Product-Oriented Environmental Management

A study of capability-building, stakeholder orientation and continuous improvement regarding products' environmental characteristics in firms

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PREFACE

During my graduation projects at Wageningen Agricultural University, I discovered that I liked doing research. After graduating in environmental science, I decided that I wanted to continue this enjoyable and stimulating activity and work towards a Ph.D. An opportunity to combine environmental science and management studies occurred in the Faculty of Technology and Management at the University of Twente. In this thesis, the results of a little more than four years of research into the organisation of product-oriented environmental management is presented. As Gummesson (1991: 18) noted "Science is a journey, not a destination." Before the outcomes of my journey are presented, this preface is a good place to acknowledge the supports and inputs provided by many people over the past few years. Some of them I would like to explicitly mention here.

First of all I would like to thank my supervisors who contributed, each in their own manner, to this research through stimulating mutual co-operation. Antoni Brack, being a law professor, commented thoroughly on my thoughts and writings. His detailed suggestions certainly found their way into the thesis. Olaf Fisscher, my other supervisor, took a more philosophical approach and was always able to confront me with alternative points of view on theory and on the structure of the thesis. Several joint excursions (summer workshops, a conference etc.) provided additional opportunities to discuss a broad range of ideas. From more of a distance, Maarten Arentsen from the University of Twente's Center for Clean Technology and Environmental Policy (CSTM) helped me to maintain close linkages with the fields of environmental management and policy, to an extent through the MATRIC project. This project considered the ways in which technology is managed in society, looking for opportunities to adapt sociotechnical developments to the goal of reducing risks of climate change. Together, these three people have provided guidance to my research project, and the process, while leaving me sufficient room to explore my own directions.

To carry out research within companies requires access. The firms discussed in the case studies presented in this thesis gave me the opportunity to look at the way they were dealing with product-oriented environmental management and its organisational implications, and further they have allowed me to publish my findings in this thesis. Therefore I would like to thank DSM Resins, Xerox Europe, IBM and 3M. In particular, a special word of thanks is due to the key sponsors within these companies since they provided me with a thorough insight into their respective companies and assisted in the many practicalities involved in conducting case study research. In addition to the case studies, the discussions I had with representatives from other companies, consultancy firms, industry associations and governmental institutions supplemented and enhanced my empirical findings. Maintaining such linkages with the real world is important in a study that aims not only to contribute to theoretical developments in corporate environmental management and management studies, but also seeks to provide practical applications of the insights gathered.

In addition to having guidance throughout the research project and obtaining access to companies, being able to discuss and sharpen one's ideas is also important during a research project. Therefore, I would like to thank the people with whom I have written papers. Alongside Antoni Brack and Olaf Fisscher, these include Tim Watts, André Nijhof and David Foley. The regular meetings of the Dutch Ph.D. network on environmental management provided another stimulating opportunity to discuss ideas and receive detailed feedback on new ideas.

I also would like to thank my colleagues at the Faculty of Technology and Management, who made my time in Twente a pleasant one. A few of them deserve special mention. With the members of the department of Operations Management and Systems Theory I have spent many a lunch and coffee break. Ine Scholten has supported me with the administrative elements of this work. My various roommates in BB-414 created a pleasant working atmosphere, and one of them, Renee Dooyeweerd, regularly commented on my ideas and writings. I would also like to mention Mark Ebben, Huub Ruël and Erik van Raaij for the discussions over the final months on the process of writing this thesis, its progress or the lack thereof. Reflecting on this process with people who were in the same boat provided encouragement. Giles Stacey assisted by improving my English.

Friends and family also took an interest in my work. I would especially like to thank my parents for their continuing support and encouragement over the years. For friends, now that my thesis is finally finished, there is time again for some 'Kolonisten' and to meet each other more often. My 'paranimfen', Nancy de Bakker and Mark Ebben, have been of great help during the final stages of my Ph.D. project and it is a pleasure to acknowledge them in this way.

Finally, Anouk I want to thank you for just being there all this time. I am glad that the travelling between Enschede and Alphen aan den Rijn will now come to an end, and look forward to the new stage we are about to enter...

Enschede, April 2001

Frank de Bakker

1.

A Need For Product-Oriented Environmental Management?

"Today, an increasing number of companies acknowledge a problem in integrating […] environmental considerations into their mainstream business decisions and organizational systems."

(Roome, 1999: 267)

1.1 Introduction - the environment as a product demand

Over the last few decades, business organisations have increasingly been held responsible for their use of the physical and natural environment[1]. Many firms are now paying attention to the environmental impacts of their actions. For a considerable period, this attention has mainly been focussed on production processes. With the continuing rise of environmental awareness, a product's environmental characteristics are now becoming more and more important to industrial organisations. In this study, the focus is on the emerging concept of product-oriented environmental management (POEM)[2] and its organisational implications for individual firms. Before this concept is defined and investigated, and the research is explained, in this section various reasons for studying this concept at a company level are identified. Kärnä (1999) provided four reasons to focus on the environmental characteristics of products. Products can be regarded as a source of environmental burden, environmental policies increasingly focus on products, many stakeholders in the product life cycle have an influence on a product's environmental characteristics. Finally, manufacturers are in a position to influence these characteristics. These reasons are discussed in more detail below.

First, products are significant contributors to environmental deterioration. The production of one tonne of consumed goods, on average, requires eight tonnes of raw material (UNEP, 1997 in Kärnä, 1999). Together with population and technology, consumption ranks as a major driver of environmental change (Princen, 1999). A product's environmental impacts result from many interrelated decisions, made at different stages in a product's life cycle (Zhang et al., 1997). To improve products' environmental characteristics, many related concepts have been proposed, such as Green Product Design (OTA, 1992), Ecodesign (Roy, 1994), Green Concurrent Engineering (Karlsson, 1997), and Design for Environment (DfE) (van Hemel, 1998). These concepts all focus on decreasing the environmental impact of products through design decisions. Increasingly, studies are being carried out on the development and implementation of such concepts, as well as into the development of tools and manuals to provide product developers with information regarding a product's environmental performance. Life Cycle Assessment (LCA) is one well-known tool, intended to evaluate the environmental profile of a product (Keoleian, 1993). As Magnusson (2000) argues, much of the literature on ecodesign and related concepts consists of manuals and guidelines (e.g., Brezet & van Hemel, 1997; Holloway, 1997), giving ecodesign research a highly practical, technical and normative character. Lenox and Ehrenfeld (1997) comment that the development of environmental design tools has much been emphasised in research, but that these

1 When speaking of the 'environment', I refer to the natural, biophysical environment. The firm's environment in terms of its wider context is usually referred to here as 'surroundings'.

2 POEM is a translation of the Dutch term 'Productgerichte Milieuzorg', also known as PMZ and introduced as such by the Dutch Ministry of the Environment in the mid 1990s. Several related concepts have been proposed. Since the acronym POEM is used in many publications (e.g., van Berkel et al., 1999; Rocha & Brezet, 1999; Brezet et al., 2000), I prefer to use this term.

tools are only one of the possible ways to integrate environmental knowledge resources into the product development process. A stronger focus on organisational aspects within a firm, and widening the view beyond mere product development towards including the entire product life cycle, could deliver a wider range of useful insights.

Alongside the environmental impact of products, a second reason for business organisations to focus on POEM is the fact that products are increasingly addressed in environmental policies (VROM, 1993; Oosterhuis et al., 1996; Mayers & France, 1999). Both at national and international levels, product-oriented environmental policies are currently being developed and enacted. Integrated Product Policy (IPP), producer responsibility, take-back regulations, and integrated chain management (ICM) are examples of such policies. These policies usually emphasise the product life cycle, aim at prevention, and highlight a producer's responsibilities. IPP, for instance, "explicitly aims to modify and improve the environmental performance of product systems" (EC DGXI, 1998a: 9). In chapter 2, some of these policies are discussed in more detail. Since regulation is often regarded as one of the important incentives for corporate environmental management (Garrod & Chadwick, 1996; Henriques & Sadorsky, 1996), the intensified attention to environmental policy for products is a second reason to examine POEM at a company level.

This links to a third reason: the involvement of many different actors, both supply chain partners within the product life cycle (e.g., suppliers, customers, recyclers), and actors surrounding and influencing this life cycle (e.g., governments, trade associations, special interest groups). These different actors could be regarded as stakeholders, being "persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity" (Donaldson & Preston, 1995: 67). Firms could be regarded as operating in networks of stakeholders, or in complex sets of relationships (Clarkson, 1995), some of which concern environmental management (e.g., Clarke & Roome, 1995; Boons, 1998). Since the actions (and inactions) of many different stakeholders could influence a product's environmental characteristics over its life cycle, the consideration of such stakeholders could provide further insights on organisational aspects of POEM at a company level.

Finally, in addition to these pressures exerted on firms mainly from outside, a fourth reason is the observation that firms themselves are also seeking ways to deal with environmental issues (Schmidheiny, 1992; Shrivastava, 1995; Hart, 1997). One of the reasons suggested in literature is that environmental management could have a positive effect on a firm's performance, and could possibly deliver a competitive advantage (e.g., Hunt & Auster, 1990; Klassen & McLaughlin, 1996; Judge & Douglas, 1998). Approaches to environmental management that go beyond regulatory compliance, often referred to as pro-activity, innovativeness or even leadership, are then important. As POEM-like approaches are not yet legally enforced, obtaining a competitive advantage and addressing stakeholder demands (including such regulatory demands) could be regarded as important drivers for such a proactive style of environmental management. Likewise, firms nowadays are no longer regarded merely as a *cause* of environmental problems, but also as contributors to possible *solutions* to this sort of problem as well (Sharma &

Vredenburg, 1998). Manufacturing firms are thus in a central position to influence a product's environmental characteristics, since they have a grip on the product development process in which a product's characteristics are determined (Kärnä, 1999), and are also centrally positioned within the product life cycle. A firm's specific position and influence on this life cycle is yet another reason to explore its approach to POEM.

So, stimulated by market pressures, challenged by possible competitive opportunities, and sometimes driven by internal considerations, firms are increasingly seeking for ways to deal with product-oriented environmental issues. Since products have a significant environmental impact, product-oriented policies are being developed and implemented. Many stakeholders both affect, and are affected by, decisions regarding the product life cycle. Although much research has already been in the fields of environmental strategy, corporate environmental management, and determining products' environmental impacts; so far, relatively little attention has been paid to organisational aspects of dealing with a product's environmental aspects within a firm (Lenox & Ehrenfeld, 1997; Cramer, 1998a; Magnusson, 2000). In other words, considering the way in which an individual firm can prepare itself to deal with a product's environmental characteristics. A firm needs to identify and develop ways to cope with these 'new' requirements. The approaches a firm develops to deal with these issues are likely to vary between firms because of their specific characteristics. Products, processes, regulations, and networks of stakeholders, will all influence the options a firm has to modify its products' characteristics, and to develop an environmental strategy concerning these products. As den Hond (1996: 17) notes: "Because firms hold different capabilities, and because they perceive different options for expanding their capabilities in trying to solve environmental issues, it is likely that their environmental strategies differ." In my research, the different organisational approaches that firms can take towards POEM are central. In this first chapter, the research is explained. The POEM concept is defined, the aim of the research is clarified and formed into a research question, and the hoped for relevance of the research indicated. The chapter concludes with an overview of the structure of the research and this thesis.

