evidence on the effect of IBIs. Carrying out these experiments is contingent on funding, and on the will of politicians and coffee mill representatives to participate.

8.5 Conclusions

The regulatory approach, disclosure programmes such as eco-efficiency profiles, and EMA systems, should be matched. Information which is provided to the regulator or to the public, and consequently the EMA framework, should be matched and kept as simple as possible, for "while full cost accounting is a daunting technique, there is much that can be done that falls short of a complete cost account" (Bebbington, 2001: 27). Simplicity also minimises sources of confusion and errors, as well as lowering compliance costs for industry and enforcement costs for the regulator.

There is no one-size-fits-all for different countries and different industries, and careful design is needed which is based on research. An example of an imaginary public disclosure scheme based on eco-efficiency profiles for the 20 largest coffee mills in Costa Rica is constructed, with data already publicly available. For the introduction of a pollution charge, a series of public goods experiments could help in establishing the design parameters for the charge.

For a developing country regulator, it is important to transfer some of the costs of monitoring and control to those who are being regulated. Moreover, civil societies' informed vigilance is more likely to be effective with a similar public disclosure scheme. Even if there is little political will to take any action on industrial water pollution, the rapid growth of voluntary ISO 14001 certifications in the developing world suggests that market pressures will stimulate some progress. The only norm that mentions costs in the context of EMSs is ISO140031 on environmental performance indicators. A norm in the ISO14000 series that matches costs with the various performance indicators could be a step in the right direction.

Appendix A: Description of Eco-efficiency Profiles for Coffee Mills

Below we will briefly describe each of the dimensions and indicate the required data for EMA purposes.

1 Materials efficiency: yield

Materials efficiency is calculated by measuring the weight of the coffee when it enters the plant, and the total final production. Differences in yield are small, and are due to regional differences in the coffee fruit and efficiency in the industrial design. Since the final payment at the end of the harvest by the coffee-millers organisation depends on the production volume, there is some scope for over-reporting, but probably not much actual cheating. Presently, data are collected reliably, since they are used to pay the coffee producers and to sell to the coffee exporters.

2 Energy efficiency: energy costs.

Coffee mills are the country's largest wood users, which makes energy efficiency an important issue. A large part of this wood comes from the coffee plantations themselves, but some of it is bought and originates in tropical forests. Supposedly, coffee mills buy only wood which is certified by the Ministry of the Environment, but this system has many leaks. Depending on the design of the coffee mill and the managerial control, energy efficiency varies, mostly among small and medium-sized plants. The data required are easy to collect, but there is confusion on how to convert different fuels to caloric values. A simple manual would be needed in order to make these data more reliable.

3 Effluent performance: effluent level

Effluent levels are supposedly measured four times a year by a certified laboratory and reported to the Ministry of Health. Unfortunately, the coffee mills do not always keep up with this mandatory frequency. Moreover, the Ministry of Health has no system that guarantees proper storage and access to these data. Since the ratio of BOD and COD is known for coffee mill effluents, it would be sufficient to measure only COD, which gives more accurate measurement results.

Another problem is the high variability of the results, due to inadequate operation of the water treatment system. Coffee mills find the operation of a water treatment system to be so difficult that nowadays the companies which build them also operate them. A serious effort should be made by the Ministry of Health to collect, analyse, report and store data on effluent performance in an appropriate manner.

4 Investment level in treatment technology: low-cost or high-cost treatment technology

There are basically two treatment technologies: ponding and anaerobic digesters. Ponding is low-cost when space is available, and has a relatively low treatment cost. Anaerobic digesters require a high initial investment but generate lower maintenance cost. It is easily observable which solution has been chosen.

Bio-gas from these digesters can be used in electric generators and thus save on the energy bill. For the most part, coffee mills have preferred ponding over bio-digesters. Only those coffee mills which do not own sufficient land to construct ponds have opted for bio-digesters or other systems. Again there are great disparities among small and medium sized industries. Presently, only low-cost and high-cost investments can be distinguished.

5 Treatment costs.

Water treatment costs are a direct consequence of the production and treatment technology in the plant. Surprisingly, data are available for all coffee mills. Again, great disparities among small and medium-sized industries exist, which suggests substantial differences in marginal abatement costs.

To calculate treatment costs, the amount of chemicals for operation of the treatment system must be measured, as well as a large number of other variables such as labour costs, energy costs, etc. It is sometimes difficult to distinguish between those costs which are devoted purely to the treatment system, and normal operating costs.

Appendix B: Spider-web Diagrams

Figure 8.B.1. Eco-efficiency profiles

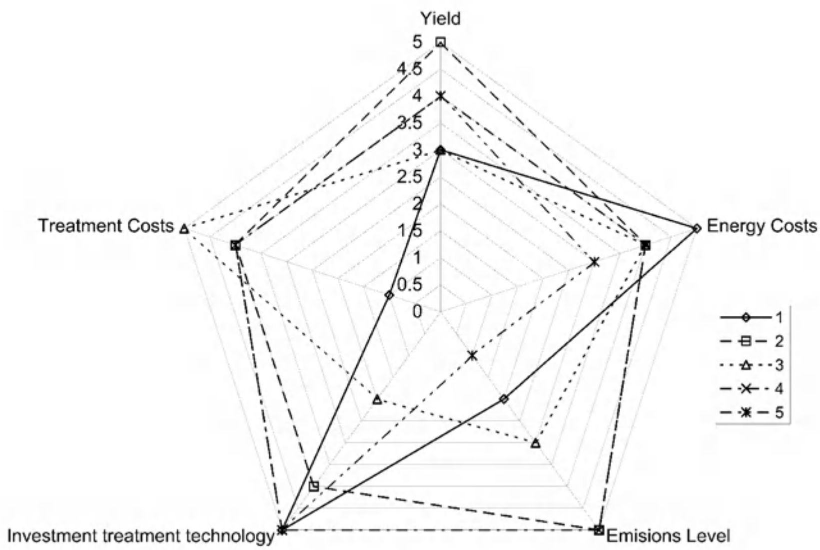
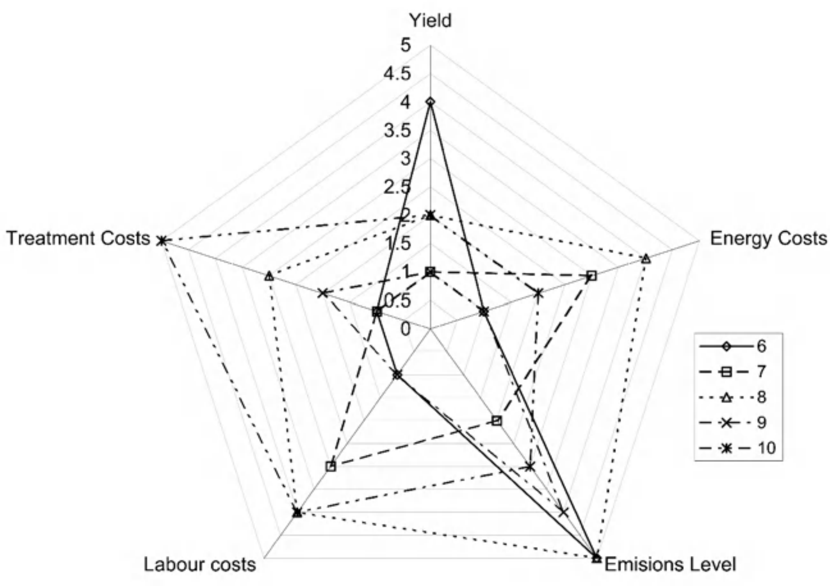


Figure 8.B.2. Eco-efficiency profiles



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III

DEVELOPMENTS IN EMA ADOPTION IN PRACTICE

9. Environmental Management Accounting for Staff Appraisal: Evidence from Australia, Germany and Japan

Roger L. Burritt

School of Business and Information Management, The Australian National University, Canberra, Australia

roger.burritt@anu.edu.au

Stefan Schaltegger

Centre for Sustainability Management, University of Lueneburg, Germany

schaltegger@uni-lueneburg.de

Katsuhiko Kokubu

Graduate School of Business Administration, Kobe University, Japan

kokubu@rokkodai.kobe-u.ac.jp

Marcus Wagner

Centre for Sustainability Management, University of Lueneburg, Germany

mwagner@uni-lueneburg.de

Abstract Interest has emerged in the idea of promoting the development of environmental management accounting systems within organisations. Various environmental management accounting frameworks and tools for analysis have been proposed and some evidence has been gathered about current practice. This paper adds to the existing body of knowledge on the potential of environmental management accounting information to be used for individual performance appraisal. It examines the results of a survey of the styles of environmental information gathered and environmental management accounting practices of companies listed on stock exchanges in Australia, Germany and Japan. The focus of the survey is on an exploratory study of the comparative link between environmental management

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accounting information and potential for assessment of the environmental performance of staff members (employees). Conclusions are drawn about the similarities and differences in practices for the respondent groups in the three countries.

9.1 Introduction

The subject of analysis here is an exploratory assessment of the availability and usefulness of environmental management accounting information for staff appraisal in three countries – Australia, Germany and Japan. The motivation of this paper is to assess whether different styles of environmental information, as recorded in environmental management accounting systems, are used in the three countries to assess performance of individual staff in order to reveal the scope for promotion (see UNDSD 2001). The nature of environmental management accounting and possible cultural influences are controversial issues. The subject matter of environmental management accounting is not settled because of the presence of varied terminology and frameworks (see Burritt et al. 2002), while the possible impact of national cultural differences also raises difficulties (Harrison and McKinnon 1999). Hence, these two issues are examined in further detail in sections 2.1 and 2.2 below.

The paper proceeds as follows: key dimensions of environmental management accounting are considered in section 2, followed by a discussion of potential links between environmental information, environmental management accounting and staff appraisal in section 3. In addition, section 3 shows the research questions which guided the study. The methods of analysis used, the questionnaire and data gathering are explained in section 4. This section also draws attention to important caveats about the results. Section 5 examines results from the questionnaire survey, while the final section indicates findings about the responses received.

9.2 Environmental Management Accounting and Possible Cultural Influences – Two Controversial Issues

9.2.1 Links with Conventional Management Accounting

Environmental management accounting is broadly concerned with the provision of information for the management of corporate environmental and economic performance through the development and implementation of environment-related accounting systems (IFAC 1998, para. 1; Burritt et al. 2002). On one hand, the concept is closely linked with conventional management accounting. For example, Horngren et al. (1997, 2) indicate that conventional management accounting provides information for five broad management purposes:

1 Formulating strategies and long-range plans;

2 Physical resource allocation decisions involving product and customer emphases and pricing;

3 Performance measurement and evaluation of people;

4 Cost, asset and liability planning, and cost, asset and liability control, of operations and activities;

5 Meeting external regulatory and legal reporting requirements.

Environmental management accounting has similar purposes, but is viewed through a green lens. While the *supply* of environmental management accounting information is linked to the ability of organisations to design systems that gather, classify, measure, estimate and record environmental phenomena which are relevant to these purposes, *demand* for the information generated by such systems stems from the use of data by managers for the purposes outlined above. The specific emphasis in this paper is on purpose 3, performance measurement and evaluation of people within the organisation.

Staff responsible for environmental impacts emanating from any part of the corporate value chain include top management, support management (such as accounting and finance managers, information and environmental management), and managers of operational activities (research and development, design, production, marketing and non-product output managers) (Porter 1985). Research by Bennett and James (1998a, 121) suggests that there is a shortage of environmental information even in the 'biggest and best' companies which would indicate that environmental information is not used widely for staff appraisal. They also find that the primary objectives of performance measurement in general are unclear (Bennett and James 1998a, x). For example, are they related to controlling, to developing awareness, or to motivating continuous improvement? [1] In this study, the focus is on the use of environmental management accounting information for only one of these purposes - the appraisal of general staff and of specific staff with environmental responsibility (full time equivalents).

Prior research also suggests that the *style* of environmental management accounting data recorded and made available is important. "Style" refers to whether monetary, physical or qualitative information is collected, recorded and made available (Gibson and Guthrie 1995, 118; Burritt and Welch 1997, 80). Style is important because of the emphasis placed in recent years on the use of cross-elasticities and cross-level indicators for assessing environmental performance, in particular through various measures of eco-efficiency[2] which compare economic value added and environmental impact added (Schaltegger and Burritt 2000: 51 & 363; Schmidheiny 1992; Burritt and Schaltegger 2001, 159-162). There have been debates over style because there is still no general agreement whether environmental management accounting should integrate monetary, physical and qualitative information (Bennett and James 1988b, 31; Schaltegger et al. 2001a; Burritt et al. 2002). Considerable interest has emerged in the idea of developing environmental management accounting systems that include all three styles of environmental information (ECOMAC 1996; Bennett and James 1997; Bennett and James 1998b; Bouma and Wolters 1999; Bartolomeo et al 1999, 2000; Schaltegger and Burritt 2000, 89; IFAC 1998; UNDSD 2001). Other attempts to extend the styles of information gathered and used in practice have recently been made. Kaplan and Norton (1992, 1993, 1996) develop the idea of the 'balanced scorecard' that combines different monetary and non-monetary performance measures as the basis for assessing overall performance of individuals. Furthermore, because conventional monetary assessments of performance 'are very imperfect approximations to the ideal' (Solomons 1965, 277) other (non-monetary) measures of performance are needed to support monetary accounting results and to throw further light on the performance of staff.

[1] Gray and Collison (2001, 25) identify the following uses of environmental management accounting: investment appraisal considerations; support of environmental management systems; performance appraisal; better identification and attribution of environmental (overhead) costs; identification of categories of existing (e.g. energy) or potential costs. Uses identified by Bennett and James (1997, 42-48) include performance measurement, operational budgeting and control; costing and cost projection; pricing and demand forecasting; investment appraisal and shareholder value analysis.

[2] Eco-efficiency is a cross-efficiency measure of the ratio between economic value added and environmental impact added by business activities (Schaltegger and Burritt 2000, 31).

A counter to this view is that the goals of business are most frequently expressed in monetary terms because of the market focus on price and the overemphasis on market values at the expense of other values. Indeed, management accounting has been accused of being driven by financial reporting practices (Kaplan 1984) and the possibility has to be considered that these may indirectly affect environmental management accounting style. Overemphasis on monetary measures has been criticised. For example, Rappaport (1978) sees it as naive that senior managers' incentive plans rely so heavily on short-term monetary measures of performance rather than on measures that are more consistent with the long-term health of the business. Overemphasis on a single monetary measure of performance will clearly encourage managers to increase performance in respect of that measure without necessarily contributing to longer run goals of the business (Kaplan 1983, 699). In addition, on the basis of 'what gets measured gets managed', non-monetary environmental aspects of performance may be ignored unless physical measures are provided (Bennett and James 1997, 43; Bennett and James 1998a, ix) and backed up with qualitative statements. Hence, it has been claimed that the appraisal of environment-related aspects of staff performance needs to be based on physical records of materials and energy flows and stocks and their impact on the environment as well as on monetary impacts of these physical data sources and qualitative information (Bennett and James 1998a, 40).

It has been suggested that a principal way in which senior managers motivate their subordinates towards effective performance is to make explicit the link between organisational rewards and the level of performance achieved (Emmanuel and Otley 1990, 81). Effective performance is performance that meets the goals which have been established for an organisation, or part of an organisation. If an organisation considers that environmental issues are important to it, the organisation is more likely to hold its managers accountable for the environmental performance for which they are responsible. In such circumstances, environmental accounting information is likely to be sought out and used by management to provide relevant information for staff appraisal and reward. Incentive systems designed to promote goal congruence between organisational and individual goals take each of the following elements of the measurement reward process into account (Hopwood 1974, 97):

- the organisation has goals (in this case environmental goals are considered),

- the extent to which these goals are achieved is included as part of the formal performance measurement system (using environmental management accounting information expressed in monetary, physical and qualitative terms), and

- organisational rewards are based on the effectiveness with which the goals are seen to be achieved.

Cross-country evidence about the first two elements is addressed here. A survey has been undertaken of the perceived importance of environmental goals, and environmental management accounting data available, in Australia, Germany and Japan, and comparisons drawn. It has to be recognised that such a view is a values-based perspective on business, specifically business values related to the control of staff behaviour. This issue is considered further in the following section which considers whether cultural influences are expected to play a part in the extent to which information about the environmental impacts of business is recorded, made available and used in staff appraisal through environmental management accounting.

9.2.2 Cultural Considerations

Can cultural values in Australia, Germany and Japan, be expected to affect the take up of environmental management accounting in business and use of the information generated for staff appraisal? Evidence does exist that the country in which financial accounting and reporting takes place affects the extent of external environmental and social disclosures (Nobes and Parker 2000; Nobes 1998; Gray et al. 1995, 50). Gray (1988) as well as Perera and Mathews (1990) hypothesised a number of relationships between accounting and national culture. Gray noted differences between the authority for and enforcement of corporate financial accounting systems in Japan, Anglo-Saxon (e.g. Australia) and Germanic countries (1988 12). However, links between culture and *financial* reporting appear to be of less potential use in the context of environment-related issues as these have largely been ignored by financial accounting and reporting to date (Schaltegger and Burritt 2000, 200). In management accounting, Salter (2000, 484-485) found that the impact of cultural variables on conventional management accounting is not always clear, while research by Williams and Seaman (2001, 446) only partially supported the cross-national transferability of factors affecting change in management control systems when they compared Singapore with results from an earlier study of Canada.

Culture has many dimensions and has been addressed through several literatures (Harrison and McKinnon 1999). One of the most common approaches is to use the research of Hofstede (1980; 2001). Harrison and McKinnon (1999) suggest that the research is based on psychology rather than sociology, anthropology and history and is narrow. Hofstede (2001, 373 ff.) tries to address these and other criticisms by examining the links between national and organisational values. Most recently Hofstede's approach was adopted by Williams and Seaman (2001, 444). Hofstede's approach is explored here.

Table 9.1 highlights five values identified by Hofstede related to culture. These are of potential interest as indicators of possible differences in cultural values in Australia, Germany and Japan that might be reflected in business values and in the use of environmental information in the appraisal of individual staff. First is long-term orientation.[3] Environmental issues engender concern for the long-run (e.g. inter-generational equity) rather than the short-run. If national culture values are reflected in the values of business organisations[4] then it seems plausible that countries with a high score on long-term orientation will adopt a longer-term perspective in strategy, planning and other aspects of management, including staff performance appraisal. With this measure Japan, ranked number 1, is classified as a country that has a long-term focus. In comparison, Australia and Germany have only mid-range rankings. On this basis, it might be expected that companies in Japan are more likely to adopt environmental management accounting systems and to use these to assess staff performance in relation to the environmental impacts of business, thereby accounting for interdependencies in values over time and physical measures of ecological impacts (Maunders and Burritt 1991, 16).

Second is masculinity. Masculinity stands for a society in which social gender roles are clearly distinct. It is of interest that a masculine perspective is focussed on material success, whereas femininity is concerned about

[3]Long-term orientation is defined as follows (Hofstede 2001, 359): "Long Term Orientation stands for the fostering of virtues orientated towards future rewards, in particular perseverance and thrift." Thrift is claimed to be positively correlated with tolerance and respect for other people. Long-term orientation is sometimes called Confucian dynamism (Hofstede and Bond 1988)

[4]This is a controversial issue, for example, Williams and Seaman (2001, 445-6) argue that 'In essence, Hofstede's (1980) method and measurement process was designed to quantify the influence of national cultures upon organisations'. They cite Soeters and Schreuder (1988) in support. In contrast, Harrison and McKinnon (1999, 491) argue that it is not sufficient to choose cultural dimensions on the basis of their differences on Hofstede's scoring alone as this is too simplistic.

the quality of life. Accounting in monetary terms is considered masculine (Hofstede 2001, 382) and business could be conceived of as being focussed on material success. Masculinity is not associated with supportive attitudes towards environmental issues. Femininity stands for a society where social gender roles overlap, in which both men and women are concerned with the quality of life (Hofstede 2001, 297). Notions of being in harmony with nature, of appreciating the intrinsic value of nature, of caring for nature, and of understanding the link between nature and improved quality of human life, are associated with deep green thinking and femininity (Maunders and Burritt 1991, 23). It is suggested here that broader styles of accounting (e.g. physical, qualitative and monetary styles) are associated with femininity. Japan, ranked number 1 in masculinity, may be expected to have a greater focus on monetary styles of accounting. In comparison, Australia and Germany have mid-range rankings.

Third, individualism[5] scores differ between the three countries. Australia has the second highest score for individualism, with Japan and Germany having similar, lower scores. In an organisational setting it is likely that individualism would be reflected in individual responsibility for actions, assessment of individual performance, and a calculative involvement of individuals with the business (Hofstede 2001, 226) rather than group-based performance measures and moral involvement. In an environmental context, a high score for individualism implies less concern for intra-generational and inter-generational equity issues, and greater focus on individual performance measures and appraisal. It might be expected that, based on this value, Australia would have a lower emphasis on environmental management accounting information and on individual staff appraisal using environmental themes.

Uncertainty avoidance is the fourth value. Uncertainty avoidance reflects the extent to which members of a culture feel threatened by uncertain or unknown situations (Hofstede 2001, 161). Hofstede argues that there is a strong relationship between planning, control and accounting systems in organisations, and national values for uncertainty avoidance (Hofstede 2001, 381). Uncertainty avoidance is also one of the principles of ecologically sustainable development - the precautionary principle.[6] The precaution-

[5]Individualism stands for a society in which the ties between individuals are loose. Everyone is expected to look after only themselves and their immediate family. Collectivism stands for a society in which people are integrated into strong, cohesive in-groups, which... continue to protect them in exchange for unquestioning loyalty (Hofstede 2001, 225).
[6]The precautionary principle is a widely contested notion (see Harding and Fisher 1999).

ary principle asserts that if there is a suspected significant environmental impact (e.g. from the building of a dam) then, in the absence of scientific evidence about the impact, the decision maker should err on the side of the environment, thereby removing the threat of imposing serious or irreversible environmental damage. Hofstede (2001, 382) argues that higher uncertainty avoidance scores are associated with: less organisational involvement with strategic planning, because this would challenge the certainties of the day; and more detail in planning and more short-term feedback control based on rules. Japan has a higher score for uncertainty avoidance in comparison with Australia and Germany and on this basis would appear to be less likely to consider strategic environmental uncertainties, thereby adopting the precautionary principle when considering environmental risk management issues and associated risk management tools, and implementing detailed environmental management accounting about impacts on the environment. The trait of uncertainty avoidance, viewed through adoption of the precautionary principle, relates to ignorance of physical environmental impacts as determinable by natural science. It might be expected that, if this value is important, there will be more emphasis on the physical style of environmental management accounting information in Japan, as compared with Australia and Germany. It should be noted, however, that studies that have measured uncertainty avoidance in western and eastern contexts and have made comparisons, have found varying results for uncertainty avoidance (Harrison and McKinnon 1999, 491), and some studies did not find the uncertainty avoidance dimension at all (Hofstede and Bond 1988, Smith et al. 1996).

Power distance is the final cultural value considered. Power distance represents the extent to which less powerful members of institutions and organisations within a country expect and accept power to be distributed unequally (Hofstede 2001, 98). Hofstede argues that planning, control and accounting systems in organisations are strongly related to power distance (Hofstede 2001, 381). All three countries possess similar but low cultural scores for power distance. The implications of this for environmental management accounting are unclear.

What are the expected influences of these different cultural values on environmental management accounting and its use for staff appraisal in the three countries?

Based on the comparative scores in Table 9.1 and subject to business values reflecting national values, several observations can be made:

- long-term orientation – companies in Japan are more likely than in Germany and Australia to adopt environmental management accounting systems and styles and to use these to assess individual staff performance;
- masculinity – Japan is more likely to focus on the gathering of environmental management accounting information in monetary terms for assessing staff performance;
- individualism - companies in Australia are less likely than in Germany and Japan to adopt environmental management accounting systems and use them to assess individual staff performance;
- uncertainty avoidance – Japanese companies are more likely to gather and use environmental management accounting information as a basis for reducing uncertainty, than in Germany and Australia; and
- power distance – unclear implications for adoption of environmental management accounting

On this basis it would appear that Japan is more likely to collect environmental management accounting information, especially in monetary terms, and to use this for staff appraisal.

The next section considers links between environmental management accounting and staff appraisal.

9.3 Information Links Between Environmental Management Accounting, Environmental Performance Measures and Staff Appraisal.

As outlined in Section 2, the use of environmental performance measures to appraise staff depends on the goals of the organisation, on whether environmental goals are seen as important, and on whether environmental information is gathered and, therefore, available for staff appraisal. The following sections examine each of these in turn – organisational goals, the collection of environmental information, and staff appraisal. Each section concludes with the research questions which were investigated in the study.

Perceived Goals of the Organisation. Solomons (1965, 277) was an early proponent of the view that performance of managers can be assessed only in terms of progress made towards a given set of objectives.

Reduction of the environmental impact added by a business through its activities is one such goal. Environmental management accounting systems provide informational support for decisions being made by management about environmental impacts of organisational activities. Commitment of top management towards the environment has been identified as an important foundation for protecting a company from environmental risk by embedding their ideas in the rest of the company (Hunt and Auster 1990, 12; also see Welford 1997, 80ff. for a discussion of the abuse of this representational power). Hence, a key question is whether the respondent, normally a member of top management such as an environmental manager or a chief executive officer (CEO), believes that environmental issues are important to the organisation.

Beyond this general question is the identification of what specific environmental issues are considered to be important. Detailed information gathering in an environmental management accounting system should mirror the environmental issues that *are, or are expected to become*, *relevant* to the organisation. A set of potential environmental issues of interest was developed, based on different environmental media identified as being important in Australia, Germany and Japan (Commonwealth of Australia 1996; OECD 2001). This set of issues includes: waste water management or water protection; non-hazardous waste management; hazardous waste management; protection of biodiversity and landscape; protection of soil and groundwater; protection of air quality; protection of cultural heritage; inland water use and management; land management and development; other natural resource use or management; damage from atmospheric or climatic conditions; damage from surface water; and other issues.

This leads to the following questions on the *goals of the organisation*:

- Is the environment perceived to be an important objective of the organisation?
- What environmental issues are seen as important or are expected to become relevant to the organisation?

Is Environmental Information Collected? Without the collection and recording of environmental data it is not possible for measures of environmental performance to be used for the appraisal of individual managers. Schaltegger and Burritt (2000, 238) recognise the necessity for transforming monetary and physical data collected about the environment into purpose-orientated information for managers who wish to show that they have improved their environmental record. For example, if monetary and physical measures of environmental performance are collected then eco-efficiency, which compares these measures, can be used to assess environmental, economic and, hence, management performance over time. However, if monetary or physical measurements are not collected then eco-efficiency cannot be calculated and managers cannot be rewarded on the basis of that measure. Hence, it is of interest to establish whether monetary or physical information about the environment is collected and recorded.

Given the available evidence about the style of *external* corporate environmental disclosures (see, for example, Gibson and Guthrie 1995, 118; Burritt and Welch 1997, 80; Hroch and Schaltegger 2001; Berkhout et al. 2001) it could be expected that there will be a greater emphasis in environmental management accounting on the collection of qualitative information than on physical or monetary environmental information. Consequently, it is useful to identify whether both quantitative and qualitative information are gathered for environmental management accounting.

Generic forms of environmental information are identified in ISO 14031 (AS/NZS 2000). Three basic categories of environmental indicators are – environmental condition, operational performance[7] and management[8] performance. Whereas environmental condition indicators provide information about the consequences of business activity, operational performance indicators describe the organisation's physical operations, and management performance indicators reveal the efforts of management to influence operations, including monetary and qualitative effects.

To appraise the environmental performance of staff, any of these indicators might be used. However, Bennett and James (1998a) note that evidence gathered from the top 100 UK companies suggests 'most environmental performance evaluation activity is still focused on operational performance indicators, rather than management performance indicators'. Similar conclusions are reached in the USA (Ditz and Ranganathan 1997; White and Zinkl 1997). These operational performance indicators are, predominantly, based on physical measures.

[7]Including inputs of materials, energy and services; the operation of facilities, and equipment and logistics; and outputs of products, services, wastes and emissions.
[8]Including environment-related financial performance; implementation of policies and programmes; conformity of actions with expectations; and community relations.

Based on these studies it might be expected that findings would not differ in Australia, Germany and Japan, and that the gathering of physical information about the environment would dominate.

If environmental information is not collected, the question then arises as to whether companies view the gathering of such information as being impracticable. From a conventional accounting perspective the impracticability of gathering monetary information is of particular importance, as the conversion of physical data into monetary amounts has been the subject of much criticism. Criticisms have been of two types. Firstly, that many environmental costs and benefits do not have readily identifiable monetary values and can be estimated only by using a range of fairly controversial economic valuation techniques such as contingent valuation and the travel cost method, so that the quality of monetary data is questioned (e.g. Kahneman and Knetsch 1992). Secondly, there are questions about the relevance and appropriateness of placing monetary values on some environmental costs and benefits (Beder 1996, 58 ff.; Hines 1991).[9] Bearing these considerations in mind the types of environmentally-related monetary measures need exploration, followed by consideration of the practicability of gathering monetary environmental information when it is not already being gathered.

This discussion leads to the following questions on *whether environmental accounting information is collected, and if so, what kind:*

- Is monetary, physical or qualitative environmental performance information collected?
- Is the collection of physical environmental information dominant?
- Is the quantification of corporate environmental performance in monetary terms seen as being practicable?

Use of Environmental Information to Appraise Staff. Environmental management accounting may be used for the specific purpose of providing a basis for staff appraisal – for example, monitoring, tracking and verification of actual performance relative to expected performance as

[9]Beder explores the following views about monetary valuation – it cannot and should not be done; decisions are better made in the political arena; assumptions made by economists are inappropriate to environmental decisions; and putting a monetary value on the environment will not save it.

a basis for providing rewards and/or improving performance of individual managers in the future (see Bennett and James 1998a, 54 ff., 99; and section 2.1 for discussion of potential negative repercussions of this process and the observation that such information is largely used to raise awareness in order to avoid environmental risks).

Porter (1985, 11-15) describes the different primary activities of a business which make up the value chain as inbound logistics, operations, transportation, marketing, etc.; while other activities provide support – environmental, procurement, accounting, legal, etc. It is not the case that all staff are equally likely to be held responsible for environmental impacts. For example, environmental managers are more likely to have responsibility for physical environmental impacts of a business than are financial managers. If the staff responsible for environmental impacts are spread evenly throughout the value chain, it is more likely that a generic environmental management accounting information system would be introduced for appraisal since the costs associated with developing such a system could be spread across the chain. Where environmental staff are clustered, for example in an environment department, the relevance of environmental information for staff appraisal is likely to be higher but more focused on the relevant style (e.g. physical) than where environmental staff are spread throughout the value chain. Hence, for considering opportunities for the promotion of environmental management accounting, it is useful to consider the spread of environmental staff throughout the value chain and whether there are differences between the use of environmental performance to appraise general staff and specialist environmental staff respectively. Where clustering is evident, the style of information that is relevant to the cluster is likely to dominate, for example, physical information for staff in an environmental department and monetary information for staff in an accounting department (Schaltegger et al. 2001a; Bennett and James 1998a).

This discussion leads to the following questions on *the appraisal of staff performance:*

- What is the average number of staff/ average number of environmental staff?
- Are environmental employees spread throughout the value chain?
- What is the relative importance of financial, physical and qualitative information in the appraisal of individual staff?

- What is the relative importance of financial, physical and qualitative information in the appraisal of individual environmental staff?

- Are different measures used to appraise general staff and environmental staff respectively?

- Do national cultural differences affect the perceptions?

9.4 Method of Analysis and Data Gathering

9.4.1 Survey Method

The survey method was adopted as the basis for cross-sectional data collection based on questionnaires distributed in Australia, Germany and Japan. The survey method permits systematic measurements over a series of cases that yield a matrix of data (Marsh 1982, 6). Surveys can have two important functions. In this exploratory study the survey served as a descriptive fact-finding mission that classifies specific dimensions of environmental management accounting systems and summarises the commonalities found (Fawcett and Downs 1986, 4). It is concerned with the distribution of responses on any one item, and results are used to reveal information about current practices, based on descriptive statistics. Surveys can also be data-gathering exercises for the application of statistical *analyses* that allow inferences to be drawn about the population from sample results (Roberts 1999, 55).

9.4.2 Potential Problems with the Survey Method

It is recognised that surveys do present several difficulties. Firstly, discussion of potential plausible relationships is necessary before the data to be collected are determined, but identified connections between variables can, at best, only add support to the expected relationship which is being examined (Roberts 1999, 56). Secondly, the application of survey instruments across several countries can suffer from different understandings of terminology when different languages are used. Hence, data quality may be reduced and the validity of any results may be less reliable. Thirdly, if a survey is applied across several countries in several languages care has to be taken that the data collection instrument is not seen to be overly restrictive. Fourthly, it has to be recognised that there is a high potential for poor response rates when questionnaires are sent to listed companies – the target organisations in this case – and non-response bias will be important (Kerlinger 1986; Bebbington et al. 1994, 111).

9.4.3 The Survey Instrument

The structured questionnaire used for this study was developed in English, and initially tested and distributed in Australia. A preliminary test of the questionnaire took part in two stages. Firstly, the CEO of a non-listed company, two academics and one environmental manager were approached to assess the clarity of the introductory letter and questions. Secondly, in a pilot study the questionnaire was sent to 20 companies chosen at random from the list available on the Australian Stock Exchange web site. The pilot testing revealed that the questionnaire required no further amendments. Following its use in Australia the questionnaire was then translated into German for distribution in Germany and into Japanese for distribution in Japan. Translations were made in Germany and Japan and then checked for correct interpretation by bi-lingual Professors involved in the research (back translation). Questions translated and distributed in the three countries were identical. The questionnaire consisted of five sections with 16 questions in total relating to: company details; staff appraisal; environmental issues addressed by organisations; organisational strategy; and attitudes about environmental performance measurement.

9.4.4 Respondents

Table 9.2 summarises the categories of respondents' positions by country. As can be seen, in Germany and Japan respondents came mainly from the group of environmental managers, whereas in Australia, respondents were more diverse, including environmental managers, directors, company secretaries, general managers, managing directors and CEOs. One reason for this is that all publicly listed companies were targeted in Australia and many companies do not have environmental managers. Other possible influences relate to the small average size of environmental staff in Australian companies in comparison with Germany, and the broader spread of environmental interests across the value chain (see Tables 9.11 and 9.12). When interpreting the results it must be recognised that the attitudes of the respondents towards environmental issues and the style of environmental information considered important may differ.

9.4.5 Sample Size

The sample size differed in each country. In Australia the questionnaire was distributed to all companies listed on the Australian Stock Exchange. In Japan the survey was sent to all companies listed on the first tier of the Tokyo Stock Exchange, while in Germany the survey went to companies listed on the first tier of the German Stock Exchange. Because of budgetary constraints, no follow-up procedures were adopted once the main questionnaire was distributed in each country (see Table 9.3).

9.4.6 Response Rate

For this study a mailed questionnaire survey was used in order to obtain data from the target respondents. A personalised letter outlining the potential benefits of the research to business accompanied the questionnaire. In particular, the letter outlined the value to business of establishing whether listed organisations record or use internal environmental information to appraise the performance of staff. Reasons supporting the use of this instrument include the fact that the research sample is spread across three countries, the available budget was modest, questions were written in closed-ended style to facilitate comparability across different cultural and language groups, and subjects in business needed time to gather information for their responses as financial and physical information needed to be gathered (Mangione 1995, 1). Letters to specifically named parties and follow-up letters, as suggested by Dilman's Total Design method, were not adopted because of resource constraints (De Leeuw and Hox 1998). Undoubtedly, these are potential contributors to the low response rates.

Table 9.3 presents the dates of survey data collection and response rates. It is recognised that the questionnaire was implemented first in Australia, followed by Germany and Japan. The authors are not aware of any factors that would have systematically biased results caused by the lag in data collection between the three countries. The highest response rate is for Japan (20.4%), with response rates being 10.5% in Germany and 11.2% in Australia. In each country many responses by letter were received indicating that the companies do not respond to questionnaires anymore, thereby increasing the non-response rates; for example, 50 such responses (12.5%) were received in Germany. This is a second important contributor to the low response rates and the non-response bias that results. However, it is argued that the exploratory nature of the research justifies consideration of the data obtained.

9.5 Results

Results are presented in terms of the research questions previously identified, listed under the main headings and then addressing each question in turn.

9.5.1 Goals of the Organisation

Is the Environment Perceived to be a High or Very High Priority to the Company? Respondent belief about how the company rates the environment is revealed in Table 9.4. A greater proportion of respondents believe that the environment is a *very high or high* corporate priority in Germany (73.8%) and Japan (65.1%) than in Australia (59.2%). While results for the sample indicate that the majority of respondents in all countries believe that the environment is rated highly or very highly as a corporate priority, it is to be expected that higher figures would be observed for Japan and Germany because of the large number of environmental managers acting as respondents.

What Environmental Issues are, or are Expected to Become, Relevant? Given the majority perception of respondents that environmental issues are rated highly or very highly, it is of interest to establish which environmental issues are seen as relevant, as these are the issues that environmental management accounting systems are most likely to need to track. Table 9.5 reveals the environmental issues which are regarded as currently being, or are expected to become, relevant in the three countries examined. In general, a larger number of German respondents see specific environmental issues as being relevant to their organisation than is the case in Japan and Australia. For example, in Germany, the environmental issue considered by the largest group of respondents to be relevant is non-hazardous waste management (90.5%). In Japan the same issue received the largest support but from a lower number of respondents (59.2%), whereas in Australia protection of soil and groundwater received the most support (but from only 58.1% of respondents). The results are consistent with the fact that more respondents in Germany see the environment as being relevant to their company.

Respondents in all countries recognise different environmental issues as being relevant. Table 9.6 illustrates that the *majority* of respondents see waste management issues as of particular importance in all three countries.

Comparison with the environmental issues expected to become relevant indicates that Australia and Japan also see ‘hazardous waste management’ as being relevant, while ‘other natural resource use or management’ is important in Germany and Japan, and ‘biodiversity’ is considered relevant by a majority of respondents only in Australia.

Government regulation could play a role in these perceptions and is said to have an important ‘check and balance’ on the recognition of environmental issues as being relevant to business (see Welford 1997, 90). Regulation is said to be a driver of environmental disclosure by 61% of respondents in Australia, 73% in Germany and 68% in Japan. No detailed examination of regulations that might affect specific environmental issues in each country has yet been carried out.

9.5.2 Is Environmental Management Accounting Information Collected?

The next consideration is whether environmental management accounting information is collected in financial, physical or qualitative terms.

Is Monetary Environmental Information Collected? Results shown in Table 9.7 reveal that in Germany, monetary information about a range of environmental matters is gathered by 85.7% of respondents, whereas only a minority collect such information in Australia (39.2%) and Japan (27.9%). The result shows that many managers still do not consider the activity of gathering monetary information about environmental issues to be useful. Hence, the opportunity for using monetary environmental information to assess environmental staff in Australia and Japan (e.g. in eco-efficiency calculations) appears far lower than in Germany, as is the voluntary corporate take-up of integrated environmental management accounting systems (see also Kokubu 2002, where a rising trend of monetary environmental management accounting disclosures is noted).

Is Non-monetary/Physical Environmental Information Collected? Table 9.8 shows that there is a great disparity between German practice, and practice in Australia and Japan in relation to physical environmental management accounting information. In Germany over three-quarters of the respondents gather physical environmental management accounting information, compared with 40% in Australia and only 21% in Japan. The results are consistent with those for monetary environmental management accounting shown in Table 9.7, thereby increasing the possibility that cross-efficiency measures can be used for the appraisal of environmental staff, integrated environmental management accounting information can be produced, and integrated environmental management accounting systems can be developed.

Is Qualitative Environmental Information Collected? A similar pattern is evident in Table 9.9, about the gathering of qualitative information on the environment, with 83% of respondents in Germany, 47% in Australia and only 16 % in Japan collecting such information in the sample period.

The Practicability of Quantifying Corporate Environmental Performance in Monetary Terms. As environmental reports show a dearth of financial information about environmental impacts, it seemed useful to ask whether quantifying corporate environmental performance in financial terms is perceived to be practicable (i.e. feasible). Table 9.10 shows the results. A large number of respondents in Australia, Germany and Japan (including almost half of the Australian respondents) are unsure whether it is practicable to measure environmental performance in financial terms, thus pointing out the scope for promoting education about and professional development on available methods. In Japan the majority agreed with the practicability of such measurement. In Germany 64.2% are unsure or disagree about its practicability, even though according to Table 9.7 they lead the way in collecting this information.

9.5.3 Appraisal of Staff

The remaining question is whether staff in general, and environmental staff in particular, are appraised using monetary, physical or qualitative information, especially where this incorporates an environmental dimension.

Number of Staff / Number of Environmental Staff. Although in Table 9.11 figures for environmental staff numbers are unavailable for Japan, comparisons reveal large differences between the average number of staff employed by respondents with specific environmental responsibilities in Australia and Germany. These figures are somewhat confounded by differences in the size of companies, with German respondents being more than 12 times the size of Australian companies, as represented by average total employee numbers. On an average per capita basis Australia has a higher proportion of staff with environmental responsibilities than Germany.

Are Environmental Employees Spread Throughout the Value Chain? Information about the distribution of staff with specific environmental responsibilities within the value chain is compared in Table 9.12, where it can be seen that they are employed in all stages of the value chain in all countries. However, there is some clustering as 58.8% of companies in Japan and 66.7% of companies in Germany employ environmental specialists in separate environmental groups (only 16.8% are so employed in Australia, implying greater integration). There is a strong presence of environmental staff in production in all three countries, with environmental staff being well represented in research and development and product design in Germany. The early part of the value chain has a larger proportion of environmental staff which might be indicative of the growing importance of the desire to prevent adverse environmental impacts.

What Style of Information is Important in the Appraisal of Staff Performance? If respondents believe that information on corporate environmental performance is relevant to decision making, this implies that companies might also be expected to hold individuals responsible for the results of these decisions. As mentioned above, the environmental management accounting literature discusses three styles of information that might be available about the environment – monetary, physical and qualitative (Schaltegger and Burritt 2000). Each style of information might provide a basis for appraisal of staff performance in the three countries (see Table 9.13). Table 9.13 indicates the way that respondents perceive the importance of environmental information. In Japan a smaller proportion of respondents thought that monetary, physical and qualitative performance measures were 'important or very important' than was the case in Australia and Germany. However, in Australia and Germany similar emphasis was placed on all three styles of performance measures, which were considered "important" or "very important" by between 70-90% of respondents in these two countries.

This does not accord with the view that in Australia and Germany there is a focus on monetary measures for staff appraisal (Salter 2000, 496), and is more supportive of a balanced scorecard view of performance appraisal.

9.5.4 What Style of Information is Important in the Appraisal of the Performance of Environmental Staff?

Table 9.14 reveals a large increase in 'no' answers from respondents when appraisal of staff with specific responsibilities for the environment is addressed in Australia and Japan. It confirms that for the cohort in Japan, the majority of respondents answering the question do not see financial, physical or qualitative information styles as being 'important or very important' in the performance appraisal of those responsible for environmental issues. It also confirms that staff with specific responsibility for environmental matters are not appraised differently from other staff, although financial measures appear to be less important for environmental staff in Germany and Australia. Hence, it appears on the face of these results that the scope for promoting tools for measurement of the performance of individual environmental staff appears to be greatest in Japan.

9.6 Indicative Findings from the Responses Received

In this paper exploration across three countries – Australia, Germany and Japan – is undertaken to see whether the environment is seen as an important objective of business and whether there are any differences in relation to the styles of environmental information gathered and recorded that would facilitate the use of measures such as eco-efficiency as a basis for appraisal of staff.

The environment is perceived to be a high or very high priority to the organisation by the majority of respondents in all three countries.

Results indicate that a range of environmental issues are seen as being or becoming relevant to organisations by a majority of respondents in all three countries, with a larger group of issues being identified as relevant in Germany than in Australia and Japan The issues which are perceived as being relevant or expected to become relevant vary, though one common concern is over waste issues, especially hazardous and non-hazardous waste and wastewater. Some concerns are country-specific, for example, Australia was the only country that sees biodiversity as becoming a relevant issue.

Environmental information is collected by the vast majority of respondents in Germany, in monetary, physical and qualitative terms, which is consistent with the possibility of calculating cross-elasticities and cross-level measures of eco-efficiency, and with the information styles needed for balanced scorecard calculations. However, only a minority collects such information in Japan and Australia. Also, the collection of physical environmental information does not appear to dominate other styles.

Whereas the majority of respondents in Japan considered that measuring corporate environmental performance was practicable, almost half the respondents in Australia were unsure about this and almost two-thirds in Germany were unsure or disagreed that monetary quantification is practicable. Based on these results, the scope for promoting tools for monetary measurement of environmental performance appears to be greatest in Australia and Germany. Japan appears well aware of the practicability of measuring environmental impacts in monetary terms even though, paradoxically, it does not appear to put this into practice (see Table 9.7).

With an average of four environmental staff in Australian respondent companies it may not be cost-effective for them to introduce a separate staff appraisal system using environmental information, but with an average of 40 in Germany the set-up costs can be spread and the possibilities appear greater. In addition, in Australia there is a spread of environmental staff across all areas of the value chain. This reduces the incentive to develop separate appraisal systems using environmental indicators for staff with environmental responsibilities, except where separate environmental groups and a strong cluster in production are present (only in Germany and Japan).

There is no evidence that the styles of information used in the different countries to appraise individual employees differ, although in Germany and Australia physical and qualitative measures are used more often to appraise individual staff with environmental responsibilities. Collection of physical environmental information does not dominate monetary or qualitative sources for this purpose, although in Japan it appears that monetary, physical and qualitative styles of information are less favoured for appraisal of individual environmental staff. This is somewhat in contrast with the recent finding that individual appraisal of environmental issues is not treated lightly in Japan (Kokubu 2002: 7).

It was suggested that national cultural differences may affect business values about the importance of environmental issues, the collection of environmental management accounting information, and the use of this for appraising staff. The results provide contrary evidence about the impact of national cultural values. On long-term orientation, Japan did not dominate in the use of environmental management accounting systems and styles, or in their use to appraise staff. On masculinity, Japan did not have a greater focus on gathering monetary environmental information and using it to appraise staff. On individualism, Germany did show a greater proclivity to use environmental management accounting relative to Australia, but Japan did not. Finally, on uncertainty avoidance, Japan did not dominate Germany and Australia on this value. Culture would appear to be of less importance than might be anticipated in the use and promotion of environmental management accounting information for staff appraisal in the three countries examined.

Table 9.1. Comparison of scores on cultural dimensions in Australia, Germany and Japan[a] (Salter, 2000 pp. 484; Hofstede, 1991; 2001 pp. 500)

Country	**Long-Term Orientation**	**Masculinity**	**Individualism**	**Uncertainty Avoidance**	**Power Distance**
Australia	31 (22)	61 (16)	90 (2)	51 (37)	36 (41)
Germany	31 (22)	66 (9)	67 (15)	65 (29)	35 (42-44)
Japan	80 (1)	95 (1)	46 (22)	92 (7)	54 (33)
Range (all countries)	0-80	5-95	6-91	8-112	11-104

[a] Figures in brackets represent position out of 50 countries and 3 regions, except for Long-Term Orientation which relates to 31 countries and 2 regions.

Table 9.2. Position of respondents

Country	**Position**				
	Director/ Company Secretary	**General Manager/ Managing Director/ CEO**	**Environmental Manager**	**Other**	**Total**
Australia	28	67	9	21	125
Germany	8	0	30	4	42
Japan	1	0	185	86	272

Table 9.3. Collection of data and response rates

Country	**Questionnaires Distributed**	**Usable responses received**	**% response rate**	**Dates data collected**
Australia	1121	125	11.2	21.5.98 – 26.6.98
Germany	400	42	10.5	20.9.99 – 30.9.99
Japan	1339	273	20.4	1.4.99 – 30.4.99
Total	2860	440	15.4	

Table 9.4. Belief about how the company rates the environment as a corporate priority[a,b]

	Country							
Category	**Australia**		**Germany**		**Japan**		**Total**	
	No.	**Percent**	**No.**	**Percent**	**No.**	**Percent**	**No.**	**Percent**
Very high	29	23.2%	7	16.7%	53	19.5%	89	20.3%
High	45	36.0%	24	57.1%	124	45.6%	193	44.0%
Moderate	30	24.0%	9	21.4%	75	27.6%	114	26.0%
Low	10	8.0%	1	2.4%	14	5.1%	25	5.7%
Very Low	8	6.4%	1	2.4%	3	1.1%	12	2.7%
No answer	3	2.4%	-	-	3	1.1%	6	1.4%
Total	125	100.0%	42	100%	272	100%	439	100.0%

[a] Table based on the question: "How do you believe your company rates the environment as a corporate priority?"
[b] Differences between the observed and the expected frequencies between countries are significant (Chi-square = 16.258, df = 8, sig. level = 0.039).

Table 9.5. Environmental issues currently regarded as being relevant to the organisation[a]

	Country		
Environmental issue relevant?	**Australia % Yes**	**Germany % Yes**	**Japan % Yes**
Waste water management	56.8	76.2	47.4
Non-hazardous waste management	50.4	90.5	59.2
Hazardous waste management	44.0	85.7	45.2
Protection of biodiversity and landscape	48.8	23.8	7.7
Protection of soil and groundwater	58.4	66.7	31.6
Protection of air quality	35.2	64.3	58.1
Inland water use and management	30.4	26.2	15.4
Land management and development	36.8	14.3	15.8
Other natural resource use or management	31.2	42.9	20.6
Damage from atmospheric or climatic conditions	15.2	28.6	6.6
Damage from surface water	32.0	21.4	4.8
Other	6.4	9.5	8.1

[a] Table based on the question: "Which of the following environmental matters are currently relevant to your organisation?")