1.2 A definition of POEM

Before turning to organisational aspects of POEM, and indicating the aim of this research, it is useful to provide a working definition of the POEM concept as applied throughout this research. In table 1.1, an overview of the various definitions of this concept found in the literature is presented. The development of this concept is outlined further in the next chapter, as are several closely related concepts.

Table 1.1 *An overview of definitions of POEM*

Definitions of POEM
1. POEM is "an environmental management system with a special focus on the continuous improvement of products' eco-efficiency (ecological and economic) along the life cycle, through the systematic integration of eco-design in the company's strategies and practices" (Rocha & Brezet, 1999: 32)
2. Product-oriented environmental management systems are promoted "as management initiatives from companies to direct and implement environmental improvements in their products" (van Berkel et al., 1999: 447).
3. "Product-oriented environmental management (POEM) is a management tool in which by taking a systematic approach all processes and activities in a company can be organized such that the environmental impact along the product chain can be constantly controlled, minimized and avoided wherever possible" (Brezet et al., 2000: iii).

In all these definitions, management systems are emphasised. In dealing with a product's environmental characteristics at a company level, such systems can be supportive, for instance through the provision of guidelines for the systematic organisation of POEM, and for standardised information management (Shaft et al., 1997). Yet, in studying a firm's characteristics, looking beyond structures and systems is also important. According to van Hemel (1998: 82), the topic of environmental management in industrial companies "also deals with the need to study the organizational and cultural characteristics of companies that are actually managing to deal with the environmental aspects of their businesses and thus improve environmental management." In this research, attention is focussed on the organisational aspects of POEM, and broadening the definition beyond management systems is therefore necessary.

Hence, in this research, POEM is defined as *a systematic approach to organising a firm in such a way that improving the environmental performance of its products across their life cycles becomes an integrated part of operations and strategy*. In this study, the introduction and implementation of POEM at the company level are central. Through this definition, and the emphasis on an integrated approach, both system-technical and social-dynamic aspects of the concept can be addressed. The aim of the research, and the corresponding research question, are discussed in the next section.

1.3 Research aim and question

Attention to a product's environmental characteristics is growing, and firms are increasingly trying to find ways to organise themselves with regard to these product-oriented environmental issues. The organisational consequences of POEM for firms are however not yet very clear (Lenox & Ehrenfeld, 1997; Cramer, 1998a). It is to resolving this uncertainty that this research wants to contribute. Therefore, the **aim** of this research is succinctly formulated as: gaining an insight into the organisational

implications of POEM at the individual firm level. The research intends to contribute to the development and application of theoretical insights on this integrated form of environmental management, and to deliver practical insights on the organisation of POEM. To contribute to theory *development*, links between the concept of POEM and organisational theory are investigated, while theory *application* is striven for through the empirical part of the research. This will be further outlined in the following section.

The research aim provides guidance for the formulation of a central research question. As POEM is concerned with the integration of environmental considerations into a firm's product-oriented activities, the perspective that is chosen is that of an individual company. Dealing with the environmental effects of products involves many functions in a firm, both at the strategic and operational levels. Firms are in a position to influence their products' environmental characteristics, but they are also in the position that many other stakeholders, such as governments, customers or suppliers, target their demands. Firms are thus stimulated, or forced by a variety of stakeholders, to address these product demands. To be able to meet these demands organisationally, firms need to possess, or acquire and develop, and maintain the appropriate capabilities. In general, a capability can be defined as "a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end" (Amit & Schoemaker, 1993: 35). The process of organising POEM is therefore considered to be a capability-building process, which occurs in a complex setting of different stakeholder interests. The perspective of an individual firm is also chosen because firms are increasingly targeted in product policies, both nationally and internationally[3]. Moreover, factors that affect an entire product life cycle, or networks of stakeholders, will also have consequences at the individual firm level. It is therefore useful to consider both the motivations for firms to get involved in POEM, and the way they try to organise this.

In this research, the emphasis is on studying individual firms that work proactively on product-oriented environmental issues. As Aragón-Correa (1998: 557) observes, "firms with proactive business strategies are also those responding most decisively to the new natural environmental challenges." Product-oriented environmental management is one such new challenge, since it is a fairly novel and innovative way of organising corporate environmental management, and one to which a firm has to develop a response. In the next chapter, a more detailed explanation of classifications and typologies of firms' approaches towards environmental management is presented, including attention to proactive environmental strategies. The focus of this research is also on large firms[4], as in such firms a stronger diversity of functions and departments can often be found, and this

[3] Some of these environmental policies are aimed at consumers (Krämer, 1993; Wilhelmsson, 1998). However, many product-related environmental policies are aimed at specifically influencing and regulating producers and their operations (Verschuuren, 1994; Oosterhuis et al., 1997).

[4] In this research, the four firms studied are multinational corporations, operating in many countries and employing thousands of people.

could facilitate the study of the interactions between these functions and departments. An extensive explanation of the criteria used to select the five case study firms is provided in chapter 5. Overall, these considerations lead up to the formation of the following **central research question** for this study:

Why and how do large, proactive, firms organise product-oriented environmental management, both at a strategic and at an operational level?

To address this research question, both theoretical and empirical insights are employed. This research is explorative in nature and applies theoretical frameworks, which are further enhanced through interaction with the empirical research. These frameworks for the description and analysis of POEM are developed on the basis of several theoretical streams. The theoretical inputs are briefly introduced in section 1.4, which also considers the theoretical relevance of this research. It is hoped that the empirical part of the research will deliver valuable insights about the organisation of POEM in practice. The frameworks developed in this study are applied to the empirical findings. In section 1.5 the empirical relevance of the research is discussed.

1.4 Theoretical background and relevance of the study

From the previous sections it can be seen that the organisation of POEM can be regarded as a capability-building process in which different stakeholder interests have to be balanced in a continuous effort in order to improve a product's environmental characteristics over its life cycle. Formulated like this, different theoretical perspectives can contribute to a better understanding of the organisational capabilities required for the organisation of POEM. According to Gladwin (1993), research in the field of environmental management could benefit from seeking links to organisational theory[5]. In this research, a contribution to theory development is sought by combining insights from three streams of literature that closely relate to the specific characteristics of POEM. These three central theoretical inputs are: a resource-based view and related capability perspective, a stakeholder approach, and total quality management and continuous improvement. These three streams of literature are briefly introduced below. An extensive discussion of these theories is provided in chapter 3, while the combination of the different streams into useful research frameworks is discussed in chapter 4.

The ***resource-based view*** (RBV) of the firm (e.g., Wernerfelt, 1984; Barney, 1991; Peteraf, 1993) argues that valuable, costly-to-copy resources and capabilities provide individual firms with the sources of sustainable competitive advantage. The

[5] In chapter 5, the interplay between management studies, environmental management and methodology is discussed.

derived natural resource-based view (N-RBV) (Hart, 1995) considers competitive advantage to be based upon a firm's relationship with the natural environment. Alongside technical and economic performance, environmental performance should be taken into account in a firm's product-related activities. In such a way, organising POEM might contribute to obtaining both competitive and environmental advantages. Although the possibilities of obtaining a competitive advantage through environmental management are sometimes disputed (Colby et al., 1995; Reinhardt, 1998), an increasing number of firms seem to be working on the development and implementation of environmental management focussed on products. Directly related to the RBV is the concept of ***capabilities***[6]. Environmental management, especially when regarding products, involves aspects that are relatively new to many firms, such as considering environmental effects across the complete product life cycle, and addressing different stakeholders' interests. To anticipate these aspects, a firm needs to develop and maintain organisational capabilities, which Collis (1994: 145) defines as "the socially complex routines that determine the efficiency with which firms physically transform inputs into outputs." The composition and quality of a firm's resource and capability base need to be maintained in a continuous effort to remain in line with influences such as varying stakeholder demands or changing levels of knowledge. This requires a continuous alignment of the existing organisational capabilities with the preferred or required ones. As den Hond (1996) argues, increasing the understanding of capability-building could be regarded as a scholarly contribution from this type of research. Considering the process of developing and implementing the organisational capabilities required to organise POEM is a first building block towards the theoretical frameworks needed to answer the research question.

A second relevant theoretical stream for this research is ***stakeholder approaches***, since products involve many different stakeholders during their life cycle, and because environmental issues often are stakeholder-led (Roome, 1992). As with capabilities and the RBV, a wide range of literature has emerged over the last 15 years on stakeholder issues. Stakeholders "are identified through the actual or potential harms and benefits that they experience or anticipate experiencing as a result of the firm's actions or inactions" (Donaldson & Preston, 1995: 85). Identifying and monitoring these different stakeholder interests is an important element of organising POEM. A firm should try to obtain an overview of what is happening to its products throughout their life cycles, which stakeholder demands are involved, and then decide how to balance these demands. A stakeholder's power could be regarded as depending upon the nature and the level of threat that a stakeholder poses to a firm, and that stakeholder's perceived legitimacy (Fineman & Clarke, 1996). A firm's response to an issue such as POEM, the way they do (or do not) organise to meet this requirement, is thus likely to be guided by the managerial

[6] The concepts of capabilities and competencies (e.g., Prahalad & Hamel, 1990; Leonard-Barton, 1992; Stalk et al., 1992; Collis, 1994) are closely related to the RBV. As Barney (1997) indicates, the differences among the terms resources, competences and capabilities are subtle at best. In chapter 3, capabilities are discussed more extensively and in a broader context.

perception of, and reaction to, the issue involved (Henriques & Sadorsky, 1999). Responding to stakeholders' demands concerning a product's environmental characteristics is seen as increasingly important. As Hart (1995: 1002) put it: "over time, a product-stewardship strategy will extend beyond the pre-emption of firm-specific resources and use of LCA to become a stakeholder-oriented (legitimacy-based) process." Focussing on the role of managerial decision-makers in dealing with stakeholder demands could reveal insights into the motivation for firms engaging in POEM.

The final theoretical area that is selected in this research concerns ***quality management*** and ***continuous improvement*** (CI). Product characteristics and stakeholder demands are in constant flux, and firms have to be prepared for this. Providing the appropriate organisational structures and continually maintaining these is therefore necessary. In guiding the systematic, technical, aspects of POEM, total quality management (TQM) could provide support, as is recognised in the literature on environmental management systems (e.g., Angell & Klassen, 1999; Kitazawa & Sarkis, 2000). The plan-do-check-act cycle, well known in quality management (Deming, 1986), is proposed as a guiding principle in the Dutch guidebook on POEM (VROM, 1999a). Such systems could also be linked to capability-building and the resource-based view, as both CI and TQM could contribute to obtaining an inimitable competitive advantage (Powell, 1995; Savolainen, 1999). The process of capability-building can also be regarded as a process of continuous improvement. These theoretical areas could contribute to an understanding of organisational structure. System-based approaches, however, only highlight parts of the organisational process of POEM. Therefore, when considering TQM and CI, care should be taken to also include the social-dynamic aspects. Applying insights in which system-technical and social-dynamic aspects are balanced is helpful.