Table 9.6. Current environmental issues seen by the majority of respondents as relevant to their organisation[a]

Australia	Germany	Japan
Environmental issues currently relevant		
• Protection of soil and groundwater • Waste water management • Non-hazardous waste management	• Non-hazardous waste management • Hazardous waste management • Waste water management • Protection of soil and groundwater • Protection of air quality	• Non-hazardous waste management • Protection of air quality
Environmental issues expected to become relevant		
• Biodiversity • Hazardous waste management • Land management and development	• Other natural resource use or management	• Waste water management • Hazardous waste management • Protection of soil and groundwater • Other natural resource use or management

[a] Table based on the majority views observable in Table 9.5 and results of the question: "Which environmental matters are or are expected to become relevant to your organisation?"

Table 9.7. Collection of monetary environmental information[a,b]

	Country					
Category	**Australia**		**Germany**		**Japan**	
	No.	**%**	**No.**	**%**	**No.**	**%**
No	76	60.8	6	14.3	193	71.0
Yes	49	39.2	36	87.5	76	27.9
No answer					3	1.1
Total	125	100.0	42	100.0	272	100.0

[a] Table based on the question: "Does your organisation gather information about any environmental matters in financial terms?"
[b] Differences between the observed and the expected frequencies between countries are highly significant (Chi-square = 51.889, df = 2, sig. level < 0.001).

Table 9.8. Collection of non-monetary/physical environmental information[a,b]

	Country					
Rating	**Australia**		**Germany**		**Japan**	
	No.	**%**	**No.**	**%**	**No.**	**%**
No	74	59.2	10	23.8	210	77.2
Yes	50	40.0	32	76.2	57	21.0
No answer	1	0.8			5	1.8
Total	125	100.0	42	100.0	272	100.0

[a] Table based on the question: "Does your organisation gather information about any environmental matters in non-monetary/ physical terms?"
[b] Differences of the observed and the expected frequencies between countries are highly significant (Chi-square = 55.466, df = 2, sig. level < 0.001).

Table 9.9. Collection of qualitative environmental information[a,b]

	Country					
Rating	**Australia**		**Germany**		**Japan**	
	No.	**%**	**No.**	**%**	**No.**	**%**
No	65	52.0	6	14.3	217	79.8
Yes	59	47.2	35	83.3	43	15.8
No answer	1	0.8	1	2.4	12	4.4
Total	125	100.0	42	100.0	272	100.0

[a] Table based on the question "Does your organisation gather information about any environmental matters in qualitative terms?"
[b] Differences between observed and expected frequencies in the table are highly significant (Chi-square = 95.677, df = 2, sig. level < 0.001)

Table 9.10. Practicability of measuring environmental impacts in monetary terms[a,b]

	Country					
Category	**Australia**		**Germany**		**Japan**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Strongly agree	9	7.2	3	7.1	8	2.9
Agree	40	32.0	9	21.4	147	54.0
Not sure	57	45.6	9	21.4	84	30.9
Disagree	17	13.6	15	35.7	10	3.7
Strongly disagree	1	0.8	3	7.1	2	0.7
No answer	1	0.8	3	7.1	21	7.7
Total	125	100.0	42	100.0	272	100.0

[a] Table based on the question "Do you agree that quantifying corporate environmental performance in financial terms is practicable?"
[b] Differences between observed and expected frequencies in the table are highly significant (Chi-square = 80.050, df = 8, sig. level < 0.001).

Table 9.11. Number of staff and environmental staff compared[a]

	Number of staff					
Country	**Average number of staff with specific responsibility for environmental issues**	**Range**		**Average number of staff employed**	**Range**	
		Min	**Max**		**Min**	**Max**
Australia	4	0	56	1,187	0	38,000
Germany	40	0	400	14,443	0	180,000
Japan	NA	NA	NA	6,613	0	173,000

NA = Not available
[a] Table based on the questions: "How many employees did your company have at the end of the financial year?"; and, "How many full-time equivalent staff does your organisation employ with *specific* responsibilities for environmental issues?"

Table 9.12. Distribution of environmental staff in the value chain[a]

Country						
Category	**Australia**		**Germany**		**Japan**	
Companies responding 'yes':	**No.**	**%**	**No.**	**%**	**No.**	**%**
R & D	22	17.6	17	40.5	56	20.6
Product Design	13	10.4	16	38.1	67	24.6
Production	41	32.8	22	52.4	93	34.2
Marketing	6	4.8	8	19.0	15	5.5
Distribution	8	6.4	5	11.9	25	9.2
Customer Service	3	2.4	4	9.5	17	6.3
Finance / Accounts	6	4.8	4	9.5	10	3.7
Legal compliance	19	15.2	10	23.8	11	4.0
Public relations	11	8.8	7	16.7	21	7.7
Separate environmental group	21	16.8	28	66.7	160	58.8
Other	20	16.0	18	42.9	43	15.8
Total number of companies in sample	125		42		272	

[a] Table based on the question: "In what functional areas are staff with specific environmental responsibilities employed?"

Table 9.13. The relative importance of monetary, physical, and qualitative measures in the appraisal of individual staff performance in the company[a,b]

Rating	Australia						Germany						Japan					
	Financial		**Physical**		**Qualitative**		**Financial**		**Physical**		**Qualitative**		**Financial**		**Physical**		**Qualitative**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Unimportant	5	4.0	2	1.6	1	0.8	3	7.1	2	4.8			14	5.1	15	5.5	13	4.8
Not very important	18	14.4	8	6.4	7	5.6	3	7.1	6	14.3	2	4.8	76	27.9	74	27.2	99	36.4
Important	69	55.2	82	65.6	71	56.8	27	64.3	28	66.7	24	57.1	139	51.1	139	51.1	116	42.6
Very Important	29	23.2	30	24.0	43	34.4	6	14.3	2	4.8	12	28.6						
No answer	4	3.2	3	2.4	3	2.4	3	7.1	4	9.5	4	9.5	43	15.8	44	16.2	44	16.2
Total	125	100.0	125	100.0	125	100.0	42	100.0	42	100.0	42	100.0	272	100.0	272	100.0	272	100.0

(Spanning header above the countries: ***Country***)

[a] Table based on the question: "How important are financial and physical measures or qualitative considerations in the appraisal of individual staff performance in your organisation?"

[b] Differences between the observed and expected frequencies in the table for are highly significant for all three:- financial measures (Chi-square = 69.925, df = 6, sig. level < 0.001); physical measures (Chi-square = 88.157, df = 6, sig. level < 0.001); and qualitative measures (Chi-square = 135.055, df = 6, sig. level < 0.001).

Table 9.14. Importance of information for appraisal of staff with environmental responsibilities[a,b]

Category	Australia						Germany						Japan					
	Financial		**Physical**		**Qualitative**		**Financial**		**Physical**		**Qualitative**		**Financial**		**Physical**		**Qualitative**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Unimportant	9	7.2	5	4.0	4	3.2	3	7.1	4	9.5			34	12.5	23	8.5	21	7.7
Not very important	32	25.6	10	8.0	8	6.4	13	31.0	9	21.4	3	7.1	114	41.9	101	37.1	100	36.8
Important	37	29.6	58	46.4	50	40.0	20	47.6	23	54.8	26	61.9	68	25.0	92	33.8	94	34.6
Very important	11	8.8	17	13.6	27	21.6	4	9.5			10	23.8	[c]		[c]		[c]	
No answer	36	28.8	35	28.0	36	28.8	2	4.8	6	14.3	3	7.1	56	20.6	56	20.6	57	21.0
Total	125	100.0	125	100.0	125	100.0	42	100.0	42	100.0	42	100.0	272	100.0	272	100.0	272	100.0

[a] Table based on the question: "How important are financial and physical measures or qualitative considerations in the appraisal of individuals with specific responsibility for environmental matters in your organisation?"

[b] Differences between the observed and expected frequencies in the table for are highly significant for all three: financial measures (Chi-square = 37.944, df = 6, sig. level < 0.001); physical measures (Chi-square = 88.074, df = 6, sig. level < 0.001); and qualitative measures (Chi-square = 108.540, df = 6, sig. level < 0.001).

[c] Category not included on Japanese questionnaire

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10. Environmental Performance Measurement Through Accounting Systems: A Survey of UK Practice

David Collison, Rick Clark, James Barbour, Andrew Buck, Rennie Fraser, Bob Lyon, Andrew Magowan and Alasdair Sloan*†‡

Abstract This paper describes an investigation of the integration of environmental performance measurement into core corporate management accounting and financial information systems. A postal questionnaire was sent (in 1999 with a follow up mailing in 2000) to Finance Directors of UK companies. A wide range of organisations, in terms of size and activity, was sought by surveying the Top 200 companies in the UK and the Top 500 companies in Scotland. A total of 165 replies was received. The results are presented in aggregate and some sections are analysed by company size and degree of "environmental sensitivity". The questionnaire addressed, inter alia: the importance of environmental issues for the companies and whether they quantified environmental costs or benefits; whether environmental issues were considered in capital investment, and other purchasing (and marketing) decisions; practices in the allocation of environmental costs (according to a detailed list of possible categories), and estimates of their current and likely future significance. Broadly speaking the results show an association between the separate identification/quantification of environmental issues and the size and degree of environmental sensitivity of respondents' firms. Open questions sought views on the above and, in particular, on whether respondents' could suggest how management accounting systems might be altered in order to improve environmental performance measurement. This latter question elicited a "No" response from about 20% of respondents, "Don't know" from about 30% and "Yes" from about 50%. Respondents with an accounting background were much more likely to answer "No" than

*Members of the Environmental Issues Working Party (EIWP) of The Institute of Chartered Accountants of Scotland. Rick Clark is Convener and James Barbour is Secretary.

†Address for correspondence: David Collison, University of Dundee, d.j.collison@dundee.ac.uk

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those without. By far the most common suggestion related to more detailed accounts coding procedures, a number of respondents recommended an increased role for physical measures, a number advised setting and monitoring key performance indicators. Only 3 respondents' expressed doubt about the role that accounting could play in addressing environmental issues.

10.1 Introduction

The importance of environmental management accounting (EMA) is apparent from a current and ongoing initiative of the United Nations Commission on Sustainable Development. The Expert Working Group (EWG) organised under the mandate of the UN initiative (which has many members in common with the EMAN network), recognises that the interests of wider society, as well as those of companies and other organisations will be served by increased expertise in, and application of EMA. This public policy perspective is recognised in the title of the working group's first major publication, *Improving Governments' Role in the Promotion of Environmental Managerial Accounting (UN 2000).* That report notes that the nature of management accounting militates against unduly prescriptive EMA programmes:

> "There is no consensus on the scope, content or procedures of EMA, and it would probably not be useful to try to reach consensus or promote standardization. EMA systems should be adapted to the management needs and priorities of specific enterprises, economic sectors and national systems for accounting and reporting. To a large extent, EMA procedures that focus management attention on environmental costs are more important than the particular system used or results obtained." (UN 2000, Introduction)

It is in the spirit of this advice that the EIWP undertook the survey of practice in UK companies that is reported in this paper. It is hoped that the results may aid understanding of the state of development of environmental management accounting; perhaps allow companies to assess their own level of development in relation to their peers - in other words that it will allow a degree of benchmarking; that it may allow good ideas and suggestions to be spread; that it will raise awareness of and interest in the issues; and perhaps serve as a basis of comparison for any future surveys. The paper notes, in particular, views about how, in the judgement of respondents, a management accounting system could be altered in order to improve a company's ability to measure its environmental performance.

10.1.1 EMA Literature - a Brief Review

The work of the UN in this area was alluded to above (see also UN 2001a and 2001b) but, of course, work in this area has been developing over a number of years and the UN EWG is one of a number of mutually reinforcing initiatives. In particular there are close links between the EMAN networks and the UN EWG, including their overlapping membership of leading authors from around the world. The UN and EMAN initiatives have developed and drawn on a range of academic and professional studies that have appeared over the last decade or so.

Much of the work that has been done has been in the form of case studies that have sought to highlight good practice often within relatively progressive companies. In particular the EU funded *ECOMAC* Project *"Eco-management accounting as a tool for environmental management"* (see Bouma and Wolters, 1998; Bartolomeo et al., 1999 and Bartolomeo et al., 2000) was an ambitious study covering a wide range of companies by size and industry in a number of European countries. In North America the well known study, by Ditz et al (1995) reported in some depth on a number of cases, while Epstein (1996) reported on a wider range of companies. The literature that has been developing in various parts of the globe has begun to be drawn together in various ways, (see, for example, Bennet and James 1998a), as well as informing the EMAN and UN initiatives.

In addition a number of important text books have been at the forefront of raising awareness of the implications of environmental issues for accounting (e.g. Gray et al. 1993, Gray and Bebbington 2001, Schaltegger et al. 1996, and Schaltegger and Burritt 2000) while institutional and professional body guidance has included the widely influential work of the US Environmental Protection Agency and Tellus Institute (e.g. EPA 1995), and statements, or less formal guidance, from professional bodies (e.g. SMAC 1996, CIMA 1997, IFAC 1998) as well as commissioned research reports (e.g. Bennet and James 1998b). Though professional accounting bodies have been proactive to some degree in EMA the global profession, as a whole, has been criticised for its lack of leadership in promoting improved EMA practices amongst its members. (See ACCA/UNEP 2002 - a report on the accounting profession prepared as a contribution to the 2002 World Summit on Sustainable Development) By contrast, the efforts of EMAN, the UN and others in taking initiatives to raise the profile and effectiveness of EMA are applauded in the same report.

The survey of practice that is reported in this paper seeks to complement some of the more detailed case studies and prescriptive work that have already been done by investigating EMA activity (or the lack of it) across a wide range of UK companies, and by seeking the views of accountants at company level regarding the importance and feasibility of utilising accounting systems to improve environmental performance. This also complements the work done on behalf of ICAS by Gray et al (1998) which, *inter alia*, surveyed accountants and environmental managers regarding the impact of the environmental agenda, with a particular emphasis on external reporting.

The next section describes the research method and procedures for analysing the results which are then presented, in a number of cases in graphical form, in the subsequent main section; Appendices A and B report on some tentative insights based, unusually, on three companies which each returned (possibly unwittingly) two separate questionnaires; Appendix C contains a summary of certain comments from respondents to the questionnaire while Appendix D reproduces the questionnaire and includes an overall summary of responses.

10.2 Research Method and Approach to Analysis of Results

A key requirement of the survey was to ensure representation from a wide cross section of companies in terms of size and sector. It was felt that this could be conveniently achieved by using readily available listings of companies as follows: the Scottish Business Insider Magazine's database of the largest 500 Scottish companies (Scottish Business Insider 1998), and the Top 200 listed companies on the London Stock Exchange (Financial Times 1998).

The Scottish Insider 500 listing happened to give a Scottish bias to the total number of companies surveyed but this was a secondary consideration. Given that there was no particular reason to suppose that practice in these companies would be systematically different to those in other parts of the UK[1], this listing was used as a convenient cross section of UK industry covering a reasonably wide range of company size.

[1]It was pointed out in Gray et al. (1998) that some companies were conscious that regulatory enforcement could indeed vary in the rigour of its application from one locality to another. Notwithstanding that observation, and the separate regulatory agency for environmental protection in Scotland, the EIWP had no reason to suppose that Scottish based companies would show

The total number of companies which was initially targeted was somewhat less than 700 since several companies were present in both groups. Mergers had also reduced the total number and the total number of questionnaires posted amounted to 624. A total of 113 usable replies were received to the first mailing[2]. The second mailing[3] resulted in a further 52 usable replies being received giving a total of 165, a response rate of 26.4%.

The questionnaires were addressed to Finance Directors. Table 10.1 summarises the job titles of those who replied. Some consideration of the possible influence of the respondents' position on certain replies appears below.

Table 10.1.

Respondents		
Title	No	%
Finance Director	68	41
Other Finance Title	50	30
Other (e.g. Director, Company Secretary)	31	19
Environmental Manager/Director	10	6
Not stated	6	4
Total	165	100

10.2.1 Response Bias

There was some evidence of a bias in the responses received: companies with potentially the most significant environmental impact (see below for an explanation of this term in the context of this survey) had a greater propensity to respond than those with only a moderate or low impact. Evidence for this bias was identified by comparing early and late responses. In this case, early and late respondents were tested using the natural groups formed by those who responded to the first and to the second mailings respectively. There were 113 in the first group and 52 in the second. The results of a chi squared test are shown in Table 10.2; these show early and late respondents cross-tabulated with the environmental sensitivity of their

systematic differences to those in the rest of the UK. The local differences referred to in Gray et al. related to the approach of individuals rather than to systematic differences in regime.

[2]This took place in July 1999.

[3]This took place in December 1999.

companies. The total is less than 165 because of lack of data about some companies' industry grouping.

Table 10.2.

	Environmental Sensitivity		
Respondents	Most Sensitive	Moderately and less Sensitive	Total
Early	61	49	110
Late	18	27	45
Total	79	76	155

Chi-squared test for response bias based on comparing early and late respondents by environmental sensitivity of their companies.

Table 10.2 shows an association between speed of response and environmental sensitivity which is significant[4] at 6%. One might expect that the questionnaire would, *ceteris paribus*, be of more interest to recipients whose companies are relatively environmentally sensitive and would presumably be easier for them to complete, given the probability of heightened awareness of such elements in their finance function. There are arguably more incentives (e.g. cost control, reduced liabilities, reputational protection) for companies which in relative terms have a more significant impact on the environment to measure and account for the financial costs associated with their business' operations. As detailed above, testing of early and late responses supports this hypothesis with the results from the first mailing disproportionately reflecting experiences and views drawn from companies whose operations would be regarded as having potentially the most significant environmental impact. As a result, it cannot be claimed that the results of this study are necessarily representative of all the companies to which the questionnaire was sent. However they do constitute, in their own right, a sizeable proportion of industrial and commercial activity, with an aggregate turnover, for example, of approximately £200 billion.

10.2.2 Aspects of Questionnaire Analysis

The overall aggregate responses to the questionnaire are shown in the format of the original questionnaire at Appendix D. The main presentation and discussion of the questionnaire results appears in the next section and commences with a brief overview of the "global results". However to

[4]Using Fizler's Exact Test (1 sided) (p value .058).

Table 10.3.

		Turnover Range	No of Companies
Size 1	Largest firms	£300m and over	61
Size 2	Medium firms	£75m - £300m	28
Size 3	Smallest firms	£8m - £75m	69

sharpen the analysis and our understanding of the information contained in the responses each questionnaire was coded to indicate "size" and "environmental sensitivity" of each respondent company and much of the material presented in the next section is based on these classifications which are explained below.

Size. Size was established by use of turnover figures which were, as far as possible, based on the year end closest to 31 December 1996. Difficulties in acquisition of the relevant data lead to seven companies not being included in the size analyses. The turnover figures for the remainder were ranked from 1 to 158 and ranged from over £10bn to approximately £8m per annum. The ranking number, rather than the actual turnover figure, was entered in the database since certain tests of association could give misleading results where the sizes are so dissimilar. The firms were split into three size categories as shown in Table 10.3.

These divisions, while to some extent arbitrary, allowed differences associated with firm size to be more readily discerned by concentrating on comparisons between the largest and smallest, while giving reasonably large numbers in each of the extreme categories to aid statistical reliability. It is worth emphasising that while our sample does include a wide size range it excludes smaller SMEs.

Environmental Sensitivity. A level of environmental sensitivity was allocated to each respondent company based on the respondent's description of its activities. Companies were allocated to 14 industrial/commercial sectors as shown in Table 10.4 (and lack of information lead to a few companies being allocated to "other" or "unknown" categories). Each sector was allocated, based on an assessment by the EIWP, into 3 levels of environmental sensitivity (1 being most sensitive etc) as shown in the Table.

Table 10.4.

Industry Classification (Showing level of environmental sensitivity)
Agriculture(1)
Chemicals and Pharmaceuticals(1)
Electronics/Engineering/Manufacturing(1)
Energy and Water(1)
Extractive Industries(1)
Food and Drink(1)
Paper/Packaging(1)
Waste Processing (1)
Media/Telecoms(2)
Property/Construction(2)
Transport(2)
Financial Services(3)
Hotels/Leisure(3)
Retail(3)

(1) most environmentally sensitive
(2) moderately environmentally sensitive
(3) less environmentally sensitive

The aggregate number of companies falling in to each of the three broad sectors was as shown in Table 10.5.

Table 10.5.

		No of companies
Group 1	Most environmentally sensitive	79
Group 2	Moderately environmentally sensitive	37
Group 3	Less environmentally sensitive	40
	Unallocated	9

A test for association between ranking and environmental sensitivity showed a negative relationship which was just significant at the 5% level[5]. When grouped into the three size categories the same test showed no significant association. A cross tabulation of the three group sizes against the industry sectors in Table 10.4 is shown in Table 10.6 and, as may be expected, shows

[5]Kendall Correlation Co-efficient of .049 (2 tailed test).

a rather uneven picture. The largest firms dominate the categories of "energy and water" and "financial services" and, to an extent, "chemicals and pharmaceuticals", while all of the firms in the agriculture sector are in the smallest size category. The groupings by size and environmental sensitivity which are used for much of the analysis may therefore hide further industry specific influences. The analyses and cross tabulations that appear below should be read with this caveat in mind but nonetheless a number of insights based on the broad aggregates do emerge (see below). Naturally the descriptive statistics and tests shown below are more reliable, all else being equal, the larger are the number of observations on which they are based and a balance has been struck between group size and the degree of resolution of the analysis[6]. Some aspects of the report e.g. specific comments by respondents can be identified more accurately (subject to confidentiality constraints) by size and type of business.

Table 10.6.

	Size 1 Largest	Size 2 Medium	Size 3 Smallest	Total
Agriculture			7	7
Chemicals and Pharm'ls	3		1	4
Electronics/Eng'g/Manuf'g	7	6	17	30
Energy and Water	7			7
Extractive Industries	2	3	1	6
Food and Drink	4	2	7	13
Paper/Packaging	1	4	3	8
Waste Processing	1	1	1	3
Media/Telecoms	5	3	2	10
Property/Construction	4	2	7	13
Transport	5	2	6	13
Financial Services	12	1	2	15
Hotels/Leisure	2	1	3	6
Retail	6	3	8	17
Other	2		4	6
Total	61	28	69	158

In the following section the questionnaire responses are summarised and analysed in a number of different ways, often in graphical form to help

[6]If readers of this report have specific queries regarding particular industry groups or otherwise the authors would be pleased to respond to individual requests - subject to our overriding confidentiality constraint regarding individual responses).

assimilation of what can be a large amount of detail. Those questions that have been analysed in graphical form are typically those that are 'main' questions - in that an answer was expected from all respondents - a number of questions were conditional on earlier "yes or no" answers or require finer levels of detail and as a result in some cases the number of respondents was low and could give a potentially misleading picture.

A feature of a number of the graphs is that they show percentage responses from each group - rather than absolute responses - in order to aid comparability. In each case the graph title and key should make this clear. The question(s) to which each graph relates is given the unique number based on the questionnaire but the wording of the questions is sometimes paraphrased/shortened to aid the readability of the overall layout. The precise wording of each question can be found in Appendix D.

In addition to the graphical analysis Tables 10.8 to 10.11 show further comparisons and tests of mean responses to a number of questions. Those tables give some appreciation of how responses are associated with the level of environmental sensitivity while controlling for size, and vice versa.

10.3 Responses to Questionnaire: Main Results and Discussion

10.3.1 Overview of Results

The questionnaire comprised two main sections: one designed to elicit information about general attitudes and responses to environmental factors, and a second to find out more detailed information about the tracking and controlling of environmental costs and revenues. In this introductory overview important company characteristics like industry and size will be ignored to concentrate on the aggregated results though more detailed cross tabulation analysis is reflected in the more detailed discussion and the graphical summaries of data that follow.

The aspect of the environmental agenda most cited by companies as affecting their financial position "to a great extent" was legal compliance, followed by commercial pressures but with voluntary desire being a far from insignificant factor: comparable percentages of respondents were 27%[7], 13%

[7] These, and similar percentages quoted below ignore respondents who answered 'Don't Know' or 'Non-applicable' as well as those who left a question unanswered. Full detail is in Appendix D.

and 11% respectively. Equivalent figures for respondents who felt these matters were of, at least, some significance for them were 93%, 88% and 92%.

Some separate quantification of environmental costs or benefits had been undertaken by 29% of respondents. Reasons for not quantifying included non materiality (69% of the "non-quantifiers") (though here it may be noted that total environmentally related costs may be underemphasised precisely because they are not made explicit); 90% of them said that non-quantification resulted from their not being separately identified within the accounting system; and 59% of "non-quantifiers" thought that separate quantification would be too difficult. The difference between *recording* and *financially quantifying* came out clearly: 62% of respondents stated that their companies recorded the activities which affected their overall environmental impact but of these only 40% could readily identify the associated costs and revenues. Some separate reporting of environmental expenditure or revenue had been done, the most common medium being the monthly management accounts (30% of respondents), followed by an environmental report (25%). Explicit mentions in the conventional reporting package were a minority activity with the operating and financial review being the most common location for such disclosures (14% of respondents).

The financial relevance of environmental issues is more manifest in companies' spending decisions with 70% considering them as part of capital investment appraisal and 77% of respondents stating that environmental factors are taken into account in purchasing. Amongst the latter category (91%) consider the direct cost of materials or equipment purchases, with a smaller proportion (73%) considering the indirect costs or benefits such as reduced monitoring, or lower risk of incurring clean up costs. On the revenue side a substantial proportion of companies (44%) are (or are considering) offering products with significant environmental credentials of which about one third would apply premium pricing for the enhanced environmental performance.

More detailed aspects of the questionnaire included questions about specific cost or revenue allocations, and about their financial and environmental importance. By far the most financially important category (out of a total of 16 suggested on the questionnaire) was Energy (cited by 98 companies) followed by Distribution/Transport (41) Water (34) Packaging (32) Waste (26) - other categories were mentioned but by much fewer respondents. When asked about environmental rather than financial importance (a disparity in perception which raises subtle questions about conventional prior-

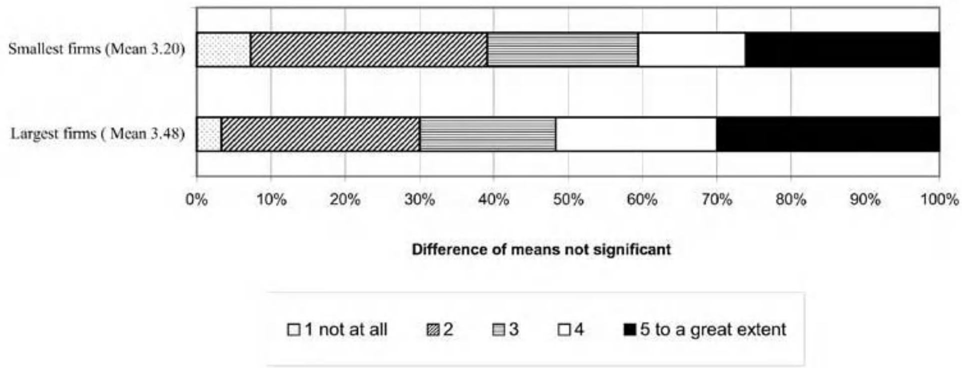

Figure 10.1. Qn A1.1 To what extent does environmental legal compliance affect your financial position?

ities) the leading categories were Waste (42), Energy (29), Environmental monitoring and licensing (17), Distribution/Transport (15), Packaging (11), Air emissions (11) and Water (10). The most common accounting treatment was allocation as overhead. Much less common was allocation to a product or process though this was done by at least some companies in every category and was actually the more common treatment for the single category of Packaging. Some examples show the scope and nature of the responses in this section (in a few cases a single company may use more than one approach): 117 companies allocate energy to overhead while 63 allocate to a product or process; 61 companies allocate environmental fines and penalties to overhead while 13 allocate to a product or process, and the numbers for clean-up costs are 62 and 28 respectively. Looking to the future, roughly 20% to 50% of respondents thought each category would become more important in five years though broadly comparable numbers envisaged no likely change. Very few (or no) respondents thought that any categories would diminish in importance over the same time scale.

There follow graphical summaries of responses to some of the main questions analysed, in some cases, by the size or sensitivity of respondents' companies.

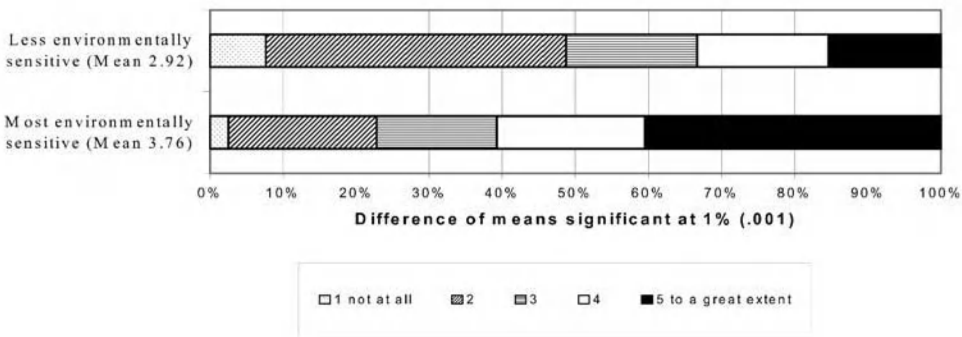

Figure 10.2. Qn A1.1 To what extent does environmental legal compliance affect your financial position?

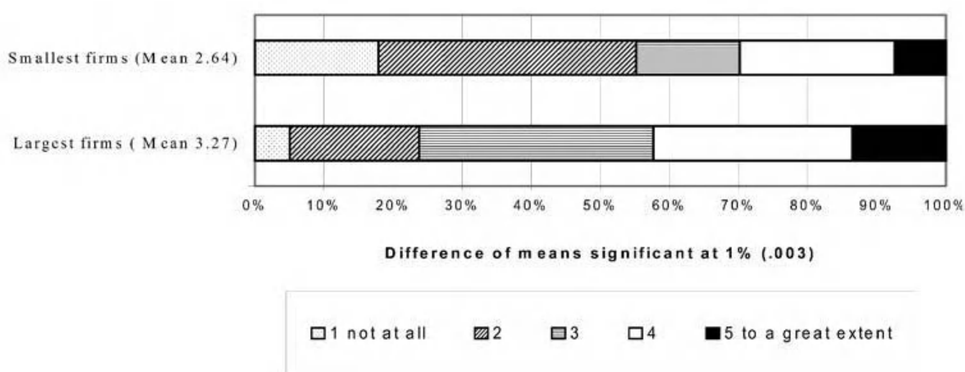

Figure 10.3. Qn A1.2 To what extent do environmentally related commercial pressures affect your financial position?

10.3.2 Further Details of Key Questions

Unsurprisingly the impact of environmental legal compliance (Figures 10.1 and 10.2) appears to be associated with environmental sensitivity rather than size and the difference shown in Figure 10.2 is clearly significant. Very few respondents report no effect.

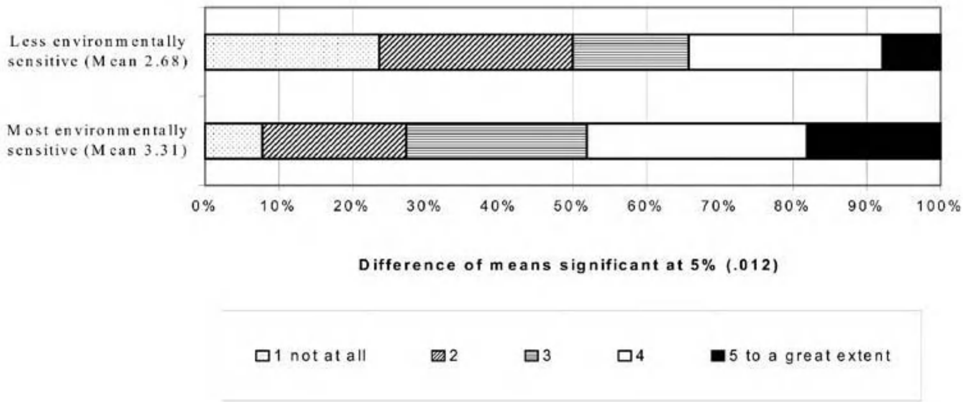

Figure 10.4. Qn A1.2 To what extent do environmentally related commercial pressures affect your financial position?

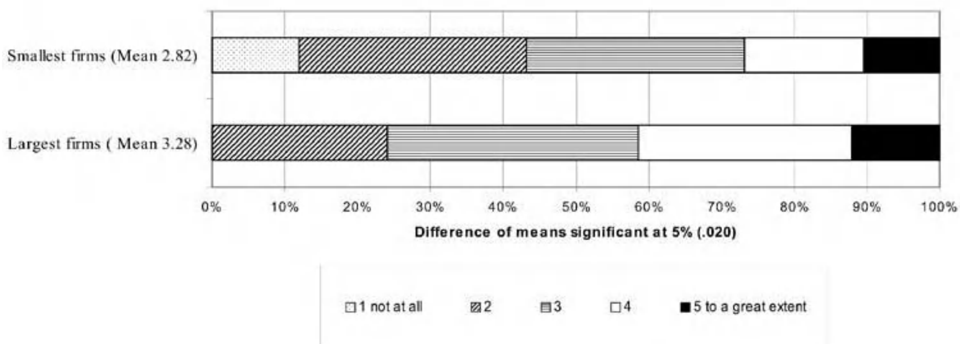

Figure 10.5. Qn A1.3 To what extent does an environmentally related voluntary desire on your part affect your financial position?

Environmental commercial pressures (Figures 10.3 and 10.4) seem to be significantly related to both size and environmental sensitivity. The precise nature of these pressures is not clear but business supply chain issues as well as final consumer tastes are possibly influential. A greater number report no effect than was the case for legal compliance. The highly significant size effect may also be related to more intangible reputational issues which, *ceteris paribus*, are likely to vary with size and resulting political visibility.

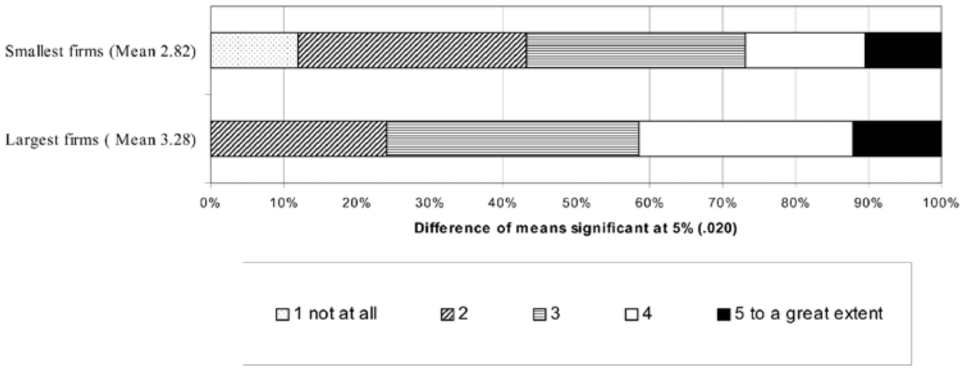

Figure 10.6. Qn A1.3 To what extent does an environmentally related voluntary desire on your part affect your financial position?

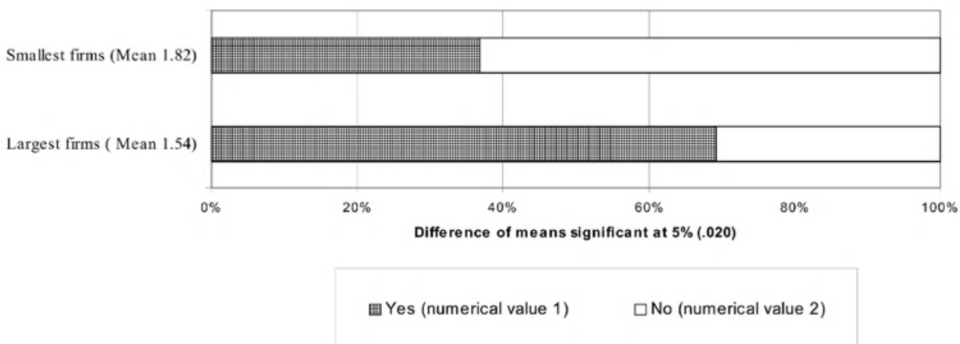

Figure 10.7. Qn A2.1 Have you quantified separately, the costs or benefits associated with any of the above (A1.1 - A1.3) factors?

Voluntary effects (Figures 10.5 and 10.6) also appear to be associated with size and sensitivity. Again reputational issues may be significant here. It is notable that none of the largest firms responded "not at all" to this question about voluntary commitment, though this was true of some of the smallest.

Separate quantification (Figure 10.7) of environmental costs or benefits is significantly associated with company size. While this result is consistent

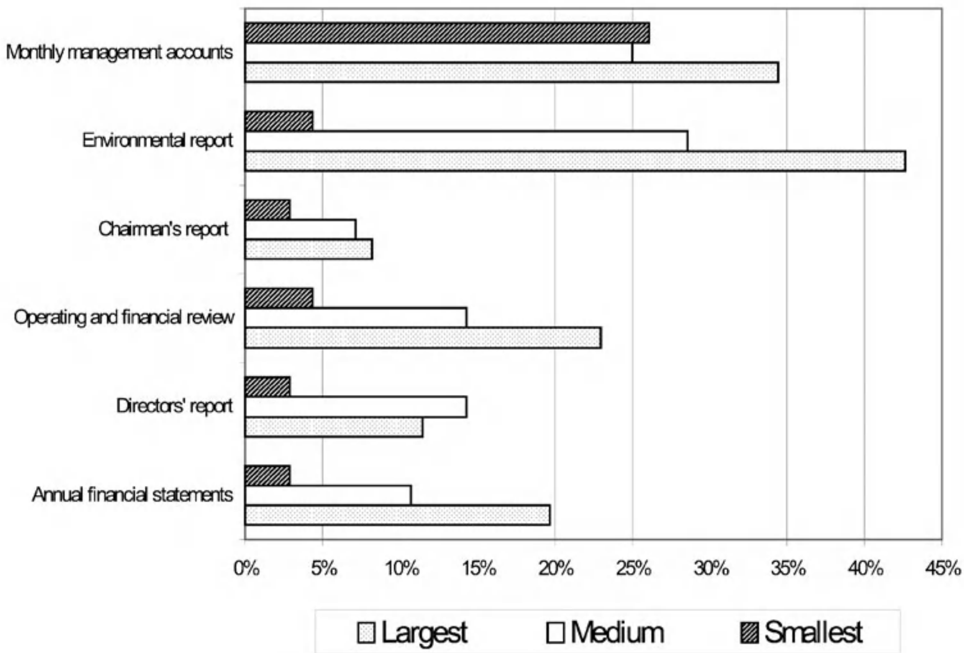

Figure 10.8. Qn A5 Percentage in each size category who have reported separately any item of environmental expenditure or revenue in any of the following.

with an expectation that sophistication of information systems would be a function of company size, it is perhaps a cause for concern given that environmental issues are relevant to companies of all sizes.

Separate reporting of environmental items (Figure 10.8) is generally strongly associated with company size across all of the "public domain" documents, with the Environmental Report being the most common vehicle for such disclosures. The particular importance of management accounting is also highlighted in Figure 10.8 in that it is of almost equal importance to companies of all sizes. For all but the largest companies it is also by far the most common way of recording and reporting environmental expenditures or revenues. These results perhaps show the importance of initiatives to raise the profile of EMA in that they have particular potential to induce a response from companies of all sizes.

An unexpected feature shown in Figure 10.9 is the relatively high proportion of the smallest firms who can readily identify environmentally related

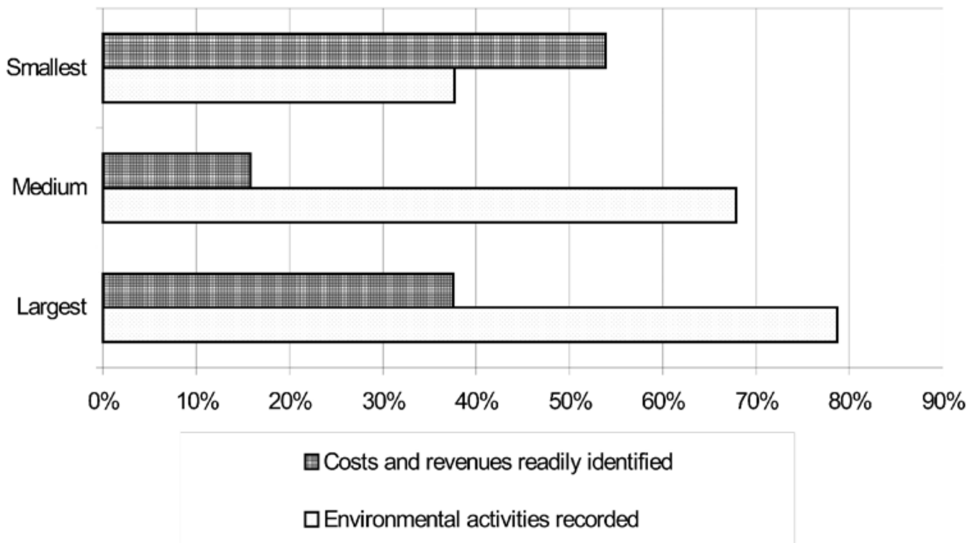

Figure 10.9. Qns A6 and A7 Percentage in each size category who have a record of activities affecting environmental impact and, of those, percentage who can readily identify the associated costs and revenues.

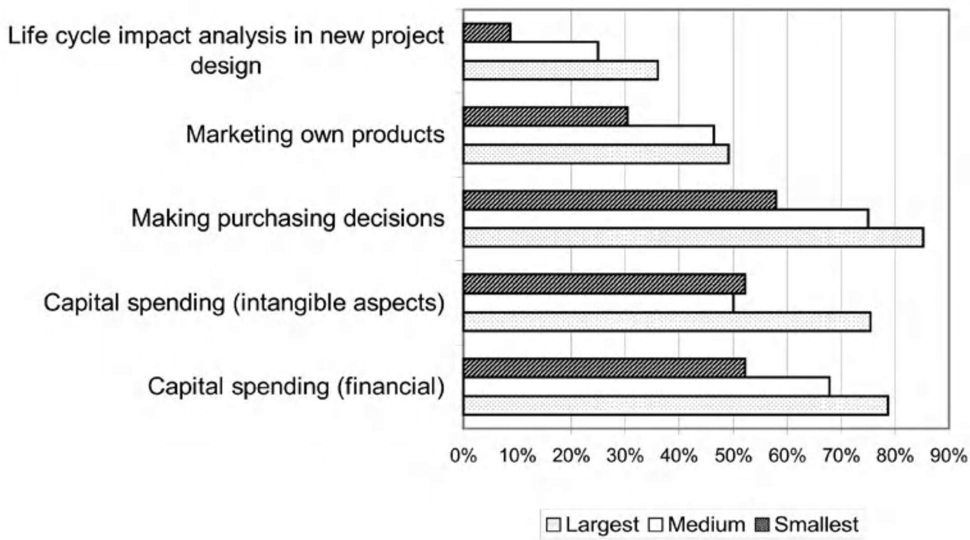

Figure 10.10. Qns A9-A11, A13 and A15 Percentage of respondents by size who consider environmental matters in each of the following contexts.

costs and revenues. Greater sophistication of information systems may normally be associated with increasing firm size but perhaps this is offset by complexity and, in particular, it may be that in smaller firms respondents at Finance Director (or similar) level may be more acquainted with and confident about either the precision of their information systems or they may have closer and more detailed knowledge of operations. This aspect of the results is unusual, however (see Tables 10.10 and 10.11 below for an overview of differences in responses based on size).

Another possible interpretation of these results is that larger companies have more complex processes and are more conscious of the difficulties of recording all of the associated costs and revenues.

The results in Figure 10.10 suggest that greater company size is associated with more sophistication in terms of consideration of environmental issues regarding product design, purchasing and capital spending decisions. High levels of participation in these activities are noticeable here though the results also suggest scope for improvement in procedures, particularly for

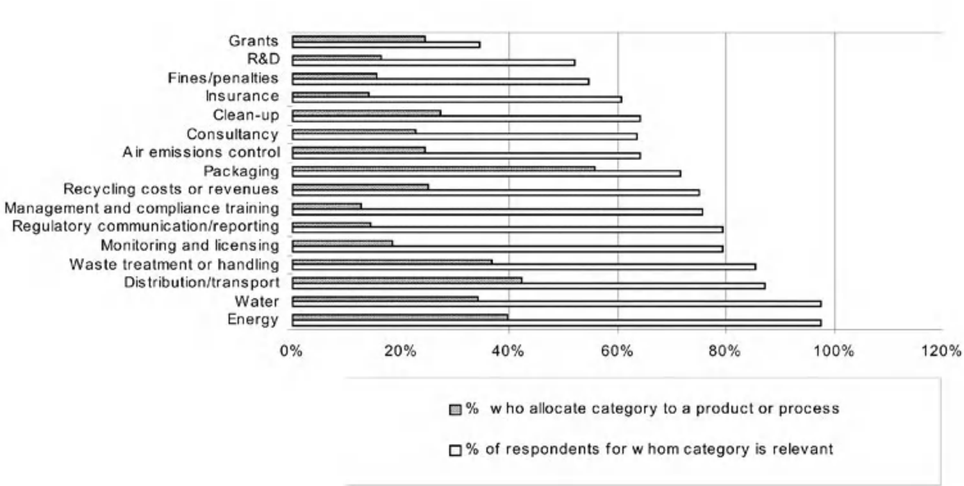

Figure 10.11. Qn B1 Percentage of respondents for whom category is relevant and, of those, percentage who allocate category to a product or process.

smaller companies, and more generally regarding life cycle analysis and marketing.

Leaving aside the size effect illustrated in Figure 10.10, the relative emphasis given to certain areas e.g. capital spending and life cycle analysis is consistent with other findings (e.g. Bartolomeo et al. 2000 and Frost and Wilmshurst 2000).

Figures 10.11 - 10.13 show a list of environmental cost or revenue categories. They highlight the extent to which they are relevant to respondents' companies, this being almost universal for energy and water (see B1 in Appendix D for full details of the data which are partly summarised in the Figures), and almost all categories have relevance for the majority of companies. Allocation to product or process, rather than to overhead is, generally, only done by between 20% and 40% of companies depending on category, with packaging being the notable exception. Product or process allocation is consistently more likely to be found amongst the environmentally sensitive companies (see Figures 10.12 and 10.13 for a comparison), a difference which is discussed further below.

In Figure 10.14 below the answers to Qn B3 are summarised. Companies were asked to identify, from the categories as shown in Figures 10.11 - 10.13,

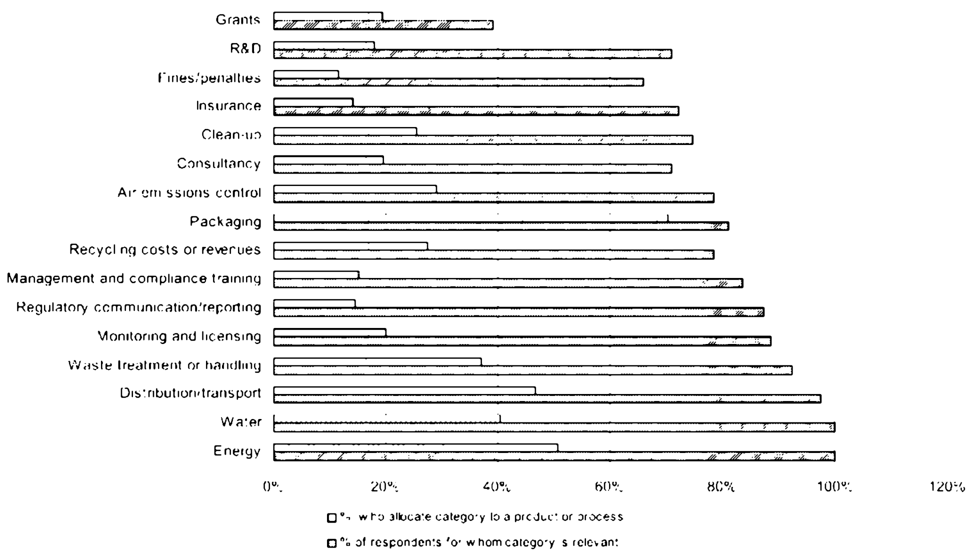

Figure 10.12. Qn B1 (most environmentally sensitive only) Percentage of respondents for whom category is relevant and, of those, percentage who allocate category to a product or process.

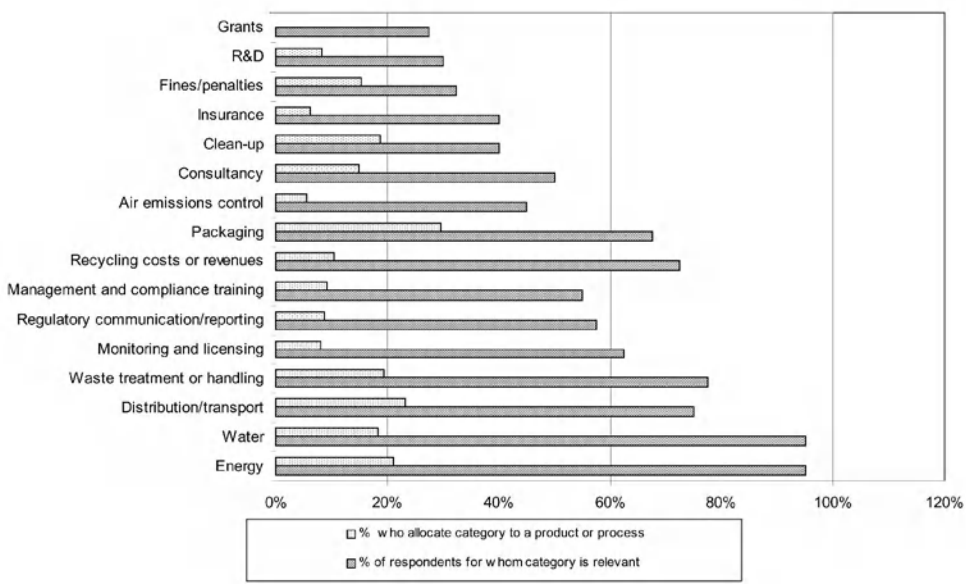

Figure 10.13. Qn B1 (less environmentally sensitive only) Percentage of respondents for whom category is relevant and, of those, percentage who allocate category to a product or process.

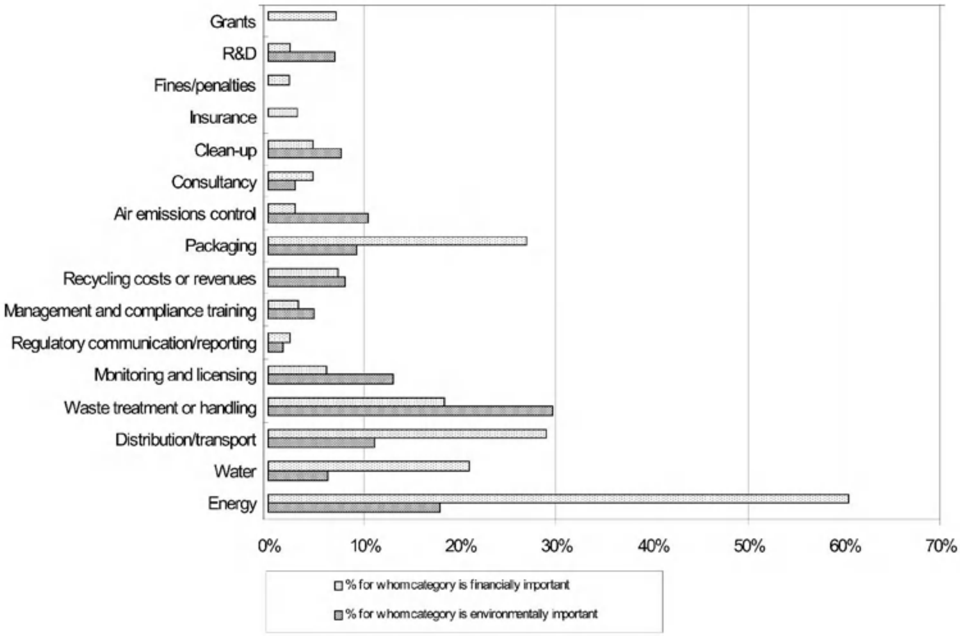

Figure 10.14. Qn B3 Comparison of financial and environmental importance of category - in order of overall relevance of category (See Q. B1 - Figure 10.11).

those that were of most importance to them. They were not limited in their number of choices, so a *caveat* should be given about the approach to the question that may have been taken by different respondents and resulting comparability. However Figure 10.14 does show proportions of categories that received special mention for being financially or environmentally important; these are, therefore, the categories where attention is most likely to be focussed for many firms. The great difference in some cases between a category's financial and environmental importance raises the possibility that a "mismatch" in this area could be a cause for concern. The data here is clearly "rough and ready" and it would be unwise to infer too much from it. Perhaps, at a minimum, it serves as a reminder that many environmental externalities are not captured by transaction costs, and one might speculate whether this phenomenon may be in the minds of some of the respondents.

10.3.3 Size and Environmental Sensitivity: Further Analysis

The weak inverse correlation between size and environmental sensitivity was mentioned above although the range of industries means that this relationship is unlikely to be uniform. For example a particular factor helping to drive that result is the predominance of large firms in the financial sector (low environmental sensitivity) and of small firms in the agricultural sector (high sensitivity).

It seemed worth getting an (admittedly rather crude) picture of how responses varied according to size and environmental sensitivity respectively while controlling for the other factor. These results are shown in Tables 10.8 and 10.9 where size is held constant, and in Tables 10.10 and 10.11 where environmental sensitivity is held constant. The questions summarised in Tables 10.8 - 10.11 are those which were potentially relevant to all respondents i.e. their relevance does not depend on a “Yes” or “No” response to a previous question. For ease of reference the text of the questions is reproduced below in Table 10.7.

The means shown for Questions A1.1-A1.3 give more detail than, but are broadly consistent with, the graphical summaries shown in Figures 10.1-10.6 above. In all cases, even when size/environmental sensitivity is held constant, the impact accorded to environmental issues, whether legal, commercial or voluntary is greater for large firms compared to small, and for more ‘environmentally sensitive’ firms compared to those that are less so. While both sets of results may be expected the one that gives potential cause for concern is the result based on size. Environmental impacts arise from firms of all sizes and lower levels of awareness and, perhaps, expertise in smaller firms suggest that initiatives which aim at that sector could be of particular benefit.

The questions from A2 to A15 focus on actions taken by firms in either recording environmental costs/benefits or activities (A2, A5.1-A5.6, A6) evaluating environmental factors as part of new projects or general purchasing decisions (A9, A10, A11, A15) or offering products/services with particular environmental credentials (A13). The results show an almost complete consistency whereby greater size or environmental sensitivity is associated with a more pro active approach to environmental issues. In many cases the differences in responses are highly significant.

The differences in responses based on environmental sensitivity bear comparison with a previous survey carried out in Australia (Frost and Wilmshurst 2000) . Those authors found that while there was a significant association

Table 10.7.

A1	To what extent do the following aspects of the environmental agenda affect your financial position:
A1.1	legal compliance?
A1.2	commercial pressures?
A1.3	voluntary desire on your part?
A2	Have you quantified separately, the environmental costs or benefits associated with any of the above factors?
A5	Have you reported separately any item of environmental expenditure or revenue through any of the following:
A5.1	annual financial statements?
A5.2	directors' report?
A5.3	operating and financial review?
A5.4	chairman's report?
A5.5	environmental report?
A5.6	monthly management accounts?
A6	Have you a record of the activities which your company performs that affect its overall environmental impact?
A9	Are the financial impacts of environmental matters considered when you evaluate capital spending plans?
A10	Are non-financial or intangible environmental costs/benefits (e.g. corporate image) considered when you evaluate capital spending plans?
A11	Have you considered, or started to take account of, environmental factors when making purchases?
A13	Have you considered or started offering a product/service primarily marketed for its environmental credentials?
A15	Do you carry out environmental life cycle impact analysis during the design phase of a new project?

between environmental sensitivity and external reporting they failed to find conclusive evidence of a similar association with environment-related management accounting other than for very specific activities, e.g. contamination and clean up, associated with certain specific industries. To some extent their findings are mirrored in the figures shown in Tables 10.8 and 10.9 (see for example Questions A5.3 and A5.5 relating to external reporting in the Operating and Financial review and in Environmental Reports). However there is also limited evidence of differences, some statistically significant, in internal accounting. More intuitively the clearly different profiles shown in Figures 10.12 and 10.13 above are consistent with an association between environmental sensitivity and the development of environmental management accounting procedures.

Table 10.8.

Smallest firms only - mean values (i.e. a comparison of environmental sensitivity effect with size held constant)			
Question	Most environmentally sensitive (n = 37)	Less environmentally sensitive (n = 13)	Sig* Level
A1.1**	3.59	2.61	5% (.020)
A1.2**	2.97	1.92	5% (.015)
A1.3**	3.00	2.42	NS
A2	1.73	2.00	1% (.001)
A5.1	1.97	2.00	NS
A5.2	1.95	2.00	NS
A5.3	1.92	2.00	10% (.083)
A5.4	1.94	2.00	NS
A5.5	1.91	2.00	10% (.083)
A5.6	1.62	1.85	10% (.100)
A6	1.50	1.75	NS
A9	1.34	1.82	1% (.004)
A10	1.46	1.44	NS
A11	1.32	1.56	NS
A13	1.67	1.75	NS
A15	1.89	1.92	NS

∗ 2 tailed test
∗∗ Means based on a scale of 1-5 (see questionnaire). All other questions were Yes/No and means were calculated by coding Yes = 1 and No = 2
NS Not significant

10.3.4 Suggestions for Improving Environmental Performance Measurement

Question B7 asked:

In general, are there ways in which you think a management accounting system could be altered to improve a company's ability to measure its environmental performance? And this was followed by the open Question, B8:

If "Yes" to B7, we would welcome any brief suggestions.

Question B7 elicited a "Yes" response from 74 (about 50% of respondents), "Don't know" from 48 (about 30%) and "No" from 33 (about 50%). A striking feature of the replies to B7 was the difference between Yes/No responses from those who were accountants (being finance directors or hav-

Table 10.9.

Largest firms only - mean values (i.e. comparison of environmental sensitivity effect with size held constant)			
Question	Most environmentally sensitive (n = 25)	Less environmentally sensitive (n = 20)	Sig Level
A1.1	3.96	3.16	5% (.035)
A1.2	3.63	3.16	NS
A1.3	3.63	3.10	10% (.078)
A2	1.41	1.68	10% (.084)
A5.1	1.78	1.80	NS
A5.2	1.79	1.89	NS
A5.3	1.63	1.90	5% (.03)
A5.4	1.91	1.95	NS
A5.5	1.38	1.78	1% (.007)
A5.6	1.67	1.80	NS
A6	1.00	1.39	1% (.004)
A9	1.00	1.41	1% (.004)
A10	1.12	1.18	NS
A11	1.04	1.00	NS
A13	1.45	1.32	NS
A15	1.38	1.58	NS

see Table 10.8 for explanation of values

ing a title which included reference to finance or accounting, see Table 10.1 above) and those who were not. This is summarised in Table 10.12. (Not all respondents gave job details hence numbers in the Table do not reconcile to above mentioned totals.)

This difference shows a statistically significant (at 1%) difference between the two groups, and while the reasons for this difference are not at all clear, the result does suggest a need for some accountants to begin to rise to the challenge of the environmental agenda (see Bebbington et al. 1994) and perhaps emphasises the importance of initiatives like that of the UN (see above).

All of the responses to the related open question B8 are listed in Appendix C. To give context to the comments they are listed by industry group and the size category of respondents' companies is also given.

By far the most common suggestion related to more detailed accounts coding procedures, a number of respondents recommended an increased role for

Table 10.10.

Most environmentally sensitive firms only - mean values (i.e. comparison of size effect with environmental sensitivity held constant)			
Question	Largest (n = 25)	Smallest (n = 37)	Sig Level
A1.1	3.96	3.59	NS
A1.2	3.63	2.97	5% (.028)
A1.3	3.64	3.00	5% (.044)
A2	1.42	1.73	5% (.017)
A5.1	1.78	1.97	5% (.049)
A5.2	1.79	1.95	NS
A5.3	1.63	1.92	5% (.013)
A5.4	1.91	1.94	NS
A5.5	1.38	1.91	1% (.000)
A5.6	1.67	1.62	NS
A6	1.00	1.50	1% (.000)
A9	1.00	1.34	1% (.000)
A10	1.12	1.46	1% (.003)
A11	1.04	1.32	1% (.002)
A13	1.45	1.67	NS
A15	1.38	1.89	1% (.000)

see Table 10.8 for explanation of values

physical measures, while a number advised setting and monitoring key performance indicators. The small number of responses which made explicit mention of ABC was consistent with the potential limitation of this technique (unless supported by environmental management expertise) which was noted in the ECOMAC study (see e.g. Bartolomeo et al. 2000).

Only 3 respondents expressed doubts about the role that accounting could play in addressing environmental issues. This small number of explicit doubters (3 out of a total of 46 who commented - see Appendix C) may seem at first sight to conflict with the number (and proportion) of those who answered 'No' to Question B7 (see Table 10.12). However it should be borne in mind that, strictly speaking, Qn B8 only sought comments from those who had answered 'Yes' to Qn B7 and so the number of 'sceptics' may well be under represented within the list of comments to Qn B8. With hindsight perhaps the questionnaire should have explicitly invited those who answered 'No' to B7 to give their comments.

It could also be the case, of course, that a 'No' response to B7 need not suggest any scepticism about the potential of accounting to enhance environ-

Table 10.11.

Less environmentally sensitive firms only - mean values (i.e. comparison of size effect with environmental sensitivity held constant)			
Question	Largest (n = 20)	Smallest (n = 13)	Sig Level
A1.1	3.16	2.62	NS
A1.2	3.16	1.92	1% (.009)
A1.3	3.10	2.42	10% (.09)
A2	1.68	2.00	1% (.01)
A5.1	1.80	2.00	5% (.042)
A5.2	1.89	2.00	NS
A5.3	1.90	2.00	NS
A5.4	1.95	2.00	NS
A5.5	1.78	2.00	5% (.042)
A5.6	1.80	1.85	NS
A6	1.39	1.75	10% (.055)
A9	1.41	1.82	5% (.027)
A10	1.19	1.44	NS
A11	1.00	1.56	5% (.013)
A13	1.32	1.75	5% (.018)
A15	1.58	1.92	10% (0.67)

see Table 10.8 for explanation of values

Table 10.12.

Responses to Question B7		
	Yes	No
“Accountants”	49	30
Others	23	1
Total	72	31

mental performance - it may merely suggest a lack of thought or knowledge (with resulting diffidence) as to how this could be achieved.

Three responses were from environmental managers and of these Response 23 is worthy of note in that it suggests that desirable actions in relation to environmental issues might be impeded if accountants highlight the costs while being unable to quantify benefits.

10.4 Concluding Remarks

The results of the survey reveal a variety of viewpoints about the significance of environmental issues for business and variety of practice in terms of identifying, recording and analysing the financial implications of environmental factors. Responses to many questions were associated with the size of respondents' companies, and with their environmental sensitivity. The results suggest that a number of companies, particularly smaller ones have scope to improve their awareness and their management accounting practices. They also suggest that management accounting is a particularly accessible way for accountants, especially in smaller firms, to bring their expertise to bear in highlighting and analysing environmental issues. One note of caution suggests that a sizeable minority of accountants, and a much greater proportion of accountants than of other responding groups, are pessimistic or unimaginative about the scope for management accounting to evolve to improve a company's ability to measure its environmental performance.

All of these results underline the importance of initiatives whose aim is to promote environmental managerial accounting.

Appendices A and B each describe tentative inferences drawn from three sets of two responses, each from one company. The tentative nature of these reports is emphasised: they cannot be deemed representative of a larger population and they clearly lack the richness to be thought of as case studies. Nonetheless, with these caveats, they may offer some intriguing insights. Appendix A deals with a pair of questionnaires from different individuals from the same company. Appendix B deals with two pairs of questionnaires from two individuals.

Appendix A: Views of Environmental Managers Compared to Those of Finance Directors or Accountants

An earlier ICAS research project (Gray et al. 1998) had explicitly considered the above issue (see also Bartolomeo et al. 2000 and Parker 2000) and it was not an original aim of this survey to compare attitudes of the above groups. The questionnaire was addressed in all cases to "the finance director" but inevitably in some organisations the completion of the questionnaire would have been undertaken by someone else. Section C of the questionnaire asked, *inter alia*, about the position and responsibilities of the person who had completed it and the breakdown appears in Table 10.1.

One company in the building materials industry returned two questionnaires, one from the Finance Director (FD) and one from the Environmental Manager (EM). It was not clear whether or not this was intentional. Only one of the questionnaires (that from the FD) has been included in the aggregated responses used for the main analysis in this report but a comparison of the two completed questionnaires makes interesting reading and will be briefly mentioned in this section as a 'mini case study'[8]:

The FD and the EM gave similar responses to question A1 regarding the importance of legal, commercial and voluntary environmental factors on the financial position of the company. However, the next question, which asked if the environmental costs and benefits relating to these factors had been quantified, was answered 'Yes' by the FD and 'No' by the EM. Supplementary questions on this main issue and responses elsewhere suggested a significant difference in the interpretation of this question. The EM explained that where environmental measures were taken to reduce risks and enhance reputation it would be difficult to quantify benefits and that to examine only the costs would be misleading. He also noted the classic problem of differentiating between environmental and operational costs. On the subject of external reporting both respondents were consistent except that the EM was aware of separate environmental reporting in the OFR of which the FD was not: the EM also volunteered that an environmental report was planned for the future.

On a number of operational issues there were some significant differences between the two respondents and while one would expect a specialist to have more detailed and up to date knowledge than a 'generalist'; and while accountants' concepts of materiality may also be relevant (see Gray et al., 1998) some of the differences suggest room for improved communication and awareness of environmental issues. The FD stated that purchasing decisions did not involve consideration of environmental factors - in contradiction to the EM who not only said they did but that direct costs, indirect costs and benefits and intangible factors had all been explicitly considered. The FD stated that environmental issues were not relevant to marketing the company's own products in direct contradiction to the EM's response. The FD said that environmental life cycle assessments were carried out as part of a new project design - again in contradiction to the EM: it is of course possible that definitional issues could affect responses - including this one.

Section B asked in some detail about cost classification and allocation and while there were some differences of opinion about whether certain costs would become more or less significant in the medium term the major difference in responses concerned the specificity of cost allocation. The EM asserted that all environmental costs/benefits were allocated to overhead while the FD stated that well over half the categories were allocated to products or processes. Again this difference may relate to definition - the EM amplified by saying that costs or revenues were allocated to individual sites or to central accounts. When asked which of four costing methods (process, standard, ABC or batch/job/contract)were in use in the organisation the FD ticked "Yes" for each method except ABC whereas the EM ticked "Yes" only for ABC: some confusion over terminology is a possible explanation here but overall this limited evidence suggests there may well be scope for improved understanding and communication between financial and environmental managers. This inference, limited though it is in terms of generalisability, perhaps raises a question that was not emphasised in the Gray et al. study[9], that is:

[8]It is not, of course, possible to generalise from the example of this one company.
[9]The Gray et al. study was not based on pairs of respondents from the same companies.

could the different specialist backgrounds and perceptions of environmental and financial managers lead to apparently different descriptions of the same activity.

Appendix B: Influence of the Survey on Recipients?

A conscious, if subsidiary aim of the survey project, was to raise the profile and awareness of the issues in question. While no claims are made for the success of such an intangible aspiration, the working party was interested to receive evidence that is at least consistent with some achievement in that direction. This (very limited and non-generalisable) evidence again appeared as a result of questionnaires being received from the same company - in fact this occurred in the case of two further companies but in both of these cases the same person had sent in two replies[10]. One respondent (R1) was Finance Director of a company in the steel sector, the other (R2) was Financial Controller in a wholesale consumer products company.

In the case of R1 a period of 4 months separated the two replies and while there was, reassuringly, a large measure of consistency in the responses there were some (potentially) significant differences:

1 The second response showed that capital spending plans did involve consideration of environmental matters whereas the earlier response stated they did not.

2 The first response showed, in section B1, that four cost categories were allocated to overhead, the rest not being identified separately or being non-applicable, and zero categories were expected to change significantly in 3-5 years. The second response showed one category now being allocated to a specific product or process (distribution/transport), and five cost categories were expected to become more significant in 3-5 years (energy, water, packaging, air emissions control and distribution/transport).

3 A potentially more ambiguous change in response was that whereas separate reporting of environmental items in management accounts was reported as taking place in the first response this had become a "No" response in the second.

Respondent R2, whose replies were separated by $4\frac{1}{2}$ months, again showed general consistency but some notable changes were apparent.

1 The financial impact of a voluntary desire to respond to the environmental agenda had been classified as '2' initially but had become '4' ('1' = not at all, '5' = to a great extent) in the later response.

2 Separate reporting of environmental issues was consistently answered 'No' in section A5 in the first response but in the second this had become a 'Yes' for the operating and financial review and for the monthly management accounts.

[10] It is not known whether these respondents were aware that they were sending in a second response - in the absence of any enclosure or annotation to that effect it seems likely that these respondents had forgotten about or were unsure whether they replied to the original mailing. At a time when postal survey response rates are commonly perceived as falling due to "questionnaire fatigue" such a co-operative attitude is both noteworthy and welcome.

3 In questions A6-A8 respondents were asked if they recorded activities which affected environmental impact - and also if they could financially quantify them as positive or negative effects. In the first reply R2 said there was no such record but in the second reply a record, which allowed financial quantification, was reported as being kept.

4 Elsewhere in section A considerable change was apparent in that intangible environmental costs/benefits had become part of capital spending appraisal; while direct, indirect and intangible environmental factors were all considered when making purchases (each factor had received a 'no' reply previously).

5 In section B environmental consultants costs had appeared as a relevant issue in the second reply (allocated to overhead); also and perhaps relatedly, energy costs had changed from being a likely source of increased costs to showing an expected reduction while a change in the opposite direction was expected in the case of "waste treatment or handling". Waste was also highlighted as environmentally important in B3, joining distribution/transport which had appeared alone in the first reply.

Appendix C: Complete Listing of Respondents' Comments Based on Questions B7 and B8

Question B7 asked:

> In general, are there ways in which you think a management accounting system could be altered to improve a company's ability to measure its environmental performance?

And this was followed by the open Question, B8:

> If "Yes" to B7, we would welcome any brief suggestions.

Responses are grouped by type of industry and also show the size category of respondents' companies.

(Size 1 is largest, Size 3 is smallest - See Table 10.3 for details.)

Note: Only three responses (23, 26 and 40) were somewhat sceptical of the positive role that EMA could play in relation to environmental performance improvement. Three responses were from environmental managers (23, 34 and 37).

Electronics/Engineering/Manufacturing

1 Recent creation of separate environmental department to monitor risk/compliance will entail more detailed performance reporting. This will require us to break out environmental costs more clearly and to monitor ongoing costs and performance. (Size 1)

2 However, we question whether *financial* measurements are the most appropriate. Other criteria (such as energy used) are probably more relevant. (Size 1)

3 Capex appraisal systems to evaluate energy savings/process cost savings. General performance monitoring is difficult other than to segregate total expenditures into separate cost centre with appropriate budgetary analyses. (Size 2)

4 Through ABC which we don't use at present but are moving towards (Size 2)

5 The possibilities are endless and would be limited only by the size and capability of the Finance department. (Size 3)

6 Specifically identified and categorised reporting. (Size 3)

7 Not a priority at present. (Size 3)

8 Waste reduction, energy cost/output ratios etc. (Size 3)

Energy and Water

9 Internalising environmental costs (Size 1)

10 Need to have a clear definition of environmental costs/revenues/ could group into separate cost/project centre and monitor (Size 1)

11 Measures of energy, water usage, benchmarks for plant and vehicle emissions and simple identification of core costs. (Size 1)

Food and Drink

12 Collection of non-financial, environmental data as part of monthly management reporting; separate identification of costs incurred re environmental enhancement; specific measures set as targets.(Size 1)

13 Correct notification of costs (Size 2)

14 A carefully considered coding system would help us. (Size 2)

15 Use on/in methods such as ABC/ABM. (Size 3)

Paper/Packaging

16 Variance analysis of discharges/waste tied in to allowable levels. (Size 2)

17 Need ABC with flexible view points, so can review from environmental perspective (Size 2)

18 Must firstly understand key drivers/ View as any other process cost - direct or indirect (Size 2)

Waste Processing

19 Identification of costs is the key. In our business each and every cost is environmental in nature - other businesses may be able to separate. (Size 2)

Media/Telecoms

20 Separate P&L lines for environment cost lines and development of relevant ratios and KPIs(Size 1)

21 Rather than having two dimensional accounting system (profit/cost centre and expense/income codes), a "three dimensional" system would help identify environmental costs more readily. (Size Unknown)

Property/Construction

22 Chart of accounts should include a code to identify a cost as environmental as well as say a process cost to a particular cost centre. (Size 1)

23 One would end up with accurate costs and fudged benefits. (Respondent was an environmental manager) (Size 1)

24 Setting of 2 or 3 key environmental performance targets and reporting against those. (Size 1)

25 Recording energy consumption as well as expenditure(Size 1)

26 Unlikely to come through accounting processes. (Size 2)

27 Emphasis on cost categories which have environmental impact. (Size 3)

Transport

28 Splitting out of environmental costs and public disclosure. (Size 1)

29 Capture of units of consumption, waste volumes etc to complement cost data. (Size 1)

30 More detail could be made visible in terms of environmental KPI's but would be expensive for insignificant costs being identified. (Size 1)

31 Decide on KPIs and then measure them. (Size 2)

32 Identification of "environmental" cost/revenues and production of a "strategy" with specific KPI's/ identified/System analyses (sub analyses) to allow monitoring and reporting. (Size 3)

Financial Services

33 Using environmental factors as part of a balanced score card approach to planning/reporting(Size 1)

34 Yes, there has to be a way, but I am not an accounts expert. I would start from the premise that measuring these costs is "business critical" and have the accounts references separately collated and monitored as part of the normal business risk monitoring. (Respondent was an environmental manager). (Size 1)

35 Increase ability to control and monitor energy costs at operating/user level. (Size 1)

36 Allocate separate nominal codes to report budget/actual costs. (Size 1)

37 Separate/additional cost centres (Respondent was an environmental manager) (Size 1)

38 Resource use should be linked to cost: income ratios (Size 1)

39 Not always an accounting issue! (Size unknown)

Hotels/Leisure

40 No - as costs would outweigh any benefits. (Size 3)

41 Ability to identify all environmental costs (Size 3)

Retail

42 Separate identification of environmental costs/Environmental performance measures. (Size 1)

43 Improvement could be achieved by use of account key - but difficult in practise (Size 1)

44 Simply in a/c's structure/data base/coding etc then using more analysis from suppliers (Size 1)

45 Interested to know what is possible (Size 3)

Unspecified Industry

46 I'm sure the answer is 'yes' although I haven't considered how this might be achieved. (Size 3)

Appendix D: Questionnaire and Summary of Responses

Section A

Please tick as appropriate.	Not at all all 1	2	3	4	To a great extent 5	Don't Know
A1 To what extent do the following aspects of the environmental agenda affect your financial position:						
• legal compliance?	**11** *7%*	**45** *28%*	**32** *20%*	**31** *19%*	**44** *27%*	**2**
• commercial pressures?	**19** *12%*	**43** *27%*	**39** *24%*	**39** *24%*	**20** *13%*	**3**
• voluntary desire on your part?	**12** *8%*	**40** *26%*	**54** *34%*	**34** *22%*	**17** *11%*	**2**
• other ? (please specify below)						
						7 Responses
Comments (if any)						

Please tick as appropriate.	Yes	No	Don't know	Not applicable
A2 Have you quantified separately, the environmental costs or benefits associated with any of the above factors ? **(If "Yes" go to A3, otherwise go to A4)**	**46** *29%*	**113** *71%*	**1**	**4**
Which factors (if any)				**16 Responses**

Note: Percentages ignore respondents who answered 'Don't Know', 'Non-applicable' as well as those who left a question unanswered.

	Please tick as appropriate.	**Yes**	**No**	**Don't know**	**Not applicable**
A3	If **"Yes"** to A2, how did you achieve this?				
	• within the financial accounting system?	**27** ***69%***	**12** ***31%***	**1**	**4**
	• within the management information system?	**33** ***79%***	**9** ***21%***	**0**	**4**
	• within the environmental management system?	**22** ***67%***	**11** ***33%***	**1**	**9**
	• by management assessment?	**32** ***84%***	**6** ***16%***	**0**	**5**
	• other ? (please specify below)				
		1 Response			
	Comment (if any)				
A4	**If not "Yes"** to A2, is this because:				
	• environmental costs or benefits are not material to the scale of your business?	**66** ***69%***	**30** ***31%***	**2**	**1**
	• environmental costs or benefits are not identified separately in your accounting information systems?	**84** ***90%***	**9** ***10%***	**1**	**1**
	• it would be too difficult?	**32** ***59%***	**22** ***41%***	**18**	**9**
	• other ? (please specify below)				
		4 Responses			
	Comment (if any)				

	Please tick as appropriate.	**Yes**	No	**Don't know**	**Not applicable**
A5	Have you reported separately any item of environmental expenditure or revenue through any of the following:				
	• annual financial statements?	**18** ***11%***	**143** ***89%***	**1**	**0**
	• directors' report?	**14** ***9%***	**147** ***91%***	**1**	**0**
	• operating and financial review?	**23** ***14%***	**138** ***86%***	**0**	**1**
	• chairman's report?	**9** ***6%***	**145** ***94%***	**2**	**3**
	• environmental report?	**37** ***25%***	**110** ***75%***	**0**	**4**
	• monthly management accounts?	**49** ***30%***	**113** ***70%***	**0**	**0**
	• other ? (please specify below)	**9 Responses**			
	Comment (if any)				
A6	Have you a record of the activities which your company performs that affect its overall environmental impact?	**96** ***62%***	**58** ***38%***	**9**	**1**
A7	If "Yes" to A6, do you know which of these activities contributes to your company's overall environmental performance (good and bad)?	**86** ***96%***	**4** ***4%***	**6**	**5**
A8	If "Yes" to A6, can you readily identify the costs and revenues associated with each activity?	**35** ***40%***	**52** ***60%***	**3**	**6**
	Comment (if any)				

	Please tick as appropriate.	Yes	No	Don't know	Not applicable
A9	Are the financial impacts of environmental matters considered when you evaluate capital spending plans?	**105** *70%*	**46** *30%*	**4**	**9**
A10	Are non-financial or intangible environmental costs/benefits (e.g. corporate image) considered when you evaluate capital spending plans?	**99** *66%*	**51** *34%*	**5**	**9**
A11	Have you considered, or started to take account of, environmental factors when making purchases?	**116** *77%*	**35** *23%*	**10**	**2**
A12	If "**Yes**" to A11, have you considered:				
	• the direct costs of the materials/equipment or services purchased?	**97** *91%*	**10** *9%*	**5**	**4**
	• the indirect financial costs or benefits of the choice you make? (e.g. reduced monitoring, fewer regulatory visits, reduced risk of clean-up costs etc)	**77** *73%*	**29** *27%*	**1**	**9**
	• the non-financial or intangible costs or benefits? (e.g. corporate image)	**76** *69%*	**35** *31%*	**2**	**4**
A13	Have you considered or started offering a product/service primarily marketed for its environmental credentials?	**65** *44%*	**83** *56%*	**2**	**14**
A14	If "**Yes**" to A13, is there a premium charged?	**23** *38%*	**38** *62%*	**1**	**15**
A15	Do you carry out environmental life cycle impact analysis during the design phase of a new project?	**35** *28%*	**92** *72%*	**14**	**19**
A16	If "**No**" to A15, do you intend to within the next three years?	**11** *16%*	**56** *84%*	**35**	**15**
A17	If "**Yes**" to A15 or A16, does this, or will this, include a related lifecycle cost/benefit impacts analysis?	**24** *75%*	**8** *25%*	**12**	**16**
	Comment (if any)				

Section B

B1 In terms of your management and cost accounting systems, please indicate how, if at all, you currently allocate the following environmentally-related cost or revenue categories. You can tick more than one column if this is appropriate. Also, please indicate in the final column if you consider the cost will become more or less significant for your organisation's financial performance in the next 3 to 5 years. If you believe it will be:

- more significant - indicate this by ticking "+"
- less significant - indicate this by ticking "-"
- no likely change or too uncertain - indicate this by ticking "="

Cost or revenue category	Allocated to a product or process?	Allocated to overhead?	Not Identified Separately?	N/A	More or Less Significant in 3-5 years		No likely change
					+	-	=
Energy costs	64	115	3	4	69	12	64
Water costs	55	116	7	4	64	7	72
Packaging costs	66	45	14	47	54	5	66
Air emissions control	26	39	39	59	58	3	53
Distribution / transport	61	80	7	21	74	7	54
Waste treatment or handling	52	83	10	24	88	4	44
Recycling costs or revenues	31	63	27	41	74	3	54
Environmental monitoring and licensing	24	76	29	34	79	1	51
Regulatory communication/ reporting	19	80	35	34	78	0	54
Environmental consultants costs	24	72	14	60	49	1	75
Environmental management and compliance training	16	78	33	40	79	0	52
Environmental fines/penalties	14	60	18	75	28	5	92
Environmental insurance	14	58	25	65	40	2	79
Clean-up costs	29	62	16	59	39	10	78
R&D spend on environmental issues	14	47	26	79	41	1	71
Grants received for environmental purposes	14	29	13	108	18	2	89
Comment (if any)							

	Please tick as appropriate	Yes	No	Don't know	Not applicable
B2	Do you consider any of the cost or revenue categories in B1 as part of your budgetary process?	**132** *84%*	**25** *16%*	**3**	2
B3	If "**Yes**" to B2, which are the most important ones (please specify below):				
	(a) financially	**See Figure 10.14**			
	(b) environmentally	**See Figure 10.14**			
B4	If "**Yes**" to B2, do you investigate variances between budgeted and actual expenditure or revenue?	**126** *95%*	**7** *5%*	**2**	3
B5	If "**Yes**" to B2, are these categories used as, or incorporated into, key performance indicators for your business?	**65** *53%*	**58** *47%*	**5**	5
B6	Which of the following costing methods best describe(s) the one used in your organisation? *(please tick one or two only)*				
	• process costing	**35**	**13**	**1**	**9**
	• standard costing	**53**	**14**	**1**	**9**
	• activity based costing	**40**	**8**	**1**	**10**
	• batch / job / contract costing	**50**	**7**	**1**	**8**
	• other (please specify below)				
		16 Responses			
B7	In general, are there ways in which you think a management accounting system could be altered to improve a company's ability to measure its environmental performance?	**74**	**33**	**48**	**4**
B8	If "**Yes**" to B7, we would welcome any brief suggestions:				
		46 Responses			

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11. Cost Management in the Textile Chain: Reducing Environmental Impacts and Costs for Green Products*

Stefan Seuring

Supply Chain Management Centre, Carl von Ossietzky - University of Oldenburg, Germany

stefan.seuring@uni-oldenburg.de

Abstract Greening products requires that their life cycle or supply chain be observed. Within environmental management accounting, the supply chain has been identified as an important factor to be analysed. This has led to the development of life cycle costing, which assesses costs along the total life cycle. However, this approach still neglects the importance of the individual actors along the life cycle or supply chain. Supply chain management integrates these individual actors, since it deals with the management of both materials and information flows as well as with relationships between companies. Cost management in the supply chain must build on these roots. Consequently, supply chain costing distinguishes three cost levels: *direct*, *activity-based* and *transaction* costs. The suitability of this approach is illustrated in two case studies which document business practices at Otto, a leading German mail order business, and Steilmann, a leading German-based European clothing producer.

11.1 Introduction

Several industries have come under pressure from non-governmental organisations (NGOs) regarding environmental and social problems which are abundant in their supply chains, i.e. in the life cycles of their products. One prominent example is the textile and apparel industry, where Western producers and retailers are held accountable for both pollution occurring during manufacturing and social problems in related companies. Examples

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M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 233-256.

of this are the action taken by the Clean Clothes Campaign during the Football World Cups of 1998 and 2002[1] and the claims against Nike and Adidas[2] that their products are produced in ways which deny basic social needs, such as access to toilets and clean drinking water. This is one reason why proactive companies aim to improve the environmental and social performance of their products. This often triggers the need to change how these companies source their products from suppliers, and the relationships that these companies have with their suppliers.

Despite frequent statements that customers would be willing to buy green products and even to pay a higher price for them, companies which offer such green products find it difficult to make money selling them (Meyer and Hohmann, 2000). Only if they can be sold at a price which is competitive with conventional products can these green products realise the returns required. However, the greening of the products often incurs additional costs along the supply chain.

The question therefore arises of how companies can manage their supply chains to achieve environmental and social accountability as well as reduced costs. This paper will address this question in two stages. First, some basic aspects of environmental management accounting (EMA) will be taken up to look specifically at how supply chain issues are currently integrated. Some background on supply chain management will be provided, and the concept of supply chain costing will be introduced. Second, the supply chain for textiles and apparel, referred to as "the textile chain", will be described briefly. Two illustrative case studies from the textile and clothing industry will be provided. Finally, some conclusions are drawn on how the management of supply chains might influence future developments in EMA.

11.2 Incorporating the Supply Chain into Environmental Management Accounting

Environmental management accounting (EMA) is defined by the International Federation of Accountants (IFAC 1998: paragraph 1): "Environmental Management Accounting is the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While

[1]See information at: http://www.cleanclothes.org/campaign/wk2002.htm, 05/11/2002
[2]Last reported on German TV on 22/10/2002. See details at: http://www.zdf.de/ZDFde/inhalt/0,1872,2019964,00.html, 05/11/2002

this may include reporting and auditing in some companies, environmental management accounting typically involves life cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management." Hence, the scope of EMA reaches beyond the individual company, as can best be seen by the inclusion of the term *life cycle costing*. In this respect, it is helpful to look at concepts offered to structure the topics discussed among EMA.

Table 11.1. Approaches to Environmental Accounting (Bennett and James 1998: 31, amended)

	Organisation	**Supply Chain**	**Society**
Non-financial focus (Physical EMA)	Energy and materials accounting	Life cycle assessment	Environmental impact assessment
Financial focus (Monetary EMA)	Environment-related financial accounting	Life cycle cost assessment	Environmental externalities costing

As Table 11.1 presents, two criteria are used to systematise the approaches taken. First, a distinction is made between non-financial data, which is normally measured in physical units, and financial (monetary) data (Burritt et al. 2002: 39). The second dimension comprises the scope and the addressees of the information which is gathered and reported, which includes both the sources from which data is gathered and the recipients of the information. This can be internal to the company, supply chain or life cycle-wide, or related to all stakeholders. Bennett and James use the terms *life cycle (cost) assessment* to describe the instruments used, but summarise it using the heading "supply chain." This indicates a close connection between the two terms.

When the environmental debate started in the 1960s and 1970s, life cycle studies emerged as a suitable tool for collecting information about products and the environmental impacts that are caused along the various stages of their production. This has expanded into the ISO 14040 series on life cycle assessment (LCA) (ISO 1997), which states: "LCA is a technique for assessing the environmental aspects and potential impacts associated with a product [...] throughout a product's life (i.e. from cradle to grave)." Numerous case studies have been compiled where life cycle data for products is collected. These data sets then form the basis for environmental improvements to products or processes.

Life cycle costing has risen to prominence as a cost-oriented application of LCA. It is frequently mentioned when the overall framework of EMA is addressed (Bennett and James 1998: 31, US EPA 1998: 81, Schaltegger and Burritt 2000: 124) but is also present in classical texts on management accounting and cost management (Kaplan and Cooper 1997: 270, Cooper and Slagmulder 1999: 48). This has led to several contributions where life cycle costing is presented for particular products such as specialty papers (White et al. 1996: 7.1-7.19), batteries and solvents (Cohan 1996: 135-151), photocopiers (Bennett and James 1998: 347-361), or car and aeroplane parts (Rebitzer 2002: 127-146). One frequently stated argument for the use of life cycle costing builds on the need to integrate information beyond the price of a product, as this leads to wrong decisions. In a total cost assessment, various other, hidden, costs have to be integrated, such as the costs of acquisition, use and disposal (Bierma et al. 1998: 259).

Without aiming at a full review, one major deficit can be identified in the literature. All discussions imply that the life cycle is managed as an entity in itself. It is not clear who decides on the individual steps in the production process or aims to fulfil customer demand, which is, after all, the ultimate aim of every product or service offered. The life cycle of a product forms a given issue, which seems outside the control of the individual companies taking part in it. This leads to the ideas behind supply chain management, as will be discussed in the next section. The research presented subsequently will offer insights into what costs must be reported in a supply chain. Moreover, two examples are described regarding how companies report and manage these costs by using both physical and monetary measures.

11.2.1 Supply Chain Management

Supply chain management (SCM) is a fairly new term on the business agenda. "The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Materials and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships, to achieve a sustainable competitive advantage." (Handfield and Nichols 1999: 2). Even though it is not part of the definition, "end of life" issues such as take-back, recycling or disposal, form an integral part of SCM. This is captured in terms such as *green-*

ing supply chains (Handfield and Nichols 1999: 159) and *integrated chain management* (Wolters et al. 1997).

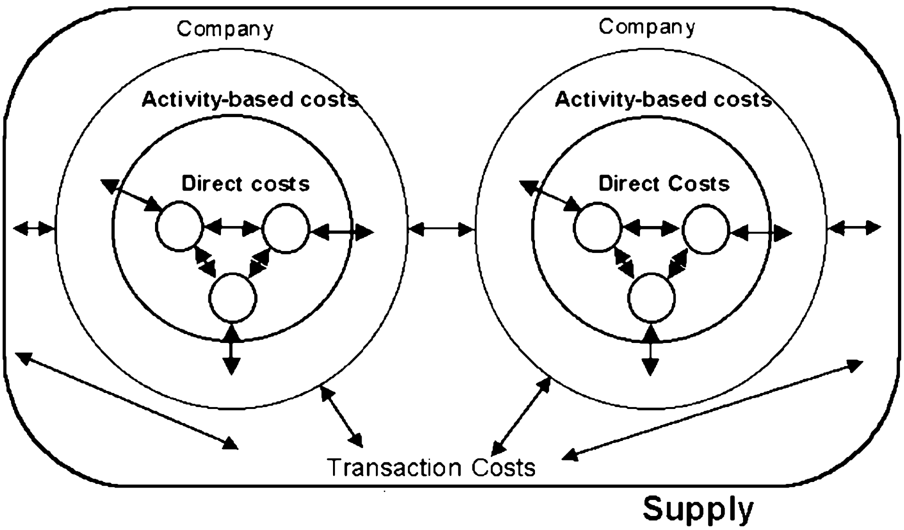
Looking at the SCM definition above, it is evident that both materials and information flows as well as relationships are of great importance to the management of the textile chain. The material flows along the supply chain relate directly to the environmental problems along the textile chain, as will be described below. An individual company can achieve only limited improvements if it acts on its own behalf, so partners must be found who are willing to cooperate before the life cycle and/or supply chain can be set up and optimised to reduce environmental impacts, increase profitability, and/or reduce costs.

This brings to light the close connection between the life cycle and the supply chain concept. Both are related to subsequent stages of manufacturing or operations and form the physical backbone of a product or service offered. SCM places great emphasis on the need to fulfil customer requirements. If these are not met, the supply chain and the companies that form it might vanish. This provides a link back to life cycle assessment, since the entity which is analysed and optimised is now no longer the individual company but the supply chain (Christopher 1998: 28). This may even lead to sub-optimisation for one company, but improve the performance of the supply chain in total. Similarly, improvements based on a LCA study should avoid environmental problems being merely moved from one stage of the life cycle to a previous or subsequent stage.

11.2.2 Supply Chain Costing

In both streams of literature, i.e. life cycle assessment and SCM, the relevance of actors is often neglected even though they form an integral part in the supply chain. Often, even without this being mentioned explicitly, it is claimed that a single company, usually the largest one or the one closest to the final customer, acts as a focal firm in making major decisions and governing the supply chain (Cooper and Slagmulder 1999: 119, Schary and Skjøtt-Larsen 2001: 94). This highlights the need to move beyond simple process-related tools for the management of a supply chain. Hence, the total cost assessment which is desired must take the organisational settings in a supply chain into account (Goldbach 2002), constituting the cost arising from cooperation with suppliers and customers (Seuring 2002). Williamson (1983) refers to these costs for supplier selection, contracting and control as *transaction costs*. Hence, if the total cost of the supply chain or

Figure 11.1. Cost Levels in Supply Chain Costing (Seuring 2002: 23)



life cycle are taken into account, these transaction costs must be integrated with the more "physical costs traditionally reported and measured in (environmental) management accounting." This leads to the question: which costs are relevant in the total cost analysis of a supply chain, and how can these be analysed and managed?

Most traditional cost management techniques look only at the internal costs incurred by companies. Direct and indirect costs are distinguished in order to manage costs according to the decisions which determine them. However, various decisions can be made only by considering the needs and abilities of suppliers and customers and analysing the costs created through cooperation with them. Without referring to transaction cost economics in detail, the term *transaction costs* within the concept of supply chain costing is applied in a simplistic way. Building on the traditional separation of direct costs and indirect or activity-based costs (overheads), this leads to a differentiation into three cost levels: *direct costs*, *activity-based costs* and *transaction costs*, as displayed in Figure 11.1.[3] The three terms are defined as follows:

[3]Activity-based costing is a full costing method that allocates all costs, i.e. direct and indirect, to products. Here, it is meant that indirect costs are allocated through an activity-based costing system, so that the term "activity-based costs" is used.

1 Direct Costs
Direct costs are caused by the production of each single entity of a product, and include such costs as materials, labour and machines, which are controlled by the prices of materials and labour.

2 Activity-Based Costs
Activity-based costs are caused by activities that cannot be directly related to products, but instead are caused by administrative processes that must be performed in order to be able to manufacture and deliver products. These costs arise from the organisational framework of the company.

3 Transaction Costs
Transaction costs encompass all activities dealing with information on, and communication with, suppliers and customers. These costs therefore arise from interactions with other companies in the supply chain.

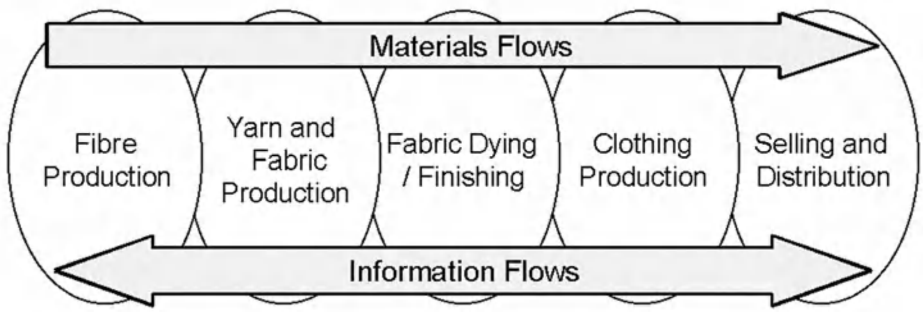
The three cost levels provide a basis for the analysis and optimisation of costs in supply chains. Furthermore, they are closely linked to EMA, so that measures taken by a focal company to be accountable for the supply chain can be reported. Taking this discussion together, two questions need to be addressed:

1 Environmental Impacts:
How can environmental impacts across the life cycle or supply chain be reduced if various companies are involved and each is responsible for its own operation?
How do decisions made by one company influence environmental impacts at the supplier and customer level, since improvements made at one stage may lead to improved environmental performance and lower overall costs?

2 Cost Reductions:
How can costs along the supply chain be measured and managed for both environmental improvement and economic results, i.e. how can products be environmentally improved without being more expensive than conventionally produced products?

A supply chain costing approach will be taken which makes the supply chain and the actors/companies within this chain its focal point, whilst offering

Figure 11.2. The Textile and Apparel Supply Chain (Seuring 2001b: 151)



cost management tools that allow total cost management along the supply chain (Seuring 2002, 24). Subsequently, two cases will be described. The first serves as a general description of the multitude of effects and actions which are required if green products are to be produced and environmental standards are to be complied with during production. The second provides evidence of how supply chain costing is applied in a cooperative manner. At the end of each case, some comments will be made on how Otto and Steilmann manage costs in the supply chain, i.e. how they cooperate with suppliers, collect or exchange cost information, and introduce actions.

11.3 Two Illustrative Case Studies of Textile Chains

This textile chain is used as a simplified description of supplier-buyer relations needed to offer products to final customers in the textile and apparel industry. As Figure 11.2 reveals, five closely-interlinked stages in the textile chain are distinguished in a simplified manner.

Reference is subsequently made to the supply chain for cotton, as an example of the most-used natural clothing fibre, as well as to polyester, the most-used synthetic clothing fibre. First, fibres are produced by either cotton farming or by crude oil processing and polymerisation. Next, yarn (one-dimensional) is produced by spinning the cotton fibres or polyester filaments. Weaving or knitting the yarn leads to the creation of fabrics (two-dimensional). The dyeing and finishing of both cotton and polyester textile fabrics include processes that specify colour and improve the wearing properties of the fabric, or modify its look or feel. Additional storage and handling processes are required to separate the green products from "regular" materials. The next step is the manufacture of the apparel itself, in which the finished fabrics are also combined with, for example, zippers or buttons. Selling and distribution represents the companies that decide which fashion clothing is produced, and in which styles (product varieties) and quality. Hence, they have a major influence on all previous stages. Apart from transport, only limited environmental problems occur in selling and distribution, which can be carried out by a single company or within a distribution system (wholesalers, retailers) of varying depth.

Environmental problems include the use of chemicals such as pesticides and additives, water for cotton irrigation, water for processing, and waste water creation. This highlights the need to green these supply chains (on environmental problems in cotton production, see Myers and Stolton 1999, in polyester production, see Schmidt 1999). Much of the textile industry operates in second or third-world countries where the workers, mainly women, operate under enormous pressure and humiliating labour conditions. However, although these social problems are important and need to be addressed by the textile industry, they are not discussed further within this paper.