In addition to these three main theoretical inputs, it must be emphasised that POEM explicitly involves products. Although the emphasis of the current study is not on product development and innovation, consulting literature on these topics could be helpful for several reasons. Firstly, various recent studies on product development have highlighted capability-building processes and organisational capabilities (e.g., Leonard-Barton, 1992; Iansiti & Clark, 1994; Verona, 1999). Incorporating insights from product development and innovation could improve the understanding of the process of organisational capability-building concerning a product's characteristics. Secondly, attention to environmental characteristics in product development and innovation is rapidly growing (Zhang et al., 1997). Studies consider, for instance, the stimuli and barriers to the application of Design for Environment in small and medium sized enterprises (van Hemel, 1998) or the integration of DfE in industrial product development processes and environmental management systems (Karlsson, 1997). Others have considered the application of a chain perspective (Kärnä, 1999) and the combination of incremental and radical change for environmental compliance (Magnusson, 2000). These studies identify options and obstacles that could be viewed as organisational problems. Finally, a link with stakeholders is also visible in product development and innovation. The importance of stakeholders, and networks of actors, to products, is increasingly

emphasised (e.g., Bras-Klapwijk & Enserink, 1997; Boons, 1998; van Hemel, 1998). Viewing the product development process as one that is influenced by many different stakeholder interests, both internally and externally, highlights the importance for firms to pay attention to such interests in a continuous manner.

Such environmental product development and innovation insights closely relate to the three theoretical topics included in this research. In the discussion on these theoretical areas in chapter 3, attention is therefore paid to the links between these respective areas and product-oriented environmental management.

1.5 Empirical background and the relevance of the study

The concept of POEM is relatively new. Although calls for the incorporation of environmental considerations into product development and design date back several decades (e.g., Papanek, 1972; Varble, 1972), the increasing attention paid to product-related environmental activities within firms is a fairly recent development. This attention has arisen along various routes. Many instruments and methodologies have been developed to perform various types of environmental evaluation, resulting in a variety of tools and methodologies, such as Life Cycle Assessment (LCA) and Risk Assessment (Keiolean, 1993; Troge, 2000). Other research has addressed the end-of-life stages of products, through concepts such as reverse logistics, asset recovery, and recycling (Ayres et al., 1997; Gungor & Gupta, 1999). Compared to these issues, POEM aims at a more integrated and strategic approach. POEM is characterised by the systematic, organisational attention paid by a firm to a decrease in the overall environmental burden of its products. Many elements from these different approaches could be incorporated, such as carrying out an LCA or developing a structure for reverse logistics, but the emphasis is on the integrated approach and its organisational features. As noted in a recent European report, in the Netherlands POEM is seen as an ‘umbrella’ for integrated product policies, such as LCA development and packaging initiatives (EC DGXI, 2000).

In my research, the point of departure for studying POEM in practice is the Dutch situation as, in the Netherlands, some important developments in this area have recently taken place. Therefore, a short characterisation of the situation is presented here. The concept of POEM in the Netherlands was developed with co-operation between government and business. Between 1996 and 1998 much information on the possible design of an approach for POEM was obtained through workshops, pilot projects, experiments and in-company feasibility studies (Rocha & Brezet, 1999). Through this process, the business community was stimulated to become acquainted with the concept of POEM, and a subsidy scheme enabled firms to engage in pilot projects at low risk. This approach led to a gradual development in the concept of POEM, which received broad support. To stimulate and assist companies and industrial sectors to start using POEM, the Dutch Ministry of the

Environment, in 1999, published a guidebook on POEM (VROM, 1999a)[7]. This book was to an extent based on experiences with the pilot projects and the workshops. The guidebook was introduced to acquaint participants with the different aspects of POEM, and to promote the concept of POEM indicating its advantages and how such environmental management could be organised. To stimulate firms and branches of industry to implement POEM initiatives, a second subsidy scheme was established (Novem, 1999). This was intended to introduce and stimulate a systematic process of continuous improvement in products, through product-oriented environmental management systems that are focussed on decreasing the environmental burden of products and improving their environmental performance. The scheme is applicable to both firms and industry associations. In chapter 2, these developments are described in greater detail, and are briefly embedded in an international context.

In my research, most of the case study interviews took place in companies based in the Netherlands. As POEM involves the entire product life cycle, firms that operate at different stages of the life cycle have been addressed, ranging from the chemical industry through to manufacturers of consumer products, and also included were firms involved with asset recovery operations. In this way, different stakeholder interests, across the product life cycle, have been monitored. Adhering strictly to the situation within the Netherlands would, however, be too narrow an approach, as a product's life cycle can cut across borders. The selection of the case study firms was therefore not restricted to the Netherlands, 3 out of the 5 selected case study firms were part of foreign multinationals. The case selection was focussed on large industrial firms that had demonstrated a proactive approach towards environmental management. This decision was made because such firms are more likely to be able to put significant effort into POEM. Through a qualitative methodology, in which interviews with managerial decision-makers formed an important input, an attempt was made to obtain an insight into the reasons and ways in which large proactive firms organise POEM, both at strategic and operational levels. Research frameworks, constructed on the basis of theoretical inputs, guided this empirical research process.

The desired practical relevance of this research can be stated as delivering a useable, operational contribution to the self-regulating capacities of industrial firms, by producing insights into, and analyses of, the application of POEM. Besides this broader societal relevance, a more concrete, practical, relevance can be achieved by co-operating actively with the representatives from case study firms, who are actually organising POEM in their firms. Such research may assist firms in developing and implementing their unique approaches to POEM, both strategically and operationally. The scientific relevance of this project is closely linked to the desired practical relevance, as is often the case in the field of management studies. This dual character of management research is discussed in chapter 5, where attention is given to the relationship between management theory and management practice. The

[7] This guidebook, the *Handreiking Productgerichte Milieuzorg* (VROM, 1999a), is discussed in greater detail in chapter 2.

methodological considerations behind this research are discussed there in more detail.

1.6 Outline of the research and the thesis

As discussed in the previous sections, the central question considers the motivations and ways in which large, proactive, firms develop and maintain product-oriented environmental management, both at the strategic and the operational level. To address this question, three different theoretical insights are combined, leading to the development of several research frameworks for the description and analysis of POEM. In the empirical part of the research, the application of these frameworks is demonstrated with the intention of producing an enhanced insight into the introduction and implementation of POEM at the firm level, and a contribution to theory development.

The research process is based on a continuous interaction between theory and practice, through what is sometimes referred to as a 'parallel iterative process' (Verschuren & Doorewaard, 1995). This implies that the research is refined as the project progresses, by constantly reacting to new findings and, if necessary, adjusting the focus of the research. The project started with literature research, but made contact with empirical practice at an early stage. These contacts were mainly based on exploratory interviews and observations, and assisted in setting the focus for the research, and in confirming the selected research approach. Later in the project, these iterations continued. Not only is the empirical situation regarding 'products and the environment' developing rapidly, new theoretical insights are increasingly being developed as well. Maintaining sufficient flexibility in the research process to cope with these changes, especially when a combination of three dynamic theoretical areas is applied, is important. Schematically, the research process is represented in figure 1.1. The first two case studies assisted in refining the research framework, as indicated by the double-ended arrow. In the following three case studies, this framework is applied.

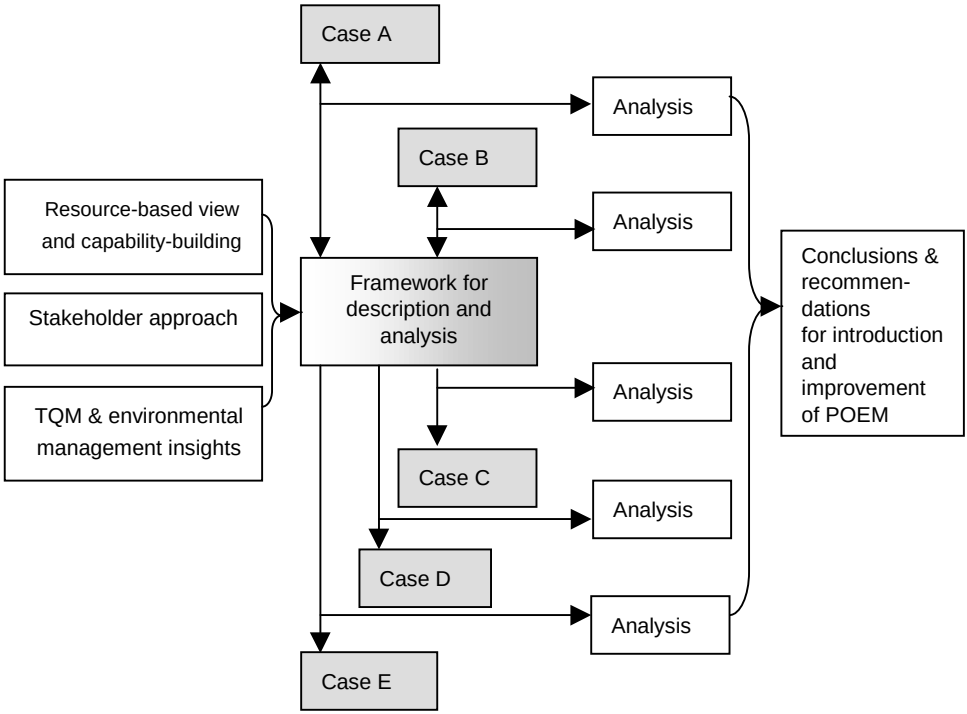

Figure 1.1 *A schematic overview of the research approach*

Before turning to the different theoretical inputs, outlined in section 1.3, attention is first given to the context of POEM. In chapter 2, the increasing attention for corporate environmental management in general, and product-oriented environmental management in particular, is described. Attention is also given to the transition from process-oriented to product-oriented environmental management, and to the different postures that a firm can adopt towards environmental management, including a proactive stance. Also the role of environmental policies, both in the Netherlands and from an international perspective, is discussed. This discussion provides an overview of the context in which the concept of POEM is currently being developed and implemented within those proactive firms that are working on the topic.

Chapters 3 and 4 form the theoretical element of the research. Chapter 3 contains the main theoretical inputs for this thesis: a capability-building perspective related to the resource-based view of the firm; stakeholder approaches; and quality management and continuous improvement. These three main areas are all briefly related to insights gained from product development and innovation literature, and attention is paid to the links between these areas and environmental management. Chapter 3 is intended to present an overview of the current understanding, thus

providing a solid basis for the development of research frameworks. Subsequently, in chapter 4, the different theoretical perspectives are integrated into research frameworks. The concept of responsibility is applied in order to link the theoretical areas. Responsibility can be interpreted in terms of fluctuating expectations (Lenk, 1992). To meet the varying demands that the organisation of POEM imposes on a firm, continuous reconsideration of the various stakeholders' views, and a dynamic view of the organisational capabilities required is necessary. Identifying different stakeholder demands, and balancing these in a continuous effort, is influenced by the interpretations of managerial decision-makers (Fineman & Clarke, 1996). To develop an adequate response, firms need to develop and maintain the appropriate organisational capabilities. This view results in research frameworks that are applicable for the description and analysis of the organisational aspects of POEM in the empirical part of this research. These frameworks are used to guide the application of theoretical insights in the empirical part of this research.