Whilst this description centres around the processes carried out, the formation of partnerships along the supply chain is not to be neglected. The textile and apparel industry is characterised by a short-term, single transaction orientation that hinders rather than promotes active partnering (Forza et al 2000; Romano and Vinelli 2001).

11.3.1 The Case of Organic Cotton Clothing at Otto

Founded in 1949 in Hamburg, Germany, Otto GmbH & Co. is the largest mail order business in the world. Whilst its headquarters are still there, the Otto group presently consists of 90 companies in 23 countries, employing almost 76,000 people worldwide with a turnover of €23.5 billion in 2001. The products traded by Otto cover a wide range, including clothing, electronics and household appliances.

Fashion Value and Response to Pressure Groups. Otto started to introduce environmentally-responsible apparel in the early 1990s. This comprised both cotton and other fibre collections, and aimed to limit harmful substances at the level of the product. In 1997, Otto decided to extend optimisations to the whole textile chain, with the objective of providing "sustainable" cotton clothes for a highly fashionable mass market. The challenge was to realise a value-adding process in which economic, ecological and social aspects would be equally respected. Hence, Otto acted as the focal company in the supply chain which initiated and managed it at the beginning, whilst providing the link to the final customers.

These organic cotton clothes were not to cost significantly more than conventional clothes, while at the same time they should maintain the high quality and fashion standards of Otto. One measure taken at Otto was the development of checklists for evaluating suppliers in respect of their environmental and social performance. Only if a supplier meets the required standards will they be accepted. If the supplier is able to meet certain higher standards and achieves a good performance over several deliveries, they are then designated as an "approved eco-supplier."

The major question which arose in this context was not only how to solve the technical problems of greener production, but how to coordinate the activities of a highly complex network of different partners who were involved (Goldbach 2002) and thereby control costs in order to achieve the environmental performance which was required for organic cotton products. The steps taken to identify suitable partners and implement environmental measures are explained by using a supply chain costing framework.

Starting the Organic Cotton Chain at Otto. When Otto started to introduce organic cotton products, it found that no organic cotton was available (Seuring 2001b: 155), since less than 0.1% of global cotton production is produced under organic standards (Meyer and Hohmann 2000: 59).

In the conventional chain, Otto purchases finished products from suppliers. Since this was not possible for organic cotton products, Otto had to search for suppliers at all levels of the supply chain. The search led to Turkey, where all stages of the supply chain from cotton farming to clothing production were available, and agents were employed there to find farmers who were willing to switch to organic farming. Similarly, spinners, weavers, dyers and sewers had to be identified for cooperation in the organic cotton supply chain. These activities were seen as an investment in supply chain partnerships. The three cost levels of supply chain costing can be used to describe the costs incurred and the measures taken (Seuring 2001a, 2001b):-

- **Direct Costs**
  The conversion to organic cotton takes about three to five years. Only after this period will an external certification body, an independent small specialised company, allow cotton growers to sell their harvest as organic cotton. Profit declines dramatically in the first few years following the decision to grow organically, since on the one hand yields decline and on the other hand farmers are not allowed to sell their existing cotton as organic. This transition is true for other stages of the supply chain as well. Dye works must optimise their processes when using new types of environmentally friendly colours.

- **Activity-Based Costs**
  When spinners and weavers process organic cotton, they have to treat it separately from conventional cotton. Additional cleaning of machinery and separate storage is necessary in order to avoid the spillage of pesticides or other harmful substances into organic cotton, leading to higher costs. Cost reductions can be achieved through, for example, time integration of processes[4], which plays an important role in the fashion industry supply chain (Fisher et al. 1994: 105). The usage of processing capacities among suppliers is planned jointly in order to yield a higher capacity utilisation at supplier factories, and lower stock levels. Such measures might also be implemented for conventional cotton, but to date are not yet common practice (Abernathy et al. 1999; Forza et al. 2000).

- **Transaction Costs**
  The technical support for suppliers falls into this category. Suppliers are often unable to reach the technical and environmental standards set by the retailer, so Otto cooperated with a consultant who helped suppliers to put together and optimise materials and energy flow inventories for their production facilities. Whilst the farming of organic cotton is and remains more expensive, most other processes can be expected to reach the same cost level as those for conventional cotton.

Operating the Organic Cotton Chain. Not only the formation of the network, but also its operation leads to increased costs (Seuring 2001b). The technical and administrative processes which are carried out in order to

[4]Traditionally, each level of the supply chain operates independently, and stocks are used to balance the flow of materials. If the processes are integrated in a timely manner, with one process following another directly, then stock holding points and their related costs are eliminated.

produce the clothing also lead to a multitude of cost effects. Whilst the production of organic cotton clothes leads to increased costs, close cooperation of firms in the supply chain is ensured by the integration of technical and managerial processes. Logistical and supply chain management measures can be implemented in order to resist increases in costs.

- **Direct Costs**
  This is the domain of traditional pollution prevention measures. As an example, the introduction of environmentally friendly dyes reduces the impact on rivers and/or the amount of money which has to be spent on waste water treatment. A second example is the establishment of technical standards. At the direct cost level, this might reduce production costs, for example the use of certain additives during spinning affects weaving costs. Agreement on such matters as better additives that reduce yarn splits during weaving might increase costs for the spinning company. If the supply chain is coordinated, the weaving company and/or other partners downstream might compensate for these costs, thus improving overall performance.

- **Activity-Based Costs**
  One important issue is the volume which is processed in a single batch. Organic cotton batches are often smaller than conventional cotton batches, thus incurring additional set-up costs, as is also the case for the administrative processes which are needed. The use of information technology has reduced administrative process costs dramatically in recent years. In a coordinated supply chain, the use of such technologies improves overall performance and reduces the cycle time which is needed to produce and deliver the product to the customer.

- **Transaction costs**
  Meeting the standards set for an "approved eco-supplier" includes meeting the quality standards of Otto. The quality controls are therefore shifted to the supplier, which avoids the costly transfer of inadequate apparel products to the Otto warehouse. The total costs of working with a certain supplier are reduced, since less control is needed and fewer products become obsolete.

  The overall action which is taken can be seen as a form of investment in the supplier network, which allows Otto to respond to the two major questions which were raised earlier. On the one hand, it indicates supply chain accountability. On the other hand, it allows cost management and the achievement of an acceptable production level. Only if both factors are managed proactively will Otto be able to offer competitive products and stay in the market in the long term.

Managing the Organic Cotton Chain. Otto originally organised its supply chain by searching for partners across all stages, covering cotton farming, spinning, weaving, dyeing, finishing and clothing production. Before the start of the project, Otto's environmental department gathered data on environmental problems in the cotton chain. For the production of organic cotton, existing standards were used as a basis[5]. By aiming to achieve these standards of production at all stages of the supply chain, physical measures formed an important basis. These included the reduction of waste water and the elimination of environmentally harmful dyes or finishing additives. The reporting of these improvements was done by the individual companies, mainly to their own management. However, since Otto helped their suppliers to improve their environmental performance, there was some exchange of information between suppliers and Otto, but this was limited to such data as the suppliers felt confident about handing over to Otto. A consultant, partly paid for by Otto, helped some suppliers to conduct a materials and energy flow analysis of their operations (physical measures) and to calculate achievable cost savings (monetary measures), but such reporting was still limited to the boundaries of the individual company.

At the level of the supply chain, this leads to increased costs, as mentioned before. Otto therefore tried to collect data across the whole supply chain in order to identify the potential for cost savings. This was difficult to conduct, since some of their suppliers do not have (detailed) reporting structures, and therefore calculate costs in a "done as ever" mode, based on an established accounting system. As one example, overhead (or cost-plus) calculation is used, which means that if a more expensive raw material is processed (which organic cotton usually is) then more overhead costs are allocated to the spinning or weaving of such organic cotton. Even though this is not justified, these costs were reported and allocated based on an

[5]See for example the standards set by the International Natural Textile Association (http://www.naturtextil.com, 05/11/2002). These were not taken up on a direct basis, but provide an independent example of such standards.

activity analysis. This is one obstacle on which Otto still has to work, so the process of reporting and reducing chain-wide costs continues.

Furthermore, the transaction costs created throughout the chain have led to a restructuring of the chain operation. One example is the number of suppliers involved, which was reduced in order to limit the number of transactions that are necessary between them. Furthermore, their operational processes are coordinated, as mentioned before. This is based on monetary measures estimated by Otto, but again these are not reported within traditional accounting systems. Even if only the costs directly incurred at Otto are taken into account, they still have a significant impact on the price of organic cotton clothing. The measures described earlier were introduced in order to reduce these costs. However, the formation of a new supply chain for innovative products is expected to require significant investments.

11.3.2 The Case of Eco-Polyester Linings at Steilmann

The company Klaus Steilmann GmbH & Co. KG was founded in 1958 in Wattenscheid, Germany, in the Ruhr region, and the company headquarters is still located there today. The core business of Steilmann is the design and sale of clothing. Production is carried out at suppliers around the world, and major customers include Marks & Spencer and C&A. In 2001, the company had a turnover of over €700 million and employed about 14,500 people, mainly in Rumania, where currently about 12,000 (mostly female) employees work.

Among the product range offered to its suppliers, apparel made from polyester traditionally plays an important role. In the mid 1990s, Steilmann was approached by a chemicals company which suggested that a new, environmentally improved polyester called "eco-polyester" might be used for its products. This company had developed a new catalyst for the polymerisation process which uses titanium oxide instead of antimony trioxide, thus eliminating the problem of heavy metal (antimony) usage in the polymerisation process (Thier-Grebe and Rabe, 2000). During subsequent production steps, small quantities of antimony spill over into sewage water.

Starting the Polyester Linings Chain at Steilmann. The example of polyester linings will subsequently be used to explain the cost influences and measures taken in supply chain costing at Steilmann. Whilst both fabrics and linings can be made from polyester, the companies involved turned first to linings. Polyester linings are used in a wide range of fashion products and account for about 70% of all linings used for apparel. It is therefore a product with a fairly stable and comparatively high demand so far as fabrics are concerned. The two suppliers involved will here be referred to as "chemical company" and "textile company" respectively. Since both companies operate in Western Europe, they have to obey environmental regulations and social standards, so the introduction of the new catalyst was therefore a major environmental improvement. As shown in Table 11.2, a shortened supply chain was used.

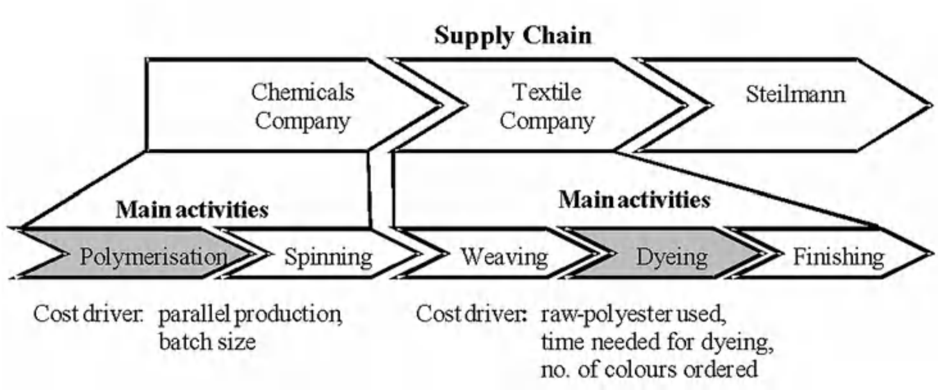
Table 11.2. Some Data on the Polyester Linings Supply Chain

Supply Chain Stage	**Chemical Company**	**Textile Company**	**Steilmann**
General business	Filament and yarn production	Fabric weaving, dyeing, finishing	Clothing production and sales
Yearly output/usage [metres/year]	c. 500,000,000	c. 40,000,000	c. 4,000,000
Number of colours produced/orders	Colourless	About 300 different colours offered	Reduction to about 50 colours

Even though Steilmann is the focal firm of this chain, its power over its suppliers is limited, as can best be seen from the normalised output (line 3 of Table 11.2). The amount of polyester lining that Steilmann's purchases each year account for only about 1% of the chemical company's production. Furthermore, the product variety is very different. Whilst one type of polyester and one type of yarn is used for these linings, the textile company can offer up to 300 different dyes. In order to allow the introduction of the polyester linings into the market, measures had to be taken to achieve a cost level which was comparable to conventional production (Seuring 2001a). However, the two suppliers will still not be able to switch their production completely to environmentally improved polyester. One reason is that the automobile industry, for example, requires certification of every material and component which is used, which is costly and is therefore usually carried out only for a new model. Since the chemical company supplies a significant amount of its output to this industry, it cannot switch exclusively to the production of eco-polyester.

Process Analysis and Identification of Cost Drivers. An activity-based costing approach was applied, covering the three stages of the supply

Figure 11.3. The Polyester Linings Supply Chain



chain. Along the different stages of the supply chain, a process analysis was carried out to identify the processes where major additional costs arise during the production of the environmentally improved polyester (see Figure 11.3).

As mentioned in Figure 11.3, one major obstacle is the parallel production during polymerisation at the chemical company. Only through the use of a batch process[6] is it possible to switch between the two polyester qualities, but this causes additional costs. Cleaning the production equipment is necessary in order to avoid spillages of antimony into the eco-polyester. Since only a few other chemical company customers demand eco-polyester, the batch sizes which are produced are much smaller than those for conventional polyester. These two cost drivers were identified, since the subsequent spinning process is relatively uncritical in respect of both environmental impacts and the associated costs .

Within the textile company, three main processes were identified: weaving, dyeing and finishing. During weaving, only one type of yarn is used: white raw lining, which is intermediately stored. The critical process is dyeing, since in this process the lining (which has so far been uniform) gets a specific colour and therefore cannot subsequently be used for any other colour, and has to be stored and processed separately. The new catalyst used during polymerisation makes it necessary to change the dyeing process, since the

[6]Worldwide, most polyester is produced in continuous flow processes, which are cheaper but less flexible.

chemical properties of the linings change. Each colour used must undergo a costly set-up process, including some laboratory test runs, so the number of colours ordered by Steilmann requires the textile company to incur major costs.

No physical or chemical processes are used at Steilmann, so the catalyst has no influence on the processes carried out there. This is a strong argument for the interrelatedness of the processes in the supply chain, since Steilmann's desire to offer eco-polyester to its customers can be implemented only if its suppliers are willing to accept the changes that are needed in their own production processes. This is possible only if Steilmann takes several measures and forms a strong partnership with these suppliers.

Cost Reductions in the Polyester Linings Chain. Within the individual companies, only minor cost savings at the direct cost level could be achieved. Both have a high degree of experience in their production, and run their particular processes with economies of scale.

Cost savings could be realised only by assessing the way in which company processes are interlinked, hence looking at the activity-based and transaction cost levels. As mentioned above, one typical measure is to shorten the supply chain. Since only three companies are involved, this reduced the number of interfaces to just two. At the interface between the chemical and textile company, order processing was improved. Bundling orders[7] from the textile company and thereby placing a lower number of orders allows larger batches to be produced during polymerisation. Raw polyester is stored and spinning is carried out to order, reducing the higher storage costs for the yarn. However, the storage capacity of the textile company must still be taken into account in order to avoid higher costs for storage created at this stage of the supply chain.

Dyeing has already been identified as the most important process. Consequently, an internal project was set up at Steilmann to reduce the number of polyester lining colours which were ordered. Until the project was started, each department ordered linings independently, totalling about 300 different colours. Through the means of the project, various actions were introduced. First, a single standardised quality was purchased. Second, the number of colours ordered was limited to about 50 per season. Third, the

[7] "Bundling orders" is the combination of a number of small orders into a single large order.

colours ordered were classified into three categories of A, B or C, according to the amount of polyester lining ordered per year.

Furthermore, a production planning routine was introduced to integrate Steilmann and its supplier. Previously, polyester linings were ordered by Steilmann as they were needed, so that delivery took about two weeks for all colours. Optimised planning was attained on the basis of a new contract. Hence, the one-time transaction costs[8] for conducting the internal project at Steilmann and for negotiating a new delivery mode with the textile company led to reduced activity-based costs. C-colours are ordered in the traditional way. For the major A and B fractions for the polyester linings ordered (which account for about 80% of the total amount), a forecast is made for each season. On this basis, the supplier changes from a made-to-order to a made-to-stock process, which reduces the delivery time after Steilmann has placed its order to only two days.

The textile company has the guarantee that Steilmann sources from them exclusively and in certain amounts, thus reducing the risk of being left with obsolete stocks that might then be sold only at a lower price. Moreover, only a reduced number of colours has to be set up, which is by far the highest cost reduction achieved and can be attributed to the activity-based costs of the supplier. Finally, the textile company receives production forecasts from Steilmann, which it can use to plan and control its own production in order to yield better capacity utilisation.

Steilmann also reduced direct and activity-based costs for inventory carried and order processes carried out, but it still had to invest in transaction costs, which are only "paid off" by acquiring eco-polyester linings at a price which is competitive with conventional linings.

Managing the Eco-Polyester Chain. Before eco-polyester linings were pioneered, Steilmann already sourced from the textile company on an order-by-order basis, but also purchased polyester linings from different suppliers. The introduction of eco-polyester led to a new form of cooperation along the supply chain, since all stages were included. In conventional textile chains, Steilmann has no contact with companies beyond their first-tier suppliers.

[8] Still, ongoing transaction costs remain for each order placed at the textile company.

In the project with the chemical and textile company, it was evident that these two needed to cooperate in a different way as well. Steilmann organised a "round table" at which managers from all three companies met. This helped to reveal several of the stated problems and started a process to find solutions that no individual company would have been able to reach on its own. This included the exchange of some technical details on the processes used, as well as discussion of their costs. The managers involved were still keen not to reveal too many details, especially regarding their cost situation, but debate on technical details and searching for solutions as well as negotiating prices at both interfaces and across all three companies allowed the goals set to be achieved. The commitment of Steilmann to source all its polyester linings through this chain and to guarantee this for several years formed an important basis for future business dealings. Environmental performance at both suppliers was improved, which was reported through indicators such as (for example) lower payments for waste water treatment by the chemicals and textile companies, while the target costs set, i.e. the price paid for conventional polyester linings, were almost met.

The process of EMA was not centralised, but instead remained dispersed over the three companies in the textile chain. The major environmental improvement, i.e. the use of the new catalyst and the reduced impacts along the chain, were achieved mainly at the chemical company. This created less waste water which contained heavy metals (physical measure), resulting in lower fees (monetary measure). The chemical company mentioned this during negotiations, but claimed that these cost savings were offset by higher administrative (activity-based) costs. The textile company, due to the additional direct and activity-based costs incurred, would not have processed eco-polyester without the reduction in number of colours (physical measure) or the guarantee from Steilmann to buy it (monetary measure).

This case reveals that although both physical and monetary measures are used in the supply chain, no single reporting system was introduced. This will be difficult to achieve, as each company is responsible for its own operations. Even though this new form of cooperation was established, there is still much to do in order to achieve a borderless supply chain. Open-book accounting across companies is a challenge, since the line between information exchange which would be needed and the protection of internal data must be found. These are challenges for the continuous improvement processes in the two textile chains described, as well as in almost all supply chains.

11.4 Concluding Remarks and Future Directions

Both case studies provide evidence of the suitability of SCM and supply chain costing to advance the introduction of environmentally responsible clothing to mass markets. The two dimensions of SCM are apparent, since materials and information flows have to be managed in order to acquire the correct raw materials and to transform these into the required products. Information flows are also an important part of partnership building, since suppliers who are willing to change might not have the knowledge on hand to do so. This brings the second dimension of managing partnerships into play, and both Otto and Steilmann had to change their attitude on how to deal with suppliers. Traditional arms-length treatment, where a supplier is used on only a deal-by-deal basis, would have entirely prevented the introduction of green products.

The analysis of costs between the three cost levels of direct, activity-based and transaction costs sheds new light on how the decision of one company influences costs at another company in a supply chain. Only joint analysis and optimisation can reveal how costs can be reduced; the discussion of the case studies is limited here, in order to illustrate this concept. Future research will have to show how this can be integrated into the day-to-day business of cost management within companies.

However, the limitations of the cases reported are evident. Both supply chains were set up to yield certain environmental optimisations in the production of apparel. They have been operating for only a limited time span, so there are still further improvements to be achieved. Accounting systems for individual companies are not designed to report transactions costs created by the cooperation with suppliers. Even so, the debate on such costs has gained considerable ground in recent years (see for example the total cost of ownership concept, Ellram 1993, 1995). Further work on the integration of supply chain costing into traditional accounting and cost management systems still needs to be carried out.

Finally, the link back to life cycle costing and EMA is addressed. In several regards, life cycle costing and supply chain costing are similar to each other. Both take into account the different stages of a life cycle or supply chain. The closeness of the two approaches is evident, since the two terms can be used almost interchangeably. However, the major difference is seen with the explicit integration of transaction costs and therefore the perspective of the individual actors in the supply chain. Future research might look at the conceptual basis of both techniques and explore how an integration and joint development will advance the understanding of costs in the life cycle or supply chain.

At the beginning of this paper, it was noted that physical and monetary EMA are distinguishable. The case studies relate to both, since environmental impacts are measured in physical units, whilst (especially in the Steilmann case) the outcome of the single measures was given in monetary units. This is just one further example of how closely the two types of measure are related to each other. The individual situation must determine the appropriate unit, since the emphasis will increasingly be on outcomes and not only on reporting, if green products are to be sold successfully on mass markets. However, it must be acknowledged that the implementation of supply chain costing as day-to-day business will depend on finding the right organisational context in which to make it work, in order both to contribute to the goals stated (namely the reduction of environmental impacts), and to operate the supply chain in a cost-effective manner.

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12. Institutional Changes and Environmental Management Accounting: Decentralisation and Liberalisation

Jan Jaap Bouma

Erasmus Centre for Sustainable Development and Management (ESM), Erasmus University Rotterdam (EUR), Netherlands; Department of General Economics, Ghent University, Belgium.

Bouma@fsw.eur.nl

Aad Correljé

Erasmus Centre for Sustainable Development and Management (ESM), Erasmus University Rotterdam (EUR), Netherlands; Faculty of Technology, Policy and Management (TBM), Department of Economics Infrastructures, Delft University of Technology (TUD), Netherlands.

a.correlje@tbm.tudelft.nl

Abstract This paper uses an institutional perspective to explore how EMA practices are being influenced by societal and institutional change. It focuses on two sectors in the process of decentralization and liberalization, namely, public water management and the energy sector. Shifts in the institutional and politico-economic context will be linked to the changes in their EMA systems. It is concluded that in both sectors a tension will remain between, on the one hand, the use of economic instruments and methods of evaluation as efficient tools for decision-making and, on the other, the fact that a 'price' is often insufficient as an indicator for rational, informed decision-making. Non-ambivalent qualitative and quantitative indicators will therefore remain necessary for the evaluation of alternatives and for environmental policy-making. It is observed that the processes of decentralisation and liberalization induced more variation in the demand for EMA information about *specific* types of environmental performance. Decentralisation and liberalisation bring many aspects of environmental performance into the realm of 'customer or stakeholder relations and commercial strategy' in EMA, as positive or negative 'marketing assets' to a firm or a product. The design of EMA systems and the choice of indicators will therefore closely reflect 'what the market dictates'. Commercial strategies and the variation in the specific physical and societal context of a firm will lead to a

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much larger variety in the demand for EMA information and in processing approaches.

12.1 Introduction

A major theme in management accounting literature has been the issue of how contextual change influences the design of accounting systems and the development of new techniques. A well-known example of such an influential development is the automation of production processes, which required radical changes in the ways that overhead costs were allocated between activities and individual products, and thus contributed to the elaboration of Activity Based Costing systems (Horngren and Foster, 1991).

The behavioural consequences of changes in traditional management accounting are well analysed to date (see Hopwood, 1987; Hartmann, 2000). Growing concern with the environment, and societal pressures to reduce environmental impacts, have induced firms to develop the concept of Environmental Management Accounting (EMA). Traditional and newly developed methods of appraisal have been adopted in order to generate the environmental information that has enabled firms' managements to deal with the 'environmental problems' and pressures that have been placed on them by society. This new information has been partly financial in nature, but has also included physical, ecological, social and legal aspects (Bartolomeo *et al.*, 2000).

This paper explores how EMA practices are being influenced by societal and institutional change. In particular, it investigates how the trends of decentralisation in decision-making, and liberalisation in many industry sectors which were previously part of the public sector, influences the evolution of EMA systems. Since the early 1980s, to varying extents in different countries, the public domain in society has been reduced. Infrastructure industries and public services such as telecoms, public transport, water and energy supply, waste collection, and education and health, have been increasingly exposed to the 'dynamism of the market' and/or privatised. In other public-sector tasks such as spatial planning, environmental protection, and public housing, new governance structures are being introduced which remove decision-making and policy implementation as far as is reasonably possible from the central, often national, public authority towards the executive level, introducing new stakeholders such as local organisations and end-users. Moreover, the activities of the firms and organisations are frequently brought under the overview of regulatory agencies and/or competition authorities.

This paper focuses on two sectors which are in the process of decentralisation and liberalisation, namely public water management and the energy sector respectively. The current shifts in the institutional and politico-economic context of these sectors will be explained and linked to changes in the EMA systems and the techniques designed to provide the appropriate information to their management. In public water management, the main issue is the rise of stakeholder involvement through stakeholders' increased participation in decision-making processes and the integration of their specific concerns into the assessment of hydraulic investment projects. The energy sector is in the process of liberalisation and privatisation and as a consequence, formerly captive energy *consumers* now become free *customers*, whilst public ownership is gradually making way for a structure in which a multitude of private shareholders are to be addressed and informed.

An important trend in water policy, as well as in energy policy, is the increasingly widespread use of economic policy instruments in which pricing and the taxation of water and energy are used to influence users and producers in their behaviour. The use of economic instruments instead of a command-and-control approach seems to require the development of new, different methods of information management and processing. Indeed, economic instruments provide a choice and assume that those responsible for taking action actively value and evaluate their options before doing so.

12.2 The Changing Context of Environmental Accounting

"Environmental accounting" is a broad term for accounting activities which are concerned with the state of the environment at both national level and also within organisations and firms. Environmental accounting processes both monetised and non-monetised information (Bartolomeo *et al.*, 2000). EMA can be regarded as a subset of environmental accounting (Orbach and Liedtke, 1998) which refers to accounting systems and techniques that provide decision-makers and management with financial and non-financial information about the firm or organisation and its environment. EMA therefore produces much more than information on environmental costs. As specific demands for knowledge and insight determine the types of information which are requested, the management perspective dominates the definition and form of the information, and the adoption of EMA techniques. The question for consideration is: how does management define its information needs?

Organisations are constantly in change, and some changes affect only the operational level of an organisation. Accounting will of course reflect these changes in the costs and revenues which are reported, but there are no implications for the accounting systems and techniques employed as such. However, change may also be related to shifts in the institutional context that influence organisations more structurally. A clear example is the adoption of legislation that requires organisations to generate information about their impacts on the environment and their abatement efforts, and to report this to external stakeholders such as environmental agencies and interest groups, and to their customers. New systems and methods of accounting systems will then have to be developed in order to fulfil these information demands.

An institutional perspective can be useful to understand the contingencies that shape information demands and, as a consequence, the design criteria for accounting systems. Understanding organisational behaviour is improved by looking at the institutions that create and structure patterns of behaviour (see Powell and DiMaggio, 1984; Boons *et al.*, 2000; Bouma and van der Veen, 2002). According to North (1990), accounting systems can be looked upon as institutions that structure the generation and processing of data within an organisation. At the same time, these accounting systems are connected to, and shaped by, the broader institutional context in which the organisation or firm operates in society, involving its relationships with other public and private organisations, including firms and individuals. These relations may vary in their degree of formality ranging from obligatory legally-prescribed modes of interaction and exchange to social norms and routines.

Accounting literature is rich in insights into the relationships between changing social contexts and accounting practices. Tinker and Neimar (1987) have studied the role of annual reports in corporate responses to gender and class contradictions, and contingency theory explores the impact of the external and internal aspects of organisations on accounting behaviour (see Bouma and van Veen, 2002; Cowen *et al.* 1987). This chapter, however, will explore the impact of decentralisation, deregulation and liberalisation of formerly publicly dominated sectors on the development of environmental accounting practices for management use. Indeed, the analysis of changes to EMA as a response to these shifting modes of public-private coordination seems to be a neglected field of investigation.

The economic-institutional approach builds on earlier work on the relationship between accounting and its social context by identifying the mechanisms that explain changes in accounting behaviour in response to a changing society. In particular, theories of *institutional isomorphism* may provide a useful framework for examining how decentralisation and liberalisation influence the development of EMA. Indeed, the observation that more and more organisations and firms adopt EMA systems implies an increase in the "homogeneity of organisational forms and practices" (Powell and DiMaggio, 1984: 64). According to Hawley (1968), isomorphism can be defined as a constraining process that forces one unit in a population to resemble other units that face the same set of (environmental) conditions. Different mechanisms have been identified through which this process occurs, and Powell and DiMaggio (1984: 67-74) present three types. *Coercive isomorphism* relates to the formal and informal pressures which are exerted on organisations by other organisations upon which they are dependent and by cultural expectations in the society within which they function. An example would be the pressure put on firms to adopt EMA by means of legislation. *Mimetic isomorphism* is a mechanism that reflects the behaviour of an organisation when dealing with uncertainty. A high level of uncertainty, resulting from ambiguous goals, drives organisations to copy the behaviour of other organisations. *Normative isomorphism* relates to the pressures that push organisations, as a result of their professional and educational environments, into working conditions and work which becomes homogenised.

Changes in the context of organisations through these three mechanisms may induce isomorphism, which may either stimulate or hinder innovations in their accounting behaviour. The examples from water management (section 4) and the energy sector (section 5) illustrate how decentralisation and liberalisation can influence the mechanism of isomorphism in the development of environmental accounting practices.

12.3 Institutional Changes: Decentralisation and Deregulation

Following World War II, societies in most OECD countries developed a sizeable public domain in which public authorities operated a variety of industries and services such as telecoms, public transport, water and energy supply, waste collection, education and health. Other public-sector tasks such as spatial planning, environmental protection, and public housing, were carried out in a highly centralised manner, directed from national, ministerial level. Subordinate bodies largely had only executive tasks and very little discretion in the way in which they carried these out. Executive organisations, not to mention their customers, had no influence on the co-ordination of objectives, approaches and resources.

State-owned firms and public services thus supplied the goods and services that the administration deemed appropriate. Accountability for their performance, including the terms in which performance was measured, was directed at and determined by hierarchical branches of the bureaucracy, who channelled this information upwards to the central level. In principle, the government was held responsible by citizens and other stakeholders for the actions and decisions of its bureaucracy, and for the consequences of its policies, through the political process and representative democratic institutions (Foreman-Peck and Millward, 1994).

By the end of the 1970s, dissatisfaction began to grow with the performance as well as the cost of this centralised, state-dominated approach in such large segments of society. The economic thinking that advocated a 'withdrawal of the state' became increasingly influential in the political debate around the issue. It was argued that the state had done a poor job in supplying low quality, high-cost services and in the centralised execution of its policies. Lack of knowledge and 'strategic' behaviour on behalf of (members of) the administration, plus lack of choice regarding the use of their resources by citizens and private firms, were among the central elements in the increasingly powerful critique of the interventionist state (see Vickers and Yarrow, 1988; Armstrong *et al.*, 1994; Newbery, 2001: 1-25; for the Netherlands, see Künneke, 1991).

Instead, it was argued that new governing structures should be introduced that would make citizens responsible again for their own choices, and through which the state could guide citizens by encouraging or discouraging specific behaviour, leaving the eventual solution to their own discretion. The dynamic process in competitive markets was highlighted, focusing on creative entrepreneurial discovery and assuming that consumers would employ their free choice to select the quality and added value of products. Gradually, the idea that the liberalisation of publicly regulated economic sectors improves their short-term efficiency and long-term innovativeness became common wisdom among many policy-makers and political parties (Kirzner, 1997).

It is clear however that in water management as well as in the energy sector there will always remain a tension between, on the one hand, the use of economic instruments and methods of evaluation as efficient tools for decision-making and, on the other hand, the fact that a 'price' is often insufficient as an indicator to support rational, informed decision-making. For both sectors, the following two sections will outline firstly the main physical impacts to be reported on, secondly the nature of the structural change observed in the sector, and thirdly changes in EMA practices.

12.4 Water Management

In local and regional public water management, citizens together with representatives of economic and other interest groups, and of municipalities, are increasingly being involved in the formerly highly centralised and closed processes of decision-making. Now, instead of being subject only to measures of central public water management, these new actors are given a voice, as well as behavioural responsibilities, in local water issues within the context of the broader framework of the general and environmental objectives of Dutch Integral Water Management. To an increasing extent, these stakeholders see their interests reflected in decision-making processes through the institutionalisation of the economic pricing of water. Increasingly, the application of financial (i.e. indirect) regulation is gaining support from policy makers. Examples of this process include the introduction of levies that deliberately reflect the volumes of water used, and the pricing of discharge permits to internalise the environmental impacts of discharges of pollutants to surface water. Both instruments reflect the economic value of water. From the perspective of neo-classical economics, the pricing of water will bring about a re-allocation of water from sectors with a lower added value, such as agriculture, to sectors in which a higher social value is attached to water use, such as nature conservation. Another form of the institutionalisation of pricing is to be found in the procedures through which decision-makers identify and assess the effects of hydraulic works on water systems in the course of performing a Cost Benefit Analysis. The pricing of water is a direct consequence of deregulation and decentralisation. Instead of influencing the allocation of water through command-and-control instruments, on the basis of detailed governmental objectives, pricing is used to steer the allocation of water. Section 4 shows that the rules that establish the price of water systems, such as river basins, are undergoing significant changes (CW, 1999).

12.4.1 Physical Impacts

Organisations that deal with the quantity and quality of water in the widest sense face the challenge of handling the potentially enormous ecological, social and economic impacts which are associated with the manipulation of parts of water systems. In both the public and private sectors, organisations and firms find themselves involved in what is often referred to as 'water management'. Water quantity dimensions are strongly linked to the specific physical and spatial context. At some locations, the focus is strongly on flood prevention, whilst scarcity is the major concern in other areas. The implementation of the Water Framework Directive of the European Community addresses water quantity issues as matters that should be dealt with principally through the economic analysis of water use and the application of economic policy instruments (EC, 2001). The key challenge is to understand the dynamics of water demand and supply, how these dynamics evolve over time, and what kind of phenomena drives these changes. An informal document that aims at supporting the implementation of the directive deals with three aspects of water management (WATECO, 2002)[1]:

- the characterisation of the river basin in terms of the economics of water uses, trends in water supply and demand, and current levels of water, and recovery of the costs of water services;

- the identification of water bodies or groups of water bodies which are not achieving the environmental objective of the directive;

- a programme of measures to manage a river basin. Water supply and demand should be matched in the most effective manner possible (adoption of the 'polluter pays' principle, use of cost-effectiveness analysis, and the consideration of economic policy instruments such as water pricing).

With respect to the supply and demand of water, a distinction is made between the quantity and quality of water, and the particular use which is made of it. Thus, the demand for drinking water is associated with high

[1]This document aims to support the implementation of the Water Framework Directive and was drawn up by a European working group of experts and stakeholders, under the auspices of the EU Member States and Commission.

quality standards. This type of water demand cannot be satisfied with water taken from a river contaminated by heavy metals such as cadmium, effluents contributing to eutrophication, or phosphates. Neither can the water requirements of precious and sensitive eco-systems be satisfied by poor quality water.

12.4.2 Structural Change

The case for structural change in water management is motivated and justified with reference to the increased damage caused by the misuse of water and increased attention on the quality of water. The demand for improved management of water quantity and quality emerges from growth in population densities, economic activities and urbanisation which cause pollution, erosion of the soil and faster drainage in upstream countries such as Germany, Belgium and France. The multinational character of the problem has inspired the European Union to re-think water management issues in terms of river basins and stakeholder involvement rather than on a national scale (EU 2001).

Dutch government agencies and civil society organisations recognise the need to develop a system of integrated water management in which aspects such as the quality and quantity of water, safety, regeneration and sustainability are dealt with in relation to each other. Such an approach, it is argued, requires integral planning processes that address the needs and interests of all economic and societal sectors. Currently, several types of instruments are employed. These involve assessment instruments such as Cost Benefit Analysis (CBA) that are used in the evaluation of projects in, for example, coastal zone and river basin management. The cornerstone of water management is still the traditional instrument of direct regulation, but the use of economic instruments such as taxes and subsidies is gaining importance. The existing legal framework and instruments are gradually modified to enable the realisation of an integrated approach[2].

To underscore its decision-making processes, the Dutch Ministry of Transport, Public Works and Water Management (V&W) traditionally collects and processes information on the economic, environmental and social dimensions of water supply and demand. There is a continuing need to control the quality and quantity of water and to adjust to changing phys-

[2]The need for adoption is under continuous discussion in relation to the choice of government policy approaches (RWS, 1998; DWW, 2001).

ical and geological circumstances. However, as argued above, the social context of this process is changing. In particular, the economic implications of ecological effects, following interventions to control water systems, have become accepted as substantial and significant information inputs into the decision-making process. Moreover, an emerging tendency can be observed in EU-member states to monetise the environmental effects of water management interventions (Wateco, 2002).

Other important drivers for structural change in water management involve: (a) changes in societal environmental awareness, which are reflected in more stringent environmental legislation; (b) technological advances in flood control, including hydraulic works to protect coastal zones from flooding, whilst safeguarding the hydraulic needs of ecosystems; (c) a widening of the spatial focus of water management, from smaller areas protected by dykes to areas the size of a complete river basin; and (d) the fact that management recognises the needs of an increasing number of stakeholders.

12.4.3 Developments in EMA

Several of the structural changes in water management referred to above are reflected in the use of CBA by decision-makers. By using this assessment technique, decision-makers try to evaluate all the socio-economic consequences of their interventions. This development has strong similarities to the rise of the EMA technique of Total Cost Assessment (TCA). In 1993, the US Environmental Protection Agency (EPA) organised a workshop to produce an Action Agenda to encourage the use of TCA by businesses. TCA is designed to facilitate an understanding of the full range of environmental costs associated with a project and the integration of these costs into decision-making (EPA, 1995). TCA is a private rather than a social CBA, and was applauded for the comprehensive way in which it incorporated the financial costs and benefits of environmental projects.

Within Dutch water management the use of a traditional CBA has been standard practice in project evaluation for a long time. Recently, however, it is noticeable that a widening concept of costs and benefits has sought to include the economic benefits and costs of ecological consequences. As an example, it is enlightening to consider the process of decision-making which relates to investments in hydraulic works in the Grevelingen sea inlet. This project is part of the large Delta plan, protecting most of the south-west Netherlands from flooding. The first CBA was carried out in 1954 on the Delta project as a whole and included the Grevelingen works. A second

CBA was carried out in 1972, assessing the Grevelingen project with a particular focus on the costs and benefits of developing it as a natural conservation and recreation area. In 1974 a third CBA took place as a reduced version of the second one, with an emphasis on cost-effectiveness analysis. Whereas the three CBAs all report on the economic dimensions of the consequences of the project, they differ markedly in their design. The very same information was generated in a fourth CBA after the projects were installed when the economic dimensions of the projects were reported to the management in 2000.

It is clear that the accounting of costs and benefits with respect to the Grevelingen has changed over time. The most extensive CBA was performed in the 1954 analysis, assessing all sub-projects of the Delta Plan in an integrated study. Numerous cost and benefit items were examined, but environmental values were not given a great deal of attention. A more complete identification of environmental costs and benefits was carried out in 1972 and 1974, yet these CBAs were less complete in the sense that they focused on only those projects relevant to the development of the Grevelingen as a lake for recreation and as a conservation area, within the limits set by the Delta sub-projects that by then had already been completed.

Table 12.1 compares these four CBAs. All of these identify the potential *recreational* benefits of the projects, but the 1954 and 1974 versions provide only partial analyses of these benefits. The 1974 CBA estimated the value of recreation in the newly constructed Grevelingen lake as the consumer surplus generated, which is the difference between the price that consumers are willing to pay for a service or product and the price they actually pay. The 1954 and 1974 CBAs estimated the recreational value by estimating the potential cash flows (for example, from rent) resulting from the recreational use of the lake.

Environmental values were taken into consideration in the various CBAs, but in different ways. The impact of hydraulic projects on the existence value of natural amenities was identified in the CBAs, but was not quantified as a cost or benefit. Furthermore, the 1954 CBA did not calculate costs and benefits in great detail, because of technical and other uncertainties (e.g. impacts on eco-system and market developments). With regard to the cost specifications of the Delta Plan, the Dutch Delta Act states that "a more extended specification of the amounts listed in this balance with respect to the general and preliminary characteristics of the CBA seems inappropriate...". However, for large hydraulic works, including some works related to Lake Grevelingen, cost estimates are made. Referred to as natural values, environmental values were identified in the 1972 and 1974 CBA, but not quantified as yet.

As shown here, after the completion of the Grevelingen projects there was a continuous increase in environmental awareness among the staff of the public organisation that managed the Delta works. As a consequence, the ecological dimensions of the water systems were modelled and accounted for in non-financial terms. Insights into the economic value of ecological dimensions, such as the benefits for fisheries and the growing intrinsic value of the natural environment, gradually drove management towards a monetary evaluation of the ecological dimensions in order to underline the economic appeal of their past decisions. Yet, in this process, it gradually came to be suspected that the additional economic costs of the ecological effects of past decisions could be substantially higher. Substantial efforts were made to link physical interventions in the water system to their ecological consequences and to include the economic costs and benefits thereof in the final evaluation. A study by Bouma and Saeijs (2000) on the Grevelingen provided some approximate indications on the economic losses related to the reduced ecological quality of the area. These new insights inspired a process of change in water management, the outcome of which is still unknown.

Table 12.1. A comparison of three cost-benefit analyses assessing the hydraulic works in the Grevelingen sea inlet (Bouma and Saeijs, 2000).

	1954	**1972**	**1974**	**2000**
Recreational value	Identified and partly quantified	Identified and quantified	Identified and partly quantified	Identified and partly quantified
Environmental value	Not identified	Not identified	Identified	Identified and partly quantified

An important role for an ecologically oriented CBA is to inform external stakeholders that their stakes are acknowledged in the decision-making process. This is also suggested by the regular application of CBA outcomes in the political struggles around the execution of specific projects. In this respect, the use of EMA as a link between internal and external information demands requires the further development of generally accepted CBA formats and practices. Further research on the behavioural consequences of EMA is required with respect to the use of ecologically oriented CBAs.

In water management, it can be concluded at this stage that the way in which costs and benefits are accounted for in decision-making is strongly determined by the political process and by the lobbying activities of social groups and businesses. Formal pressure can be observed, for example, in relation to EU directives to integrate ecological costs and benefits into project appraisal procedures. Informal pressures are put upon the Ministry of Water Management by stakeholders with an economic, or other, interest in the outcomes of its decisions[3]. The physical dimensions of the field will of course determine what kind of ecological consequences are at stake, and in general these may be quite diverse. EMA techniques, CBAs and systems for integral water management should be capable of dealing with this diversity.

It can be concluded that the mechanism of coercive isomorphism which was referred to above will play an important role in the further development and use of EMA, in the shape of an ecologically oriented CBA. The identification of the effect of this particular mechanism provides insights into processes that transform institutional developments into concrete consequences for EMA. Table 12.2 summarises some contextual developments in water management and their implications for EMA in this field. In addition to coercive isomorphism, the mechanisms of normative and mimetic isomorphism influence the further development of EMA techniques such as CBAs in water management. With respect to normative isomorphism, further professionalisation ("normative isomorphism") is likely to occur in the process of developing eco-CBAs. This would occur as a consequence of an increase in practical experience together with this topic receiving continuing academic attention (see for example Turner *et al.*, 1994). Mimetic isomorphism may also occur within the context of water management. As decision-makers face uncertainties in dealing with the effects of hydrological projects that they have difficulty in evaluating (for example, the value of nature conservation), they might copy the approach that other decision makers use in similar contexts.

[3] A current research project at the Erasmus Centre for Sustainable Development and Management (ESM), Erasmus University, Rotterdam, deals with these issues in the context of the use of economic instruments in integrated water management: see Bouma and Correljé (2000) and Boot and Schuijt (2001).

Table 12.2. Overview of institutional changes with their implications for environmental accounting activities in water management

Institutional issues related to decentralisation	**Implication for environmental management accounting activities**
Increased role for market mechanisms in the allocation of water to different users.	Focus on the economic values of water systems for different stakeholders in the assessment techniques for project appraisal. More involvement of stakeholders in attaching monetary values to ecological costs and benefits in a CBA.
Increased pressure for accountability (linking external reporting to internal reporting)	Information externally gathered is forced into the EMA reporting systems. Transparency and professional legitimisation is needed with regard to the format of the CBA that is used for decision- making.
Changes in the set of stakeholders	Recognition of the information demands of stakeholders with an interest in environmental quality (such as environmental pressure groups).

12.5 The Energy Sector

The Dutch energy sector is in a process of liberalisation and partial privatisation. The traditional approach to the environmental impacts of energy production and consumption implied that the energy firms, and the Ministries of Economic Affairs (EZ) and of the Environment (VROM), developed and implemented detailed ‘action plans’. In the new liberalist approach this system of self-regulation has been abandoned. The firms are now expected only to meet the general environmental standards imposed upon them, whilst economic instruments such as carbon taxes and subsidies for energy efficiency, and labels for the use and supply of ‘green’ energy, are expected to contribute to the development of a sustainable energy supply system. Within the context of a competitive market, these changes require a fundamental overhaul of the strategic management of the firms in the sector and of their information needs (Correljé, 1999).

12.5.1 Physical Impacts

The main physical impacts addressed in respect of the energy sector are the several types of emissions (CO_2, NO_x, SO_2 , volatile compounds, dust) which emerge from the production and use of (fossil) fuels. By and large, the four main solutions to these problems are: (1) the reduction of emissions through end-of-pipe measures; (2) increase in energy efficiency per activity; (3) reduction in energy use by discouraging energy-intensive activities; (4) enhanced use of non-fossil fuel energy.

In the traditional structure, before liberalisation, the Dutch energy sector concluded 'voluntary' agreements with the government that included aggregate objectives for the reduction of those emissions. The allocation of reductions between the various firms was determined through negotiations between those firms themselves. It is important to realise that in those plans the former energy utilities were given the task of not only reducing their own emissions, but also of carrying out and monitoring energy conservation policy towards the various groups of end-users such as domestic users, commerce, industrial sectors, etc. On the basis of these voluntary agreements, the firms in the sector, together with the Ministries of Economic Affairs (EZ) and of the Environment (VROM), developed and implemented detailed action plans for execution by the local distribution firms, which were owned by municipalities. These plans included information campaigns, technical assistance on energy-saving measures, and encouragement of the use of 'green power', funded through a levy on consumption which financed subsidies for the distribution firms and end-users. The utilities thus assumed the responsibility to meet pre-specified targets through specific target-group oriented projects, for which they were compensated. These targets were defined, at least formally, in terms of their contribution to each of the four main solutions referred to above.

12.5.2 Structural Change

By the mid-1990s, the Dutch Government initiated a process of liberalisation in the energy sector (EZ, 1996). A new electricity law was accepted in April 1999, and in June 2000 the new gas law was passed. In stages, three pre-defined categories of end-users were given the right to 'shop around'. Electricity and natural gas distribution networks have been opened up to third-party suppliers, and the operation of these networks has been separated from the trade divisions of the former utilities.

Parallel to this liberalisation, a radical restructuring of the sector is taking place which involves horizontal integration, vertical (de-)integration, diversification and a limited degree of privatisation. Most of the local utilities have merged into three large multi-utility firms, dividing up the country, plus a number of smaller gas or power suppliers. Joint ventures have been established with foreign firms to supply liberalised groups of consumers. The four large power production firms have either been sold by their provincial and municipal shareholders to foreign firms, or re-integrated into Dutch distribution firms. New market participants are constructing independent electricity production capacity, and/or import electricity from Germany or France. The current industry structure, the existence of excess production capacity and low-priced imports, and the regulatory objectives pursued by the competition authority, DTe, are encouraging a fairly competitive market for electricity. In contrast, the behaviour of the gas industry remains tied to its place within the European gas system, which so far has not provided for lower priced gas on the continent (Correljé and Odell, 2000).

Meanwhile, the Dutch government maintains ambitious objectives regarding energy conservation and the use of renewable energy (EZ, 1999, 2001), but the traditional approach towards the environmental impacts of energy production and consumption has been abandoned. Parallel to the liberalisation of the energy market, the government was developing a new sustainability policy, based largely on economic instruments (such as subsidies and taxes which stimulate new ways to engage in innovative and effective initiatives), instead of on the traditional self-regulation of target groups. It also reduced the role of the (former) energy utilities, for whom energy-saving can no longer be considered a core activity. Since the firms now consider each other as competitors, they reject sectoral agreements and refuse to share strategic information on their customers and markets. In addition, the pressure upon firms to enhance profitability has reduced the staff and finance available, while the traditional cross-subsidisation between energy supply and network exploitation is now impossible (Correljé 1999, 2001).

12.5.3 Developments in EMA

In the past, the execution of the energy-saving campaigns was of considerable importance to the energy firms' operations. The objectives which were agreed upon and formulated in the Environmental Plan for the Energy Sector, as well as in the individual plans for each of the firms, were among the main parameters upon which the utilities based their environmental strategies. The degree to which they were successful in meeting their targets determined the amount of compensation that they eventually received eventually, and the firms were obliged to keep track of their achievements and report them in Annual Reports. Information about the execution of the firm's sustainable energy plans and the way in which the several target groups were addressed (whether successfully or not) was an essential element in management information, though this information was directed exclusively at proving that the standards and targets agreed upon with the Ministries of Economic Affairs (EZ) and of the Environment (VROM) had been met.

In the current liberalising context, the firms in the sector are as a minimum expected to meet the general environmental standards of their own operations, but the purpose of carbon taxes and subsidies for energy efficiency and tax-rebates for 'green' energy is to stimulate *users* to purchase sustainable energy. The supply-side firms are expected to make amounts of green power and equipment available within the context of a competitive market, so that the user has the choice of where to go, and suppliers have to compete. Moreover, the utilities have been split up into energy supply firms and network operators with separate accounts and operations, which impedes the allocation of cost and revenue elements as a function of what is most 'practical', given the parties involved. Finally, it is no longer self-evident that users buy their energy from the supplier which is associated with the firm that, at arms' length, operates the network. This has consequences for the four main groups of firms in the sectors:- traditional production firms; new producers of green power; retail energy suppliers; and network operators.

For the *traditional production* firms, the situation has not changed dramatically. They have to meet the general environmental and emission standards of their own operation. EMA may however become crucial, if tradable emissions permits are introduced. This will require management to choose between, on the one hand, the option that involves producing power, selling it and buying emission permits in the market and, on the other, the option to stop production when the quota has been reached, or to invest in sustainable power production.

For *new producers* of green power, adequate information about their production, particularly of the primary energy inputs water, wind, sun, biomass, etc., is crucial since the valuable green label is awarded only if the origin of the power can be shown to be green.

For the *retail energy suppliers,* the fact that the policy for green power is fairly successful among consumers, whilst a system of labelling is being developed for both indigenous and imported green power, requires the management of these firms in the sector to take seriously into account the origins of their power. In addition, it can be expected that systems of labelling will also be developed to brand imported nuclear and brown-coal generated electricity, in order to distinguish it from ‘green’ or ‘blue’ (natural gas-fired) power.

For the *network operators*, the need to develop an adequate EMA system emerges from the fact that the Dutch Gas and Electricity Laws have enabled municipalities to start tendering procedures for the construction of energy infrastructures in newly (re)constructed areas. Obligatory energy use standards are directed only at buildings. According to the Dutch Electricity Law and the Gas Law, supply options that apply to an area or neighbourhood are not allowed in principle when they interfere with the required separation of the operation of networks and supply. To support the development of local sustainable energy supply systems, both the Electricity and Gas Laws contain a provision that enables municipalities to select firms other than the appointed regional network operator, in a competitive procedure for the construction and exploitation of environmentally friendly supply systems, involving the operation of the local network as well as the supply function. Competition with other potential applicants should stimulate bidding firms to develop more innovative, cost-effective and sustainable concepts, whilst safeguarding the required cost realism. This tendering approach requires municipalities to create an effective selection procedure which includes effective criteria for evaluation and measures to control the exploitation of the newly created sustainable systems, since these will become new local monopolies. This requires the network operators to devise new appropriate systems of information gathering and processing, in order both to be able to tender effectively (possibly with specific partners) and to operate the systems (Correljé, 2001).

Table 12.3 summarises the observed changes in the energy sector. It could be argued that the demise of traditional environmental policy through the utilities has reduced the role of coercive isomorphism as a unifying force. Policy instruments are now aimed directly at energy users, whilst energy sector firms have been given leeway to develop their own brands and images. This produces a situation in which EMA systems seem to develop according to the specific role of sustainability in each firm’s marketing approach. This is reflected in the information which is presented and highlighted in Annual Reports and media advertising. Coercive isomorphism emerges only around those issues where the Dutch regulator, DTe, demands reporting on firms’ specific behaviour; but so far it has not addressed environmental issues and therefore this has not been applied yet to EMA.

Neither does mimetic isomorphism as a mechanism for dealing with uncertainty seem important in the development of EMA. In spite of considerable uncertainty, in order to get rid of their uniform public utility image, firms in the sector try to emphasise the ways in which they differ from their competitors in their commercial and environmental approaches. The same development can be observed regarding normative isomorphism. In the past, professional culture and a common educational background were proverbial in the sector. In today's energy sector, however, firms deliberately 'shake up' their staff by adding new people from different commercial, strategic and technological backgrounds.

Table 12.3. Overview of institutional changes with its implications for accounting activities in the energy sector.

Institutional issue	**Implication for environmental management accounting activities**
Liberalisation and privatisation	Focus on stakeholders and (potential) shareholder value and regulators' guidelines in decision-making, steering the specific use of EMA.
Increased pressure for accountability (linking external reporting to internal reporting)	Strategically motivated external information demands determine the production of specific environmental data.
Change in the set of stakeholders	EMA serves (informally) customers and interest groups, (more formally) municipalities, business partners and suppliers of power and financiers; and (as fixed by legislation) regulators and government.

12.6 Final Remarks

It has been stated already that in both water management and the energy sector, there will remain a tension between, on the one hand, the use of economic instruments and methods of evaluation as efficient tools for decision-making and, on the other hand, the fact that a 'price' is often insufficient as an indicator to support rational, informed decision-making. This is, firstly, a consequence of the complex mix of features which alternative choices represent, and the fact that they cannot be added. A second factor is that the actual 'service' delivered is not so easily defined, either in terms of scale and scope or in terms of quality or reliability (Correljé, 1999). The simple conclusion is that unambivalent qualitative and quantitative indicators will remain necessary for the evaluation of alternatives and for environmental policy-making.

A further conclusion from this overview of the change in EMA practices is that the processes of decentralisation and liberalisation in the water and the energy sector have resulted in a more varied requirement for EMA information about specific types of environmental performance. In the past, the environmental performance of a centralised sector was defined and evaluated by public authorities under a certain amount of influence from the political process and environmental interest groups. Consequently, it was part of the institutional relations of management and EMA practices were structured accordingly.

Today, however, decentralisation and liberalisation may bring many aspects of environmental performance into the realm of customer/stakeholder relations and commercial strategy in EMA. Specific environmental aspects of products and production may become positive or negative 'marketing assets' to a firm or a product, either attracting new customers or 'selling' (water management) strategies to traditional ones. Hence, the feedback between central commercial objectives and some environmental aspects will become much stronger.

The consequences for the design of EMA systems and the choice of indicators will be very much a reflection of what the market dictates. So, in the broad sense of a trend towards commercialism, it is true that the results of decentralisation and liberalisation are predictable and that the mechanism of isomorphism will stimulate homogeneous behaviour. However, the specific strategies which are chosen by firms and organisations and the variations in their specific physical and societal contexts will lead to a much larger variety in the demand for EMA information and in processing approaches.

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13. Introducing Environmental Management Accounting into Small and Medium-Sized Enterprises*†

Aldo Pilisi and Alessia Venturelli

ECO 90, Environment and Safety Department, Associazione Industriale Bresciana (A.I.B.), Italy

pilisi@aib.bs.it

Abstract The Industry Association of Brescia (AIB) has recently started a programme to promote environment management systems (EMSs) and safety management systems (SMSs) among its small and medium-sized (SME) member companies, with the aim of the continuous improvement of plant safety. The programme is based on the premise that plant safety is closely related to the quality of the organisation, to which the EMS and SMS can contribute.

To support this programme, a research campaign was launched to collect data and gain the experience necessary to overcome the present reluctance of almost all the SMEs for these systems. This four-year campaign involves sixty pilot companies of differing sizes, operating in different industrial fields and already having quality management systems (QMS) implemented and certified. In these pilot companies firstly an EMS and subsequently a SMS will be implemented.

Despite the very favourable conditions offered to the pilot companies and the high level of confidence between the association and its members, very few companies initially agreed to implement the proposed systems. However these difficulties were overcome and the campaign is now successfully in progress. The experts are now working 'in the field' in more than twenty pilot companies, which will have a certified EMS implemented by early 2002, and another forty are on the waiting list.

*This paper reports on the design of and initial results from a research project which is also the subject of the following paper, Venturelli and Pilisi "EMA in SMEs: Ten Italian Case Studies". These papers are intended to be read together, in the sequence in which they appear in this book.

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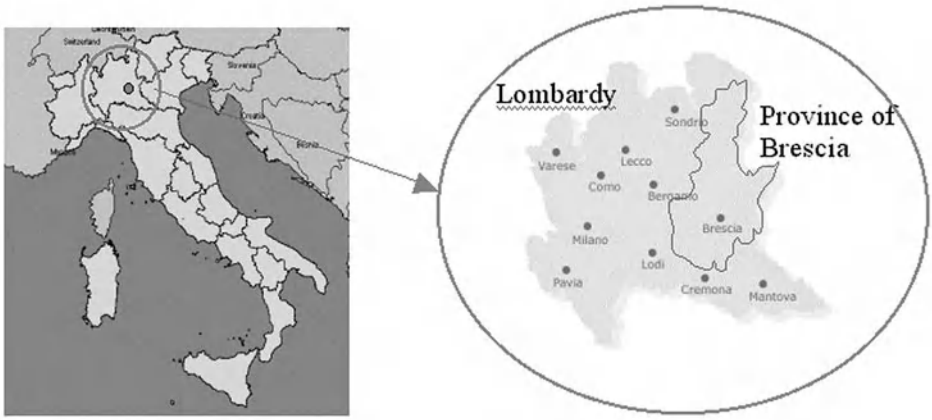
M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 281-307.

Figure 13.1. Location of AIB



The analysis of operational costs played a vital role in gathering and convincing the pilot companies, which were interested primarily in reducing operational costs as part of their production costs. A lot of attention was therefore devoted to this: starting from the QMS costs and following a particular approach, the companies have been assisted not only in implementing an EMA system, but also in improving their accounting systems generally.

These considerations, together with the work already performed in the campaign, will be addressed in the paper.

13.1 Industry in Brescia and the Industry Association of Brescia (AIB)

13.1.1 About AIB

The Industry Association of Brescia (AIB) is in Lombardy, a region in the north of Italy. Brescia is the second largest city in Lombardy, with about 200,000 inhabitants, and is situated about 100 kilometres east of Milan. The whole province has over 1,100,000 inhabitants in an area of 4,800 square kilometres and represents one of Italy's most important industrial centres, with over 90,000 firms and 480,000 employees.

AIB is the third largest local industry association in Italy, after Milan and Turin, with about 1,500 associated firms. It is one of more than 100 local association members of Confindustria, the main national federation of manufacturing and service companies in Italy. Confindustria represents industrialists in their relationships with Italy's political and administrative institutions, including the government, parliament, trade unions, etc. With its 111,000 associated companies and about 4,200,000 employees, it is divided into local associations (such as AIB), regional and sectorial federations, as well as into associations of categories.

The operating structure of AIB consists of about eighty employees, divided into four main departments. The environmental and safety department (ECO 90) is helping firms to solve their current problems concerning safety and the environment. It also promotes strategic or long-term initiatives which are of interest to all associates, but which they are unable to manage on an individual basis.

13.2 AIB's Strategy in the Field of Safety

The project on environmental, quality and safety systems illustrated in this paper started from such an initiative. It began two years ago and its objective was to promote the process of continuous improvement in safety in the workplace.

The following three considerations served as a starting-point:

1. The passing of EEC Directive number 391/89 into Italian law has not had the expected results.
2. The quality of safety in the companies depends closely on the quality of their organisation.
3. Possible integrated and certified, can contribute significantly towards improving the organisation and hence safety.

On this basis, AIB developed a strategy and the required measures to arrive at a widespread use of safety systems in the participating companies. The strategy was tailored to the needs and characteristics of small and medium-sized enterprises (SMEs).

Table 13.1 shows the overall number of local units in the Province of Brescia, compared with Italy as a whole. It is immediately apparent that the great majority of these firms, at both national and local levels, have less than ten employees (92% in Brescia, and 94% at a national level). Since this figure is calculated from all activities this is perhaps not surprising, since it includes all small businesses, such as shops and artisans.

Table 13.1. Total number of Italian and Brescia local units.

Employees	under 10	10-50	50-100	100-200	200-500	over 500	Total
Brescia							
Number of firms	71,637	5,856	382	160	74	10	78,119
%	91.7%	7.5%	0.5%	0.2%	0.1%	0.0%	100.0%
Italy							
Number of firms	3,232,814	178,791	13,623	5,930	2,814	888	3,434,860
%	94.1%	5.2%	0.4%	0.2%	0.1%	0.0%	100.0%

Table 13.2. Number of local units excluding shops, farms and building firms.

Employees	10-50	50-100	100-200	200-500	over 500	Total
Brescia						
No. of firms	3,757	268	107	56	6	4,194
%	89.6%	6.4%	2.6%	1.3%	0.1%	100.0%
Italy						
No. of firms	89,022	7,417	3,262	1,467	407	101,575
%	87.6%	7.3%	3.2%	1.4%	0.4%	100.0%

Table 13.2 shows the same statistics, excluding companies such as shops, farms and building firms which are not considered to be industrial enterprises and which are known to have only a limited number of employees. Firms with less than ten employees, for which standardised systems of management can seldom be applied, are also excluded. The table shows that even after this, most industrial companies are small firms: in Italy, more than 95% of the companies have less than 100 employees and indeed in Brescia, 90% have 10 to 50 employees.

It is interesting to note two peculiarities of industry in Brescia, which demonstrate the importance of local companies within the Italian context, and which helped in giving direction to the research project:

1 there are about a hundred different provinces in Italy, so it is apparent from the total column of Table 13.2 that Brescia has approximately four times as many companies as the national average across all provinces.

2 in terms of the numbers of local units, Table 13.3 shows data for the two most common industry activities.

Table 13.3. Number of local units engaged in the two most common activities in Brescia.

Code	Activities	Number of local units in Brescia	% of Italy
27	Production of metals and alloys	287	16.4%
28	Making and working of metal products, excluding machinery	1,239	7.4%

The two activities represent 16.7% and 7.4% respectively of all national firms in these sectors: in fact Brescia is one of the main industrial centres for metal-working.

Taking into account the specific situation described above, it was decided to launch a test campaign in favour of the less-organised SMEs. As a result, a model would be created that could then be applied to other associate companies of the AIB. It should be noted that the introduction of EMA systems was not originally an objective, and that this was only considered at a later stage.

13.3 Experimental Campaign for Environmental, Quality and Safety Management Systems

13.3.1 Initial Actions Before Implementing a Safety Strategy

The project on environmental, quality and safety systems started with two considerations in mind:

1 in order to involve the companies, which were sometimes very reluctant to adopt management systems especially for safety and the environment, AIB had to convince them of the technical, operational and, above all, economic advantages of these systems.

2 the existing experience and competence within the companies were not sufficient to reach this aim.

13.3.2 Experience in Standardised Management Systems

The following figures on the certification of environmental management systems (EMSs), according to Standard ISO 14001 and as of 31st October 2001, indicate the limited diffusion of management systems and therefore of the limited experience available in applying them:

- in Brescia and Province only 22 firms were certified (27 local units);
- in Lombardy only 271 local units were certified;
- in Italy as a whole only 1090 were certified (in the context of 3.5 million local units);

So far only a very limited number of companies, usually belonging to particular production sectors or with high environmental impacts, have shown interest in environmental accounting. The number of companies certified according to the Eco-Management and Audit Scheme (EMAS), the other well-known standard for EMSs, does not show any significant difference: there are less than 100 EMAS-registered sites in Italy[1]. Safety systems are virtually unknown.

Table 13.4 below shows the number of Italian companies with ISO 9000 and ISO 14001 certificates. The large difference in the applications of quality management systems (QMSs) and of EMSs is notable.

The experience of AIB's ECO 90 office shows that companies with ISO 9000 certificates are not necessarily better disposed towards the introduction of environmental and safety systems, and that in fact they frequently adopt such systems for marketing reasons rather than because of any real belief in their advantages.

13.3.3 Aims

The project on environmental, quality and safety systems had two aims:

1. to create the experience that was lacking;
2. to enable the creation of a group of experts who could transfer this experience to all companies.

[1]For application of EMSs in Italy see: Andriola (1998); ANPA (1998).

Table 13.4. Number of quality and environmental system certificates.

Region	**30 June 2001**		**31 October 2001**	
	ISO 9000	**ISO 14001**	**ISO 9000**	**ISO 14001**
Abruzzo	949	51	1,055	54
Basilicata	320	8	367	10
Calabria	561	9	726	10
Campania	2,653	56	3,397	73
Emilia Romagna	4,202	63	4,934	92
Friuli Venezia Giulia	937	21	1,093	30
Lazio	3,326	35	4,440	45
Liguria	1,240	39	1,384	53
Lombardia	**10,659**	**195**	**12,203**	**271**
Marche	1,078	12	1,209	12
Molise	207	8	234	12
Piemonte	3,727	89	4,592	116
Puglia	1,437	43	1,755	59
Sardegna	482	11	616	17
Sicilia	1,202	21	1,622	44
Toscana	2,561	37	2,967	47
Trentino Alto Adige	548	26	655	34
Umbria	774	4	938	5
Valle d'Aosta	79	2	105	1
Veneto	4,183	82	4,982	105
Undefined	92	14	-	-
Total	**45700**	**826**	**49274**	**1090**

It was decided to set up an integrated quality, safety and environmental management system in sixty SME member firms. They were chosen in association with local universities and operators in this sector with particular environmental and safety expertise.

As an incentive to persuade firms to take part in this experimental project, the AIB and the local Chamber of Commerce offered to cover all costs incurred.

13.3.4 The Three Phases

In view of the complexity of the issue and in particular the difficulty of motivating member companies to participate, the project was designed to be phased in as gradually as possible. It was divided into three successive campaigns to test in quality-certified firms:

1 EMSs;

2 safety systems;

3 integrated quality, safety and environmental management systems.

Each phase should have involved 10, 20 and 30 companies respectively, making a total of 60. Precedence was given to testing EMSs, for the following reasons:

- there was a certain diffusion of ISO 14001 certificates, and so there was some experience to refer to.
- there would be sufficient time to study and select the regulations and criteria to apply to safety systems.
- furthermore, this allowed companies to acquire experience on the certification of management systems, starting from the simplest ones. In SMEs, the environment is certainly a simpler subject to tackle than is safety.

13.3.5 Guidelines

On the basis of a preliminary run in four pilot companies, a first version of guidelines for adopting an EMS was set up and then discussed with the main ISO 14001 certifying bodies. The guidelines addressed, in particular, the development of a preliminary environmental analysis and documentation, since these are the activities that require most work in the companies. The preliminary environmental analysis aimed to identify any legislative shortcomings and to indicate where environmental improvements could be carried out. The method proposed was as follows[2]:

1 Analysis of the site (company description and territorial ties)

2 Analysis of production activity (analysis of the production cycle, materials balances and analysis of suppliers)

3 Analysis of environmental aspects, such as emissions to air, releases to water, wastes, contamination of land, etc.

[2]For a survey of methods see: AICQ (1999); Casciani et al (1997, 1999); D'Incognito (1997); Federchimica (2000); Gervasoni (2000); Venturi (1998).

4 Analysis of accidents

5 Assessment of environmental aspects and of accidents

The establishment of materials balances in the study of the production cycle (as required for step 2 above, analysis of production activity) turned out to be a new issue for the companies. This required a series of partial balances for each production phase, the sum of which was to be used as a materials balance for the whole production process. At the same time it would become possible to identify the environmental impacts of the production processes, of which the companies were at that stage unaware. From the outset, various employees in the participating companies were involved, thus initiating a process of training and information throughout the whole firm.

The tables for the analysis of the various environmental aspects (see point 3 above, analysis of environmental impacts) are based on the ECO90 office's twenty years of experience in environmental concerns , and turned out to be particularly efficient.

The guidelines for documentation included:

- a proposed structure for procedures and the manual
- proposed chapter headings for the manual
- a list of procedures needed
- examples of operating procedures, which were very useful for the companies.

13.3.6 Project Partners

For the project on environmental, quality and safety systems it was decided to choose partners who:

1 could give technical support and have experience complementary to that which AIB's ECO 90 office could offer;

2 have technical and scientific prestige (necessary to overcome any reluctance from the companies);

3 have a high public visibility (helpful in achieving the strategic aims);

4 would give financial support.

The partners finally chosen were: the Brescia Chamber of Commerce; local universities, in particular the Faculties of Engineering, Physics (for the environment) and Medicine; and the ENI Enrico Mattei Foundation. The partners operated within an organisational scheme which was coordinated by AIB. Furthermore, some of the most highly-qualified consultants in the Brescia area collaborated under contract with personnel of the ECO 90 Office for the practical implementation. They were thought of as the 'apostles' who would later spread the word of the experience gathered during the project to all member companies of AIB.

13.4 EMA as an Instrument to Recruit Pilot Companies

13.4.1 Criteria for the Selection of Companies

As it expected to have a large number of candidates, AIB decided in planning the project to define selection criteria for candidate companies so that the experiment would have a precise statistical significance. A model sample of firms was set up which was representative of the structure of local industry and covered the 15 main production activities of industry in Brescia (see Table 13.5).

By analysing these activities and excluding both those that could not be considered fully industrial (such as commerce, the tertiary sector, and agricultural activity), and companies with less than 10 employees (where an EMS was not very appropriate), the 'ideal' sample was set up as follows:

Suitable candidate companies would have to belong to one of the groups defined in the ideal sample above, be small, and adhere adequately to the following criteria:

1 environmental impact: this parameter led to a preference for either companies with the largest number of environmental problems typical of their sector, or companies that represented the 'worst case' in terms of technology and the location of the site in relation to built-up areas.

2 commitment: how willing and motivated the companies were to join the experiment.

Table 13.5. Number of local units in the main production activities in Brescia

Activity	**Number of employees**					**Total**	**%**
	10-50	**50-100**	**100-200**	**200-500**	**over 500**		
Production and working of metal products, excluding machinery and plant	1,164	58	10	7	0	1,239	29.5%
Production of machinery and mechanical apparatus; installation and repair	410	59	21	8	3	501	11.9%
Production of clothing; preparation and dying of furs	428	16	4	3	0	451	10.8%
Textile industry	314	27	15	6	0	362	8.6%
Production of metals and alloys	205	36	30	14	2	287	6.8%
Production of articles from rubber and plastics	223	16	6	1	0	246	5.9%
Preparation and tanning of leather; production of suitcases, bags, footwear	176	6	2	0	0	184	4.4%
Other professional and entrepreneurial activities	132	7	4	1	1	145	3.5%
Food and drink industries	119	12	4	2	0	137	3.3%
Production of goods from non-metallic minerals	120	7	2	2	0	131	3.1%
Production of machinery and electrical apparatus	113	11	4	3	0	131	3.1%

It was also decided to give priority to companies with a well-developed company ethos and where stakeholders were exerting a certain pressure on environmental issues.

Table 13.6. The "ideal" sample.

Sectors	**Number of firms**
Mechanical	30
Foundries, Steelworks etc.	5
Footwear	4
Chemical	4
Quarries	3
Textiles	3
Paper and printing	2
Wood	2
Food	2
Cheese	2
Transport	1
Knitwear	1
Clothes	1
Total	60

13.4.2 Introducing EMA Experimentation

In practice, however, these selection criteria proved unworkable. Despite the great advantages offered (participation was free-of-charge; the involvement of well-known experts in the field; the presence of scientific heavyweights from both local universities; the guarantee of AIB's total assistance in the future running of the scheme) and in spite of many contacts with member companies (sector meetings, assemblies, information materials, direct contacts and various kinds of communications), it was difficult to motivate ten firms to participate and to reach the number required for the first phase. Part of this lack of interest shown by SMEs was due to their mentality; they were against any organisational structure or system that would restrict their freedom of action. Above all, they saw an EMS as an extra cost which would not be balanced by measurable benefits.

The initial ideas had to be abandoned and different ways of convincing companies had to be found. The project was adapted to represent more closely the real needs of SMEs – an aspect that had perhaps been initially undervalued.

To overcome this reluctance, it was decided to offer an assessment of environmental costs in addition, as a further part of the total packet of services; however this still did not represent sufficient incentive to create enough interest in the companies. Again, there were negative reactions to AIB's offer and this activity was viewed as creating an extra cost, with only marginal benefits that were insufficient to justify it.

As previously mentioned, the pilot companies were chosen from those with a certified QMS. It was found that these companies were very interested in knowing the costs of their QMSs, but that very few actually already knew these. Pressed to accept an EMA, and curious as to the evaluation tables that AIB proposed[3], many companies finally accepted the proposal of the project to implement an EMS and EMA, on condition that AIB also carried out a quality costs evaluation. In other words, the solution to the main problem of attracting enough pilot companies was to combine both evaluations.

13.5 The First Phase of the Project

13.5.1 The Companies Involved

Applying the selection criteria explained above and visiting the sites, 12 companies were chosen from a total of 15 candidate companies; Table 13.7 lists their activities.

13.5.2 Environmental Problems

In the first phase all companies except one adopted an EMS. Most had already undergone auditing for certification to the ISO 14001 standard, carried out by an external body and with positive results. The technical and environmental difficulties found and resolved during the first phase are shown in Table 13.8.

An initial close analysis of the environmental problems shows that corrective actions were often linked with regulatory authorisations or actions of an organisational nature. It was rarely the case that laws were actually broken, requiring specific alterations of the production process. [4]

In firm 2, for example, one result of the project inspection and the action taken to comply with regulations was the identification that it was necessary to obtain authorisation for drawing water from a well. Also, as a result of

[3] See Venturelli and Pilisi, "Environmental Management Accounting in Small and Medium-Sized Enterprises: Ten Italian Cases". For EMA bibliography see the references in the same paper.
[4] These are, however, first conclusions from only a small sample of cases and can be validated only after completing the analysis in all of the 60 pilot companies.

Table 13.7. Firms involved in Phase 1

Production sector	**N°**	**Employees**	**Production activity**
Mechanical	1	80	Production of brass articles for heating and bathrooms from pressed or die-cast semi-worked materials
	2	50	Production of parts for industrial motors by machining from semi-worked cast-iron
	3	160	Production of spare parts and accessories for cars, lorries, tractors, motorbikes, micro motors; mechanical work in general, starting from pressed or cast semi-worked materials
	4	108	Production of taps and valves
Steelworks	5	390	Steel production by continuous casting of hot rolled wire rods and hot rolled bars
Building materials	6	140	Production of corrugated and flat fibre cement sheets
Dairy products	7	15	Production of Grana Padano cheese from milk
	8	190	Production of dairy products e.g. butter, cheese, from milk and its derivatives
Food and drink	9	30	Treatment, bottling and sale of wine
Textiles	10	220	Industrial cleaners, ironing, hiring of sheets, etc.; washing, mending, ironing and packaging of laundry
Chemical	11	18	Production of wheels for off hand and precision tool sharpening and for surface grinding
	12	30	Pressing of plastics

checking compliance for sewage disposal, this was found to be implicitly authorised by the building permit.

Environmental problems typical of the type of industrial activity were identified, for example, oil storage and the risk of oil spillage for mechanical companies (firms 1 and 3), or waste-water disposal for cheese companies and the food sector in general.

Table 13.8. Environmental problems.

Sector	**N°**	**Environmental Problem**	**Corrective/ Preventive Action**
Mechanical companies	1	Risk of spills	Construction of containment tanks for refuse deposits and stores for oils, etc.
		Waste, emissions	Improvements in organisational conditions for managing these (management of authorisations for transport and refuse disposal, filing of air emission authorisations, etc.),
	2	Water provision: lack of authorisation for use of well	Legalisation through request for pardon
		Sewage: council authorisation for use of septic tank	Septic tank was shown in building permit, so implicitly authorised
	3	Emissions	Conducting outside emissions from welder and from hardening oven. New plant for treatment of oily fumes emitted from machining department.
		Risk of spills	Construction of containment tanks in oil store, setting up emergency procedures for accidental spillages in the open.
		Packaging: lack of CONAI declaration	Situation regularised in 2001
	4	Fire risk: lack of prevention certificate	Drawing up preliminary project and its approval by the Fire Department. Work in progress in view of final inspection by Fire Department.
		Civilian sewage system: rainwater not separated from sewage water.	Separation of sewage systems, activation of detritus tank for sewage, and rebuilding and new lay-out for rain drains. Emergency precautions were also taken.

Table 13.8 (continued)
Environmental problems.

Sector	**N°**	**Environmental Problem**	**Corrective/ Preventive Action**
		Management of substances stockpiled in production departments	Reorganisation of oil drums stocked in departments, and labelling of containers for all substances used
Steelworks	5	Noise	Planned erection new factory building, which will reduce the worst noise emissions (caused by the melting furnace) for those outside.
		Initial rain water	Plan to collect initial rain water
		Emissions, refuse, waste water discharge	Formalisation of management procedures for these environmental aspects, which were already correct in practice
Building materials	6	Drawing of water from well	Regularisation of authorisation to drill well and extract water
		Emissions	Analysis and checking that two emissions were within limits (related to aspiration for pre-heating of sheets before painting). This was thought by the firm not to be significant, but there were doubts about the interpretation of laws and it was considered prudent to monitor
Building materials	6	Noise	Repeating the measurement and checking of limits for noise emission towards a nearby built-up area. A long-term improvement plan (the substitution of old components with new, more silent, ones) and procedures to limit noise
Cheese	7	Waste water discharge	Regularisation of authorisation for industrial water for new plant, and measurement and checking of respect of limits.
	8	Emissions	Regularisation of authorisation for new emissions

Table 13.8 (continued)
Environmental problems.

Sector	N°	Environmental Problem	Corrective/ Preventive Action
		Waste water discharge	The firm's waste-water treatment plant (chemical/physical) could not manage to guarantee conformity to authorised limits for COD and BOD. These polluting substances are however accepted willingly by the town sewage works operator, because they improve its efficiency. Talks are therefore under way to obtain a variation to the present authorisation.
Food	9	Civilian sewage system	Carrying of this liquid from present unauthorised septic tank to firm's waste water plant.
Textile	10	Management of dangerous substances: detergent store	Construction of containment tanks for detergents stored near firm's waste water plant and automation of the extraction of these detergents in order to prevent the possible mixing of incompatible substances.
		Underground tanks: fuel stores	Removal of underground tank for diesel for vehicles. Testing to see if the ground is polluted, purchase of new external tank and relative authorisation
Chemical	11	Refuse	Regularisation of the management of incoming and outgoing registers, and authorisation for transport and disposal
		Emissions	Measurement of the concentration of ammonia in emissions from oven for resinoid abrasive grinders. Provision of differential pressure gauge for sleeve filters for dust emissions.
	12	Lack of usability certificate	The firm decided to suspend the process of adopting an EMS. The main reason was the lack of a usability certificate, added to the incorrect management of a temporary refuse deposit and a series of changes to be made to obtain a fire certificate.

13.5.3 Behavioural Problems

Another interesting aspect of the project is the series of 'behavioural' problems that were detected or that occurred during the auditing process. These are very variable and specific to the particular company involved.

The AIB workgroup set up for this project had to intervene a number of times to resolve problems. For example:

- an intervention of the workgroup in firm 2, for training on ISO 14000 rules.
- an observation made by the same workgroup in firm 6 to the consultant, who was unable to apply the methodology in order to carry out correctly the initial environmental analysis.

This shows that even local consultancy firms who were specialists in environmental concerns lacked specific know-how in setting up EMSs, and in fact needed the help of the project workgroup for this.

13.5.4 Documentation and Audits by Certifying Bodies

Contrary to expectations, the formal writing of the documentation was not a major difficulty. Often the companies themselves, who had learned from their previous experience with the QMS, proposed solutions that were best suited for them. It should be noted only that due to modifications which were made to rules on quality system management by the 2000 ISO 9001, some companies preferred for the sake of simplicity to integrate their quality and environment systems only partially or sometimes not at all.

It is interesting to mention briefly the behaviour of the certifying bodies during the two audits established. Approaches to verification were very different, even among inspectors belonging to the same organisation. For example, there were audits of compliance with legislation carried out by lawyers and verification by technical persons who showed their ignorance of environmental legislation. There were also inspectors who carried out in-depth interviews with the firm's employees, even those without any particular environmental functions, and others who accepted general assurances by the Environmental Manager on fundamental parts of the system. This problem of uniformity of audits, though not confined to that of environmental systems, should always be kept in mind. These problems are perhaps even greater in QMS audits, given the wide range of the subject.

Table 13.9. Difficulties in Behaviour.

Sect.	N°	Problem	Solution
Mechanical	1	The consultant applied his own analysis schemes and the workgroup method with little flexibility; he preferred to compile all documents himself, and involved the firm only to a limited degree.	The workgroup requested that the materials balances which were compiled by the consultant after meetings with the firm, were at least checked by the section head.
		The Quality Manager rarely accepted suggestions from the consultant or the workgroup, as he had his own philosophy and did not accept other views of the problem.	
	2	The consultant was seldom present in the firm. He maintained that he had frequent contacts with the firm by telephone etc., but did not seem to follow any well-defined methodology.	After a programmed meeting the workgroup, in agreement with the firm and the consultant, fixed the agenda for the next meeting in order to bring activities back to the project guidelines.
		The firm requested basic training on the ISO 14001 standard, which it thought would help in tackling more successfully the initial environmental analysis that was under way.	In a special meeting, the workgroup explained the content of the ISO 14001 standard to the complete satisfaction of the firm.
	3	The project representative for the firm had problems with lack of time, given his many different tasks, and so had difficulty in the stage of formally drawing up the preliminary environmental analysis	Since drawing up the documentation was a fairly large job, the workgroup informed management of the need for another person to help the Environmental Manager.

Table 13.9 (continued)
Difficulties in Behaviour.

Sect.	**N°**	**Problem**	**Solution**
		The Quality Manager seemed opposed to using a person from his office in the project of adopting a system of environmental management.	The workgroup, together with the important collaboration of the person responsible for the environment, defined a way of involving this person in a way that satisfied the management and the Quality Manager.
	4	The person from the firm responsible for the project had limited autonomy and a scant knowledge of environmental issues.	The workgroup worked closely with this person, helping him both with technical problems (using the ECO 90 office) and with management choices.
		This work took a long time, largely because of the low level of interest by the firm in the project.	The project head and the workgroup continued to press management and the various departments involved.
Steel works	5	The consultant used an evaluation table that was unsuitable for a firm of this type.	The workgroup made various objections, pointing out problems that were not taken into consideration by the consultant's method.
		The firm showed little willingness to provide data about the working of the production process.	The project head explained to management the problems for which data was needed in order to understand thoroughly the preliminary environmental analysis phase
Building materials	6	The firm did not intend to do the materials balances itself, confirming the researchers' impression that they were not prepared to collaborate in any great way.	The workgroup pushed the consultant, who was not sufficiently assertive, to involve the firm as much as possible, asking for example that department heads verify the materials balances that were drawn up.

Table 13.9 (continued)
Difficulties in Behaviour.

Sect.	**N°**	**Problem**	**Solution**
Cheese	7	The firm's representative who was dealing with the research project was not familiar with the firm's environmental problems and did not have sufficient autonomy to obtain the information. This lost time.	The management put a new person at the disposal of the project.
	8	The consultant, who already had a close relationship with the firm, did not keep the workgroup constantly updated.	The workgroup asked the consultant to constantly update it on work in progress and asked to analyse the main areas of non-conformance which were found.
		The consultant told the firm that some modifications were required, although these were not required by law and/or were not strictly environmental (e.g. the microclimate in one department).	In a meeting with the firm, the workgroup pointed out that some modifications requested by the consultant were not legally obligatory, but rather were indications of possible improvements.
Food	9	The firm had some problems with the fact that at different meetings of the workgroup, different people were present.	The workgroup pointed out that it was impossible to always have the same people present and reiterated the roles of the workgroup and the consultant in these activities so as to avoid future misunderstandings.
		The consultant wished to project a strong determined image to the firm, sometimes going against the work of the workgroup.	The workgroup agreed on rules of behaviour for meetings involving the firm and the consultancy company. Any arguments and reciprocal complaints would be aired at a different time.

Table 13.9 (continued)
Difficulties in Behaviour.

Sect.	**N°**	**Problem**	**Solution**
Textiles	10	The firm complained that there were too many people in meetings and thus problems in making decisions for the firm's representative on the project	The workgroup and consultant agreed to hold future meetings with a limited number of people. In fact some experts that were needed at the beginning (e.g. energy expert, fire expert, quality) were no longer necessary.
		The consultant had problems with the fact that the firm presented him with problems in another factory, that according to the initial agreement should not have been part of the experiment.	The workgroup told the firm again of the field of application of the project, saying that it could involve the consultant in other factories not included in the initial agreement only on payment of his fees.
		The firm organised meetings with the consultant without inviting the workgroup, and in one case when he showed some opposition, demanded his presence.	As the certification audit was imminent, brought forward at the insistence of the firm, the workgroup decided to avoid arguments and limited itself to verifying how the work was going.
Chemical	11	The firm's representative sometimes did not agree with the consultant and asked for a separate view from its own usual consultant.	On the firm's request, a meeting was organised with the firm's consultant, who agreed with the proposed improvements made to the firm.
	12	The firm was slow to find the documentation requested, due to the overwork of the firm's representative to this project, and because of his lack of experience of environmental problems.	The workgroup pointed out the problem to this representative, who first asked that the work should concentrate on any non-conformances with the law, which should be made known to the management. Later the management itself asked to suspend the project.

13.6 The Second Phase of the Project

The second phase of the project was launched upon completion of the first phase. In this phase, 23 companies were chosen to implement an EMS. This number is regarded as sufficient for the project in view of the novelties introduced with the study of quality and environmental costs.

Towards the end of 2001, moreover, four companies, chosen from those with particular bonds of friendship with AIB, started to experiment with an occupational health and safety management system.

Project activities in these 27 companies are currently under way.

13.7 Summary of Project Development

Below there is a brief summary of the phases which led the project, by an original route, into experimenting with EMAs in Brescia SMEs:

- AIB arrived at EMAs not as a result of an initial aim to tackle this issue but indirectly, starting from a programme to promote integrated systems for the management of quality, safety and the environment among all 1500 members. This was an instrument for improving the organisation of the companies and, as a result, their safety.
- The project safety improvement programme is directed towards SMEs, which are the vast majority of AIB members, of Brescia firms and of Italian companies in general, and which represent the backbone of Brescia's industrial system.
- Existing experience of EMSs in SMEs is negligible, having so far been applied only by large companies with an organisation to match. Experience of management systems for safety is totally lacking.
- To convince the members of AIB with solid arguments of the worth of the project proposal , it was decided to create the experience that was lacking, and an experimental programme was set up to implement the proposed systems in 60 associated companies as a pilot study.
- It was at first very difficult to find 60 firms willing to take part, and in order to convince them, AIB had to offer very favourable conditions. The services were free of charge and expert technical assistance was offered, backed up by the presence of the two local universities and the best consultants operating in the area.

Table 13.10. Firms participating in Phase 2.

N°	**Produc. sector**	**N° employees**	**Production activity**	**Current situation**
1	Chemical	156	Production and sale of industrial gaskets and technical items from rubber	Preliminary inspections
2		88	Production of paints; wholesale and retail sale of paint	Preliminary environmental analysis (PEA) in an advanced stage
3	Mechanical	913	Production of hunting, defence and light military arms	Preliminary inspections
4		397	Production of mechanical parts and sub-units for others, hot pressing, steels, machine tools	PEA in initial stage
5		290	Production and sales of locks, padlocks and systems of closure in general	PEA in an advanced stage
6		184	Stainless steel cutlery, trays, kitchenware for the home and communities	PEA in an advanced stage
7		95	Production of door handles	Suspended
8		78	Production of cylinders and pistons for engines	Documentation being defined
9		74	Production of steel die holders	PEA in an advanced stage
10		54	Production of metal bobbins for cables, wire-drawing and special apparatus	Preliminary inspections
11		53	Production of valves and taps	PEA in an advanced stage
12		43	Construction of fire-engines and civil protection vehicles	PEA in initial stage
13		31	Production and sale of valves and flexible pipes	PEA in an advanced stage
14		31	Production of acoustic alarms for vehicles and boats, pumps for transfer of liquids, bilge pumps	Preliminary inspections

Table 13.10 (continued)
Firms participating in Phase 2.

N°	Produc. sector	N° employees	Production activity	Current situation
15		25	Production of tools for thread-cutting, screw taps, mills, rollers, threaded and smooth callipers	PEA in initial stage
16		15	Assembly of lead batteries for starters/traction	Documentation being defined
17	Metals, Foundries	274	Extrusion of aluminium draw pieces for building and industry	Documentation being defined
18		161	Foundry, fusion in shell of aluminium	PEA in initial stage
19		148	Production of aluminium and semi-worked items	PEA in initial stage
20		79	Semi-worked items in brass, with extrusion of bars, extruded and drawn brass	PEA in initial stage
21		44	Production of lighting systems in aluminium for outdoors	PEA in initial stage
22	Tertiary	158	Installation of electricity and telephone lines	Preliminary inspections
23		28	Production and distribution of heat, energy services, retail sale of fuel oils and similar	PEA in initial stage

- With this offer, AIB managed to convince just over 10 companies. Companies' reluctance was partly weakened when AIB introduced EMA as a supplementary service, though even this was insufficient.

- The experimental programme reached full success and the number of candidates exceeded the target of 60 companies only when, as well as EMA, AIB offered the evaluation of quality costs.

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14. EMA in SMEs: Ten Italian Case Studies

Alessia Venturelli and Aldo Pilisi

ECO 90, Environment and Safety Department, Associazione Industriale Bresciana (A.I.B.), Italy

venturelli@aib.bs.it

Abstract The research project described in this paper is part of a programme conceived by the Industry Association of Brescia (AIB) to promote the diffusion of Environment and Safety Management Systems among its member companies. Initial difficulties regarding the implementation of environmental management accounting (EMA) systems in the pilot companies, concerns about operational costs, the need to adapt accounting systems, and some reluctance to collect data, were finally overcome by providing technical assistance and tools. Starting with the evaluation of quality management system (QMS) costs, specific schemes have been developed and provided to the companies, based primarily on evaluation methods for quality costs, but at the same time fully complying with EMA requirements. On this basis, collaboration with the companies started to be satisfactory and useful.

This paper presents these schemes together with the results of their application in ten small to medium-sized companies operating in different industrial sectors.

14.1 Introduction

The Industry Association of Brescia (Associazione Industriale Bresciana, AIB) entered the field of environmental accounting not because of a primary interest in the subject, but as a consequence of the needs that emerged during the project described in Pilisi and Venturelli's "Introducing Environmental Management Accounting into Small and Medium-Sized Enterprises"[1], which aims to promote integrated quality, safety and environmental management systems in associated companies. In this project, environmental accounting, together with the assessment of quality costs, was of fundamental importance in order to start the project at all and to

[1]See the previous paper, which can be considered to be an indispensable introduction to this paper and necessary in order to understand it fully.

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 309-332.

bring it to success. In order to convince companies to participate in testing the proposed management systems, it was imperative to give them convincing evaluations of the impact that these systems – in particular the environmental management system (EMS) – would have on their balance sheets.

This paper describes the preliminary results from the practical implementation of an environmental accounting system in ten small and medium-sized companies (SMEs) in the province of Brescia. The paper does not propose new theories, but will limit itself to describing the practical experiences of the researchers with the companies during the first year of the project. A substantial part of this paper is dedicated to the genesis of this research and to the evaluation tables for environmental costs which were used in the firms.

14.2 Preliminary Phase: Analysis of the 'State-of-Art' in the Application of Environmental Accounting in SMEs

14.2.1 Findings in SMEs

The research project on environmental accounting in Brescia SMEs was preceded by a preliminary study phase to analyse existing information on the topic of environmental accounting for SMEs in theory and in practice[2]. The project began by analysing the definitions of environmental cost, in order to have a clear idea of the object of the study, and to have a solid base from which to work. The definitions found were not convincing, and included items that were far from being environmental and much more of concern to management in general. It was also evident that this problem was not confined to companies, but had also been faced by statistical institutes such as the Italian ISTAT and the European Eurostat[3].

After analysing definitions of environmental cost, the researchers considered the state-of-art in the application of environmental accounting in SMEs, especially in Italy, looking for case studies, through a literature search amongst both Italian and foreign sources, and from direct contacts in

[2]See in particular: Bartolomeo et al (1995); Bartolomeo (1997); Bennett and James (1998); EPA (1995a); Gray (1993); Schaltegger et al (1996); Schaltegger and Burritt (2000). See also the case studies in the publications of Tellus Institute (1993, 1995, 2000).
[3]Eurostat (1994).

Italy with experts that had been described as the "most well-informed" or "richest in experience"[4]. The results of all these contacts, which were aimed at detecting practical examples of applications of EMA in SMEs applicable to the companies involved in the project, was however disappointing and made it clear that the project could not proceed along an already well-trodden path. There were some examples of previous experience in Italy, but these were limited to large companies (such as companies of the ENI group or SGS Thomson) with environmental impacts on a much larger scale, or to a few cases of SMEs with "enlightened" industrialists[5]. In SMEs, on the other hand, practical experience of the application of environmental accounting systems can be characterised as almost non-existent.

Some important projects were found, such as the ECOMAC project in Europe[6], and that of the EPA[7] (Environmental Protection Agency) on an international level, but these dealt mostly with large companies. In any case, these did not implement an EMA from the beginning, and so had not faced the real difficulties and possible benefits that were particularly interesting for this project. For the most part they had taken a 'snapshot' of an instant in time, without following up its evolution over time, so that there was no case of a 'moving film' which might show how to structure an EMA system.

The results of the research activities in this first phase led to the conclusion that there was nothing in either theory or practice that could serve as a practical guide in applying environmental accounting to SMEs. It was therefore concluded that this experience would have to be obtained directly by visiting typical Brescian SMEs, examining their environmental problems, and gathering data at first hand. A further important point to consider was the attitude towards environmental costs. Apart from a handful of enlightened industrialists, representatives from most firms already involved in the project were fairly sceptical and said that they thought environmental costs to be of little importance. They had trouble in clearly identifying them, and intuitively thought that they were negligible in comparison to overall costs.

[4]The authors would like to mention in particular the Bocconi University in Milan, especially the Institute for Management of Energy Sources (IEFE) and the European Centre for Environmental Protection Studies (SPACE), the Institute for the Environment (IPA), the ENI Enrico Mattei Foundation in Milan (which later became a member of the project co-ordination committee) and a number of consultancy firms.

[5]See, for example, the case of Cartiera Favini SPA in Bartolomeo et al (1999).

[6]All the ECOMAC cases are included in Bartolomeo et al (1999).

[7]A description of EPA's Environmental Accounting Project and many resources can be found at the web-site: http://www.epa.gov/opptintr/acctg/.

14.2.2 Looking for a Solution: Environmental Costs as a Complement to Quality Costs

Faced with the difficulties described above, it was decided to gain practical experience through a 'Trojan horse' approach that would help to obtain data on environmental costs 'through the back door'. This 'Trojan horse' was quality costs, for which consolidated experience and agreed methods already existed. Furthermore, the firms were enthusiastic about the researchers' proposal to quantify what they spent on quality.

The fact that the Dutch Ecomac cases had used the same classification for both environmental costs and for quality costs was considered to be a confirmation of this approach[8]. It was decided to offer to companies a joint appraisal of quality plus environmental costs, using the same classification and the same approach for both. Quality costs, for which there were accepted definitions and several years of consolidated experience and studies[9], were then investigated in depth. Furthermore, it was found that most firms that had already implemented a quality management system (QMS) were interested in quantifying what they spent on quality - something that was often not under control, apart from the "costs of non-quality". In fact, in some cases they had trouble giving even an approximate figure, as a percentage of total costs or of sales, for instance.

As well as the usefulness for its own sake of having at least a general idea of the level of quality costs, it should be mentioned that this quantification is required by the standards themselves: ISO 9000 refers explicitly to the measurement of quality costs as an integral part of a system of quality management. Furthermore, the certification bodies are starting to ask for a quantification of quality costs during audit. References to quality costs within the quality standards can be found in standard ISO 9001/2000 (the so-called "Vision") and in ISO/TR 10014/1998. ISO 9004/2000 (the 9001/2000 guidelines) contains an explicit paragraph on "costs of quality" in section eight "measurement, analysis and improvement". "Economic and financial measurements" (8.2.1.1.) are mentioned, as an instrument for identifying areas for improvement in the performance of the management system, as well as "analysis of quality cost data" (8.2.1.3) - and even, in detail, "analysis of the costs of prevention, checking and of non-conformity"

[8] For the Dutch cases see Bouma *Some development of environmental management accounting in the Netherlands* in Bennett et al (1998) and Diependaal and De Walle (1994).

[9] American Society for Quality Control (1987, 1995); Dale Barrie and Plunkett (1999); Harrington (1987); Saita M (1971, 1991).

(8.2.1.4) - and “assignment and reduction of costs” (8.2.2). ISO/TR 10014 “Guidelines for managing the economics of quality” cites the classic model of quality costs: “Prevention, Appraisal, Failure” (PAF).

Since the firms under study often based their actions on standards, it was important in the project to have standards to which to refer. Several cases were referred to in which the measurement of quality costs was introduced because of explicit references in the standards.