Chapters 5 and 6 contain the empirical part of the research project. Prior to the case studies being described and analysed using these research frameworks, attention is given to the methodological considerations that have led to the selection of the research methodology and research design. In this research, I have opted for a qualitative research design, building on multiple case studies in different industries. The rationale behind these choices is explained in chapter 5. After these methodological considerations, in chapter 6, the different case studies and the most important findings are presented. These are reported using a consistent structure, allowing for better comparison between the different cases. All the cases are first analysed individually, which results in some specific findings. The chapter concludes with a cross-case analysis and concluding remarks.

Finally, in chapter 7, the theoretical and empirical parts of the research are pulled together and the research question answered. The approach taken in the thesis is discussed, and suggestions made for further research. As this research is in the field of management studies, the findings are developed in two directions. Firstly, attention is given to the implications of the findings on theory, reflecting on the combination of theoretical perspectives that has been proposed in this study. Following this, the possible implications of this study for firms engaging in the development and implementation of organisational capabilities concerning products' environmental characteristics, are discussed.

2.

Environment, Business and Policy

"Product-oriented environmental policy can be conceived as belonging to an integrated policy approach, taking into account the intricate social, economic and technological systems in which products are embedded. In this systems view, various actors play their roles."

(Oosterhuis et al., 1997: 26)

2.1 Introduction

The character of environmental management in industry has changed over recent decades. The natural and physical environment have long been seen as an external influence on business; first neglected for a long time but later slowly taken up as an obligatory issue, with which one was forced to comply. Until in the 1980s, environmental problems were often dealt with by pollution control through so-called 'end-of-pipe' or corrective measures. Such additional measures are no longer regarded as sufficient to achieve the environmental improvements that are perceived to be necessary. Through process-orientation, attention in environmental management has been shifting towards more integrated approaches, and currently focuses increasingly on products' environmental characteristics. "The efficiency of additional process-oriented measures tends to decrease as uncontrolled non-point sources become more important as contributors to pollution" (Oosterhuis et al., 1996: 33). Products are one of these hard to control sources of environmental burden, and have been acknowledged as such by various parties involved over recent years. Both nationally and internationally, policy makers in various countries have been working on the development of product-oriented environmental policies[8], a process influenced by different stakeholders – not least companies and their representatives. Policies have been evolving over time, as have the ideas of the different stakeholders on this issue. The main focus in this research is on the position of individual industrial firms. To see the development of POEM in a larger perspective, attention is paid to the changing relationship between business and the environment, presenting a general overview of relevant developments in the area of environmental management.

This chapter outlines the developing concept of POEM. First, in section 2.2, the changing concern for the environment is considered. To be able to consider these developments in a wider context, the section contains an overview of three important factors in the changing general environmental awareness. Because the point of departure in studying POEM in this research is the Dutch situation, specific attention is paid to the rising environmental awareness in the Netherlands. To relate this growing general awareness to the position of business, literature on corporate environmental management is discussed in section 2.3. Subsequently, in section 2.4, an overview is provided of recent developments in product-oriented environmental policy. Emphasis, again, is on changes in Dutch environmental policy, as Dutch initiatives in the development of POEM were one of the initiating factors of this

[8] These developments took place under different names, but all shared attention to product-related environmental impacts. In the Netherlands, in 1993, a workshop was organised on 'Product-Oriented Environmental Policy' (VROM, 1994). Also, international research was commissioned on product-oriented environmental policies in Europe (Oosterhuis et al., 1996; Scholl, 1996). Meanwhile, concepts such as product-takeback, integrated product policy (IPP) and extended producer responsibility (EPR) were gaining importance at the national and international levels (e.g., Lifset, 1993; Kärnä, 1999; Mayers & France, 1999). Some international product-oriented policy approaches are illustrated in section 2.5.

research. To enable an international perspective, in section 2.5, a brief overview of further product-oriented environmental policies is given. Finally, in section 2.6, an overview is presented of insights gained from this chapter.

2.2 Waves of environmental concern - a brief history

Concern for the environmental effects of human actions has a long history. Over time, many different examples of environmental concern can be found, ranging from deforestation, air and water pollution to nature conservation and climate change (Worster, 1988). In modern, industrial societies different classifications of periods, or 'waves', of environmental concern have been proposed (Mol, 1995; Ulhøi, 1998). Here, three waves of environmental concern are distinguished[9]. During the first, at the end of the nineteenth century and the start of the twentieth century, the first environmental groups were formed. During this first wave of environmental concern attention mainly focussed on the degradation of 'natural' landscapes through the increasing industrialisation and urbanisation (Mol, 1995). Preservation of threatened land, species, and ancient buildings were important aims of such early environmental groups.

A second wave of environmental concern arose during the 1960s and early 1970s, when new environmental groups were formed. These groups appeared to be more radical than their predecessors were. According to Mol (1995: 1), a central belief of this second wave was that "a fundamental reorganization of the social order was a condition sine qua non for an ecologically sound society." Alarming publications such as *Silent Spring* (Carson, 1962) and the report of the Club of Rome, *Limits to Growth* (Meadows et al., 1972), supported this idea, as did powerful metaphors such as 'the tragedy of the commons'[10] (Hardin, 1968). In the wake of this second wave, a vast amount of new environmental regulations were developed, often issued by newly established environmental policy institutions[11]. Meanwhile, the focus of environmental groups was gradually becoming more political (Cramer, 1989), while firms were a prime target of both environmental policy and concern. In this period, focus was on delimiting the ecological policy arena, and on ensuring pollution prevention (Keijzers, 2000).

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9 These waves of environmental concern can be seen as part of larger social developments. In the Netherlands, these include the rise of the welfare state, an increase in industrial activities, increased urbanisation, and a growing population. However, since this overview of the rise of environmental awareness is only intended to present a background to the development of the concept of POEM, these social developments are not addressed in this research.

10 This metaphor addresses the issue of overpopulation from an interdisciplinary point of view.

11 For instance, in the USA the US Environmental Protection Agency (EPA) was formed in 1970, while in the Netherlands the predecessor of the current Ministry of the Environment was founded in 1971. Mol (1995) views this creation of government departments for the environment as one of the most significant successes of this second wave of environmental concern, together with the expanding environmental legislation and the growing enthusiasm for the environmental movement.

At the end of the 1980s and in the early 1990s, worldwide environmental awareness again increased tremendously. The internationally renowned report *Our Common Future* of the World Commission on Environment and Development (WCED, 1987), also known as the 'Brundlandt Commission report', has been influential in initiating a third wave of environmental concern, peaking at the Earth Summit in Rio in 1992. Typical of this third wave were the broad societal attention to issues of environment and development, and the integrative approach taken towards these issues, which were taken into account in a variety of decisions, both policy and business. In a well-known publication by the Business Council on Sustainable Development, Schmidheiny (1992: 12) notes that "Progress toward sustainable development makes good business sense because it can create competitive advantages and new opportunities. But it requires far-reaching shifts in corporate attitudes and new ways of doing business." Munoz (2000) similarly speaks of a paradigm shift towards a new interpretation of development, while Mol (1995: 3) observes "a fundamental environmental reform of the modern institutions."

Because the development of POEM in the Netherlands was a factor in initiating this research, specific attention is paid to the Dutch situation. During the third wave, the environmental forecasting study *Zorgen voor Morgen* (Concern for Tomorrow) (RIVM, 1988) and the following first *Nationaal Milieubeleidsplan* (National Environmental Policy Plan (NEPP)) (VROM, 1989) received a lot of attention throughout Dutch society. The RIVM study concluded that radical reductions (70-90%) in environmental pollution were needed, and also possible, to retain a liveable environment in the Netherlands in 2010. As Keijzers (2000: 186) noted, this study and the WCED report "challenged society to formulate sustainable development policies as a means of managing resource stocks for the benefit of both present and future generations." Environmental awareness among a wide range of social actors rapidly increased. Actors such as trade unions, consumers' associations, political parties and employers' federations rushed to declare their commitment, issuing statements on their environmental concern. Although possible solutions to environmental problems varied among these diverse actors, there appeared to be a shared concern, which initiated transformations that had an impact on 'business and the environment'. According to de Groene and Hafkamp (1994), three central elements demonstrate the increasing environmental awareness in the Netherlands: a growing awareness of soil pollution and 'new' environmental problems, fundamental changes in environmental regulation and policy, and the emerging concept of sustainable development. In the following subsections, these three elements are illustrated and related briefly to the position of firms. In the next section, 2.3, specific attention is paid to the relationship between business and the environment.

2.2.1 Soil pollution and other 'new' environmental problems

The discovery of several severe soil pollution instances in the 1970s and early 1980s, some of them even necessitating the demolition of vast residential areas, gave rise to a broad societal appeal for environmental action. Soil pollution, caused by the dumping of chemical waste, demonstrated to firms the severe liability and potential

financial consequences of environmental degradation. This was only one of the 'new' environmental problems[12]. Other important emerging problems were acidification and 'acid rain', and ozone depletion. Major environmental disasters, such as in Bhopal or Chernobyl, occurred in the 1980s, while international awareness of climate change increased both in scientific and policy circles. A strong increase of public environmental concern was visible during this period (de Ridder & Scholten, 1993). Such national and international developments influenced the revival of environmental awareness in the Netherlands.

As Cramer (1989) indicates, these 'new' problems had been known for some time, yet it was not until the 1980s that the severity of their impacts became widely known and clearly visible. In was not surprising that these problems had long been largely invisible, since they had a different scope than the more well-known environmental problems such as water pollution or smell. Concerning ozone depletion and the greenhouse effect, Hajer (1995: 10) indicates that these problems "are different in terms of scale, time, and techniques. They take what has become known as the 'global biosphere' as their level of analysis, and portray problems that will often materialise many years from now." As the scope of environmental problems was growing, the role of science in identifying these problems changed as well[13]. Throughout society the view of environmental problems and the perception of their impact and scope also changed. Based on the growing general environmental awareness and concern, calls for action were issued towards policy-makers and companies. Environmental problems became more accepted as valid points for attention in societal debates, thus affecting different actors in society.

2.2.2 Regulatory changes

A second element to be discussed in relation to the increasing environmental awareness is the changing Dutch environmental policy and regulation[14]. Since the 1960s, much environmental regulation and policy has been developed, which gradually became split up in many complex compartments. Historically, different regulating bodies were responsible for different parts of the environmental regulations, a situation that had led to a variety of diverse laws and rules, making co-ordination and compliance increasingly difficult. Procedural inconsistency and a transfer of environmental problems from one physical compartment to another could

[12] 'New' here refers to the appearance of problems that had previously not been receiving much attention as environmental problems. Other, more directly visible environmental problems such as water and air pollution, noise and smell had previously received most notice.

[13] Environmental problems have become increasingly complex and interrelated. Traditionally, science had a more limited task to provide proof of the damaging effects of humankind on the environment. Nowadays, science is increasingly active in policy-making processes as scientists are "given the task of determining the levels of pollution which nature can endure" (Hajer, 1995: 27).