Considering the lack of experience of environmental accounting in SMEs, and the level of importance that the companies gave to environmental costs in contrast to the consolidated experience in quality costing and the degree to which they had assimilated ISO 9000 quality standards, it was decided to set up a scheme for the joint collection of quality and environmental costs. Even after deciding to combine quality with the environment, however, the project’s difficulties were not over. It should be remembered that the firms under study have only a basic accounting system (though sometimes a flexible one) which suffered from a lack of communication between their various departments. The establishment of EMA systems therefore required that the firms themselves had first to be reorganised.

The evaluation tables used in the project, which gather environmental costs as a complement to quality costs, use the same logic and the same classifications for both categories.

14.3 Evaluation Tables for Quality and Environmental Costs

14.3.1 Aims

To build up the schemes to collect environmental and quality costs, there were two aims: the first a minimum objective for this research, and the second a more ambitious, long-term one. Each aim corresponds to a phase of work in the firms.

The first aim is to understand and quantify how much it costs the firm to implement and maintain a QMS and an EMS. In this phase a ‘snapshot’ of the firm was made, to describe the situation at a certain moment in time. On this basis the firm then decides if the collection of these costs should be continued, moving from a ‘snapshot’ to a ‘film’. In short, the researchers tried to give the company as much information as possible, so that it could decide whether to continue measuring. It could in fact be the case that the costs of data collection are higher than the benefit derived from measuring them. Evaluation tables are used in this first phase of contact with the firm, to achieve the first aim. With this as a base, the research can then proceed to the second, more important, phase.

The second aim consists of setting up a periodic monitoring of quality and environmental costs in order to keep them under control, using the necessary links with the accounting systems and other databases. In this second phase the researchers search with the firm for the most relevant costs to keep under control.

14.3.2 Evaluation Tables

The evaluation tables used in the first phase include several columns and rows that correspond to each cost item. The tables are described below:

Table 14.1. The columns.

Code	Category	Environmental and quality cost item	Source	Explanatory notes	Examples

The first column of Table 14.1 provides cost codes: A, B, C for the environment and X, Y, and Z for quality. These codes correspond to three categories shown in second column: prevention, monitoring and failure.

In addition it is useful to list the classification of quality costs which served as a model to define the categories for environmental costs shown in Table 14.2.

The third column of Table 14.1 contains the cost types or cost items. The detailed list of possible entries is shown in Table 14.4.

Table 14.2. The three categories for environmental costs.

1. Prevention costs: all costs sustained within the production site to prevent and avoid negative environmental effects and to improve the firm's image. Included here are, for example, costs for running the EMS, costs for measures to prevent negative environmental impacts at source, and managing relations with third parties.

2. Monitoring costs: costs sustained to monitor and control the working of the EMS and the cost of monitoring environmental performance, such as the cost of laboratory analysis.

3. Failure costs (or non-environmental costs), divided into internal and external failure costs:

> **3a. Internal failure costs:** all costs strictly connected to the environmental impacts of the production process within the site, costs caused either by an inefficient use of natural resources or by the treatment of the pollution produced (end-of-pipe solutions) that was not avoided by preventive action. These include waste water treatment, air emission treatment, and the storage of waste inside the site.
>
> **3b. External failure costs:** costs for impacts outside the site, therefore more visible to the public, and for which the firm is economically responsible. These include the transport and treatment of refuse outside the site, and fines and payments to third parties for environmental damage.

Table 14.3. The three categories for quality costs.

1. Prevention costs: all costs sustained by the firm to prevent non-conformity of the product. These include the cost of planning the quality management system, training, and the choice of suppliers.

2. Monitoring costs: costs sustained to check that the process is carried out as planned. There are costs for checks during production, laboratory costs, certification and so on.

3a. Internal failure costs: these occur every time the system does not work as planned, but the non-conformity is not evident from outside. These include reworking costs, scrap, and analysis to find the reason for non-conformity.

3b. External failure costs: costs for non-conformities that are found after the product reaches the buyer, for example costs of returns and the management of complaints.

Table 14.4. The cost items for environment.

Prevention Costs	**Monitoring Costs**	**Failure Costs**
A1 EMS Planning/co-ordination	B1 External audits	C1 Legal expenses
A2 Production and updating documents	B2 Internal audits	C2 Penalties/fines
A3 Training/information	B3 Inspections by customers	C3 Environmental insurance
A4 Staff training on legislation compliance	B4 Inspections to suppliers	C4 Operational costs of aspiration and abatement systems
A5 Communication	B5 Control instruments: maintenance and calibration	C5 Operational costs of boilers and vapour generators
A6 Suppliers information/updating	B6 Purchase of control instruments	C6 Operational costs of co-generation groups
A7 Expenses for environmental accounting management	B7 Monitoring of waste water	C7 Operational costs of waste water systems
A8 Customer/market analysis	B8 Monitoring of emissions to air	C8 Emissions to air testing and monitoring bookkeeping
A9 Qualifying new suppliers	B9 Waste analysis	C9 Collection and waste management
A10 Administration	B10 Noise measurement	C10 Rent of rubbish skips
A11 Environmental R&D	B11 Soil, subsoil and aquifer analysis	C11 Disposal
A12 Purchase/installation of machines/plants with lower impact (environmental portion)	B12 Reporting to control authorities	C12 Waste treatment
A13 Modifications of machines/plant that reduce environmental impact (environmental part)	B13 Monitoring/measurements of electromagnetic and ionising radiations	C13 Off-site waste transport
A14 Plant closure/decommissioning (environmental part)	B14 Optimisation of utilities: e.g. water, electricity & gas supplies	C14 Waste taxes
A15 Waste recycling or reduction of environmental impact		C15 Sewage fee
A16 Modifications to rubbish skips		C16 Waste bookkeeping
A17 The management and more correct use of dangerous substances in the departments and laboratories		C17 Environmental contribution for CONAI
A18 Studies for emergency procedures		C18 Decontamination of soils
A19 Preventive measures for accidents, excluding fires		C19 Expenses for accidents (except decontamination of soils)
A20 Improvements in transportation of hazardous waste off-site		C20 Anti-noise measures
A21 Fire prevention		C21 Environmental measures after excavation
A22 Green zones around the industrial site		C22 Utilities: e.g. monitoring water, gas & electricity use
A23 Measures (different from green zones) for improvement of the site's visual impact		
A24 Measures for road improvement		
A25 Sponsorships and contributions for environmentalist associations and similar		
A26 Expenses for voluntary agreements		

The fourth column of Table 14.1 provides the source for the cost items, in other words the authority in literature or in practice from which the item has been taken, so that users of the table can check its origin. For quality costs, there is a generally recognised definition which is that provided by the American Society for Quality Control (ASQC), while for the environment there are many sources, given the lack of unique and unequivocal definitions. In a very few cases there are items that are not explicitly named in the literature as environmental costs. It was decided to include these items, given that most firms who have implemented an EMS sustained these costs.

At the start, during the first year of gathering environmental costs, it was considered appropriate to include everything that the firms had to spend in adopting an EMS. In following years, these cost types might not recur.

The fifth column and the sixth column of Table 14.1 respectively provide explanations of cost items, especially where these are not already clear, and examples. These explanations and examples are particularly useful when, together with the firm, the tables are analysed item-by-item: the firms need concrete examples to help them to identify the appropriate activities. These examples are constantly evolving: the more experience that is acquired by working in different firms, the more examples that can then be offered to subsequent firms. For this reason, the tables are being updated constantly.

Finally, both for the environment and for quality there are two columns that are used mainly when analysing costs. For the environment, costs that were sustained in order to comply with the law have been distinguished so far as possible from those that went beyond what was required, or so-called "voluntary costs". For quality, a distinction was made between costs that would be sustained in the normal management of a firm in any case, and those sustained because of having a certified QMS.

14.3.3 How to use the Tables

The tables list all possible quality and environmental cost types that the companies might have, classified with the same logic and in the same order. Obviously not all these cost types occur in every company, but the companies have a choice among the many alternatives supplied, rather than having difficulties with items that are too generic.

It must be remembered that the participating firms are not companies with a significant environmental impact, but are usually small, where the owner has a strong influence on the way things are run, and has the last word on everything. Environmental issues have not yet been addressed by the owners of these firms (though those of quality have) and are often considered an extra in addition to what is really necessary. In many cases it is not the cost/benefit balance that encourages owners to establish an EMS so much as but copying their rivals, the competitive spirit, and the need to 'arrive' before the competitor, often without knowing exactly where.

Requests for data have to be made with care, while considering these aspects and, above all, the natural reluctance of firms to supply economic data which can sometimes be sensitive. The researchers did not themselves request that the books of account be opened: it is the firm itself, after many meetings and after the researchers have gained their trust, that decides what information to supply. The researchers are neither inspectors nor spectators, but, as part of AIB, are able to enter these firms as friends who might be able to give advice.

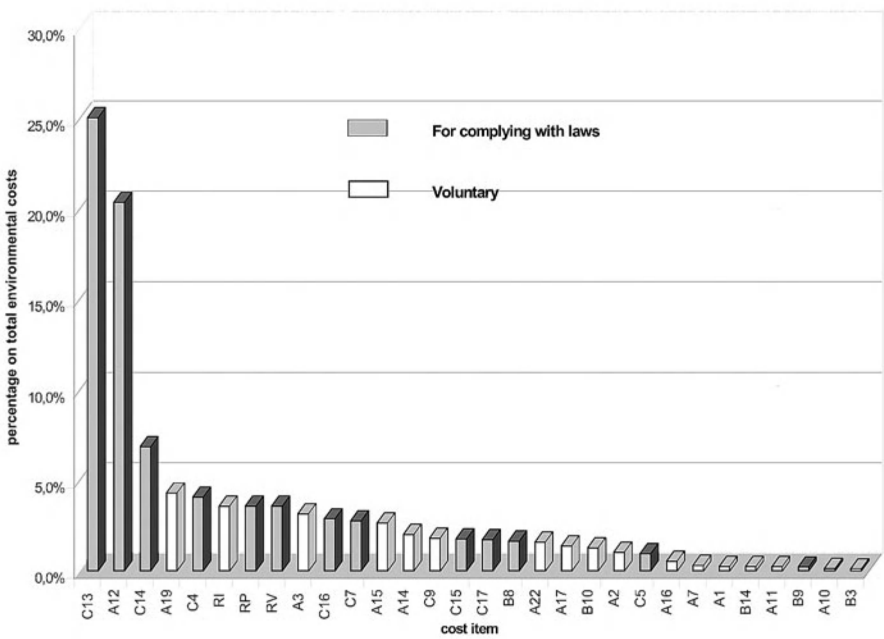
The early meetings with the firms are dedicated to quality costs, for the reasons already explained. Only when the logic of quality costs has been understood by analysing individual items, can environmental costs be considered. In spite of this stratagem, it was found that the owners, when involved in the decision about whether to continue gathering costs and how, invariably referred only to quality costs. Environmental costs are collected only "while we're at it...".

The managers involved in the first phase of identifying cost types, are the Quality Manager and the Environmental Manager (who are often the same person). Once the cost type has been identified, other departments become involved, such as Production, Technical Office, Sales, Purchasing, and Administration. It was found that the first phase typically requires five to six meetings with the Quality and Environmental Manager in order to identify costs, and to understand who sustains them and where the information is to be found (information flows). Each additional department involved then needs approximately one further day in order to quantify the actual costs for the cost types that were identified in the meetings with the Quality and Environmental Managers.

14.3.4 Evaluation of Data Gathered Using Evaluation Tables

The data collected using the evaluation tables for quality and environment costs can be analysed in different ways. The classic sub-division of environmental costs is that shown in Figure 14.1, which distinguishes environmental costs – in descending order of magnitude – from costs to comply with the law, to voluntary costs. In this specific example the costs for

Figure 14.1. Compliance and voluntary costs.



compliance predominate, as is usually the case. The X-axis shows the cost codes taken from the tables, and the Y-axis the entity of the costs.

In Figure 14.2 the same costs are divided into the classic three categories: prevention, monitoring and failure.

In Figure 14.3 the firm is offered a further way to consider its costs, divided by area of impact, as is usually proposed in the literature, so that even the traditional classification of environmental costs can be derived from the quality plus environment tables, which follow the logic of the three quality categories.

Finally, in Figure 14.4, environmental costs are shown according to their composition: time of the personnel involved, consultancy costs, assets, environmental taxes, etc.

Passing from the first to the second phase, from a mere 'snapshot' of environmental costs to a 'film', is complicated, since no help can be found in the firms' accounting systems which are nearly always general bookkeeping systems rather than cost accounting systems. It is necessary to do so,

Figure 14.2. Prevention, control and failure costs.

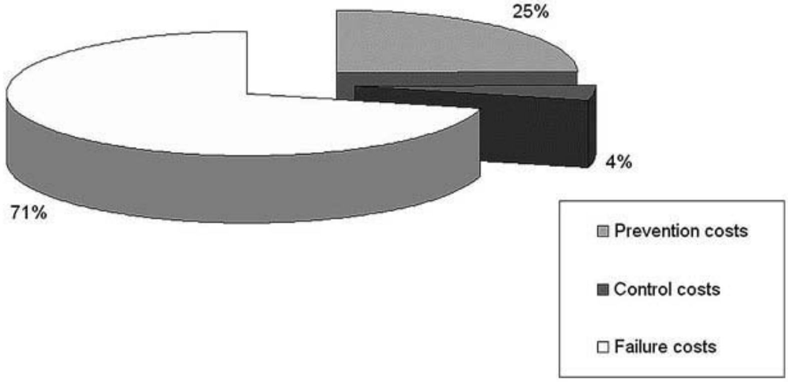


Figure 14.3. Environmental costs by area of impact.

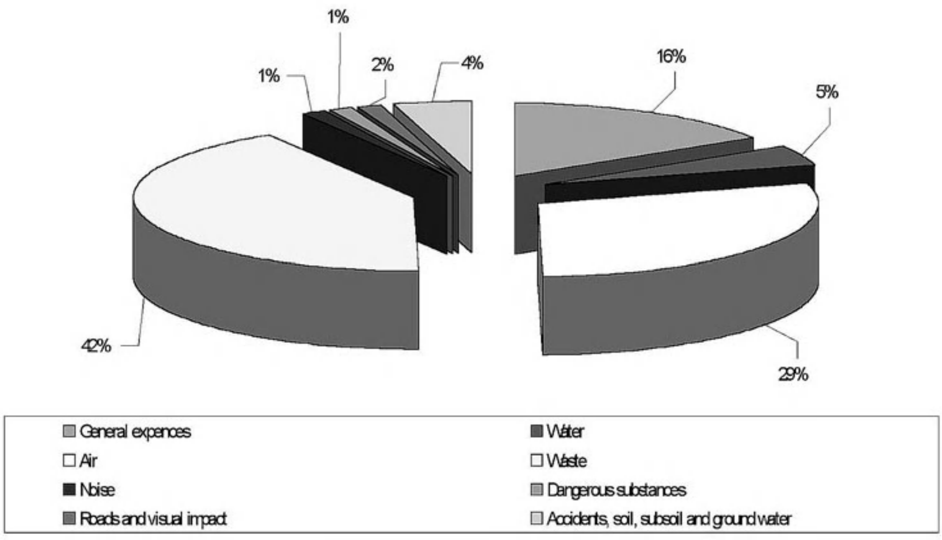
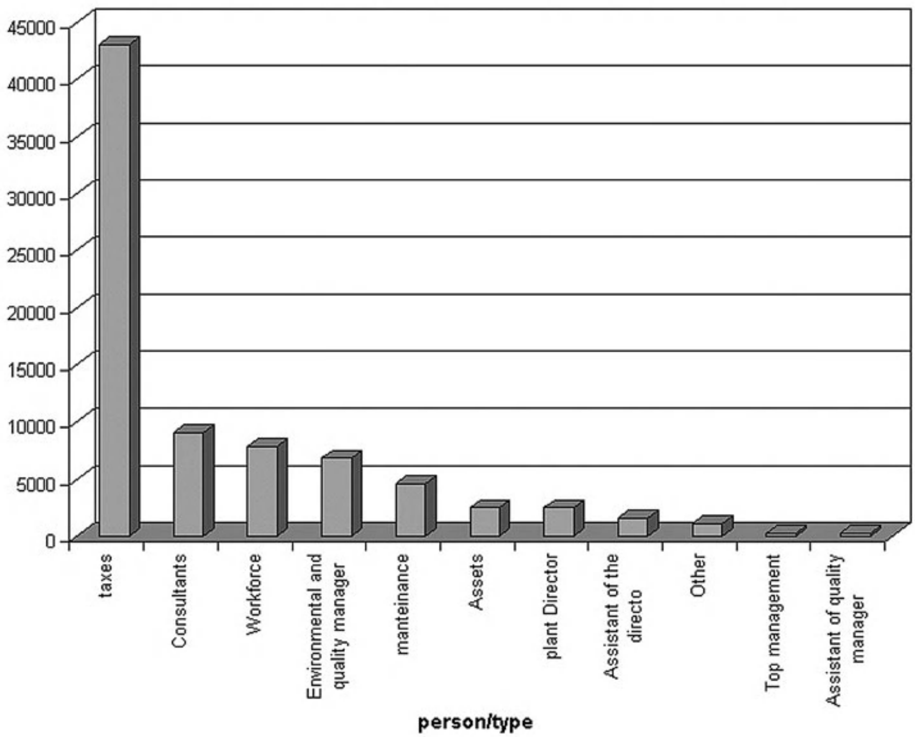


Figure 14.4. Environmental cost by person or cost type.



however, since limiting the information to a single point in time does not bring about any significant improvement: costs can be reduced only if one continues to monitor them, and a programme for improvement exists.
It is therefore necessary to establish a link between the collection of costs and the firm's accounting and information systems. Without this, there is no real overall vision of the situation, and quality and environment departments risk becoming isolated, lacking in communication with administration, and with their activities unrepresented in the company's information systems.

In this second phase, administration is involved in analysing the present accounting system and in seeking to reconcile the proposed tables with such a system. Furthermore, the data processing department has to decide if and how to insert new codes in the existing information systems. General management has a fundamental role in deciding whether to introduce the above modifications to the accounting and information systems and to decide how (e.g. how to group the cost items supplied by the evaluation tables).

Time spent in the firm varies much more from company to company than in the first phase, depending on the respective situation. In the best cases, a half-day is required with the administration to analyse the accounting system, and approximately the same time with the data processing department. Other departments, and the CEO, could also be involved. This does not include the time spent by the firm's personnel to collect data at times when AIB was not present, or the time required for the system to become operational.

14.4 Application of Evaluation Tables in Ten Firms

14.4.1 The Sample

By the beginning of 2002 the quality and environment evaluation tables had been tested in ten SMEs. In some, phase 1 was completed and phase 2 was started, whilst in others data collection is still continuing.

Four firms have less than 50 employees; three firms have between 50 and 100, two between 100 and 150, and the remaining one more than 150. Six of these firms have owners who held official positions (President, Vice-President, etc.) in AIB, and thus had a special motivation in bringing success to the project.

Table 14.5. The pilot companies.

Company	**Type and product**	**Number of employees**	**Phase**
Company 1	Mechanical. Production of spare parts and accessories for cars, lorries, tractors, motorcycles, micro motors; mechanical working in general, starting from pressed or cast semi-worked materials	150	2
Company 2	Mechanical. Product: pistons for cars	90	2
Company 3	Mechanical. Product: valves for taps	100	2
Company 4	Production of lighting systems in aluminium for outdoors	44	1
Company 5	Treatment, bottling and sale of wine	30	1
Company 6	Foundry. Product: lead shots for hunting and shooting and lead parts for batteries	20	2
Company 7	Foundry. Product: alloy wheels	140	1
Company 8	Design and trading of alloy wheels	25	1
Company 9	Mechanical. Product: injection presses for plastics	85	1
Company 10	Chemical. Production and commerce of industrial gaskets and technical items in rubber	156	1

At present, after introducing economic evaluations, the project is running smoothly. Contrary to the problem experienced at the beginning, the number of requests to participate in the project is now even higher than the initial number of 60 companies that were chosen as the basis for the project.

14.4.2 The Timing of Collection of Cost Data

Before building up and applying the evaluation tables in the firms, after closely examining the various existing theories, consideration was given to the question of when would be the most appropriate point in time to start to gather data on environmental costs. The choice was between doing so in parallel with the preliminary environmental analysis or after implementing the EMS. Different times were tried for measuring costs, although in some cases the choice was determined, rather than planned, by factors of time and of co-ordination with the part of the project that related to ISO 14001. Only in a few cases was work started when the firm had no experience of EMS. It was equally interesting for these firms to be able to have data on environmental costs before implementing the environmental management system. These figures could be compared later to the costs actually spent on adopting the system itself.

This was the situation that the firms were in at the time of cost data collection:

- All had ISO 9000 certification
- 5 firms were almost at the environmental certification stage (ISO 14001)
- 2 firms were at the preliminary environmental analysis phase
- 3 firms had not yet started an EMS

14.5 Environmental Cost in the Ten Pilot Companies

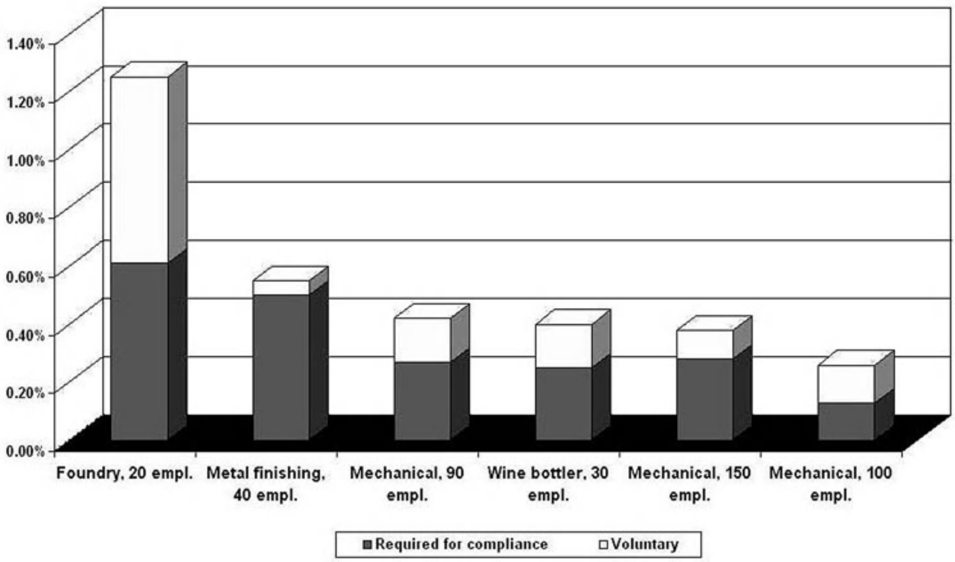
Complete data is now available for six of ten SMEs, while data is still being gathered for the others. It is clear from this data, as expected, that the environmental costs are relatively low: they range between 0.26 % and 1.25 % of sales. Of this percentage, the highest part is represented by costs for compliance.

The two firms with the highest percentage of costs are those with least sales and a relatively small number of employees. One is a foundry which produces lead shot for hunting and shooting, and lead parts for batteries, and the other is a metal finishing works which produces outdoor lamps.

These two firms represent, however, the opposite ends of the EMS implementation process. The former, small company obtained ISO 14001 certification a year ago, while the latter has not yet started an EMS. Almost all the costs of the second company are obligatory, and are made up mainly of waste disposal costs and waste taxes, as well as the operational costs of the waste water treatment plant from the coating process, in which are included the stages of degreasing, chromatisation and electrostatic painting.

The first company, on the other hand, is distinguished from all the others in having voluntary costs (0.64%) which are higher than the obligatory costs. This is atypical, because the largest cost is for consultant's fees relating to the evolution of environmental laws: and although this cost is genuine, its amount should also be considered in light of the fact that there is a

Figure 14.5. Environmental costs/sales.



family relationship between the owner and the consultant. The other most important costs here are waste handling and the purchase of replacement plant for the treatment of emissions from the foundry furnace which cannot be discharged to the open air.

The following tables show the five main costs for each firm, in decreasing order.

Table 14.6. The five main costs of pilot companies.

Item	**Foundry, 20 employees batteries**	**Item**	**Metal finishing, 40 employees Product: outdoor lamps**
A4	Staff training on legislation compliance (consultants)	C07	Operational costs of waste water plants
C12	Waste treatment (external)	C11	Waste disposal and transport
A14	Machine decommissioning	C14	Waste taxes
A12	Machines with lower environmental impact	C09	Waste management
C11	Waste disposal and transport	B08	Monitoring of emissions to air

The costs of the fourth firm, a wine bottler, represent the cost of implementing the EMS and of ISO 14001 certification, which took place towards the end of the period considered. The largest cost segment is due to preventive measures for accidents, and in particular to waste water discharge and to the operational costs for the treatment plant. This firm has its own plant for treating wine which is spilt during bottle washing. Other notable costs are for waste disposal and transport, and for waste taxes.

Table 14.7. The five main costs incurred by pilot companies.

Item	Mechanical, 90 employees Product: pistons for cars	Item	Wine bottler, 30 employees
C14	Waste taxes	A19	Preventive measures for accidents (water discharge)
C11	Waste disposal and transport	C11	Waste disposal and transport
A2	Production and updating of documents for EMS	C07	Operational costs of waste water plants
C9	Waste management	B02	External audits
C4	Operational costs of aspiration and abatement facilities	C14	Waste taxes

It can be noted that the three mechanical companies have somewhat similar costs, between 0.26% and 0.42% of sales. The company with 90 employees, which produces pistons for cars, is in the phase of environmental preliminary analysis and its highest costs are, as expected, costs for waste taxes, for waste disposal, and for transport. Its third highest cost stems from producing and updating documents (an environmental manual and procedures), since this firm is in the middle of implementing the system.

The company with 150 employees which produces automotive water pumps was examined shortly before certification. All the costs incurred for implementing the system are included, except for the cost of external audit. As for the previous firm, the highest costs are for waste disposal and transport, and for waste taxes. These are followed by the cost of a new plant for fume treatment, and training for personnel on the adoption of an EMS.

The company with 100 employees is at a slightly more advanced phase than the previous one. It should be noted that, after certification, it incurred further costs by communicating news of this to the public. There are also costs which are typical of mechanical firms.

Table 14.8. The five main costs of pilot companies.

Item	Mechanical, 150 employees Product: car pumps	Item	Mechanical, 100 employees Product: valves for taps
C11	Waste disposal and transport	C14	Waste taxes
C14	Waste taxes	B01	External audit
A19	Preventive measures for accidents	C12	Waste treatment
C4	Operating costs of aspiration and abatement facilities	A05	Communication
A3	Training/information	A04	Staff training on legislation compliance

In Figure 14.6, environmental costs are distinguished between prevention, monitoring and failure costs. The metal finishing firm, which has not yet implemented an EMS, stands out. Failure costs are in any case always high, since they include all costs connected with waste management. Monitoring costs consist mainly of the usual costs for sampling and analysing emissions, analysis of waste and wastewater, and internal audits. The preventive costs for firms which are implementing the EMS are fairly similar, and in fact the firm with the lowest prevention costs - the mechanical firm with 90 employees - is that which is at the initial stage of implementing the system. Prevention costs include: the cost of planning and co-ordinating the EMS (which are very low, since AIB is offering this service free of charge); the production and updating of documents (manual and procedures); providing information to suppliers; preventive measures for accidents; recycling; and systems that reduce environmental impacts.

14.5.1 The Comparison with Quality Costs

As shown in the following chart, the original assumptions of the companies were partly confirmed: costs of quality were indeed of a different magnitude compared to environmental costs.

Quality costs are between 1% and 6% of sales. Apart from the wine bottler, where few measures are needed for quality, quality costs are high, especially in mechanical companies.
It is evident that quality costs and environmental costs would have been of different magnitudes. This is indeed why the firms in the study considered environmental costs to be relatively unimportant. It should be remembered that only three out of ten firms were motivated to gather quality and en-

Figure 14.6. Environmental costs by prevention, control and failure.

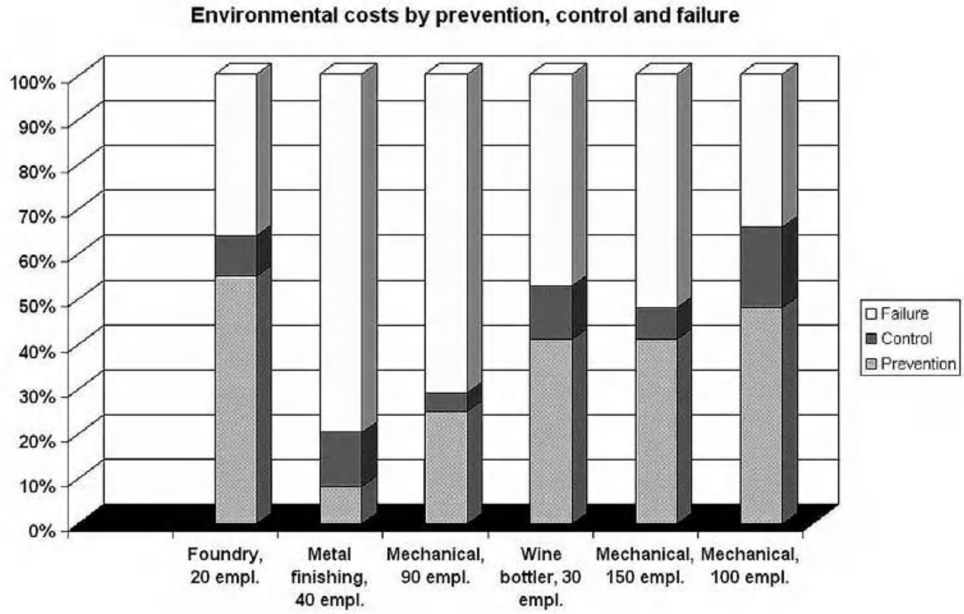
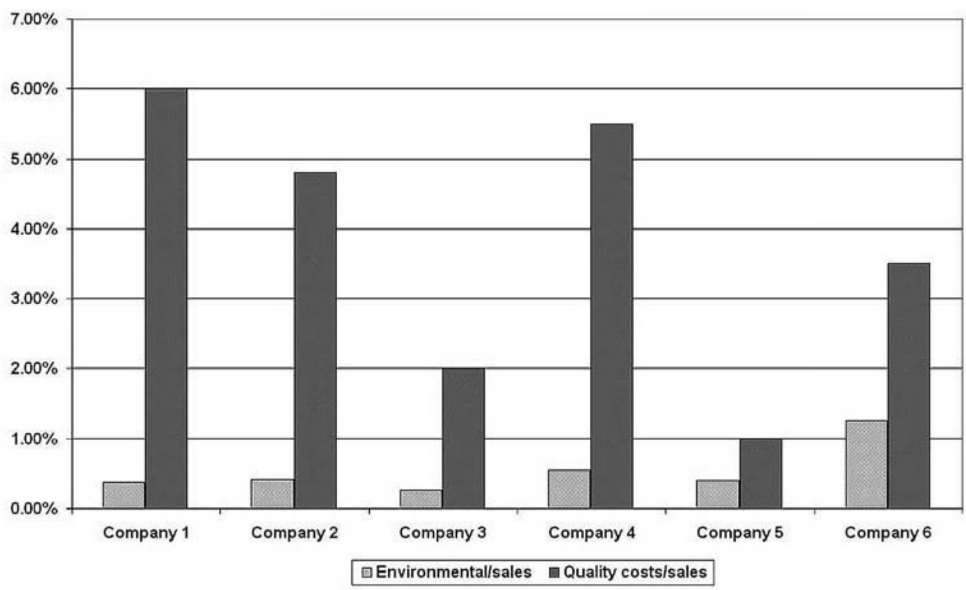


Figure 14.7. Environmental costs by prevention, control and failure



vironmental costs because of a real interest in environment costs, while the majority were interested in an accurate measurement of their quality costs, which was also required by quality standards.

14.6 Difficulties and Benefits

14.6.1 Difficulties

In the first phase of the project, no particular difficulties were encountered: the environmental cost items, which were often similar to or at least calculated following the same logic as for quality costs, could be identified by the environmental manager fairly easily.

It should be remembered that the phase of collection of environmental costs preceded the long and intense effort of implementing the EMS, which was carried out by members of AIB, representatives of the University of Brescia and local consultants. This allowed the researchers to enter companies which were well covered and can be considered a major advantage. It would have been unrealistic to have envisaged the measurement of environmental, as well as quality, costs if this had not been part of a wider project on the introduction of management systems. That is why this research on environmental accounting cannot be thoroughly understood without knowing the context in which it developed. Some firms immediately understood the cost items and could quickly put their hands on the relative figures, and thus the first aim was reached in a couple of meetings.

The second phase, requiring the direct involvement of the administration, is the more difficult. A big obstacle is that of the accounting systems, which are mostly basic bookkeeping and not cost accounting. An even bigger obstacle, however, is the 'wall' that often divides administration from environmental and quality departments, and the lack of communication between these departments.

14.6.2 Benefits

The most important benefit for the companies seems to be the improvement in the management system of the companies involved: this is also the main aim of the AIB in the project. The analysis of quality and environmental costs represents a pretext for re-thinking quality management, completing the EMS, and above all to move the firm towards a cost accounting system, however rudimentary.

The project on environmental accounting, moreover, involves all departments of the company, since information is needed from all of them: this forced them into communicating with each other on issues that were usually confined to the environment and quality departments.

In order to apply EMA to SMEs in Brescia it was first necessary to provide them with an adequate accounting system.

14.7 Conclusion

In the second and third year of this project, the preliminary experience that has been recorded here will be complemented with more data. Gradually, as with EMSs and QMSs, the testing of EMA systems in the first ten pilot companies will be completed and introduced to at least ten more companies.

It should be remembered that introducing EMA into SMEs in Brescia, however simple and rudimentary, had positive effects for the companies not only because of the link with quality costs, but mainly because the introduction was performed as part of a wider project for implementing integrated systems of quality, safety and the environment.

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15. Green Success: Process-based Environmental Cost Accounting – Implementation in SME's in Germany

Thomas Heupel

Universität Siegen, Germany

email: heupel@bwl.wiwi.uni-siegen.de

Natalie Wendisch

Universität Siegen, Germany

n.wendisch@bwl.wiwi.uni-siegen.de

Abstract This paper presents the initial results of a research project titled "Integration of Environmental Cost Accounting into Environmental Management Systems by SMEs". The project was funded by the German Federal Foundation for the Environment, Osnabrück. Following an analysis of various different concepts of environmental cost accounting, a process of implementation is shown, based on two selected enterprises.

The environmental cost accounting system to be applied is sustainability-oriented and process-based. The concept was developed for operational use in small and medium sized enterprises and represents a further development of existing flow cost accounting systems.

This document reports on the first half of the project, which will be completed in June 2003. For this reason, only the first modules of the actual project design can be presented together with examples of operational practice, and the remaining modules are therefore presented on a theoretical basis only.

15.1 Introduction

In view of the increase in corporate expenditure on environmental protection since the 1970s, and of increasing innovation and cost pressure due to international competition, environmental cost accounting has become increasingly important (Bennett and James 1998, 1999, Fichter et al. 1997).

M. Bennett et al. (eds.), Environmental Management Accounting – Purpose and Progress, 333-363.

Political influence (for example through industry guidelines and laws which affect waste balances) and ever-increasing customer sensitivities in relation to ecological matters (such as life cycle analysis) necessitate ecological considerations of costs, weights and associated criteria. In future, entrepreneurial decisions will increasingly depend on compiling information and data which reflects both ecological and economic effects (Gray et al. 1993). A sustainable way of handling these decisions so that a serious future negative impact can be avoided will not be practicable without a cost accounting system which includes an environmental cost accounting module (Gray et al. 1996). Environmental cost accounting in the context of corporate management is an essential tool in planning, management and operational control (Seidel 1995).

An examination of the costs of materials and energy consumption in manufacturing industry, which account for 50 to 70% of its overall costs, indicates an overriding need for transparency in calculations (Ministry of Economics, Transportation, Urban and Regional Development 1999).

The necessity to take account of operational value assessment of ecological aspects such as CO_2 emissions, disposal costs, handling costs of residual substances, location-related costs, costs for ecological administration, etc., leads to new requirements on a company's information and control systems. Small and medium-sized enterprises (SMEs) in particular can have difficulties in meeting these requirements, since they generally lack practical experience.

'Process-based environmental cost accounting' as a first step and 'process-based cost management' as a second step provide new and important approaches to costing and evaluating the core business of a company. A detailed analysis of materials and energy, from receipt by a company to its dispatch as either a product or as waste materials, is likely to uncover significant potential for improvement in overhead costs.

The potential for optimisation opened up in this way is explored by the usual ERP systems which are used by large companies. Since low-priced ERP systems are unavailable to SMEs, an objective can be identified to develop user-friendly database systems which have general application and which would allow the permanent integration of process-based cost accounting into a company's accounting system.

Within the framework of the project 'Integration of environmental cost accounting into environmental management systems – an exemplary development project for SMEs of representative industries', which is funded by the federal German Foundation for Environmental Issues ('Deutsche Bundesstiftung Umwelt, DBU)', process-based cost accounting is being implemented in selected companies in Eastern and Western Germany, Poland and the Czech Republic using the model proposed by the project in co-operation with the International Graduate School Zittau (IHI). The first step comprised the modelling of materials and energy flows, and this has already been completed in the participating companies. An MS Access©-based database ensures that implementation implies permanent integration. Individual database systems are either being programmed (for four selected companies of the pilot group) or are currently being tested in the companies.

This document therefore reports on the first part of the project period and on the project phases which have been worked on so far:

- Selection of a suitable concept for environmental cost accounting for an SME
- Accumulating the actual data for the company as a whole or for individual business units in an ecological balance
- Preparing a model of materials and energy flows
- Assigning costs to the cost centres and cost units

Some practical examples are included in this document.

Further phases will be:

- Harmonisation of data collection
- Permanent implementation of Flow Cost Accounting by an IT link to existing IT systems
- current controlling instruments such as the balanced scorecard model)

At this stage only a short view of project work can be given, without topical practical experience.

Towards the end of the project period, more extensive description will be made available. This will present examples of the entire project design and also of selected examples from various industrial sectors, and will also present in a theoretical way the further development of the flow cost accounting system towards a process-based sustainable accounting methodology. This sustainable accounting balances ecological and social costs with the economic costs, bringing the user a step closer to a sustainable development accounting system.

15.2 Selection of a Suitable Concept for Environmental Cost Accounting for SMEs

A suitable environmental costing concept for the working partners had to be found in the upstream conceptual phase of the project.

Figure 15.1 provides an overview of systems of environmental cost accounting which have been developed, mostly in the German-speaking countries. This Figure follows a classification designed by Seidel and Herbst (2001) and Seidel (2003). The approaches can be divided into three main groups:

- The first group ("Standards, laws, guidelines") includes mostly older concepts of environmental cost accounting, based on standards and legal provisions (such as Schulz's Environmental Cost Calculation for VCI 1993) and on national rules (UStatG: Law for environmental statistics 1974, VDI-Guideline 3800 Emission Reduction Costs 1979/2001 and Guideline EAS/JAE 2000). In accordance with UstatG, nearly 15,000 representative companies from the production sector had to declare their environmental costs annually.
- The second group ("Conventional Accounting") follows traditional cost accounting systems. It contains on the one hand old concepts based on full and partial costing, and on the other hand process-orientated approaches which were developed in response to criticisms of the old concepts. As early as 1977, Fleischmann and Paudtke developed an early environmental cost accounting system based on absorbed cost. These considerations were mainly limited to environmental investments. An extension relating only to current environmental costs is to be found in the basic approaches of Rentz (1979), Haasis (1992), and Wicke et al. (1992). The approach of Neumann-Syszka (1994) deals with the determination of risk costs based on absorbed cost. The direct costing concept of Schreiner (1990) analyses the effects of environmental protection measures on targets for profits and returns. Likewise Roth (1992) and Kloock (1993) deal with an environmental cost accounting system based on direct costing.

The aim of this approach is the support of a short-term, environmentally oriented, planning and decision making system. Generally, these early approaches assumed that environmental protection would have a negative cost effect, so they therefore supported an additive rather than an integrated route towards environmental protection. Only with an extension to include process cost accounting, and with an orientation towards the value-added chain, can cost accounting acquire a credible control capability. The approaches of Hallay and Pfriem (1992), Fischer and Blasius (1995) and Letmathe (1998) can be classified as adequate instruments for ecological controlling.

- The third group ("Inclusion of external costs") includes approaches which deal with external costs on both a monetary and a non-monetary basis. Using the approach of "Ecological Accounting", Müller-Wenk (1978) was the first to show the total environmental influences affecting a company which attempts to remain in conformity with obligatory regulations. On this basis, Schaltegger and Sturm (1992) developed a special pollution accounting system which assigns ecological damages to particular cost centres.

Environmental cost accounting was further developed by Freese and Kloock (1989). Later the work was continued by Roth (1992) where, in addition to environmental cost accounting, special attention was given to non-internalised costs for the prevention, reduction, elimination and exploitation of industrial environmental effects.

After evaluation of these environmental cost accounting systems, checking various possibilities for further development and 'opening up' classical cost accounting systems, a decision was made by the project team in favour of a process-based cost accounting system. This was especially important in view of the project's target implementation in SMEs. For modelling the production processes, this process-based cost accounting system follows in a single module the concept of materials and energy flow management (Strobel 2001a, State Institute for Environmental Protection Baden-Württemberg 1999: 11). Further new modules have been developed within the course of the project, leading to a cost accounting system which offers new possibilities for SMEs which lack in-house ERP systems. This allows secondary processes to be modelled and individual database systems to be used.

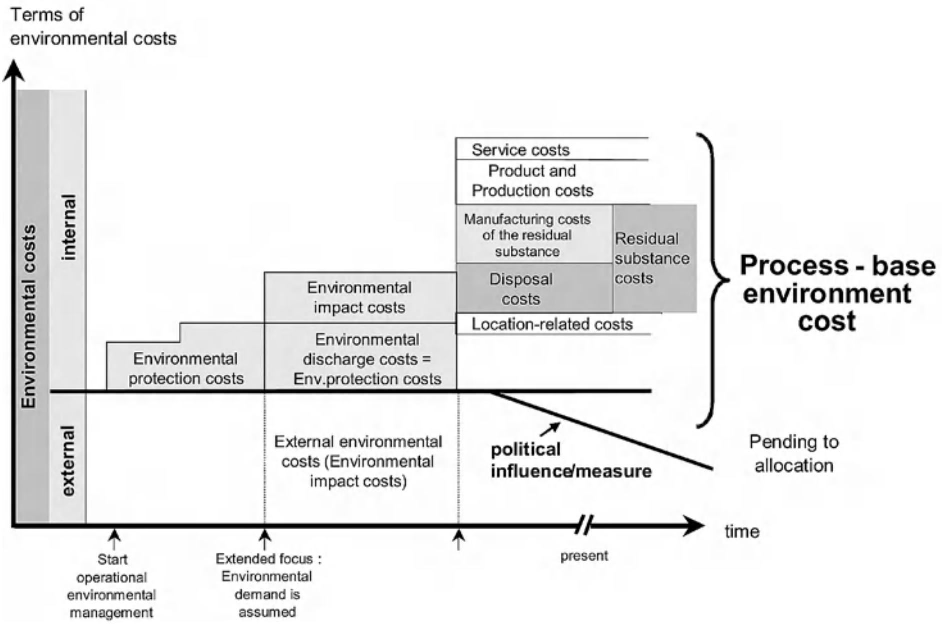
Figure 15.1. Concepts of environmental accounting

Standards, laws, guidelines	Conventional Accounting			Inclusion of external costs	
	Full-Cost Accounting	Direct Costing	Process Costing	not monetary	partly monetary
Environmental Cost Calculation *Scholz/VCI (1973)* UstatG: Law on Environmental Statistics *(1974)* VDI (Guideline) 3800: *Emission Reduction Costs (1979/2000)* Guideline EAS *JAE (2000)*	Environmental protection cost accounting *Fleischmann/ Paudtke (1977) Rentz (1979) Stölzle (1990) Haasis (1992) Wicke et al. (1992) EPA (1996) CICA (1997)* Environmental referred venture costs *Neumann-Szyszka (1994) Harding (1998)*	Multi-stage direct costing *Schreiner(1990)* Environmental oriented direct costing *Roth (1992) Kloock (1993)* Environmental protection related cost accounting *Lange/Fischer (1998)*	Materials and Energy flow oriented accounting Hallay/Pfriem *(1992)* Accounting for residual material *Fischer, Blasius (1995) BMU, UBA (1996)* Activity-Based-Costing *Heller et al. (1995)* Internal environmental accounting *Letmathe (1998)* Flow cost accounting *Wagner/Strobel (1997) Strobel (2001a)* Flow oriented environmetal accounting *Spengler et al. (1998)* Environmentally oriented cost accounting *Herbst (2001)* Materials flow based activity based costing *Schaltegger et al. (1996, 1997)*	Ecological accounting *Müller-Wenk (1978)* Environmental oriented cost-benefit calculation *Roth (1992)* Calculation of environmental impact added *Schaltegger/Sturm (1992)* Operational cost and mass calculation *Liedtke et al. (1997)*	Environmental budgeting (fully monetary) *Wagner/Janzen (1991)* Costs of Environmental Effects *BSO/Origin (1993)* Ecological oriented cost accounting *Frese, Kloock (1989) Roth (1992)* Full Cost Accounting *EPA (1996), Ontario Hydro (1997)*

The selected concept is to include a large part of that cost which can be classified as the cost of environmental protection. Figure 15.2 shows how this term has developed. From the initial understanding (which was strictly confined to the cost of environmental protection) the concept moved to 'Cost in connection with environmental load or relief'. With the shift towards integral environmental protection, the concept continues to change to imply service cost, product and production cost, site-related cost and recycling cost. Process-based environmental costs must accommodate all of these costs and also take account of other costs which have been taken on by the company either voluntarily or as the result of political pressure.

The project proposes the following definitions of relevant terms:

Figure 15.2. Terms of environmental costs



- **Environmental protection costs**: Costs resulting from "measures to reduce, prevent and/or supervise emissions" including product-oriented measures (and in a later stage, permanent expenses for ecological measures)
- **Environmental impact costs**: monetary evaluation of input aspects (environmental exploitation, environmental impoverishment) and output aspects (environmental pollution, environmental contamination) leading to a critical level of pollution of the atmosphere, hydrosphere and/or lithosphere.
- **Service costs**: All management costs in connection with environmental protection
- **Product and production costs**: Costs of raw, auxiliary and/or working materials used for manufacturing as well as proportionate costs of tools and energy.
- **Manufacturing costs of the residual substance**: Costs for the purchase, storage, transport and/or treatment of all materials which become residual materials as offal, waste, or air emissions, etc.

- **Costs of removal of remaining materials (disposal costs)**: Costs resulting from the treatment and/or storage of remaining materials in incinerating plants and landfills, including logistics and management costs.
- **Residual substance costs**: Costs arising from the collection, treatment and/or disposal of remaining materials.
- **Location-related costs**: Costs for the use of areas and/or landscapes
- **Process-based environmental costs**: Flow costs arising from the target-oriented consumption of goods and/or services which are in close connection with materials and energy flows. These comprise the costs of materials and/or energy inputs (e.g. the purchase costs of raw, auxiliary, and working materials) as well as internal flow costs (for the internal transportation, storage, and processing of materials), and the costs of waste water treatment, waste disposal etc.
- **External environmental costs / environmental impact costs**: Costs arising from environmental pollution caused by the enterprise which are not yet internalised, reduced, eliminated or utilized and are therefore not considered in internal cost accounting.

15.3 How to Implement Process-based Environmental Cost Accounting in a Company

The following project design shows one way in which a materials and energy flow model for the permanent integration of flow cost data into a company's information system can be prepared. The method is built up in a modular manner so that it is not necessary to complete all steps simultaneously.

The following modules, as shown in Figure 15.3, can be specified:

1 **Black Box - Inputs and Outputs are recorded:** Accumulating the actual data of the company in an ecological mass balance

2 **Modelling of the Materials, and Information Flow Model:** Preparing a model of materials and energy flows

3 **Addition of all costs to the flow cost calculation:** Assigning costs to cost centres

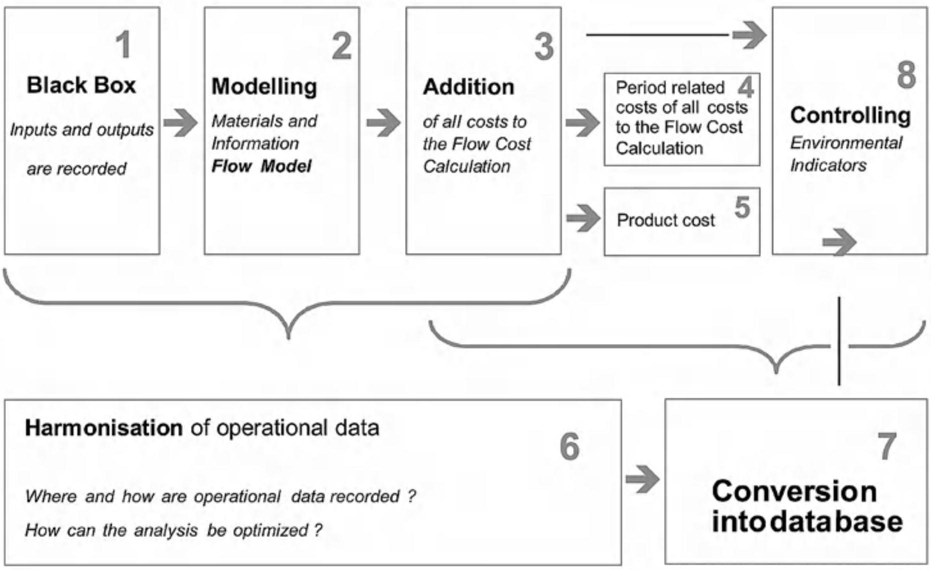
4/5 **Assigning costs to cost units:** Period-related and Product-related costing.