[14] Here, only a brief account of changes in Dutch environmental policy is presented. For more extended overviews of this policy see Arentsen et al. (1993), Goverde (1993), Leroy (1994), or Keijzers (2000).

arise (Boons, 1995). Environmental regulation developed into a highly technical field, in which company and government specialists debated about details (den Hond, 1996), and in which fragmentation in content, organisation and procedures was strongly present (Leroy, 1994). Alongside this fragmentation, weak permitting and enforcement of environmental law became problematic. These problems included, the complex character of enforcement, the inefficiency of the system of enforcement and the fact that this system enhanced passivity (Hafkamp & Molenkamp, 1990).

During the 1980s, more integrated approaches gradually became a central issue in Dutch environmental policy, as illustrated clearly in the NEPP (VROM, 1989). Integration was aimed for through diverse approaches that centred on, for example, regions, themes, substances, and target groups. According to the NEPP, an integrated approach to environmental problems was required to work towards sustainable development[15]. Central strategies therein were the closing of substance cycles and integrated chain management, energy saving and increasing energy efficiency, and quality improvement of products, production processes, raw materials, waste and the environment in order to extend substance use in the economic cycle (Cramer & Schot, 1993; Goverde, 1993). With this changing focus towards integration, the use of policy instruments also changed. Traditionally, in environmental policy, strong emphasis had been placed on instruments for regulatory governance. However, since the end of the 1980s, a growing attention to both market-based instruments of governance, such as subsidies, taxes or tradable emission rights, and to communicative instruments of governance, such as target group policies, voluntary agreements and covenants, is visible. According to Hajer (1995: 26) "deficiencies of the predominantly 'react-and-cure' formula for regulation were increasingly criticized, while the more innovative 'anticipate-and-prevent' variety gained credibility." Relying solely on regulatory approaches made it difficult for firms to take a proactive stance (Steger, 1993). To overcome such difficulties, market-based and communicative types of policy instruments were gaining prominence, while combinations of instruments were also increasingly applied.

As the approach towards business and other societal actors was gradually changing, the creation of broader support for environmental policy became an important issue. Internalisation and target group policies are two central elements of this, that are particularly relevant to the development of corporate environmental management policy, and subsequently to the development of POEM. *Internalisation* is a classical concept in social science, referring to the process by which individuals and organisations incorporate values, norms and rules of their social environment (Leroy, 1994). Making environmental responsibility an obvious factor in the choices of the various actors in society, such as consumers, producers, and policy makers, is important. Ideally, considering the environmental effects of one's activities should become second nature as a result of a focus on internalisation.

[15] The concept of sustainable development is further discussed in subsection 2.2.3.

Alongside internalisation, in environmental policy, specific groups in society were increasingly addressed through a so-called *target group policy*[16], which was considered to be an excellent instrument for bringing about integration (Klok & Kuks, 1994). In this policy approach, a government aims at finding the policy that is most effective and meets the least resistance in society through a process of societal consultation (de Hoog, 1998). Target groups included various more-or-less homogeneous societal groups that were contributing considerably to environmental problems (e.g., agriculture, industry, traffic and transport). In the NEPP, consumers were introduced as another important target group. The 'Environment and Industry' target group policy translated national environmental objectives into exact emission reduction figures for sectors of industry[17] (de Hoog, 1998). Target groups are a clear example of co-operative approaches which seek to develop and implement policy programmes in close co-operation with business (Boons, 1995). Co-operative approaches can involve a variety of different voluntary approaches. Many forms have been applied in environmental policy over time, covenants being among the most well known[18]. However, increasingly co-operative relationships between business organisations and government do not reduce the political character of the relationships, as these are rather reinforced (den Hond, 1996). Environmental problems, and the possibilities to tackle them, have become part of the debates in societal consultation processes. In these processes, network organisations such as trade associations and sector organisations play an important role as intermediaries. In product-oriented environmental management, such intermediaries are also considered important, as discussed in section 2.3.

Internalisation and target group policies leave room for industry initiatives and even stimulate such initiatives. According to de Hoog (1998), in environmental policy industry's commitment is needed in order to exploit its innovative capacity for sustainable development. For a firm, implementing a preventive and innovative approach to environmental management could lead to economic improvements. The possibility of a competitive advantage could trigger a firm to develop new solutions for product-related environmental problems. An innovative firm strategy "aims at improving the company's *capability* to produce environmentally sound products" (Cramer & Schot, 1993: 312). Changes in policy, and in the relationship between business and (environmental) policy-making, thus might create competitive

16 As Goverde (1993) indicated, the target group policy had already been proposed in the early 1980s to involve important branches of industry in technological innovations for dealing with the adverse effects of economic development on the environment.

17 Under the 'Environment and Industry' target group policy, sectoral agreements on emission reductions have been made with the following sectors: primary metals industry, chemical industry, printing industry, dairy industry, metals and electronics industry, textile and carpet industry, paper and cardboard industry, meat industry, rubber and plastics processing industry, and ready-mixed concrete and concrete products industry. These sectors together accounted for approximately 90% of industry's environmental impact (de Hoog, 1998).

18 In Dutch environmental policy, covenants are an important instrument to smooth the relationship between the different parties involved (e.g., Goverde, 1993; Michiels, 1993; Hulst, 1996). Discussing these instruments is beyond the scope of this research.

opportunities for firms, providing one possible motive for them to further explore possibilities for engaging in proactive environmental management. In the next section, the relationship between business and the environment is further examined.

2.2.3 Sustainable development - an emerging concept

The concept of sustainable development, as introduced in *Our Common Future*, was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). This concept became an important political and social issue, causing much debate in society, and finding its way into environmental policies. In the NEPP (VROM, 1989) sustainable development was one of the central elements. Many different definitions have been coined for sustainable development, and its scope and dimensions remain an issue for debate (e.g., Redclift, 1994; Ehrenfeld, 1999). In literature, a distinction is often made between narrow and broad definitions of sustainable development (van Hemel, 1998). A narrow definition regards sustainable development mainly as an issue addressing the environment and the needs of future generations. A broader definition draws in a number of wider topics such as population growth, food supply, developing countries' debts, limits on natural resources, industrial development, poverty, habitat destruction, biodiversity loss, and geographical and transgenerational inequality (van Hemel, 1998). Although the concept of sustainable development thus includes more than just environmental issues, it certainly has contributed (and continues to contribute) to raising broad environmental awareness. Often a distinction is made between 'greening' and 'sustainability', although there are clear links between the two concepts. Greening is a necessary, but not a sufficient, condition for sustainable development (Gladwin, 1993). In other words, "the greening of industry should not be confused with sustainable development, which is a goal of society as a whole. Still, a key question for the sustainability agenda is whether business can make a difference and integrate environmental and sustainability imperatives into its structure, culture and action" (Schot et al., 1997: 11).

Although the narrow definition of sustainable development is taken as a starting point in this thesis, a look at broader sustainable development is regarded as necessary, since POEM can be seen as one step in a larger developmental process. The Brundlandt Report "explicitly postulated a positive role for the business corporation in furthering the cause of environmental protection (…) by integrating environmental protection with economic performance" (Sharma & Vredenburg, 1998: 729). One way of providing a view on sustainable development from a business perspective is provided through the concept of sustainable industrial development (Krut & Munis, 1998), as detailed below in four core themes.

Table 2.1 *Central themes in sustainable industrial development (Krut & Munis, 1998)*

Sustainable industrial development
▪ Environmentally sound products, processes and services
▪ Reducing risks and hazards to human health and ecosystems
▪ Integration of sustainable development and economic growth
▪ Community/stakeholder participation in sustainable development

This interpretation of sustainable development fits in well with my research, as it provides a link between 'greening' and sustainable development from a firm's perspective. Environmentally sound products and, implicitly, processes and services, is what POEM aims to achieve. A firm working with POEM is likely to have a broader perspective of its products' environmental characteristics, explicitly considering the product life cycle. This implies attention to reducing risks and hazards, as the impacts of the complete product life cycle is taken into account. As is discussed further in the next section, engaging proactively in environmental management could contribute to an improved competitive advantage, leading to an integration of sustainable development and economic growth[19]. The third theme is thus also addressed. The fourth theme considers the inclusion of different stakeholder interests. In applying POEM, a firm ideally looks beyond its own specific contribution to the product life cycle. Various other stakeholder interests can be addressed.

The links between these themes have been investigated, in order to achieve a better insight into the organisation of POEM, and the ways in which firms could anticipate the different environmental demands imposed on them. As Roome (1994: 66) put it: "Business responses to environmental change are (…) a function of the ability of management to identify and respond to the demand for organisational change as well as the environmental risks and opportunities the company faces." Developing and implementing such an ability is thus highly relevant in organising POEM, where a broad scope of environmental management seems necessary. A further examination of the relationship between business and the environment is provided in the next section, in order to better understand the different postures that firms can adopt and the different types of environmental management.

[19] In this context, references are often made to the concept of eco-efficiency, which aims at both economic and ecological efficiency, through a process of innovation and value enhancement by minimising resource inputs (Schot et al., 1997). Keijzers (2000) considers the period from 1990 to date as emphasising eco-efficiency and encouraging the integration of ecological and economic concerns. In section 2.5, some further remarks are made about this concept.

2.3 Business and the environment - a changing relationship

Having briefly considered the changing environmental awareness within society at large, in this section the relationship between business and the environment is considered. The attitude of business towards the environment has clearly shifted as a result of the rise in overall environmental concern. As Hart (1997: 67) put it: "the environmental revolution has been almost three decades in the making, and it has changed forever how companies do business." Although expenditure on protecting the environment has increased vastly (Colby et al., 1995; Hoffman, 1997), more and more firms no longer view environmental management as just a cost factor, but have also started to see the related business opportunities. While regulators have become more interested in flexible regulation and integrative mechanisms, firms have come to see environmental issues as being strategically relevant (den Hond, 1996). Environmental management is now a part of boardroom agendas (Steger, 1993) and plays an increasingly important role in many business decisions, both at operational and strategic levels. The observation that firms are increasingly held responsible for their use of the physical and natural environment, and the fact that environmental policy explicitly addresses a product's environmental characteristics, pose new challenges to firms. To understand the possibilities for a firm to respond to these changes, it is useful to examine closer the relationship between business and the environment.

My central research question focuses on large, proactive firms and the way in which they develop and maintain product-oriented environmental management, both at strategic and operational levels. To address this question, it is necessary to take a further look at what constitutes proactivity, what is specific to POEM, and what could motivate a proactive firm to engage in such a novel topic. To determine which firms are most likely to engage in POEM, in the first subsection a few typologies and classifications are discussed in order to categorise the postures a firm could adopt towards environmental management, and to further identify the characteristics of a proactive firm. The second subsection considers different types of environmental management, placing POEM in a larger perspective. These typologies and classifications are mainly ordering devices, and do not say much about the motives that a firm can have for engaging in environmental management. In the third subsection, attention therefore is paid to such motives of proactive firms.

2.3.1 Different postures to environmental management

To categorise the different positions a firm can take towards corporate environmental management, a variety of models and taxonomies have been developed. In most of these models several stages are discerned. In general, two sorts of classifications can be identified in such environmental management strategy models (Hass, 1996). The first group, continuum/progression approaches, places companies along a continuous scale of stages that often stretches from the most reactive towards the most proactive or innovative strategies (e.g., Hunt & Auster, 1990; Roome, 1992). For example,

Roome's typology contains five stages, ranging from 'non-compliance' to 'leading edge'. Such classifications can also go beyond mere environmental management strategy. Chatterji (1995), for instance, proposes a classification for environmental R&D activities, ranging from 'reactive' to 'leadership'. The second group of typologies classifies a company's approaches within categories, without implying progression expectations (Hass, 1996). These typologies may be based on risk assessments or market opportunities, and aim at identifying generic environmental management strategies (e.g., Steger, 1993; Rondinelli & Vastag, 1996; Rugman & Verbeke, 1998).