6 **Harmonisation of operational data:** Harmonising corporate data collection

7 **Conversion into data base:** Permanently implementing flow cost accounting using an information technology (IT) tool

8 **Controlling with Environmental indicators:** Establishing environmental parameters for controlling.

Figure 15.3. Project design



The project design will be presented based on two selected enterprises:

- **Enterprise 1: Mengen and Massen Inc.**

  This enterprise sells new and re-usable products for the glass, iron and steel industry:

  a) Recycling products:

  One task for Mengen and Massen Inc. is to analyse, sort and recycle fireproof stone mixtures which are used for melting iron, steel and glass. Once the melting process is finished, the used materials will be returned to Mengen and Massen Inc., and a complex recycling process enables the enterprise then to re-sell the recycled materials.

b) New products:

The enterprise offers a selection of new stone mixtures in addition to its recycled products. The raw materials for these mixtures, such as bauxite, are ordered in large quantities from companies in Asia and Latin America. The final products are delivered to the customers after mixing.

- **Enterprise 2: Flex Inc.**

  The product range of Flex Inc. includes protection fences and guards for machines, roll gates, doors, and protective planks. As well as producing these products, the enterprise also offers design services for protection devices, and it operates in both national and international marketplaces.

  Since 1995 Flex Inc. has offered a patented fence system based on prefabricated standard elements that can be changed according to customers' requirements. The production of these components is the subject of the project referred to above.

15.4 Project Design

Preparatory Work

The introduction of process-based environmental cost accounting requires systematic actions. The first step is to set up a project organisation by nominating a project co-ordinator, forming a project team, appointing a presenter and determining the objective of the project (Fuhrer 1996, Malik 1986, Krol 1993, Watzlawick et al. 1974). An interdisciplinary task force has proved to be very efficient in this regard, and this system has been implemented in both of these pilot enterprises.

15.4.1 Accumulating in an Ecological Balance the Actual Data of Either the Whole Company or Individual Business Units

Firstly, the project team must acquire an overview of the actual situation, and review the existing cost accounting and other information systems.

For an ecological balance, everything which enters and leaves the company should be considered. The slightly abstracted visualisation of these flows helps in developing an early overview without having to deal with the process of value creation in the various production stages, with large number of inputs and outputs that this involves.

Even at this early stage, the project team may discover which stages of the production processes have a high ecological influence or lead to high costs. These production stages should receive a detailed analysis. Both Mengen and Massen Inc. and Flex Inc. were able to focus on selected production steps even at this early stage, which helped to enhance the efficiency of the analysis.

15.4.2 Preparing a Model of Materials and Energy Flows

The goal is to be able to track consistently materials and energy flows, from their inputs to their outputs. For this purpose, the limits of the system have to be defined, then the production stages and indexing steps are determined, and the materials and energy flows which connect them are defined (State Institute for Environmental Protection Baden-Württemberg 1999: 11).

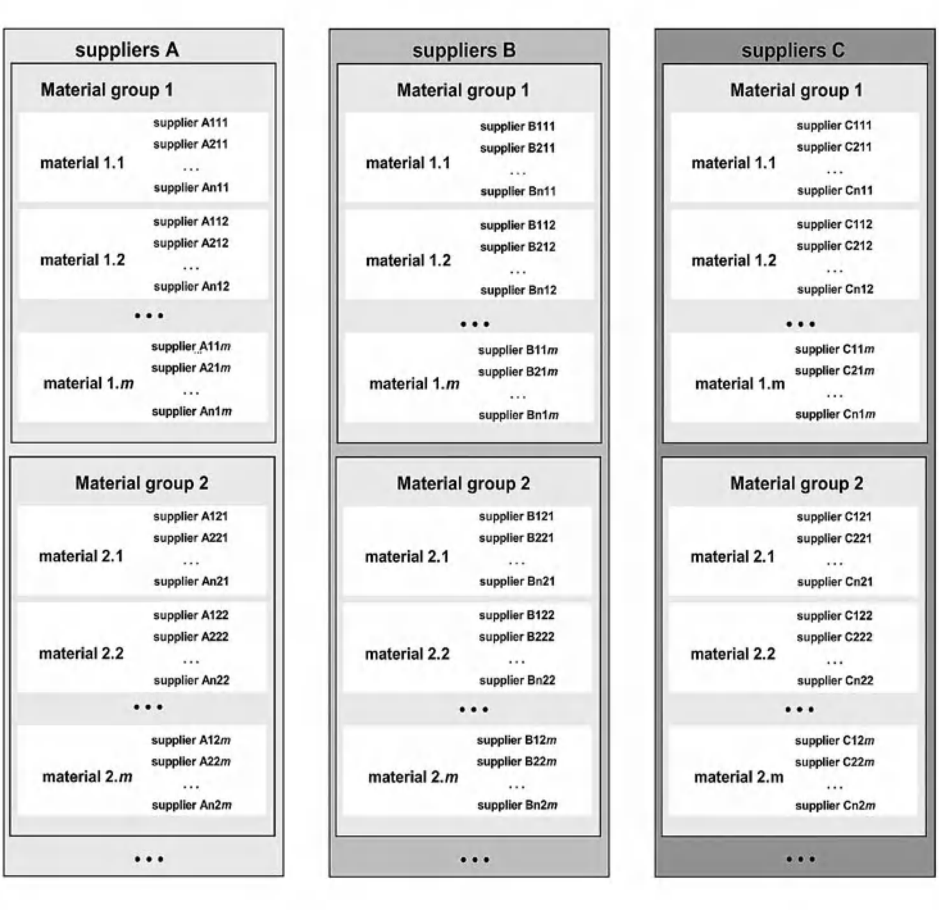
Since the situation is different for each company, the model displaying materials and energy flows will always be different. However, since the implementation uses a common set of IT tools, as will be explained later, modelling should always be done systematically. Certain areas may be similar in various companies but have a different scale.

The following paragraphs show various modelling areas and establish both differences and common features. A predefined standard model which is suitable for suppliers, incoming goods storage, processing, outgoing materials storage and customers may be helpful for implementation. Special cases should be highlighted.

Preparing a Model of the Suppliers' Structure. This model will vary depending on whether a company has many suppliers or only a few, but the structure is the same for all flow models. Purchased materials are either delivered by the supplier or collected by the manufacturing company from the supplier's premises, and are then brought either into a store or directly to the production site where they are needed.

Following a common classification, suppliers may be designated as A (very), B (less) or C (not) ecologically questionable (see Figure 15.4). Classification may be determined economically, ecologically or socially. A detailed determination is recommended, i.e. in terms of materials groups and types, especially in view of the IT implementation.

Figure 15.4. Structure of suppliers



Preparing a Model of Incoming Goods Storage. Purchased materials must be stored in different ways, depending on the production process. In agricultural enterprises, for example, seeds have to be stored in a dry and germ-free atmosphere. In the iron and steel industry, stainless steels must be separated from iron parts which are subject to corrosion. Materials contaminated with oil must be stored on a sealed base, in order to prevent ground contamination.

These examples could be continued. They show that storage rooms must be selected to suit the nature of the materials to be stored. A company will normally have several storage rooms to which incoming materials from different suppliers (see Figure 15.4) will be assigned. There are however common features of storage conditions which apply to other production processes and other industries.

Several storage rooms may be assigned for various incoming goods at any one time. After processing, a product may be assigned to either a store of the same kind (e.g. outside storage) or a different store (e.g. dry storage-room / warehouse).

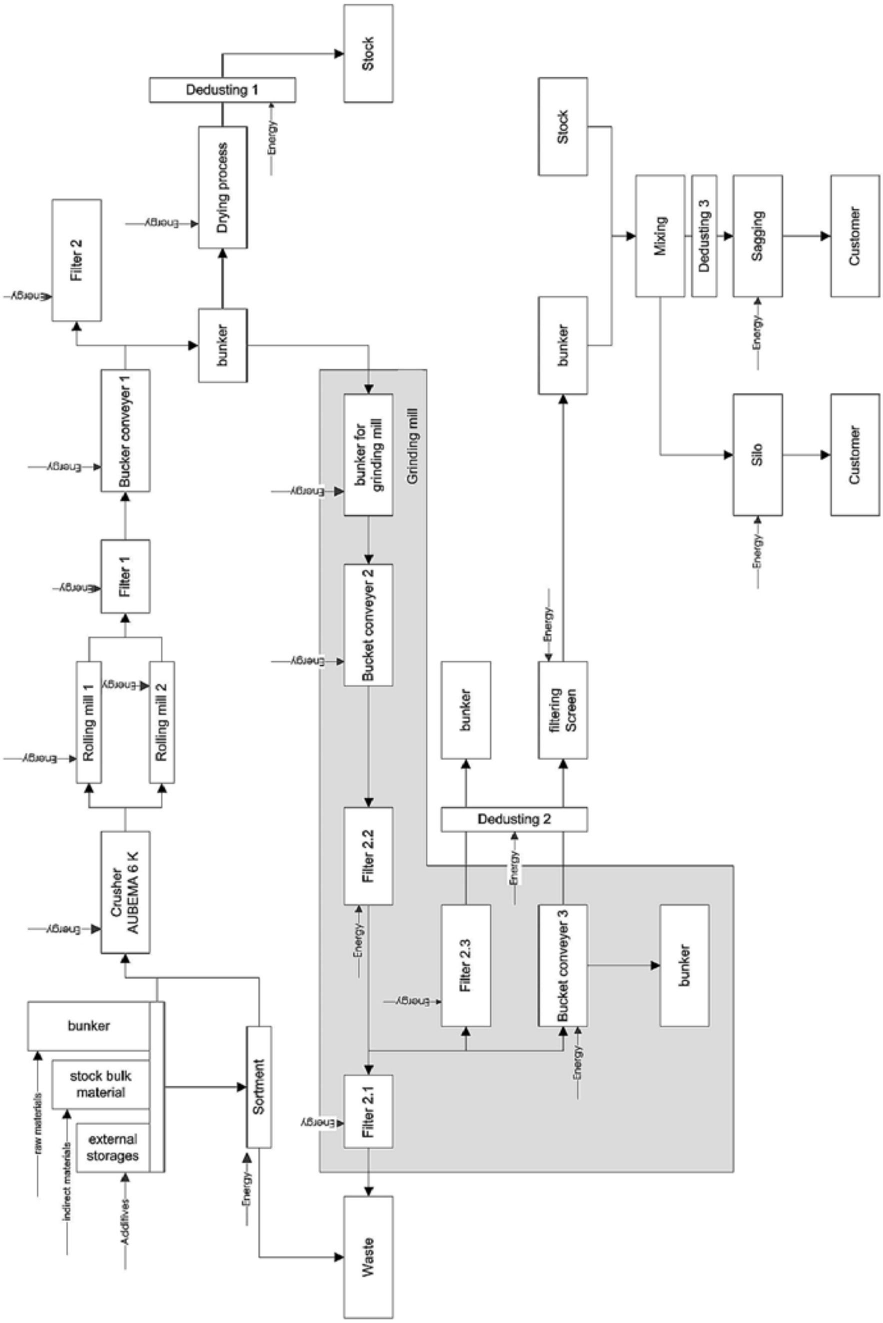
Materials of materials groups from A, B or C class suppliers are assigned to the incoming stocks $\mathrm{IS}_1 \ldots \mathrm{IS}_k$, quoting their quantity, value and delivery date. This method yields valid storage management data which allows the preparation of quantity and value-related reports, and the evaluation of the stock according to classical operational evaluation methods such as first-in-first-out (FIFO), last-in-first-out (LIFO), etc.

Preparing a Model of the Production Matrix. The different stages of actual production should be considered. A distinction may be made between two different production types, which is also provided for by the standard flow model. Both models are explained by the selected enterprises:

Version 1: Preparing a model for several consecutive production steps

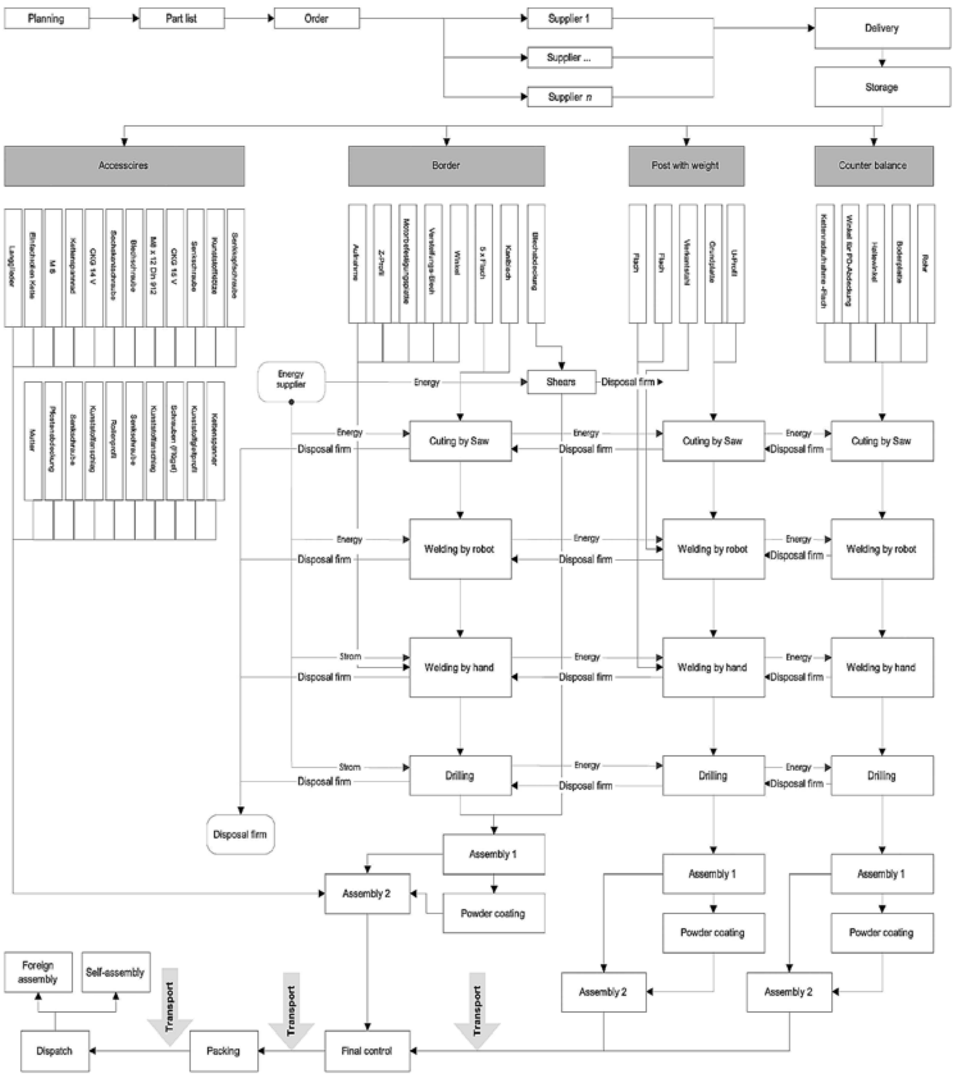
Mengen & Massen Inc. has a production process during which the incoming materials are progressively refined in each stage and the product may be sold following any stage of production. Consequently, the production process should be illustrated in a vertical direction (in the standard flow model which is shown in Figure 15.7, this route is indicated by the shaded cells).

Figure 15.5. Flow Model for Mengen & Massen Inc.



Version 2: Model with several production processes running simultaneously

Figure 15.6. Flow Model for Flex Inc.

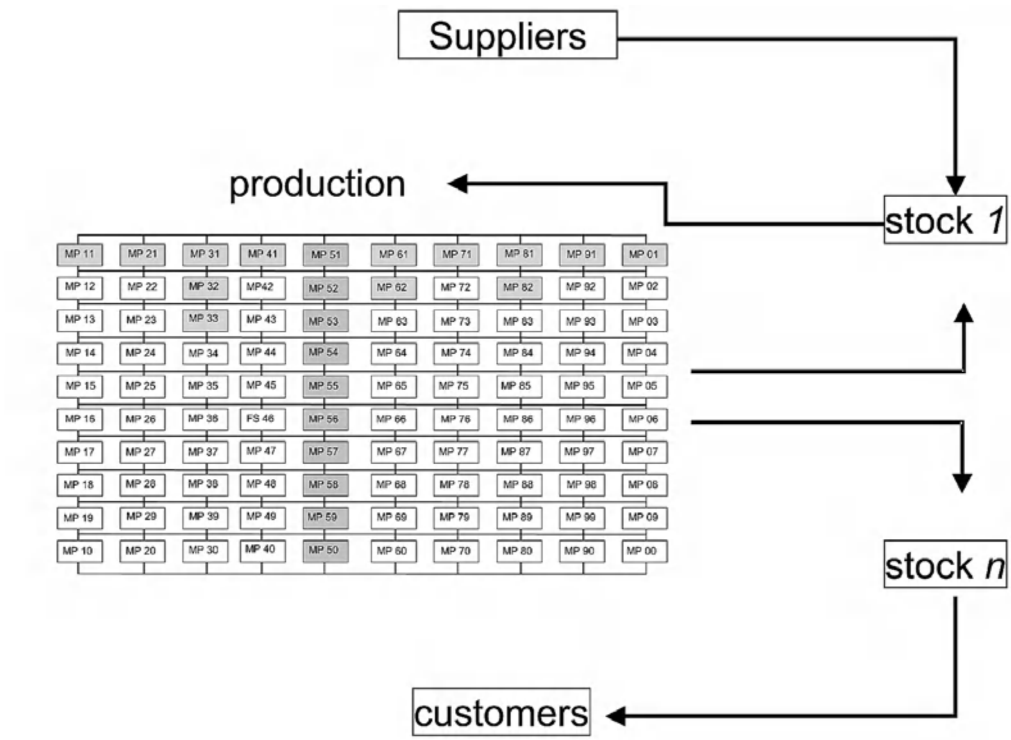


In the case of Flex Inc., several production processes are run simultaneously. The illustration shows the production of a safety guard (a special type of gate which can be lifted). Several individual components are produced separately and then assembled, either before or after being coated with a lacquer.

The standard flow model progresses in a horizontal direction (see Figure 15.7).

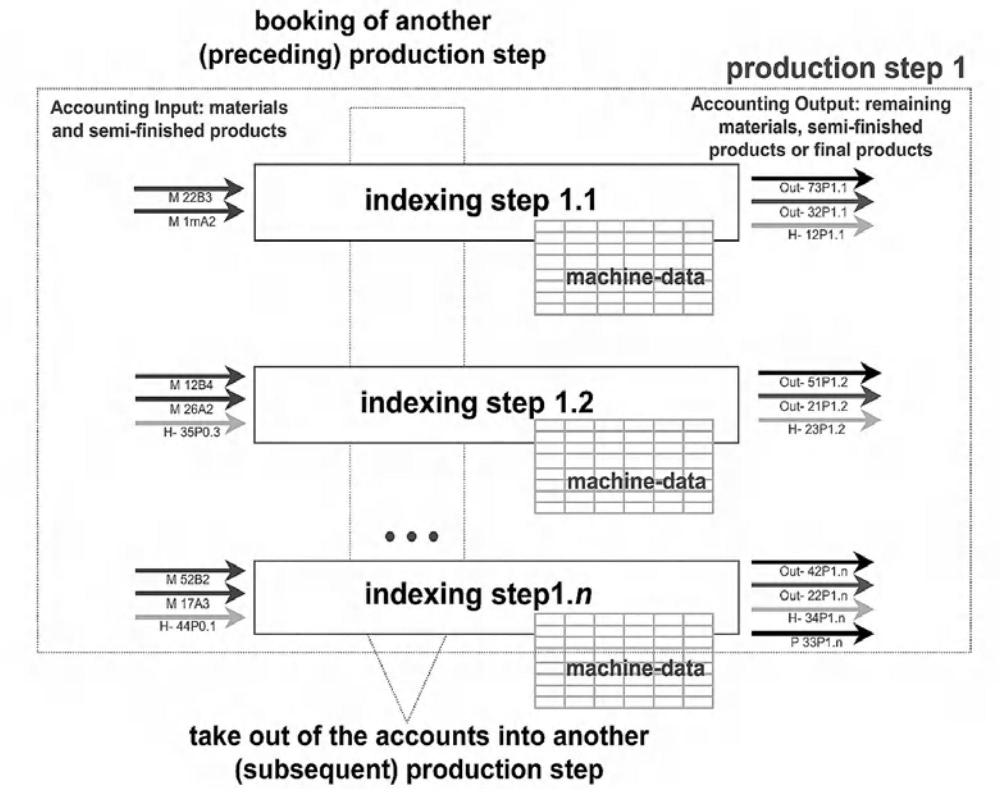
In the case of this model, processed semi-finished products from each stage of production are assigned either to the next production stage or to intermediate storage, thus obtaining a row of materials points which are connected by flows.

Figure 15.7. Standard Flow Model



The most extensive model provides a complex square structure for the production process. If several single components are produced in many production stages, a flow model is obtained which is simultaneously both broad and deep. Production flows may combine in a single product, or divide into several different production lines. The standard production model provides an approach for almost all production processes and for tracing back. Each production stage included in the standard production model may be divided into partial production steps $n_1.....n_m$. Figure 15.8 shows a proposal for a system of inputs and outputs.

Figure 15.8. Flow Model - production stage



For each production stage, incoming and outgoing materials and energy flows must be determined. Both stock materials (raw and process materials) and fabricated materials from other production stages or partial production stages can be assigned.

Semi-finished products, finished products, waste for disposal or for recycling as well as remaining materials which are not used (and may be returned to stock), are removed from the (respective) account.

Preparing a Model for the Structure of Intermediate/Sales Stock. As for the delivery and storage of incoming goods, the storage of products in intermediate or finished product storage areas, as well as the mechanism for subsequent transport to the customer, is comparable for many enterprises.

Preparing a Distribution Model for the Customer Structure. At the end of the production process, the finished product must reach the customer. There are several possibilities, such as the customers collecting the product, or the product being shipped by a forwarding agency or delivered using a company-owned delivery system.

If there are various groups of customers, the model will be adapted to suit these groups. Some companies may classify their customers as either bulk purchasers or purchasers of small quantities, or according to the ABC method. Since the structure of customers is identical with that of suppliers, there is no need to go more deeply into this topic here.

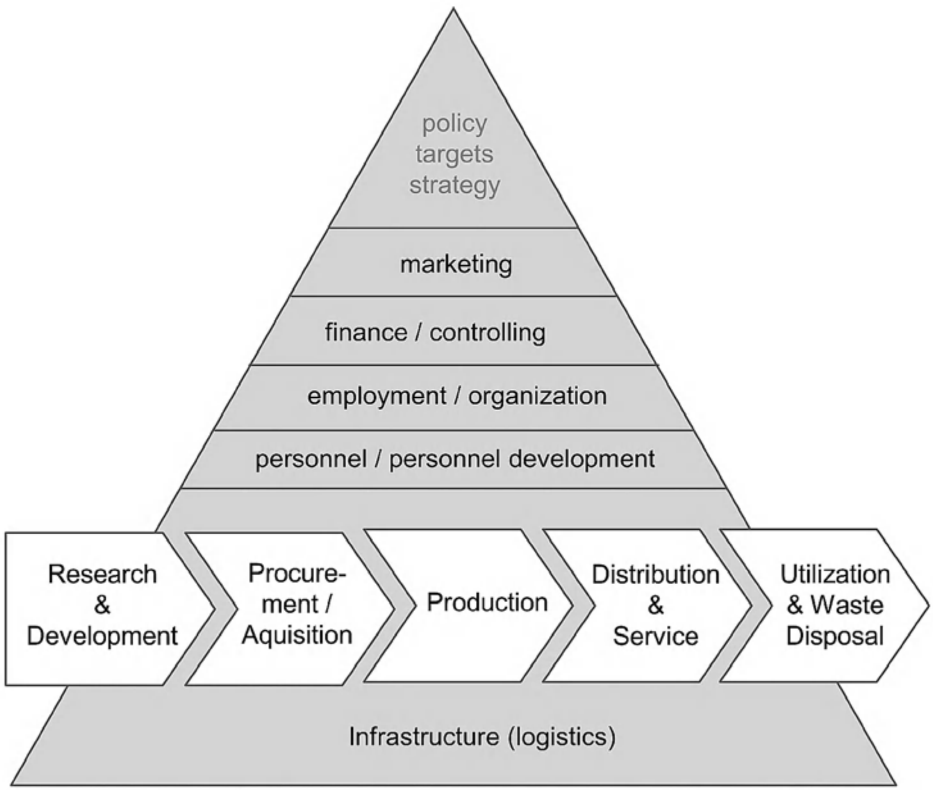
Secondary Processes. In addition to the primary process of value creation and the modelling of this using quantity points and flows, operational overheads (in the sense in which these are understood in conventional classical cost accounting) may be apportioned to the production process, and an additional model may be prepared. In order to achieve precise assignment to cost units, such cost must be calculated in a process-oriented manner.

First Analysis of Weak Points and Potential for Cost Reduction. Generally, the modelling of the flow model itself can already indicate some opportunities to make improvements in order that enhanced flow structures may soon be suggested. This is especially true when an interdisciplinary task force with production and administrative knowledge is involved in the realisation of the model, when many new findings are almost certain to appear.

Typical features of materials and energy flows are (Ministry of Economics, Transportation, Urban and Regional Development 1999: 78)

- Irregular distributions
- High losses
- Frequent change cycles
- Insufficient return

Figure 15.9. Model of secondary processes



- Unnecessary mixing
- Insufficient post-treatment

15.4.3 Assignment of Costs to Cost Centres

The materials and energy flow model which has been prepared forms the 'framework' which must be completed with specific figures representing materials flows and quantity points. This will provide answers to questions such as the following (Ministry of Economics, Transportation, Urban and Regional Development 1999: 41), and enable a basis to be determined for corrective action:

- What materials value has flowed from production to waste storage in the past year?

- What costs are incurred by rejects, arising from purchasing, storing, production and disposal?
- What is the percentage of raw materials costs as a proportion of total production costs?

15.4.4 Assignment to Cost Units

Once the costs have been assigned to cost centres, the cost can be determined on the basis of either orders or products. The flow analysis provides the quantitative and cost-related parameters for a product or an order. Furthermore, the dimensions of classical cost accounting (wages and salaries, depreciation, etc.) are considered. Such costs can however also be assigned to the processes.

15.4.5 Harmonisation of Data Collection

In developing a compatible, systematic and efficient data structure, it is appropriate to check the central information systems of the materials management and logistics functions, of production scheduling, of waste management, and of conventional accountancy, to see how these can contribute to the materials and energy flow model by providing concrete figures. The examination of existing structures allows further specification of the data requirements. Often, only slight modifications to existing systems are sufficient, whereas if the previous analysis had not been carried out then a completely new IT module would have been required. Basically, an information system must be built up which is based on a single database which is itself related to the flow model by numerous analogues in the modules, and which thereby provides management with condensed information to help in taking decisions. If this can be achieved, quantity points (cost centres in the flow cost accounting model) will be found in storage-rooms, on balance sheet accounts, or in cost centres. Information on flows is contained in production orders, movements, materials numbers, types and categories, cost elements, cost centres, cost units and waste fractions (State Institute for Environmental Protection Baden-Württemberg 1999: 20).

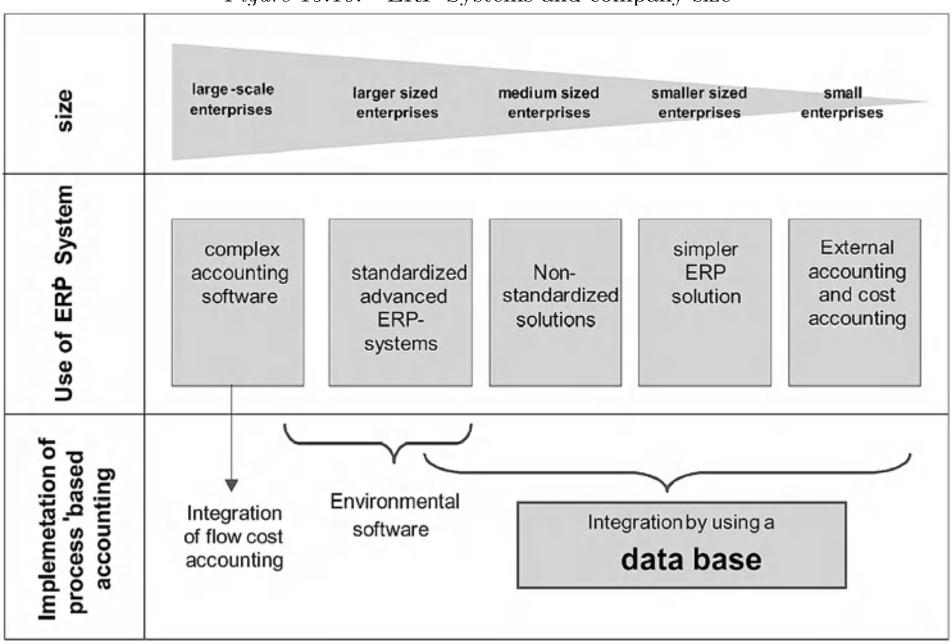
15.4.6 Permanent Implementation of Flow Cost Accounting

Since all modules introduced so far have been dealt with by a qualified project team, assisted by external consultants, it is unlikely that middle management would be able to handle this on their own. Decision makers and qualified staff have limited time and will be available only occasionally.

What can be done to exploit permanently the potential of flow cost accounting, and how can it be linked efficiently to existing cost accounting? The authors would argue that this can be managed successfully only through an IT link to existing IT systems. Environmental cost accounting involves not only the collection of environmental data but, more importantly, it permits the management and control of the business process at all times. Within the framework of a universal accounting system, flow cost accounting can systematically and comprehensively analyse operational materials flows and overheads and provide a practical management tool for the control of the enterprise.

At present, 41% of all German companies in the process industry sector use so-called Enterprise Resource Planning systems, 11% use a self-developed solution, and 48.1% do not use Enterprise Resource Planning at all (Konradin Verlagsgruppe 2001). An ERP solution is seen as an integral software solution which consists of various modules (production scheduling and controlling, materials management, financial accounting, personnel accounting, logistics, etc.). These modules are fed by inputs of the required data from a central database

Figure 15.10. ERP Systems and company size



The implementation of IT-supported environmental cost accounting depends on the size of the company and on the existing data stock. Figure 15.10 shows first solutions which are dependent on the situation which may be found in the company concerned.

The enterprises involved in this project have three alternatives for permanent data collection and the continuous application of environmental cost accounting:

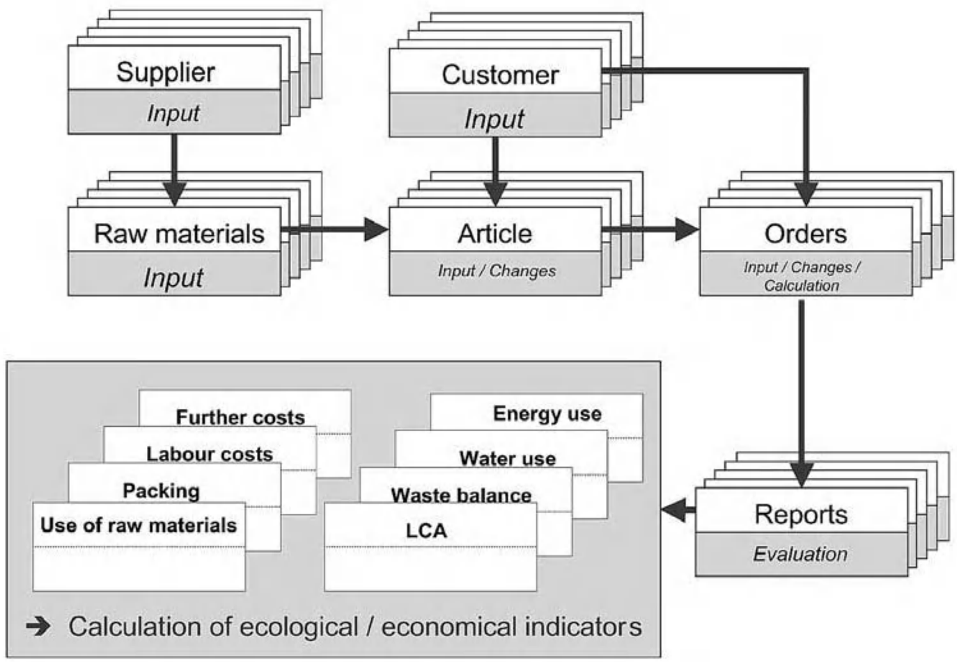
- large companies with an implemented ERP system
- small companies which are not yet working with an ERP system
- very small enterprises which will not implement an ERP system at all

In the **first case**, the enterprises have a standard ERP solution which has been in use for some years. Additional modules or the use of environmental software can be recommended for these enterprises. This kind of software uses some of the data from accounting systems to develop process-oriented accounting for materials and energy flows. Some software is able to calculate the environmental costs, but the processes of collecting and reading the data can be expensive in time. The permanent use of environmental flow cost accounting can therefore be reached only if the data system is connected to the accounting software and the central data base. The implementation of such a module would pay off for this type of company.

The **second case** is represented by those companies which have not yet perceived a need for an ERP system, but which plan to implement one in the future. These companies should either invest in a integrated solution, or alternatively to use environmental software in a stand-alone solution. Further, they could use two systems in parallel.

The **third case** addresses enterprises for which, in view of their size, an ERP system would not be worthwhile because of the high implementation cost of such a system and because, again by virtue of their size, the potential benefits of an ERP system are not recognised or foreseen. For this target group, data collection using simple user programmes is recommended. One possibility would be the implementation of a database (see Sinzig 1992: 1251, Scheer 1998). This allows the database to be extended to obtain a customised software solution. An additional benefit is the possibility of adapting the database to suit changing production processes (Strobel 2001b, Krcmaer 1999, 2000).

Figure 15.11. Data base



This solution is also recommended for companies in Poland and in the Czech Republic since in Central and Eastern European countries the penetration of ERP solutions is far behind the situation in West Germany - according to SAP, only 15% of all SMEs in this region have implemented an ERP system.

15.4.7 Formation of Environmental Figures of Control

In the previous modules, a materials and energy flow model was introduced as a basic component of process-based cost accounting. Furthermore, the possibility of the permanent implementation of an environmental cost accounting system in SMEs using an MS Access© database has been explained. From the large mass of data generated up to the present stage, parameters for control which enable time-related and industry-related comparisons to be made may be extracted from materials and information flow-orientated cost accounting.

As an extract from environmental cost accounting with condensed information, environmental parameters are very useful as controlling instruments for establishing a long-term, and therefore strategically-orientated, dimension (Seidel 1998).

15.5 The Potential of this Concept

The potential of this concept can be characterized as follows:

Solutions for different sectors and company configurations:

- Possible approaches are shown leading to efficient cost management

Improvement of data quality

- Systematic registration, preparation and representation of data and information; co-ordination of information generation and management
- ABC analysis regarding environmental, legal and cost relevance
- Exact accounting for materials, mass and energy used in the system
- Increasing transparency leads to a clear SWOT analysis (an analysis of strengths, weaknesses, opportunities and threats) and to a clear representation of costs

Implementation of process-based control

- Technical and operational optimisation becomes possible by using process-oriented planning and control
- Implementation of an indicator system for sustainable control
- Easy and practical handling

Reduction in costs

- Reduction of the materials input for products and packing
- Lower waste disposal costs
- Better machine utilisation

- Cost reduction of 3 to 10% of the operating costs

Improvement of process quality

- Optimisation of the production process
- Improvement of process safety
- Reduction of the pass-through times
- Communications improvement

Environmental relief

- Location-related environmental relief
- Reduction of the materials and energy flows

Easy handling of complex structures

- Easy to manage by using computer-based applications
- Large distribution of database applications

15.6 Summary and Outlook

In future, this project will deal increasingly with the modelling of secondary and overhead processes and attempt to identify the cost drivers of overhead costs such as those for management, procurement, technical infrastructure, personnel development, etc., and will address the long-term strategic dimension of environmental cost management. This paper is focused on process-based cost accounting and the operational short-term dimensions of cost management for environmental issues.

In a strategic long-term dimension, the concept of the Balanced Scorecard might be extended to embrace ecological considerations. The basic idea of this concept is the translation of an entrepreneurial vision into strategies, qualitative and quantitative goals, and the actions to be taken to reach them. Planning, control, management and communication are carried out by using a co-ordinated system of parameters. Balanced scorecards are above all a method to provide a framework for the successful implementation of strategy in the overall organisation. This provides an understandable control system for the achievement of strategic goals which is communicated in a transparent and clear manner by means of informative parameters (Key Performance Indicators) rather than by the formulation of strategies.

Environmental cost management with its operational short-term and strategic long-term orientation provides a valuable approach to the problem described above. The methods presented are of real benefit, especially for SMEs.

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IV

EFFECTS OF EMA

16. The Influence of ISO 14001 and EMAS Certification on Environmental and Economic Performance of Firms: an Empirical Analysis*

Marcus Wagner

Centre for Sustainability Management (CSM), University of Lüneburg, Germany

mwagner@uni-lueneburg.de

Abstract This paper analyses the influence of environmental management system certification on environmental performance as measured by physical environmental performance indicators, and on economic performance based on a variety of firm-level financial indicators. For this purpose, data on environmental performance has been collected from corporate environmental reports and emissions inventories for a sample of companies in the paper and electricity generation industries in the Netherlands, Italy, Germany and the UK; and in parallel, financial information for the same set of firms has been extracted from financial databases in a comparable format. Based on this data set, the paper reports how EMAS verification and/or ISO 14001 certification interacts with the environmental and economic performance of firms. This includes an assessment of significant differences between firms in the paper and electricity sectors, as well as a more detailed analysis of the direct relationship between the environmental and economic performance of firms in the paper industry. The paper finds that three hypotheses formulated about the link between environmental management system certification and environmental and economic performance, as well as the relationship of the latter two, are rejected. Based on the data analysed, it therefore cannot be concluded that there is a statistically significant link between the certification of environmental management systems, environmental performance, economic performance, and their relationship.

*The author dedicates this paper to the memory of Jérôme Carlens, who sadly and very unexpectedly died in April 2001. Working with him was both enjoyable and scientifically stimulating. Valuable comments of Stefan Schaltegger, Walter Wehrmeyer and Frank Figge on draft versions of this paper are gratefully acknowledged. Any remaining errors are exclusively the author's.

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16.1 Introduction

The ISO 14001 and EMAS standards for environmental management systems are a major tool for companies in various industry sectors to improve their environmental performance. Many firms have introduced certified environmental management systems and have subsequently reported positive effects on their economic performance. This is also the core of the eco-efficiency concept, which proposes that it is possible for firms to create win-win situations in which they simultaneously improve both their environmental and their economic performance. This raises the obvious question of whether the theoretical proposition of the eco-efficiency concept can be supported by empirical evidence. This paper therefore analyses the influence of ISO 14001 certification and/or EMAS verification on the environmental and economic performance of firms in the European Union, in defined industrial sectors.

Environmental management systems (EMS) have become increasingly relevant over the last five years. This is at least partly attributable to their (perceived) cost-reducing, sales-boosting and innovation-inducing effects, particularly if certified according to the EU Eco-Management and Auditing Scheme (EMAS) or ISO 14001 (ASU 1997). For example, the German Federal Environment Agency emphasises in its review report on experience with EMAS in Germany that approximately 50% of the companies which were surveyed reported cost savings (UBA 1999). However, the report also stresses that only one quarter of all respondents considered the benefit-cost ratio of introducing an EMS to be positive, with one quarter considering it to be negative and another quarter being undecided (UBA 1999). This probably points to longer payback periods for the introduction of an EMS than are usually assumed. Dyllick (1999) states in this respect that "areas of environmental competition exist where environmental problems may lead to competitive advantages or disadvantages depending on whether they are solved or not" (Dyllick 1999: 65) and stresses that "both costs and possibilities for differentiation are important to look at in this respect" (Dyllick 1999: 65). Therefore, it is likely to be insufficient to look only at cost savings when assessing the benefit-cost ratio of EMS, and to be necessary also to incorporate a much more difficult monetary evaluation of the benefits achieved by EMS through environment-based differentiation strategies and EMS-induced product or process innovations, which would probably produce a generally more positive benefit-cost ratio.

16.2 Development of Hypotheses

Regarding environmental management in general, Schaltegger and Figge (2000) argue that the amount of corporate environmental protection in itself neither spurs nor reduces shareholder value (or similarly other measures of economic performance). Contrary to the commonly held view that the amount of environmental protection (and thus the level of environmental performance which is related to it) is related (negatively or positively) to the economic performance of firms, they argue that such a relationship strongly depends on factors internal to the firm.

In particular, corporate environmental strategies, the environmental management approaches used, the activities adopted by the firm, and the tools utilised, are seen as major factors which moderate the relationship between environmental and economic performance at firm-level (Schaltegger and Synnestvedt 2001). Economic performance can be further improved if environmental protection activities are linked to the key value drivers of shareholder value, or to economic performance in general. Only if a company's environmental management approach, represented for example by its EMS, has a positive effect or a minimised detrimental effect on these value drivers, can high shareholder value or profitability be achieved simultaneously with high levels of environmental performance.[1] With regard to EMS, the arguments made by Schaltegger and Figge (2000) imply that such systems cannot be judged at "face value", and that the organisational structures resulting from them, as well as the activities initiated by them, need to be considered in detail. Dyllick (2000) for example suggests five "ideal" types of EMS (infrastructure, auditing, controlling, marketing, public relations) and points out differences between these in their aims, objectives, main stakeholders and measures. These differences may well lead to different profiles of costs and benefits, resulting in varying benefit-cost ratios.

External verification/certification of an EMS by means of EMAS verification or ISO14001 certification is a strong proxy for the fact that a company has a well-defined EMS and corporate environmental strategy (CES). Since strategy determines action, verification/certification should also implicitly address trade-offs, and move the environmental management of a firm towards more efficiency and effectiveness. On many occasions, EMS

[1] This line of argument potentially explains also why the empirical studies carried out so far have not uniformly identified the existence of a single clear link, either positive or negative, between environmental and economic performance at level of the firm.

certification is therefore used as a proxy measure for good environmental management, a prominent example being the numerous environmental and sustainability ratings offered by banks, investment firms and specialised rating organisations.

Three hypotheses can be formulated with regard to the effect of certification on environmental and economic performance, and their relationship:

Hypothesis 1: Firms certified to ISO or verified under EMAS are expected to have significantly better environmental performance (measured as index ranks and as individual normalised emission and input indicators)[2] than firms not certified/verified. Possibly this relationship is time-lagged.

Hypothesis 2: Firms certified to ISO or verified under EMAS are expected to have better average economic performance - measured as return on sales (ROS), return on capital employed (ROCE) and return on shareholder funds (ROE) - than firms not certified/verified.

Hypothesis 3: A group of firms that are certified to ISO or verified under EMAS is expected to have a more positive relationship between environmental and economic performance (i.e. clearly above-average levels of environmental performance, but at the same time over-proportionately above-average levels of economic performance), than a set of firms which are not certified to ISO or verified under EMAS.

16.3 Data Used in the Paper Manufacturing and Electricity Generation Sectors

Data was collected for a group of paper manufacturing firms in four EU countries: Germany, Italy, the Netherlands, and the United Kingdom. ISO-certified and EMAS-verified firms were distributed across these countries as described in Table 16.1. In 1996, data for 34 firms was included, whereas in 1997, 37 firms were included in the analysis. Since data was also collected for single-site firms, it is possible that a firm may be certified to ISO as well

[2]The individual normalised emissions and inputs used as environmental performance indicators were (as far as data is sufficiently available): CO_2 emissions, SO_2 emissions, NO_x emissions, total waste, hazardous waste, municipal waste, BOD emissions, COD emissions, recycled fibre input, total fuel input, total energy input, self-generated electricity, and water input, all per functional unit, i.e. per metric tonne of paper produced. Olsthoorn et al. (2001) support the use of these indicators in the paper sectors. To carry out sensitivity analysis for the most important emissions/inputs (SO_2, NO_x, COD, and water input), these were also normalised with value added as the functional unit and the results were compared to those with normalisation on the basis of metric tonnes of paper produced.

as verified under EMAS, so that the sum of ISO certifications and EMAS certifications is not always equal to the total of EMS certifications. Given that data on all the variables was not available for all firms in all years, the number of firms included in testing the hypotheses was smaller than the total number of firms reported in Table 16.1.

Regarding differences in environmental performance, for example, the number of firms with EMS which were included in testing ranged from 2 to 5 for 1996, and between 5 and 17 for 1997.

Table 16.1. EMS certification across countries for the paper manufacturing sector (out of the total number of firms included)*.

Year	**1996**			**1997**		
Country	***ISO 14001***	***EMAS***	***Total EMS***	***ISO 14001***	***EMAS***	***Total EMS***
Germany	1/10	3/10	3/10	5/10	6/10	7/10
Italy	0/7	0/7	0/7	1/9	0/9	1/9
Netherlands	1/8	0/8	1/8	4/9	1/9	4/9
United Kingdom	0/9	1/9	1/9	6/9	1/9	6/9
Total	2/34	4/34	5/34	16/37	8/37	18/37

* i.e. "1/10" means that in Germany in 1996, of 10 companies in the sector, 1 had ISO 14001 certification.

In addition to data on the paper-manufacturing sector, data for the electricity generation sector was also collected in the same four EU countries. Variables were defined in the same way as for the paper sector. The structure of this (more limited) data set of electricity generators is provided in Table 16.2. The smaller number of cases is partly due to the larger average size of firms in the sector.

Most of the environmental performance data used in this paper (as well as the data on EMS certification) was collected as part of the project "Measuring Environmental Performance of Industry (MEPI)".[3] The author also

Table 16.2. EMS certification across countries for the electricity generation sector (out of the total of firms included).

Year	**1996**			**1997**		
Country	***ISO 14001***	***EMAS***	***Total EMS***	***ISO 14001***	***EMAS***	***Total EMS***
Germany	0/9	2/9	2/9	0/8	2/8	2/8
Italy	0/2	0/2	0/2	0/2	1/2	1/2
Netherlands	0/2	0/2	0/2	0/1	0/1	0/1
United Kingdom	1/6	0/6	1/6	2/6	0/6	2/6
Total	1/19	2/19	3/19	2/17	3/17	5/17

collected additional environmental performance data based on the method used in the MEPI project (Berkhout et al. 2001) and incorporated in the MEPI database. Financial data and data on economic performance was collected from the Amadeus database maintained by Bureau van Dijk. The matching of records in the two databases was carried out based on the name and address of firms/sites, as well as on the number of employees (so far as data was available).

16.4 Hypothesis Testing for Different Data Sets

16.4.1 Hypothesis Testing for the Paper Manufacturing Sector

It was decided not to take into account the differences between EMAS and ISO, since this would have limited the availability of data too much. Also, such a separation would have created significant country correlation, since EMAS-registered firms are predominantly located in Germany, and a distinction between EMAS and ISO could also have led to significant sub-

[3]The MEPI project was funded under the 4^{th} Framework Programme (Environment and Climate) of DGXII of the European Commission. MEPI was coordinated by the Science Policy Research Unit (SPRU), University of Sussex, UK. Research has also been conducted by the Centre Entreprise-Societe-Environnement (CEE); L'Université Catholique de Louvain, Belgium; the Institute for Environmental Studies, Vrije Univesiteit Amsterdam, Netherlands; the Department of Economics and Production, Politecnico di Milano, Italy; the Institut für Ökologische Wirtschaftsforschung (IÖW), Austria; the Institute for Prospective Technological Studies (IPTS), Sevilla, Spain, and the Centre for Environmental Strategy (CES), University of Surrey, UK. Further information on MEPI can be found at www.environmental-performance.org.

sector correlation. Due to serial correlation, it is possible only to conduct tests separately for each year which is included in the data set (and in doing so, not to violate the independence assumption which is required for the test's applicability).

Since both ISO and EMAS had to be addressed, a variable "EMS" was defined which was coded "Yes" if a firm/site had ISO certification, EMAS verification, or both; otherwise, the variable was coded "No". Using the "EMS" variable to define two distinct sets of firms, Mann-Whitney U tests were then carried out for all relevant environmental variables for which sufficient data was available. Since ISO and EMAS verifications were rare in 1995, tests were carried out only for 1996 and 1997. In the tests, all countries were pooled since, in theory, country differences are irrelevant for differences between firms and sites which are respectively with or without EMS. This is because the aim of an EMS is voluntary over-compliance, and therefore the effect of national regulation, which is considered likely to be the most important country influence, is mostly irrelevant. Regulation seems to be relevant only for the uptake of EMS certification amongst firms (which is often supported by government grants, which may vary across countries), but not for the performance-related outcomes of EMS certification. In addition, Tyteca et al. (2002) argue that testing the influence of country differences on environmental performance is problematic since sub-sector membership of firms is considered a major explanatory variable, and since different countries have different sub-sector profiles, the differences which might potentially be observed between countries would be meaningless.