Using such typologies, it might seem easy to identify the characteristics of firms that take a proactive approach towards environmental management strategies. Empirical reality however is often not so clear-cut, and this type of classification or typology is criticised regularly, for instance because firms could apply different strategies to the different environmental problems that they encounter (Cramer, 1998a), or because the models might apply too narrow a focus in their definitions of environmental management (Hass, 1996). Furthermore, different parts of a multinational firm could respond differently to local regulations in different countries (Kolk, 2000). The lack of a direct linkage to a firm's overall business strategy has also been criticised (Hass, 1996).

Despite these criticisms, identifying the different positions that a firm can take towards environmental management is useful for analytical purposes. If one is interested in a firm's motivations for actively engaging in POEM, discerning a 'proactive' category of firms can be helpful in identifying possible case study firms. Partidário and Vergragt (2000: 201) define proactive behaviour as "organising one's business so as to be able to use the company's potential to benefit from opportunities and to avert threats, which may be anticipated in the environmental field." Proactivity emphasises a firm's own initiative in environmental management. As Magnusson (2000) indicates, proactivity includes an acknowledgement of environmental demands as providers of business opportunities, rather than as limitations or threats to business processes. Related terms he identifies are: active, aggressive, constructive, innovative, and opportunity-oriented. In this research, the type of firm that engages in POEM is expected to take such a proactive stance towards environmental management.

2.3.2 Different types of environmental management

Alongside strategic posture, another way of looking at the positions a firm can take on environmental management is by considering the types of corporate environmental management and technologies applied. Spliethoff and van der Kolk (1991) distinguish between cleaning technology, process-oriented environmental management or cleaner technology, and product-oriented environmental management. An indicative overview of these three types is presented in table 2.2. In this typology, the gradually broadening scope of corporate environmental management is visible. Firms can apply different types of environmental

management technologies to different problems, or combine these types. The first two types are only briefly outlined in general terms, because emphasis in this thesis is on the third category: product-oriented environmental management.

Table 2.2 *Three types of corporate environmental management, adapted from Spliethoff and van der Kolk (1991) and Kolk (2000). Translated by the author.*

	Cleaning technology	Process-oriented environmental management / Cleaner technology	Product-oriented environmental management
Approach	Accent on corrective measures	Accent on process integrated facilities	Accent on preventive measures
Type of measures	Relatively simple technical modifications	Far-reaching technical modifications	Modifications in the entire product chain
Process and/or product	Process and product are no issues for debate	Process control put central; product not an issue for debate	Attention for product and process design
Corporate environmental policy	No clear environmental policy	Environmental policy in development	Clear environmental policy
Regulation or self-regulation	Governmental norms as a guideline / own initiatives are rare	Number of own initiatives is growing	Many own initiatives; limited role of the government
Organisational approach	Environmental management is a staff activity	Environmental management is important to different functions	Environmental management is highly integrated
Environmental awareness	Limited environmental awareness	Growing environmental awareness	High environmental awareness
Environmental knowledge	Little environmental knowledge available	Environmental knowledge partly available	Much environmental knowledge available
View of the environment	Environment seen as a burden	Environment seen as a precondition	Environment seen as a challenge

Cleaning technologies. From the end of the 1960s on, many companies responded to environmental problems by the application of so-called end-of-pipe technologies, or corrective measures, which often meant that the causes of environmental problems were not removed but that their effects were mitigated. At the time, these end-of-pipe solutions were seen as the most efficient method for

cleaning up (Keijzers, 2000). Solutions were mainly sought through technological modifications external to the direct business processes, for instance through the installation of filters or purification plants. Processes and products remained largely unchanged, administrative pressure and legislation were the main motives to engage in such environmental management and structured environmental management was not much in evidence. As indicated in the previous section, traditional environmental policy did not stimulate firms much to engage in any further reaching forms of environmental management. However, the importance of these cleaning technologies should not be underestimated, as they still provide an important contribution to environmental management in production processes[20] (Venselaar, 1993). However, to reach the levels of environmental improvement currently desired, these technologies alone seem to be insufficient. Further integration of environmental management into production processes thus forms a logical next step.

Process-oriented approaches. In the middle of the 1980s, several developments in corporate environmental management took place. As noted in section 2.2, a strong upsurge in societal attention to environmental problems was visible throughout society, and environmental policy changed. The responsibility of different societal groups was placed more centrally under internalisation and target group policies. In these policies an important role was reserved for trade associations and sector organisations, acting as intermediaries between individual firms and policy-makers in environmental policy networks (e.g., Glasbergen, 1989; de Bruijn & Lulofs, 1996). Headed by the two central employers' federations, VNO and NCW, Dutch industry in the mid-1980s emphasised its own responsibility for internal monitoring of the environmental policy. The two federations together proposed the concept of Environmental Management Systems (EMS) within firms, through a brochure that has been influential in developing thinking about environmental management (VNO-NCW, 1986). The Ministry of the Environment stimulated further development of this concept in co-operation with industry, endorsing the responsibility of this target group and working closely with trade associations. In this process, increasingly attention was paid to organisational aspects of environmental management. The responsibility for organising and implementing EMSs was given to firms themselves, although government kept track of the development progress. Hence, industry had room to develop their own solutions that, if successful, could provide them with a competitive advantage. Firms could select an EMS form that suited their specific situation. Although the development and implementation of EMSs, and related initiatives, also faced difficulties[21], the co-operative way in which

[20] Such an acknowledgement of the role of cleaning technology is also a result of the growing environmental awareness, and of the mutual influencing of regulators and regulated firms.

[21] The goal set in the policy paper - to have nearly 12,000 companies with an implemented EMS by 1995 - was not achieved, as practice appeared to be more stubborn than expected. Dieleman (1999) found that organisational difficulties were among the reasons why cleaner production programmes have only been adopted in a limited way: the implementation process appears to be a difficult one. This also refers to the process of organisational capability-building as discussed in this thesis.

the initiatives were developed reflected a change in the approach to environmental policy, of policy makers, business representatives and other societal actors.

The type of environmental management that emerged could be defined as process-oriented, since the environmental impact of a firm's processes was central. Environmental aspects were becoming more important in a firm's strategy and were increasingly integrated in its management. 'Cleaner production' and 'good housekeeping' are examples. No longer was environmental management seen as a completely external issue, it was having more direct implications on the way a firm was being organised and operated. Although technological measures remain important in this type of environmental management, for instance through process modifications, organisational implications are becoming more prominent. Under this type of environmental management, however, the environmental characteristics of products and services produced by a firm are not discussed much. The focus is mainly on the firm's own business processes.

Product-oriented approaches. In cleaning technology, attention was mainly focussed on the negative by-products of production processes, such as emissions and waste. Cleaner technology and process-oriented environmental management expanded this view to include the consideration of these processes themselves. A further step within environmental management led to a further broadening of the scope of the firm, as firms came to see the importance of the supply chain in environmental management. Environmental policies also guided firms in that direction.

In the 1990s, concepts such as integrated chain management (ICM) and life cycle management (LCM) drew attention to the entire chain that a firm is part of, and to a linking element in this chain: the product. ICM is the integrated management of a supply chain in terms of environmentally, socially and economically responsible management of the production, consumption, distribution and final disposal of a product (Cramer, 1996). The understanding that environmental problems are determined over the entire product life cycle in such chains was permeating further, as were novel approaches to tackle these problems[22]. The related LCM model "emphasizes the integration of environmental issues into the company's decision-making processes, consideration of the environmental effects over product life cycle necessitated by the product stewardship and the importance of cultural change in environmental management processes" (Linnanen et al., 1995: 117). Both these concepts are related closely to the definition of POEM as applied in this thesis[23]. In POEM, the product life cycle is also central. One illustration of the product life cycle is presented in figure 2.1.

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[22] The concept of industrial ecology, for instance, considers themes such as energy and materials consumption, waste minimisation and inter-organisational co-operation (e.g., Frosch & Gallopolous, 1989; Erkman, 1997). Within this concept, processes are usually central, but explicitly looking beyond the borders of the individual firm is also endorsed.

[23] As noted in section 6.6, in one of the case studies, the approach investigated is also termed LCM.

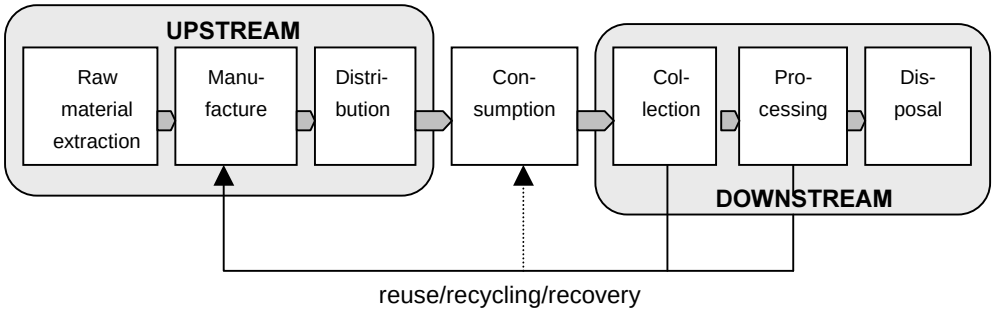

Figure 2.1 *A schematic presentation of a product life cycle (Scholl, 1996)*

To assess the environmental impact of products and substances, methodologies such as life cycle assessments (LCA) were developed, as were design practices to incorporate environmental considerations into product development, such as Design for Environment[24] (DfE). Developed using a background of natural sciences and engineering, such approaches delivered an insight into determining the environmental impact of products, and guidelines for design (den Hond, 1996). Gradually, attention broadened towards the inclusion of organisational aspects. Yet, relatively little attention has been paid so far to an organisational focus when dealing with a product's environmental aspects (e.g., Lenox & Ehrenfeld, 1997; Cramer, 1998a). Although there are close relationships between these different concepts, I use the term product-oriented environmental management to emphasise the central position of products in this type of management, and the integrative character of this concept. In this thesis, POEM is defined as systematic, organisational attention for decreasing the environmental burden of products across their life cycles as an integrated part of a firm's operations and strategy. As Romijn (2000) notes, POEM is related to three influential developments in environmental management: increased attention for ICM, an increasing focus on innovation, for instance through DfE, and growing attention to EMSs and systems-based approaches[25]. Since POEM has ties to all three of these developments, it is useful to consider it as a separate concept in environmental management. In addition, this study focuses on individual firms and the way in which they organise POEM. Thus, focussing on POEM from an organisational viewpoint is more appropriate here than adopting a chain perspective, in which entire life cycles are central.