Hypothesis 1 was initially tested using index ranks which corresponded to index scores calculated for four individual (product-output) normalised environmental performance indicators, using the method initially developed by Jaggi and Freedman (1992) in the adaptation used by Tyteca et al. (2002). The indicators used to calculate the index score were SO_2 emissions, NO_x emissions, COD emissions and total water input. However, for the analysis, ranks were used which were derived from the index scores calculated. Figure 16.1 shows in graphical form the findings when correlating index ranks with the EMS variable (as described above, with "1" coding for "Yes", and "2" coding for "No"). The index ranks denoted with squares refer to the year 1997, as does the corresponding EMS variable. The index ranks denoted by a triangle refer again to 1997, but the EMS variable for these refers to 1996, i.e. it is time-lagged for one year.

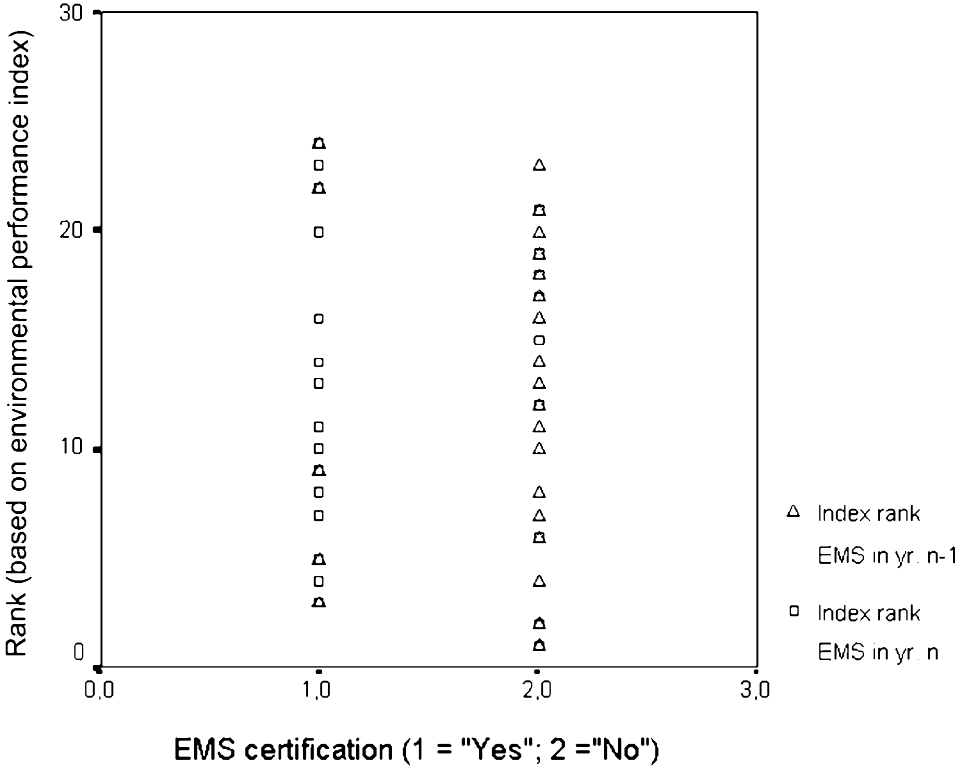
Intuitively, what can be seen from Figure 16.1 is that for both the time-lagged and the non-time-lagged case, there seems to be no significant difference in environmental performance as measured by the index ranks. This is confirmed by the corresponding Spearman rank correlation coefficients. These are insignificant for the correlation between EMS and index rank for both years, 1996 and 1997 (r = -0.019, insignificant, n = 24 for 1997 certification and r = -0.016, insignificant, n = 23 for 1996 certification).

However, the correlation between the EMS variables for 1996 and 1997 is significant (r = 0.397, 0.05 level (2-tailed), n = 35). This is as expected, given that firms/sites which had a certified EMS in 1996 also had certification in 1997. Given that results for aggregate indicators did not provide any indication of significant differences, significance testing was carried out for individual normalised emission and input indicators in order to substantiate the findings for aggregate index ranks.

The test results for individual environmental performance indicators reveal that, in all cases but one (CO_2 emissions, for which the ranks were significantly higher, based on mean ranks) in the group of firms with EMS, with U = 25, W = 70, Z = -1.861, 0.10 level (2-tailed), n = 20, the differences between EMS and non-EMS firms were not significant. One reason for the results regarding EMS could be that the effects of EMS implementation or of activities resulting from EMS may have only a delayed effect on environmental performance, for example that EMS implementation and activities in one year may have only a time-lagged effect in the following year. In order to test this possibility, U tests were carried out as described above, using 1997 environmental performance data and 1996 EMS data. Again, data for all countries was pooled. The results remained unchanged, except that CO_2 emissions too now showed no significant differences. However the small number of EMS firms in 1996 makes this latter finding less reliable than the results for 1997.

Tests were carried out across all countries during the sensitivity analysis for the most important emissions/inputs (SO_2, NO_x, COD, and water input), normalised with value added (VA-normalised) as the functional unit. These did not reveal any significant differences between EMS and non-EMS firms except for the case of water input per value added (water input with ranks significantly higher for non-time lagged EMS firms, U = 42, W = 120, Z = -1.732, 0.10 level (2-tailed), n = 24). When analysing also 1996 environmental performance data (VA-normalised) and 1996 EMS data, no significant differences were found, which supports the findings for the non-time lagged 1997 analysis. Also, no significant differences were found for

Figure 16.1. Index ranks (1997 data) for EMS certification in years n (1997) and n-1 (1996)



1996 EMS data and 1997 VA-normalised environmental performance data. Findings for VA-normalisation are therefore consistent with the findings based on normalisation on the basis of tonnes of paper produced. Based upon these findings, **Hypothesis 1 was rejected**. There is no clear evidence that firms' certification of their EMS results in significantly better environmental performance. This does not preclude, however, the possibility that the existence of an EMS in a firm (independent of whether it is certified or uncertified) does have such an effect. However, the focus of this paper is to analyse the effect of certification, so this possibility was not analysed further.

Regarding country influences, Table 16.1 shows that in 1997 more than two-thirds of the EMS firms were located in either Germany or the UK. In 1996, more than half of the EMS firms were located in Germany. Given the considerable influence of German firms, the U tests analysing the influence of EMS on environmental performance were also carried out for 1997 and for Germany only. The tests for 1997, with the EMS variable not time-lagged for Germany only, yielded basically the same results as had been found across all countries. The insignificance of differences between EMS and non-EMS firms could be reproduced except for COD emissions, where for German firms in 1997, a significant difference exists ($U = 0$, $W = 6$, $Z = -2.324$, 0.05 level (2-tailed), $n = 9$). The same tests were carried out for the United Kingdom only in 1997, which accounted for approximately one-third of the EMS firms in that year. These last tests replicated the results for Germany (i.e. there were no significant differences for those environmental performance variables for which sufficient data was available), but this may also be due to the very low number of cases available in the UK. The same findings as for German firms only in 1997 was made for 1996 in a time-lagged influence analysis of EMS on environmental performance for German firms alone. Time-lagged influence was operationalised by testing the influence of EMS status in 1996 on environmental performance in 1997. No significant differences between EMS and non-EMS firms were found for any available variables, including COD (for self-generated electricity and CO_2 emissions, the data was insufficient). Therefore, Hypothesis 1 is rejected. There is no clear evidence that firms with a certified EMS have significantly better environmental performance than those without a certified EMS or with no EMS at all.

Testing for Hypothesis 2 was carried in a similar manner to the testing for Hypothesis 1. The economic performance indicators which were used to test Hypothesis 2 were:- return on sales (ROS); return on equity (ROE);

return on capital employed (ROCE); the current ratio; the solvency ratio; value added (the only absolute, i.e. non-factored, variable); value added per employee; and the sales-to-asset ratio. Unlike the environmental performance indicators which had been used, data on economic performance indicators was available for three years: the year preceding the EMS reference year (i.e. year n-1), the year corresponding to the current state of the EMS (i.e. year n), and the year following the EMS reference year (i.e. year n+1). The influence of time lags can therefore be tested more directly than in the case of the environmental performance indicators. For this reason, no time-lagged analyses were carried out with 1996 EMS data.

It was found that in 1997 across all countries, direct influence differences (i.e. year n) between firms with EMS and those without are significant (at the 0.05 level) only in the case of the solvency ratio (U = 70, W = 190, Z = -2.171, 0.05 level (2-tailed), n = 32) and for absolute value added (U = 52, W = 172, Z = -2.509, 0.05 level (2-tailed), n = 30), but not for value added per employee. For time-lagged influence of the EMS on economic performance (i.e. year n+1), a significant difference is found only for value added (U = 56, W = 161, Z = -1.698, 0.10 level (2-tailed), n = 27). For time-lagged influence of economic performance on the EMS (i.e. year n-1), significant differences are found for value added (U = 75, W = 228, Z = -2.394, 0.05 level (2-tailed), n = 34) and for the solvency ratio (U = 92, W = 245, Z = -2.013, 0.05 level (2-tailed), n = 35).[4] The findings for 1997 across all countries suggest that broadly there is a significant difference only for value added (the only indicator which is not adjusted for firm size) and the solvency ratio. However, this also means that for six of the eight economic performance indicators analysed, no significant difference could be identified. Since return on sales, return on equity, return on capital employed, and value added per employee are all proxy measures for firm profitability, this raises doubts regarding the proposition that certification of an EMS leads to more cost-efficient environmental protection measures and activities at the level of the firm and therefore to improved economic performance. It is also possible, however, that due to (for example) the longer pay-back periods of such measures/activities, the time lag for eco-

[4]A more detailed analysis reveals that the significant differences in the case of the solvency ratio are due solely to differences for firms certified according to ISO 14001 (which is the case for approximately half of the firms). No significant differences were found for firms verified under EMAS, though this is probably due to the small number of firms which have this verification. Numbers were n = 7, out of 32 in the case of the 1997 solvency ratio (for which the number of ISO 14001 certified firms was n = 15, out of 32) and n = 8 in the case of the 1996 solvency ratio (i.e. a time-lagged influence of economic performance on EMS status, for which the number of ISO 14001 certified firms was n = 16, out of 35).

nomic performance improvements could be longer than one year; this is a hypothesis that could not directly be tested in this research. The possibility of such longer-term effects can therefore not be rejected based on the analysis reported in this paper.

The significant difference for value added might be an artificial, methodological effect. This is because, if not adjusted for firm size by division by, for example, the number of employees, production output, or sales, value added increases monotonously with firm/site size. Additionally, since larger firms and sites are more likely to be certified or registered to a formal EMS, the rankings which form the basis of the Mann-Whitney U test would lead to a situation where firms with higher value added (which would be ranked higher) would be mainly EMS firms (since they are larger). This would result in an artificially increased mean rank for EMS firms and an artificially reduced mean rank for non-EMS firms, which in turn could result in significant differences between the two sets of firms - predominantly artefacts of the methodology. This situation regarding absolute value added can be found in the data, i.e. EMS firms have much higher mean ranks than firms without EMS in all three years n, n+1, and n-1. Since in all three years, significant differences disappear when value added is controlled for firm/site size by dividing by the number of employees, it is very likely that the identified significance levels for absolute value added are a methodological artefact. In conclusion, this would mean that, except for the solvency ratio for years n and n-1, no significant difference can be identified. In terms of causality this points more towards a causal influence of economic performance on EMS adoption (i.e. better performing firms allow themselves the “luxury” of an EMS) rather than a causal influence of EMS-related activities (via increased cost-efficiency or increased sales) on the economic performance of firms.

Overall, the findings relating to economic performance indicators did not reveal significant differences at common levels except for the solvency ratio in years n-1 and n+1 (though not in year n). Based on this finding, Hypothesis 2 should be rejected. However it is also possible that most or even all economic performance improvements which are brought about by EMS certification materialise with a time-lag of more than one year.

With the data to hand, such a case would not be observable. If however economic performance improvements materialise only after time-lags of two or more years, this would also make it unlikely that EMS would lead to identification of no-cost or low-cost measures with large cost savings, since these would lead to quick performance improvements, and these were not observed in the data. Therefore, EMS seems not to bring about the fast and significant cost savings and performance improvements that it is theoretically hypothesized to do, but only small performance improvements, if any, with considerable time-lags (and thus, when discounted back to present time, with an even lower value) which would again lead to the **rejection of Hypothesis 2**.

A large proportion of the firms with an EMS in 1997 are located in the UK or in Germany. Therefore it might be possible that the differences which were identified are rather country differences (between the UK and Germany on one side, and Italy and the Netherlands on the other). To ascertain that this was not the case, the above significance tests were carried out for a data set which contained only UK and German firms. It was found that none of the differences regarding economic performance indicators between firms with and without EMS in the UK and Germany only are significant at common levels. This supports the findings across all countries, since no significant relationship could be identified for only the UK and Germany in addition to what was found across all countries. The finding that also those differences found to be significant across all countries were not found to be significant for Germany and the UK alone could be caused by the reduction in the number of cases which requires differences between mean ranks to be higher in order to be significant.

Hypothesis 3: A set of firms that are certified to ISO or verified under EMAS is expected to have a more positive relationship between environmental and economic performance (i.e. clearly above-average levels of environmental performance, but at the same time over-proportionately above-average levels of economic performance), than a set of firms which are not certified to ISO or verified under EMAS.

Hypothesis 3 was tested using value-added normalised environmental performance data for the four most important emissions/inputs ($S0_2$, NO_x, COD and water input). Median values were calculated for each of the emissions/inputs, and for each firm, environmental performance was classified as either above the median (coded "2", i.e. below-average environmental performance) or below the median (coded "1", i.e. above-average environmental performance). In addition to individual measures, an index of the four emissions/inputs was also analysed (calculated as described above). As an economic performance measure, the return on capital employed (ROCE) was chosen since it is not influenced by a firm's capital structure.

Again, above-median values were coded "2" (referring to above-average economic performance) and below-median values "1" (referring to below-average economic performance). Based on the binary environmental and economic performance variables (above or below the median), four possible combinations were derived, namely, "good environmental & good economic performance", "good environmental & bad economic performance", "bad environmental & good economic performance" and "bad environmental & bad economic performance". Operationalisation of Hypothesis 3 would then predict that EMS firms would exhibit "good environmental & good economic performance", whilst non-EMS firms would exhibit "bad environmental & bad economic performance". The other two possible states should be found to a much smaller degree. This operationalisation was tested by cross-tabulating the EMS variable introduced earlier (time-lagged and non-time-lagged) against the four combinations described. Chi-Square tests were used to test for significant differences. The results are summarised in Table 16.3.

In all cases, Chi-Square tests were insignificant at the 0.10, 0.05 and 0.01 levels. However, for any test, between 62.5% to 100% of cells had expected counts below 5, thereby violating one of the conditions of applicability for Chi-Square tests. Nevertheless, it is apparent from Table 16.3 that the distribution of cases is not as Hypothesis 3 would predict, which is that a large number of cases should be found for the combination "EMS and good environmental/good economic performance" and "non-EMS and bad environmental/bad economic performance". The categories "good environmental/bad economic performance" and "bad environmental/good economic performance" should have a much smaller number of cases. When considering the average values for EMS companies and non-EMS companies for years n and n-1 respectively, this is not observable. In addition, Exact Tests were carried out under SPSS that allow correct results to be obtained, even if the assumptions which are required in using standard asymptotic methods are not met (Bühl and Zöfel 2000: 20).[5] Overall, **Hypothesis 3 is therefore rejected**. Firms with an EMS were not found to have a better (i.e. more positive) relationship between environmental and economic performance.

[5]Results for asymptotically calculated Chi-Square values were also corrected, as far as possible, using a tabled Craddock-Flood-χ^2-correction for the distribution of the χ^2 test statistic in small contingency tables. This did not change the finding that none of the Chi-Square values were insignificant (Bortz et al. 1999: 139).

Table 16.3. Cross tabulations of EMS and relationship between environmental (env.) & economic (econ.) performance (gd.=good, bd.=bad). VA=Value Added, Index based on NO_x, SO_2, COD & water.

Variable		**gd. env./ gd. econ.**	**gd. env./ bd. econ.**	**bd. env./ gd. econ.**	**bd. env./ bd. econ.**
NO_x	EMS n	2	4	5	3
per VA	*Non-EMS n*	*5*	*3*	*1*	*3*
	EMS n-1	1	1	0	2
	Non-EMS n-1	*6*	*6*	*6*	*2*
SO_2	EMS n	1	2	6	4
per VA	*Non-EMS n*	*5*	*2*	*1*	*3*
	EMS n-1	0	2	1	1
	Non-EMS n-1	*6*	*2*	*6*	*5*
COD	EMS n	4	4	3	2
per VA	*Non-EMS n*	*1*	*2*	*3*	*4*
	EMS n-1	1	2	0	1
	Non-EMS n-1	*4*	*4*	*6*	*3*
Water	EMS n	4	0	2	6
input	*Non-EMS n*	*4*	*3*	*2*	*2*
per VA	EMS n-1	1	0	0	3
	Non-EMS n-1	*7*	*2*	*4*	*4*
Index	EMS n	5	1	1	5
per VA	*Non-EMS n*	*2*	*1*	*1*	2
	EMS n-1	1	1	0	2
	Non-EMS n-1	*7*	*2*	*2*	*6*
Averages	EMS n	3,20	2,20	3,40	4,00
across all	*Non-EMS n*	*3,40*	*2,20*	*1,60*	*2,80*
variables,	EMS n-1	0,80	1,20	0,20	1,80
not tested	*Non-EMS n-1*	*6,00*	*3,20*	*4,80*	*4,00*

16.4.2 Hypothesis Testing for the Electricity Generation Sector

Hypothesis testing[6] in the electricity sector was carried out in a similar way to the testing in the paper-manufacturing sector. Table 16.4 shows results for the testing of **Hypothesis 1**. As can be seen, no significant differences between certified and non-certified firms could be identified, though this may be due to the small number of cases available in the electricity sector.

[6]Unfortunately, the testing of Hypothesis 3 was not possible for the electricity generation sector, due to the more limited availability of data.

Also, unlike paper manufacturing, it was not possible to test time-lagged effects of certification (in 1997) on environmental performance (in 1998). Therefore, if the influences of certification on performance materialise only after some time, this would not be not picked up by the analysis. **Hypothesis 1 is rejected** in the electricity generation sector.

Table 16.5 reports the results for the analysis of the interaction of EMS certification and economic performance, i.e. the testing of Hypothesis 2, in the electricity generation sector. Here, it was also possible to analyse time-lagged influences of certification on performance and vice versa. As can be seen from Table 16.5, for only the solvency ratio in 1997 (i.e. the same year as the year of EMS certification) could a significant difference between certified and non-certified firms be identified. Importantly, no time-lagged influence of EMS certification in 1997 on economic performance in 1998 could be identified for any of the profitability, liquidity and stability measures chosen. Therefore **Hypothesis 2** too is rejected for the electricity sector.

16.5 Conclusions and Recommendations

The empirical analysis of the link between EMS certification, environmental performance, and economic performance, leads to the rejection of three important hypotheses. This means that, based on a (relatively small) sample of European paper and electricity generation firms, it was not observed that firms with a certified EMS (EMAS or ISO-based) had significantly better environmental performance, nor did they express significantly higher economic performance. These findings support the conclusion by Berkhout et al. (2001) that to date, the benefits derived from the adoption of certified EMS (either EMAS or ISO 14001-based) are uncertain. The fact that the empirical analysis presented was carried out on the paper and electricity industries is significant, since these industries have a relatively high level of environmental costs as a proportion of their total production costs. This means that in other production sectors, the cost reductions that might be achievable may be even lower than for these sectors. Any observable differences in those sectors should thus be smaller than for the paper and the electricity sectors.

Generally, the analysis shows that certification of a site or firm to an EMS standard (either EMAS or ISO 14001) neither signals environmental excellence nor guarantees economic success, in itself. From this it follows that it is also unlikely that firms or sites with an EMS would necessarily

Table 16.4. Test statistics for 1997 EMS certification & 1997 environmental performance (Exact Significance not corrected for ties).

Environmental performance indicator (FU: functional unit, KWh electricity generated)	**Mann-Whitney U**	**Wilcox-on W**	**Z**	**Asymp. Sig. (2-tailed)**	**Exact Sig. [2*(1-tailed Sig.)]**
FU Electricity (Production Output)	25.000	91.000	-0.283	0.777	0.827
CO_2 per FU	13.000	79.000	-1.175	0.240	0.280
NO_x per FU	20.000	86.000	-0.850	0.396	0.441
SO_2 per FU	19.000	85.000	-0.963	0.336	0.377
Total solid waste per FU	9.000	24.000	-0.245	0.806	0.905
Hazardous waste per FU	2.000	5.000	0.000	1.000	1.000
Municipal waste per FU	3.000	6.000	0.000	1.000	1.000
Recycled waste per FU	2.000	8.000	-1.091	0.275	0.400
Coal input per FU	4.000	14.000	0.000	1.000	1.000
Total fuel input per FU	0.000	3.000	-1.549	0.121	0.333
Gas input per FU	2.000	5.000	-0.577	0.564	0.800
Total electricity input per FU	1.000	2.000	0.000	1.000	1.000
Total oil input per FU	2.000	8.000	-0.577	0.564	0.800
Input of renewable energy per FU	0.000	1.000	-1.000	0.317	1.000
Total energy input (fuels & electricity) per FU	0.000	1.000	-1.000	0.317	1.000
Total water per FU	2.000	12.000	-1.732	0.083	0.114
Directly abstracted water per FU	0.000	3.000	-1.225	0.221	0.667
Water from public supply per FU	1.000	7.000	-0.447	0.655	1.000

have above-average environmental performance and simultaneously express above-average economic performance. This points to the determinants of

Table 16.5. Test statistics for 1997 EMS certification & economic performance (ROS: Return on Sales, ROE: Return on Equity, ROCE: Return on Capital Employed). VA=Value Added.

	Mann-Whitney U	**Wilcox-on W**	**Z**	**Asymp. Sig. (2-tailed)**	**Exact Sig. [2* (1-tailed Sig.)]**
ROS in 1997	16.000	26.000	-0.783	0.433	0.489
ROS in 1998	24.000	90.000	-0.397	0.692	0.743
ROS in 1996	18.000	73.000	-0.857	0.391	0.440
ROE in 1997	20.000	30.000	-0.261	0.794	0.851
ROE in 1998	24.000	39.000	-0.397	0.692	0.743
ROE in 1996	25.000	80.000	0.000	1.000	1.000
Current ratio in 1997	10.000	76.000	-1.567	0.117	0.138
Current ratio in 1998	20.000	86.000	-0.851	0.395	0.441
Current ratio in 1996	24.000	39.000	-0.122	0.903	0.953
Solvency ratio in 1997	8.000	74.000	-1.828	0.068	0.078
Solvency ratio in 1998	18.000	84.000	-1.076	0.282	0.320
Solvency ratio in 1996	13.000	68.000	-1.470	0.142	0.165
ROCE in 1997	16.000	61.000	-.309	0.758	0.825
ROCE in 1998	16.000	82.000	-0.783	0.433	0.489
ROCE in 1996	15.000	60.000	-0.463	0.643	0.710
VA per employee in 1997	13.000	58.000	-0.092	0.926	1.000
VA per employee in 1998	18.000	28.000	-0.522	0.602	0.661
VA per employee in 1996	19.000	64.000	-0.467	0.641	0.699

the interaction of environmental and economic performance being more complex, and thus to the need to develop a more detailed theory which would outline exactly how environmental management and corporate environmental strategies influence both economic as well as environmental performance. Schaltegger and Synnestvedt (2001) and Wagner (2000) have pointed to this and have suggested further development and operationalisation of such a theory, which is a recommendation that this paper supports.

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17. Economic Valuation of the Environment: an Institutional Perspective

Kirsten Schuijt

Erasmus Centre for Sustainable Development and Management,
Erasmus University, Rotterdam

KirstenSchuijt@hotmail.com

Abstract Economic valuation of the environment internalises environmental effects in the marketplace through the calculation of quantitative, monetary values. It may be applied by different stakeholders, including companies, governmental and non-governmental organisations. It is however not uncommon to find that different valuation studies on the same subject, carried out by different stakeholders, generate divergent economic values. Since the decision-making contexts in which economic valuation studies may be applied often consist of numerous stakeholders, there is a danger that decision-makers will become sceptical of such valuation studies if they reflect only the subjective interests of the stakeholder who carried out the study. To improve the practical applicability of economic valuation, therefore, efforts must be directed towards limiting these inconsistencies in economic valuation studies. Taking as a point of departure the argument that economic valuation is useful in certain decision-making contexts, the pursuit of improvements in economic valuation requires a focus on the *process* of economic valuation in addition to other current research efforts that focus on *methodological* issues of economic valuation. This paper will provide preliminary thoughts on the process of economic valuation from an institutional theory perspective. To complement the explanations of this perspective, the paper will focus on one particular stakeholder of the environment, namely the Dutch Ministry of Transport, Public Works and Water Management. Insights obtained from such a perspective may be used to seek solutions that pursue improvements in the economic valuation process.

17.1 Introduction

Since the publication of the WCED report ‘Our Common Future’ (WCED, 1987), more emphasis has been placed upon on the application of economic instruments as a means of modifying the behaviour of actors towards the environment (Opschoor and Turner, 1994). Environment is increasingly

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merged with economics in decision-making, which requires that environmental objectives be incorporated into economic policies. One approach towards the integration of economic and environmental aspects is through economic valuation of the environment, which internalises the environment in the marketplace by imputing an economic value such that the resource receives a market price and consumers can make a trade-off (Turner et al., 1994). The monetary measures are obtained by applying economic valuation methods that convey people's willingness to pay for an environmental change, or willingness to accept compensation for that change[1]. In this way, a wide variety of economic values may be obtained, often classified as either use values or non-use values. A *use value* comprises both the direct use of environmental resources or services (for example, the consumption of fish, water and trees) and indirect use of the environment (such as the use of natural retention capacity of wetlands and oxygen production by forests). *Non-use value* of the environment refers to the non-instrumental use of the environment, and includes existence value, the recognition of the value of the very existence of ecosystems.

In the Netherlands, a wide variety of actors have become increasingly interested in the application of economic valuation. These actors are all stakeholders of the environment: government departments whose policies affect the environment; governmental and non-governmental organisations (NGOs) that have an interest in the environment; financial institutions that finance projects which affect the environment; scientific institutions as part of their scientific research aimed at the environment; and companies whose decisions affect the environment. Each of these stakeholders may have an interest in carrying out a study that incorporates an economic valuation. Economic valuation is usually applied as a part of economic instruments such as cost-benefit analysis, multi-criteria analysis and natural resource damage assessments. Valuation of environmental changes are carried out in these instruments in order to derive a common denominator for environmental effects which allows the effects to be compared or weighed against other changes.

However economic valuation contains a variety of methodological tools on which little or no agreement exists. In the Netherlands, the discount rate

[1]Economic theory distinguishes between demand-curve approaches and non-demand curve approaches. *Demand curve approaches* are Contingent Valuation, Travel Cost and Hedonic Pricing methods; *non-demand curve approaches* include Dose-Response, Replacement Cost, Mitigation Behaviour and Opportunity Cost valuation methods.

used for discounting economic values into present value terms has been set by the Ministry of Finance[2] at 4% for government-financed projects, but there are no similar agreements on other aspects such as, for example, the types of valuation method to apply, the time horizon for discounting, or which factors to incorporate in a sensitivity analysis. As a result, different stakeholders apply diverging economic valuation methods and derive different economic values for the same environmental effects. Bal and Nijkamp (1998) state that evaluations of global economic valuation studies show that it is not unusual that there may be several different studies on the same subject, but that the outcomes of these studies may be completely different. Research has shown that such characteristics of the study as study quality, theoretical consistency, econometric techniques, the type of valuation method used, and characteristics of the study site including the area and the number of goods and services valued, all have an effect on the economic value[3].

Despite these inconsistencies, however, economic valuation can offer significant added value in certain decision-making contexts. In particular, it can play a very important role in highlighting the economic importance of ecosystems to decision-makers. Since most decisions are based on economic and financial arguments, to put a monetary value on the environment may sometimes be the only way to persuade decision-makers of the value of preserving ecosystems rather than allocating their lands and waters for other purposes. Furthermore, assigning economic values to certain ecosystem goods and services provides a system which can weigh the different economic activities within a particular ecosystem in, for example, developing management plans for the area.

Persistent inconsistencies in economic valuation studies may however seriously undermine the value of the concept in these decision-making contexts. Decision-makers will become increasingly sceptical of valuation studies if they frequently consist of a combination of methodologies that reflect the subjective preferences of one stakeholder, while the decisions often need to involve the preferences of numerous stakeholders. Taking as a point of departure the argument that economic valuation has the potential to be useful in certain decision-making contexts, it is therefore necessary to limit

[2] As an indication of different methodological applications internationally, the discount rate for government projects in Germany is 3%, in the United Kingdom it is 6%, in Denmark 7% and in France 8%. In none of these cases is it clear how this rate has been defined or determined (Eijgenraam et al., 2000).

[3] See Brouwer (2000) for an overview of these studies.

the inconsistencies in these studies in order to achieve improvements in economic valuation.

In order to limit these inconsistencies, a focus on the *process* of economic valuation is required, in addition to other current research efforts which focus on *methodological* issues of economic valuation. Valuation is a process in which actors make decisions in a series of operations or actions that are designed to achieve a certain end (or ends). Differences in the process of economic valuation may also contribute to inconsistencies in economic values, and may even explain divergences in methodological applications between stakeholders. Economic theory on economic valuation, however, does not provide a normative model for the valuation process. The role of economic theory in the valuation process is to provide the theoretical basis and background for the different steps that constitute the valuation process; the actors and their contexts are exogenous. The valuation process, however, consists of actors with different interests who operate within a specific context. Therefore, in order to understand the process, other theories must be consulted that explain the actors and their contexts, thereby making more explicit the variables that are implicit in the valuation process. Institutional theory offers such an approach.

This paper will provide preliminary thoughts on the process of economic valuation from an institutional perspective[4]. To complement the theoretical discussions, the paper will focus on one stakeholder of the environment in the Netherlands, namely the Dutch Ministry of Transport, Public Works, and Water Management. The goal of this paper is to derive a perspective on the economic valuation process that can explain the possible influences of strategic behaviour on this process, in order to obtain insights that may then be used to seek solutions and pursue improvements in the economic valuation process.

17.2 Institutions and Actor Behaviour

In the economic valuation process, different actors can be distinguished who each pursue different interests. These actors are stakeholders in the

[4]These thoughts are preliminary since the basis of this paper is a PhD thesis by the author of this paper, titled "The Process of Economic Valuation – An Institutional Perspective", which is still in progress. In this thesis, an institutional theory perspective is applied to the economic valuation process and illustrated empirically with three case studies of economic valuations in water management in the Netherlands. The goal of the thesis is to develop recommendations on how to improve the valuation process.

economic valuation process. Firstly, the process has a principal who assigns the study, and a contracting party (or parties) who will carry out the study on behalf of the principal. Other stakeholders who are part of this process may include a steering committee and a peer review group, as well as people who are interviewed and consulted during the process. Furthermore, stakeholders may also include companies, nature organisations, government departments and political parties, and the general public, since each of these has a stake in the project for which the economic valuation is carried out and thus in the valuation process itself.

The economic valuation of ecosystems is based on an actor perspective known as the neo-classical economic theory of consumer behaviour. In neo-classical economics, choices are based upon a rational balancing of costs and benefits, where individuals make those choices that maximise their utility. The influence of other factors on these choices, however, is not analysed. Instead, a boundary is drawn around the consumer, thereby ignoring the influence of social and ecological contexts on the choices that actors make. Other theories must therefore be sought that can allow for the explanation of the choices made in the valuation process by actors such as principals and contracting parties, and institutional theory is one such approach.

Institutionalist schools in economics believe that an understanding of the influence of the institutional structure on economic behaviour is necessary in order to understand better the performance of firms, markets, agents and economies in different settings (Groenewegen et al., 1995). From an institutional perspective, therefore, the behaviour of stakeholders in the valuation process is determined by their institutional context, or to put it conversely, stakeholder behaviour can be understood only by understanding the institutional context.

An institutional theory perspective on the process of economic valuation implies that the various stakeholders in the economic valuation process are embedded within a broader institutional structure. The approaches towards institutional thinking and the underlying definition of institutions differ according to author, but a useful approach is provided by North (1990) who defines *institutions* as being either created or having evolved over time in order to comprise a framework for human behaviour by directing and guiding behaviour. This framework may be defined as the set of informal and formal institutions (North, 1990). *Informal institutions* are part of the culture of a society and include norms of behaviour, ideas and ideologies. *Formal institutions* complement the effectiveness of informal institutions, and include economic and political rules and contracts. The institutional framework of society determines the behaviour of actors (including organisations and agents) - it simplifies the processes of exchange by decreasing transaction costs, such as measurement and enforcement costs and information problems, and thereby provides a stable structure to human interaction.

17.3 The Behaviour of Government Departments in the Valuation Process

Whilst North (1990) explains how institutions may affect human behaviour, it is necessary to understand what this behaviour may look like in the context of the process of economic valuation. Knight (1992) provides an interesting perspective on the behaviour of actors, based on the theory of strategic behaviour that may be applied to actors in the economic valuation process. Rational agents with competing interests are involved in a conflict in which they may develop tools such as economic valuation as a by-product in order to gain strategic advantage[5] over other agents who are involved in the conflict of interest. Whether economic valuation results in efficient outcomes (which is the perspective in neoclassical economics) is irrelevant, so long as they provide the actor with a strategic advantage.

The next question is why actors apply economic valuation as part of their strategic behaviour. Callon (1998) provides an interesting theoretical perspective which explains that 'calculating tools' (such as accounting and marketing tools) allow organisations to 'frame' behaviour - the development of a boundary within which interactions take place, independent of their context. However these calculating tools are not equally distributed, and those organisations with higher quality instruments can create an asymmetry between themselves and other organisations which endows them with a 'calculating power'. This power allows organisations to impose certain events, actions and relations that other, less powerful, organisations have to take into account. The imposition of calculating tools such as economic valuation that incorporate rules which guide decisions is therefore an important starting point in achieving market domination.

Actors such as government departments compete against other actors with different perspectives, interests and goals. For example, in the light of

[5]Knight (1992) defines "strategic advantage" as individual advantage in terms of power that constrains the actions of other actors.

the economic valuation process, significant interests and perspectives of a stakeholder will include their interest in nature and the environment and their perspective on sustainable development. Turner et al. (1994) distinguish four different perspectives on this. These range from very weak sustainability, based on the belief that consumption of exhaustible resources should be held constant only when the rents derived from the intertemporal efficient use of those resources are reinvested in reproducible capital, to very strong sustainability, which calls for a steady-state economic system based on thermodynamic limits and with constraints placed on the macro-economy such as zero economic growth and zero population growth. The weak forms of sustainability can be seen as *technocentric* approaches which adhere to the position that no constraints should be placed on individual consumers or markets. Technocentrics support an open, free market, based on the belief that technological developments can overcome environmental problems (Turner et al., 1994, p. 60). The strong forms of sustainability are *ecocentric* approaches, which support the belief that the regenerative capacity of renewable natural capital should not be threatened even if the economic benefits outweigh the economic costs to society (Turner et al., 1994). Hence, different perspectives towards sustainability exist depending on whether a more technocentric or ecocentric approach is taken.

An organisation's support for a certain approach towards sustainability helps to shape its behavioural (Turner et al., 1994). For example, it determines the *general management strategy* of an actor: whilst the primary objective of organisations which support a very weak approach to sustainability is to maximise economic growth, the primary objective of those which support a very strong approach is to reduce the scale of the economy and population growth. The approaches may also be linked to *specific management strategies* towards specific courses of action, policy or projects. For example, organisations which support a very weak approach to sustainability will support the application of conventional cost-benefit analysis, which incorporates only those environmental values for which market prices are available. On the other hand, organisations that support a very strong approach will support a complete abandonment of cost-benefit analysis, and instead call for strict controls on births, and for standards and regulations to combat pressures on natural resources.

In the same way as it affects management strategies, support for a certain sustainability perspective may also influence the choices which are made in the economic valuation process. For example, those who support stronger forms of sustainability may be inclined to incorporate more environmental functions into the analysis than would supporters of weaker forms. They are also likely to prefer a much lower discount rate since this puts more weight on the future and thus on long-term environmental effects. The time horizon which is taken into account in the discounting process is also an important function of the sustainability approach which is taken: supporters of a stronger form of sustainability would be more likely to take longer time horizons. Finally, the type of valuation method which is applied to quantify a specific environmental function may in some cases also be dependent on the sustainability approach which is taken, because those who support a stronger sustainability approach would prefer valuation methods that result in lower values.

In the strategic behaviour of actors, the goal of the economic valuation itself may also play a role in the structure of the study. Navrud (1992) distinguishes the following main goals for economic valuations:

- to create public awareness of environmental damage and environmental benefits;
- to influence decisions through the use of economic valuations;
- to identify decisions by establishing a priority ranking between different potential actions;
- to justify decisions, either ex ante or ex post;
- to justify the existence of a particular programme by pointing out the positive side-effects of its activities on the environment.

In the process of strategic behaviour, the goal that the organisation pursues as part of the process of economic valuation may direct its preferences for the structure of the study. For example, if the goal of the study is to create public awareness for an environmental benefit, the study may attempt to highlight or even to over-emphasise the economic values of this environmental benefit[6]. On the other hand, if the goal of the study is to justify a decision on the construction of a dam that has already been decided, the study may attempt to highlight or over-emphasise the benefits of the dam, as opposed to effects of the dam on the environment.

[6]Different valuation approaches may result in different outcomes. For example, it has been shown that willingness-to-pay estimates of environmental change are often significantly less than willingness-to-accept estimates (Dietz and Hafkamp, 1994).

17.4 Informal Institutional Determinants of Behaviour

The previous section explained why and how stakeholders in the valuation process act strategically and may influence the structuring of the economic valuation process. The next question is: why do governments use economic valuation of the environment in their strategic behaviour? From an institutional theory perspective, formal and informal institutions in the context of these actors determine their behaviour and thus the choices that they make in the valuation process. In this section, the context of government departments in their position as principals of economic valuation processes will be described and applied as an explanation of the use of economic valuation by government departments in their strategic behaviour. The focus is on the Ministry of Transport, Public Works and Water Management in the Netherlands, which has been particularly interested in economic valuation in its decision-making processes over the past years.

Several processes can be distinguished in the overall institutional context of environmental management generally that may be applicable to water management and influence the behaviour of government departments with respect to economic valuation in their role of principal. In this context, the institutions that determine the behaviour of actors may be distinguished between formal and informal.

Throughout their history the Netherlands have fought against an overabundance of water, and as a result they have intervened extensively in water systems. The consequences of these interventions began to be noticed towards the end of the 1960s in the form of water pollution, degradation of nature and landscape, desiccation, and pressures on use functions such as drinking water and recreation. The realisation grew that a different approach towards water management issues was needed in order to overcome these problems, and this eventually developed into a 'water system approach' that seeks to achieve a safe and liveable country with healthy, sustainable water systems (MinV&W, 1985). As a result of flooding in the 1990s, the social and political question arose of whether the country is actually sufficiently prepared for the challenges of the twenty-first century such as climate change, availability of space and land use. This stimulated an ecosystem approach to water management, in which water systems are given more space and where ecosystem functions are playing an important role in flood management. This development has called for information tools that are capable of incorporating the ecosystem in policy-making, and among the options available to policy-makers are economic instruments. One way in which environment can be included in these economic instruments is through economic valuation, which allows for the integration of environmental aspects into existing political, economic and social systems. This process has become increasingly popular over recent years among policy-makers in water management, who seek quantitative data that allows them to support certain policy decisions and to balance and weigh the effects of other policy decisions.

In this overview of the development of the attitude of the Netherlands towards water management issues, three processes may be distinguished which require further explanation. The first is a growing and changing environmental awareness in the Netherlands. Although a global environmental awareness had already developed by the close of the 19th century, it is generally assumed that it emerged later as part of a wider value change in the 1960s (Hajer, 1995). Hajer (1992) distinguishes two processes as influences which encouraged a growing environmental awareness:

a) a confrontation with incidents of environmental degradation;

b) a changing perception of the relationship between environment and society.

A series of environmental disasters in the 1960s focused the attention of the world on the threats associated with these disasters (McCormick, 1995). Furthermore, the perception of the earth as a vulnerable planet was enhanced by the publication of satellite photographs of the planet for the first time in 1966. By the beginning of the 1970s a mass environmental movement had been mobilised which recognised that humans were using up the world's stock of natural resources upon which they depend so much. In following decades, the perception of the environment changed from a romantic and aesthetic movement in the 1960s and 1970s towards a more pragmatic focus on environmental problems in the 1980s (Leroy and de Geest, 1985). The 1990s witnessed the introduction of new techniques that allowed firms to integrate the environment into their overall cost-benefit calculations (McCormick, 1995). Environmental awareness had evolved into a pragmatic, problem-oriented perspective, in which environmental protection and economic development go hand-in-hand. Such a process may have influenced the behaviour of government departments regarding economic valuation, since by placing a monetary value on environmental effects government departments meet this process in two ways. First, it meets the increasing demand to incorporate environmental effects in decisions, which is the result of increasing environmental awareness. Secondly, it meets the demand for a pragmatic approach towards the environment, because economic valuation allows for the integration of environmental effects with economic goals.

A second process that can be distinguished is a rationalisation of society. Van Doorn (1989) explains that while cultural, moral, political and ideological values and goals are retreating into the background, organisational, bureaucratic, technocratic and formalistic orientations are becoming more pronounced. This process is also recognised by Ritzer (1996), who describes how the process of 'McDonaldization' is becoming more and more dominant in most societies; a process which is characterised by efficiency, calculability, predictability and control. Rationalisation is also experienced in environmental issues, which Hajer (1995) recognises to be part of a wider process called ecological modernisation. Ecological modernisation recognises the structural character of environmental problems, but assumes that current political, economic and social institutions can deal with these environmental issues. Concepts are introduced that make environmental issues more calculable so that they can be incorporated into standard cost-benefit calculations. The process of ecological modernisation or rationalisation of society may have also played a profound role in the behaviour of government departments regarding economic valuation. Through the quantification of the environmental effects of government policies, they make these effects appear to be more predictable, controllable and, above all, calculable. Furthermore, it allows for the integration of environmental aspects into current, existing institutions, including cost-benefit calculations.

A third process of importance is the development of knowledge and information on the environment. More information and knowledge has developed which relates to the effects of human action on the environment and to the interrelationships between ecological processes. In this process, the agent's understanding of the environment develops and more ecological effects are discovered; this leads to an increased demand for measuring these additional environmental aspects in order to incorporate them in calculative decisions. In the demand for environmental knowledge, emphasis is placed primarily on quantifiable norms (in 't Veld, 2000). This demand, according to in 't Veld, is based on the belief that such information has absolute value, is objective and reduces the insecurities that are inherent in decision-making. This process may also affect the behaviour of government departments with respect to economic valuation. Particularly in water management, policy-makers have become increasingly aware of the different ecological relationships and the effects of their actions on the functioning of water systems. Much research is currently being carried out in the Netherlands to pursue improvements in measuring these effects, and one approach is to quantify them in monetary terms. In ‘t Veld’s perspective, that the quest for information is dominated by a quest for quantitative data, seems especially to point in the direction that by applying economic valuation government departments can meet the more general trend in society for environmental effects to be measured, preferably in monetary terms.

The three processes of a growing environmental awareness, rationalisation, and availability of knowledge and information, are interdependent and together influence the behaviour of organisations, including government departments. These processes provide an explanation of why organisations, in the pursuit of their subjective goals, may apply and structure economic valuation as part of their strategic behaviour. The increasing and changing environmental awareness in societies calls for more pragmatic solutions and instruments that allow for the integration of environmental effects into economic systems. Furthermore, rationalisation puts increased emphasis on efficiency and calculability in processes, while the increasing availability of environmental information and knowledge leads to an increase in the number of environmental functions that can actually be valued. As a result, economic valuation studies are products of the actors behaving strategically within their contexts.

17.5 Formal Institutional Determinants of Behaviour

The application of economic valuation of the environment in the Netherlands can be traced back to around 1973, at which time several economic valuation studies were being carried out (Hoevenagel et al., 1992). However, in these early times there were doubts on the usefulness of economic valuation for public-policy making, mainly due to the methodological weaknesses of the valuation methods that were available and a lack of reliable data. An important stimulus for economic valuation came from the United States in 1981, when President Reagan’s executive order 12291 made it mandatory for the Environmental Protection Agency to perform social cost-benefit analyses in respect of its major regulations (Navrud, 1992). Interest in economic valuation was stimulated in the Netherlands, but the studies lacked both completeness and comprehensiveness (Kuik, 1991) and towards the end of the 1980s, government interest in monetary valuation slowly diminished.

As this paper has already indicated, Dutch interest in economic valuation has grown over the last two to three years. After an interest in other tools such as multi-criteria analysis, social cost-benefit analyses which include economic values of environmental effects are now increasingly being carried out in different policy-making contexts[7]. This is a result of the informal institutional context explained above, which has also influenced the development of formal rules and regulations that support the application of economic valuation. Although other formal institutional arrangements can be found, the major impetus to the use of economic valuation by government departments in the Netherlands seems to have been the publication of the NEI/CPB report in 2000. This report recommended the application of a social cost-benefit analysis in order to evaluate government investments in large infrastructural projects. A social cost-benefit analysis evaluates the costs and benefits of actions from the view point of society, and this may incorporate external effects. Many natural resources are subject to external effects, and these can be both positive and negative, so that a social cost-benefit analysis may call for the application of economic valuation to measure the effects of an action that causes external effects on the environment. Since the publication of the report, several social cost-benefit analyses have been carried out by different government departments in the Netherlands for major projects, such as the extension of the port of Rotterdam and the construction of sea sluices at IJsselstijn. Although still met with scepticism by many, general government interest in economic valuation as a method of incorporating environmental information in decision-making among several government departments seems to be increasing.

The NEI/CPB report, however, does not provide a guideline to economic valuation and in fact no such guideline exists in the Netherlands. The result is that although economic valuation is increasingly applied by different actors due to the developments in the informal institutional structure which were explained above, there are no standardised procedures on how to structure the economic valuation process. No guidelines exist on which choices actors need to make concerning, for example, the environmental functions which should be incorporated, the valuation method which should be ap-

[7] See, for example, the cost-benefit analyses carried out for the extension of the Rotterdam port (CPB/NEI/RIVM, 2001), and the creation of 750 hectares of new nature and recreation area (NEI/RIVM, 2001).

plied, or the variables to include in a sensitivity analysis. This seriously affects the choices of actors in the economic valuation process since, in principle, actors are free to choose whatever they prefer or which leads to their preferred result.

17.6 Discussion and Conclusion

The perspective which has been discussed in this paper explains that actors in the economic valuation process are likely to behave strategically and to apply economic valuation as part of this strategic behaviour. This behaviour is determined by the informal and formal institutional context in which the actors operate. Subsequently, such behaviour may have significant influences on the choices made in the economic valuation process.

Two qualifications must be made concerning the limitations of this paper. Firstly, the institutional context has been limited to the more general institutional context at a societal level. In the context of valuation studies, both the project for which the study is carried out and all the different actors that have a stake in the valuation process (principals, contracting parties, steering committees, etc.) and their interests are important aspects in the context of every valuation process, and may have a profound influence on the choices which are made in the process itself. Secondly, the paper focused on the strategic behaviour of only government departments, but such a case can also be made for other actors too. For example, actors such as non-governmental organisations and companies may also behave strategically and apply economic valuation in order to pursue their own interests.

Furthermore, it is important to emphasise that the perspective taken in this paper is only a theoretical perspective and has yet to be tested empirically. Although empirical testing remains difficult in such social science studies, it is possible to carry out a case study analysis on different economic valuation processes in which the effects of the context in which the economic valuation processes are carried out is linked to the choices which are made in the processes. Other possible methods could be through participation in economic valuation processes in which the researcher observes how choices are made in the valuation process.

In more general terms, further research in economic valuation needs to focus increasingly on how to integrate social aspects into valuation studies. In this respect, the VALSE project (1996-1998), financed by the European

Commission, connects very well with such aspirations (see O'Connor, 1998). Through case studies, different procedures were applied to analyse how to bring actors' views and preferences into environmental decision-making processes. However, this study focused only on value formation and value statements, while it is just as important to recognise that principals and contracting parties are also part of the valuation process and thus of value formation. Hence, research that recognises economic valuation as a process in which a wide variety of stakeholders with different perspectives make choices could contribute further to the integration of social processes into valuation studies.

Due to the potential importance of the economic valuation process for certain decision-making processes, and in particular for conservation and environmental management strategies, the insights obtained from this paper may be used in discussions on how to improve the economic valuation process. These solutions need to be sought in order to limit the effects of specific stakeholders and their contexts on the valuation process, and in this respect two aspects can be identified which may contribute to such solutions. Firstly, economic valuation studies may be significantly improved by making agreements on how to structure the process of valuation studies. This limits the freedom of actors to behave strategically by subjectively choosing certain methodologies that help them to pursue their own interests. Secondly, a balance needs to be sought between integrating the multiple perspectives that exist among stakeholders of the economic valuation process, and the execution of an independent valuation study. In this respect, contractors who are independent of the project for which the study is carried out must be sought to perform the calculations. Furthermore, public participation that incorporates different perspectives into the valuation process may also constitute an important contribution that limits the ability of a single stakeholder alone to distort the valuation process.

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