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[24] Design for Environment (DfE) is only one of a broader range of design practices, sometimes referred to as DfX (Design for X). This includes approaches such as Design for Assembly (DfA), Design for Quality (DfQ), and Design for Recycling (DfR). These approaches in turn all could also be applied in the improvement of developing and implementing DfE (van Hemel & Keldmann, 1996).

[25] Romijn (2000) also notes that, in the Netherlands, these developments have been supported by different programmes such as PROMISE on ecodesign (e.g., Cramer et al., 1994; Brezet & van Hemel, 1997), and PRISMA on pollution prevention (Dieleman & de Hoo, 1993; Dieleman, 1999).

In POEM, the emphasis of the environmental measures is preventive, and a strong look at the product life cycle is visible. Guided by corporate environmental policies, and an increased environmental awareness and knowledge, many business initiatives are underway. A variety of firms have been experimenting with this broadening scope for some time now. Some firms started with activities that could be seen as part of POEM in the late 1980s. An example is the remanufacturing operations in the information and communication technology industries. These initiatives initially had a strong focus on financial motives, the use of the term 'asset recovery' was common. In some firms, attention to products' environmental characteristics was gradually incorporated in product development, sometimes referred to as Ecodesign, DfE, or Green Design. These concepts all concentrate on diminishing the environmental impacts of products through product development decisions. Alongside this, the role of other functional areas within firms was also gaining more prominence, for instance through 'green marketing' (Davis, 1991; Menon & Menon, 1997), environmentally conscious manufacturing (Sarkis, 1995; Gungor & Gupta, 1999), and environmental supply chain management (Hill, 1997; Enarsson, 1998; McIntyre et al., 1998). Issues of environmental management were thus getting further integrated into business operations and strategy, while their focus increasingly considered both processes *and* products. Considering these developments, POEM could be regarded as a logical step in a continuing process of environmental management (van Berkel et al., 1999) from greening towards sustainable development**.** This process can result in more integrated approaches, including the minimisation of the environmental burden of a firm's growth and development (Hart, 1995). A need for fundamental changes in corporate environmental management towards sustainable development is stressed regularly (Welford et al., 1998; Vellinga & Herb, 1999). From an ecodesign point of view, Brezet (1997) distinguishes between four types of ecodesign innovations, that range from product improvement, through product redesign, towards function innovation, and finally to system innovation. Product improvement and redesign are generally within the control of an individual firm, while function and system innovations require changes in consumer lifestyles and infrastructures (Stevels, 1997 in Magnusson, 2000). These latter developments thus involve a longer timescale. Over time, in the process of incorporating environmental considerations into business strategies, a shift from purely technical measures (pollution prevention, product improvement) towards thinking in terms of functions and systems, and of a fundamental renewal of technology, must gradually be made. Jansen and Vergragt (1993) indicate that such fundamental changes in technological development are only possible in close co-operation with both cultural and structural developments. Societal needs have to be translated into functions, which in turn can be fulfilled through an interplay between technology, structure and culture. New products or services can fulfill these functions. For instance, in a study on DfE, van Hemel (1998) described a strategy for new concept development, which included concepts such as dematerialisation, shared use of products, and integration and optimisation of functions.

A broader view of environmental management not only draws attention to products and services, it also fundamentally questions their function. This is posing great challenges to firms: 'how to foresee the direction of developments?' and 'how to adjust their organisation to anticipated changes?' Seen in this light, POEM is only one stage in a larger process. In studying its organisation, it is necessary to keep this observation in mind, as sufficient flexibility to be able to adjust to new developments has to be maintained. Looking at the possible motives of firms to tackle environmental problems can contribute to this understanding. In the next subsection, such motives are discussed, while in section 2.3 the concept of POEM as organised in the Netherlands is outlined.

2.3.3 Motives to engage in environmental management

The increasing impact of the field of 'business and the environment' is demonstrated by the growing attention management literature pays to environmental issues, and in the diversity of that literature (e.g., Schmidheiny, 1992; Walley & Whitehead, 1994; Porter & van der Linde, 1995; Hart, 1997; Welford, 1998). In such publications, the idea is gaining acceptance that those industrial organisations that excel in the management of environmental affairs, will benefit from constructive relationships with consumers, regulators, suppliers, and other stakeholders, thereby substantially improving their prospects of success (Hooper & Rocca, 1991). Some research suggests that well formulated environmental strategies could indeed lead to a number of business advantages, such as better quality, reduced costs, an improved environmental image, and the opening up of new markets (Maxwell et al., 1997), although such findings are also contested (Colby et al., 1995). These anticipated advantages could motivate some firms to shift their environmental management strategies towards more proactive approaches. Acclaimed 'win-win' situations - situations that are both environmentally and economically beneficial (Elkington, 1994; Porter & van der Linde, 1995) - might accelerate this shift. The concept of eco-efficiency, which is also based on this premise, is increasingly used to indicate the need to combine economic activity and environmental care, and is endorsed by the World Business Council on Sustainable Development (DeSimone & Popoff, 1997).

In the discussion on firms' motives for engaging in environmental management, several themes are visible. Post and Altman (1994) discern between compliance, market-driven, and value-based, environmentalism. Regulatory, economic and moral motives then become involved. In chapter 4 this distinction will be outlined further. Berry and Rondinelli (1998) propose a set of forces that drive proactive environmental management. These consist of four categories: regulatory demands, stakeholder forces, competitive requirements and cost factors. Regulatory demands could be considered as a specific stakeholder interest since, in research on influential stakeholders, regulation is often seen as an important driving force to engage in environmental management, as are customers (Garrod & Chadwick, 1996; Henriques & Sadorsky, 1996, 1999). Meanwhile, cost factors could be regarded as being related to competitive requirements, since getting a better grip on cost structures

could improve a firm's competitive position. Aragón-Correa (1998) claims that the positive effects of proactivity on developing environmental approaches define a new area of possible competitive advantage. Environmental issues thus could constitute a competitive requirement. One reason to proactively engage in POEM could be that companies want to differentiate themselves from their competitors. Building on these ideas, it could be that firms engage proactively in an environmental issue, such as POEM, because of anticipated stakeholder pressures and/or because they expect to obtain a competitive advantage. In table 2.3, such a selection of the driving forces for proactive environmental management is depicted.

Table 2.3 *Forces driving proactive environmental management, adapted and elaborated upon from Berry and Rondinelli (1998)*

Stakeholder interests	**Regulatory demands**	▪ more stringent regulations ▪ increasing legal liabilities ▪ more stringent legal enforcement
	Stakeholder forces	▪ public demand for environmental protection ▪ customer demand for clean processes and products ▪ shareholder rejection of environmental risks ▪ improved supply chain relationships
Competitive factors	**Competitive requirements**	▪ new business opportunities ▪ international trade agreements ▪ spread of quality management principles ▪ marketing arguments
	Cost factors	▪ increasing costs of pollution control ▪ new technologies for pollution prevention ▪ cost savings from waste reduction

In the literature, many examples of firms that aim to obtain a form of competitive advantage through environmental management are presented. Examples stem from very diverse industries, including car recycling and the chemical industry (e.g., Schot, 1992; den Hond, 1996; DeSimone & Popoff, 1997; Maxwell et al., 1997; Cramer, 1998b). Increasingly, a chain perspective is applied in such approaches. On the purchasing side, more and more companies are requiring a more stringent environmental performance by the products and materials they buy. Stakeholder pressure, for instance from chain partners, could thus be an important motive for starting to work on POEM. Meanwhile, within firms, a further balancing between different functions is necessary. Marketing, for instance, has to know what the environmental performance of the firm's products is, while purchasers will have to acquire an insight into the way purchasing decisions influence a product's environmental characteristics. Environmental information on products therefore has to be available and the different functions involved will need to be able to handle such information. Accurate information and communication are thus very important. Such information has to be well integrated into the business processes. Information

systems could provide support here (Shaft et al., 1997). An increasing number of companies acknowledge a problem in integrating environmental considerations into their mainstream business decisions and organisational systems (Roome, 1999). Looking from a chain perspectives is one way to deal with these issues, studying the implications at an individual firm level is yet another. In this thesis, the focus is on individual firms, in order to consider the implications of a firm's proactive attitude towards POEM for its business organisation.

2.4 Product-oriented environmental policy[26]

As indicated in chapter 1, in this thesis, the Dutch situation in terms of product-oriented environmental management and policy is taken as a starting point. A further characterisation of Dutch product-oriented environmental policy is necessary. In this section, a description of this policy is first presented, followed by an overview of a guidebook that was issued to assist firms to engage in POEM. The section concludes with some initial evaluations of experiences with the concept in the Netherlands.

2.4.1 Product-oriented environmental management in the Netherlands

Product-oriented environmental policy has been debated over a long period in the Netherlands. Although announced in the NEPP+ (VROM, 1990), it was not until late 1993 that a policy document on products and the environment (VROM, 1993) was issued to create clarity on the position the government would take towards this topic. A central element in this approach to product policy was information exchange (van Berkel et al., 1999). In the document it was proposed to organise product-oriented environmental policy along the lines of product files. The different actors in the product chain would have to compile product files that contained reliable information on the environmental effects of their products. This would give customers an opportunity to incorporate environmental considerations when making a selection. Market forces would then encourage firms to improve their products' environmental characteristics.

After the publication of this policy document, its contents were heavily debated. Business, represented by the central employers' federations (VNO and NCW), strongly opposed the ideas as presented, supporting the aim of the proposed policy but disagreeing with the instruments chosen. In the proposed approach, environmental aspects of products were isolated, while in practice consumers would weigh several factors in making their decisions. A frame of reference to compare such environmental information was not available (VNO-NCW, 1998), and it was questionable whether consumers would have sufficient knowledge to make environmentally sound decisions (van Berkel et al., 1999). Meanwhile, legal aspects

[26] This section is a modified and extended version of de Bakker (2000).

related to the product policy proposed were also debated[27]. A new government came into power in 1995, and the regulatory approach towards POEM was abandoned and a more co-operative approach selected[28]. This tackled a product's environmental performance directly through its producers (van Berkel et al., 1999).

From then on, the concept of POEM was developed in closer co-operation between government and business. Following their experiences with the introduction and implementation of EMSs, industry supported such a proactive approach in which a continuous and systematic improvement of products' environmental characteristics was central, alongside integrated chain management (VNO-NCW, 1998). Between 1996 and 1998 much information on a possible design for a product-oriented environmental policy was obtained through workshops, pilot projects, experiments and in-company feasibility studies (Rocha & Brezet, 1999). A variety of different firms and other stakeholders was involved in this process. The business community was also stimulated to get acquainted with the concept of POEM through a subsidy scheme that enabled firms to engage in pilot-projects at a low risk. This acquaintance was also guided by a framework that had been set by government, but was based on consultation with a broad representation of stakeholders, including business, academia and non-governmental organisations (NGOs) (VROM, 1999b). The accompanying guidebook is discussed in the next subsection. This approach led to the gradual development of the concept of POEM and initial experiences with its implementation. The government however retained the possibility of stepping in with more stringent regulations if this co-operative approach failed to meet its objectives. A lot thus depended on the degree of acceptance and internalisation within business (VNO-NCW, 1998).

2.4.2 A guidebook for POEM

To stimulate and assist companies and industrial sectors to start working with the concept, the Ministry of the Environment, in 1999, published a guidebook on POEM, based on experiences from pilot projects and workshops (VROM, 1999a). This guidebook is aimed at making participants acquainted with aspects of POEM in a step-wise manner. It is meant to promote the concept of POEM, to indicate its possible advantages, and to show how such environmental management could be organised. In table 2.4, the important advantages gained by implementing POEM, as listed in the guidebook, are presented. In this guidebook, POEM is regarded as a management instrument. The guidebook offers operational guidance and adds strategic elements to the concept. POEM is intended to continually improve the environmental characteristics of a product, and places the product life cycle in a

[27] From a legal angle, Uylenburg (1993) argued that a product's environmental aspects should not be arranged through environmental law but through product law. Verschuuren (1994) meanwhile argued that there certainly were possibilities to integrate product-oriented issues within environmental law, although a thorough adaptation to product law would be needed.

[28] This change was initiated through a letter from the new Minister of the Environment (TK II 1995-1996, 23562 nr. 6).

central position. The government stimulates the concept of POEM through subsidies and incentive schemes. Important elements discussed in the guidebook are briefly discussed in this subsection.

Table 2.4 *Advantages of Product-Oriented Environmental Management, according to the VROM guidebook (VROM, 1999a). Translated by the author.*

Advantages of product-oriented environmental management
1. **Economic advantages** such as cost avoidance through a different choice of resources, or through weight reductions, or reducing risks of environmental claims
2. **Improvement of competitive and market positions** through improved relationships with chain partners, improving the image, and because environmental and quality improvements on products can often go hand in hand
3. **Environmental gain** through an improvement in a product's environmental characteristics
4. More **chances for company-specific solutions** since the government leaves more room for initiatives from business; the government follows and facilitates

The advantages listed above could lead to a firm deciding to engage more actively in POEM. As a chain perspective is important, existing chain relationships could be the starting point for an individual firm to engage in POEM. To reach out to these different chain partners, it is essential to involve different functions and departments within a firm in that process. After all, different departments such as marketing, sales, logistics or product development, maintain various contacts with chain partners. According to the guidebook, POEM can often be linked to existing contacts in the chain, for instance between purchasers and suppliers, or sales departments and customers. Clear support of the POEM initiative from senior management however is expected to be important for organising this topic broadly within an organisation. The importance of such managerial involvement is frequently stressed (e.g., Fineman & Clarke, 1996; Cramer, 1998a; Rocha & Brezet, 1999) and will be discussed further in this thesis.

Based on an overview of the environmental effects at each stage in the product life cycle, an assessment could be made as to which stage in the chain should be tackled to decrease the environmental burden. As in process-oriented environmental management, control through a management system is promoted as an element of POEM. Tasks and responsibilities could thus be set, comparable to the ISO 14000 series of standards on environmental management. This is a widely used series of documents related to EMS and environmental management tools, which can include a product's environmental effects. However, in practice, these standards often primarily focus on the environmental impacts of a firm's own production processes, and on measures that an individual firm could implement, while POEM aims to address the entire product life cycle (van Berkel et al., 1999). Despite this, environmental standards can support the further development of POEM, as will be discussed further in chapter 3. POEM goes beyond process-oriented environmental management by applying a chain perspective, and by centrally placing a product's

environmental effects. Insights into the environmental aspects of product-related issues, such as resource consumption and selection, energy use, product design, packaging and reverse logistics, then play a role. Getting a good overview of these diverse aspects is not easy for an individual firm, as information about the entire product life cycle is needed. Over the product life cycle this might pose co-ordination problems (den Hond, 1996), while trade secrets and patents could also be an obstacle. For an individual firm, these relatively new requirements imply that specific organisational capabilities have to be developed on these product-related environmental issues.

To deal with the organisational aspects of POEM, the guidebook presents a stepwise plan, which follows the Deming cycle taken from quality management (plan-do-check-act). In brief, the plan suggests that a decision, supported by management, is made to undertake a pilot project: a product is selected. Together with chain partners, improvement actions are organised and finally the project is evaluated. Consequently, management decides whether to continue the project. Through a repetitive application of this cycle, continuous improvement of a product's environmental properties could be accomplished. In order to make the steps in the guidebook more comprehensible, a number of tools are included in the guidebook, such as matrices and questionnaires.

To stimulate firms and sectors of industry to implement POEM initiatives, in addition to the guidebook a subsidy scheme has been established (Novem, 1999). This scheme aims to introduce and stimulate a systematic process of continuous improvement in products, through product-oriented environmental management systems that aim to decrease the environmental burden of products and improve their environmental performance. The scheme is meant for both firms and industrial associations. Some important conditions in the subsidy scheme are that any system developed has to fit in with the methods of EMSs, that POEM has to aim at continuous improvement ('having a cyclical character'), and that learning is acquired during the subsidised project. The current scheme is planned to last from 1999 until 2003, and different types of projects qualify for a subsidy. In particular, industrial associations are invited to make proposals that fit with their intermediary position in the chain. However, projects from individual companies also are acceptable. In 1999 a total of 1.8 million guilders was available for this scheme (Novem, 1999); in 2000 this rose to 2.5 million guilders (Staatscourant, 2000).

2.4.3 First experiences - evaluations of POEM

Although the guidebook clearly presents a number of potential advantages, the development of POEM in many companies is still at a relatively early stage. To monitor the actual status of POEM in firms, and some related opportunities and constraints, several studies have been conducted over the last few years (DHV, 1998; VROM, 1999b; Brezet et al., 2000). These are briefly discussed here to illustrate the current situation in the Netherlands regarding POEM. The first two of these studies investigated POEM in a fairly early stage, as most of the firms involved had only just

started working with POEM. However, they do provide an insight into the expectations the investigated firms and consulted stakeholder representatives had at that time, which coincided with my research starting.

In 1998, research by a consultancy company revealed that the majority of the investigated firms (65%) were acquainted with the concept of POEM, but that this concept had not yet been well embedded in day-to-day management decisions (DHV, 1998). Organisational embedding through a management system or incorporation in business procedures was often not present. Firms started by applying measures that concerned the environmental effects of a product, such as reuse, ecodesign and redesign, or a different selection of resources. More integrated approaches seemed to take longer. The same research also revealed that about half of the investigated companies did not determine the environmental effects of the measures they took, for instance through a life cycle assessment (LCA). Intuition and external perception were considered important influences on the direction of a firm's decision-making process on such product-oriented environmental measures. According to this report, this could be explained because the motives for firms to engage in POEM were often not environmental ones. The main reasons found for engaging in such initiatives were commercial opportunities, legislation, and stimulation by the mother-company.

This DHV study also produced some recommendations: firms should strive for a stronger environmental foundation for the measures that are undertaken regarding POEM. To obtain such a foundation, several software tools are available (e.g., on LCAs and material selection). Following an initial qualitative overview, a tool can be chosen for use in a quantitative assessment. A second recommendation, for policy makers, was to stimulate market-based approaches, for instance through environmental labelling or benchmarking, since market pressure and competitiveness are seen as important motives for firms to engage in POEM[29].

Prior to issuing the guidebook on POEM, in 1998, the Dutch Ministry of the Environment also commissioned a study[30] into the development of POEM (VROM, 1999b). The research was based on a series of interviews with firms, supplemented with group interviews with representatives from stakeholders and experts. Also, the reports on 43 pilot projects that had started since 1996 were assessed. This study emphasised the main features of POEM: its chain orientation, its more strategic character relative to process-oriented environmental management, its aim of continuous improvement, and it being part of existing environmental management. It appeared that firms were often already working with parts of POEM, but that a systematic basis was regularly lacking. The research concluded that, in principle, every company could apply POEM, although it seemed to be easier for larger firms to implement the concept. Conversely, the more international dealings a firm has, or

[29] Dieleman (1999) found, at least for the cleaner production programme he studied, that this statement does not apply. He noted that such incentives were not sufficient for firms to actively engage in such programmes. Pollution prevention options are not always as easy to implement as suggested, and they should be considered within the context in which they are to be implemented.

[30] This study was conducted by the consultancy firm PriceWaterhouseCoopers.

the more it is part of an international chain, the more difficult it becomes to retrieve the necessary information. Industrial associations can play an important role in the development of, and communication about, POEM. Finally, the importance of market considerations was underlined in this report. The role of the government was seen as facilitating, as setting boundaries; a finding in line with the changing stance taken on environmental policy. The non-legislatory character of POEM was emphasised. Because product life cycles can vary widely, both between firms and between products, companies insisted on flexibility rather than stronger regulation, although government would have to create some preconditions and offer guidance. The guidebook on POEM and the accompanying subsidy scheme were intended to meet these recommendations.

In both these investigations (DHV, 1998; VROM, 1999b), the importance of networks was stressed. Local governments, for instance, need to be better informed about POEM and its implications, and they could also be used to disseminate ideas about POEM, as they are in frequent contact with firms. Communication, and the provision of information, are important requirements in making such a form of environmental management a success. Giving attention to the organisational capabilities of an individual firm could therefore contribute to a better understanding of the process of organising POEM.

The previous two studies were conducted while POEM was in its early stages. Recently, the Ministry of the Environment commissioned an evaluation of 55 of the initial POEM projects, in order to get an insight into the success and failure factors (Brezet et al., 2000). This study considered issues such as stimuli and barriers for POEM, the role of industrial associations, possible links with quality and environmental management systems, and the influence of size and type of firm. A great deal of information on the experiences of firms in organising parts of POEM was described and analysed in this study. Although these findings did not appear in time for me to incorporate them into my empirical work, the results provide interesting comparative material. Such a comparison is provided in the final chapter of this thesis, after the presentation of the empirical results. Before the way in which these empirical results were obtained is explained, through a discussion on the theoretical and empirical inputs in the subsequent chapters, the perspective on POEM is broadened beyond the Dutch situation in the next section.

2.5 An international outlook: POEM in perspective

In environmental policy, emphasis is gradually shifting towards “a more integrated, holistic approach to tackle product-related environmental problems, which are often multi-dimensional” (Kärnä, 1999: 73). Not only in the Netherlands are such integrated approaches to a product’s environmental characteristics an emerging issue in environmental policy (VROM, 1993; Reijnders, 1996). Although, in this thesis, Dutch product-oriented environmental policy is a starting point, it is important to reflect upon a more international perspective as well for several reasons. Firstly,

many of the firms involved in a product life cycle are affected by different policies, for instance because they are located in different countries. Secondly, international policies can also affect national policies, for instance through the European Union or through organisations such as the OECD. Finally, the different cases studied in this thesis originate from, and operate within, different countries and thus have to deal with alternative approaches towards POEM.

Two environmental policy concepts that have been developed recently are discussed here since they could have a considerable impact on the way industries operate in future (Kärnä, 1999). Especially within Europe, the concept of Integrated Product Policy (IPP) is currently being debated, while the concept of Extended Producer Responsibility (EPR) appears to be gaining attention worldwide.

2.5.1 Integrated Product Policy (IPP)

Integrated Product Policy (IPP) is a relatively new topic of environmental policy, and looks at the whole life cycle of products with the aim of reducing their environmental impacts. Although the concept is still under development, according to Kärnä (1999) a variety of different instruments could be applied under the umbrella of integrated product policy, such as environmental labelling, extended producer responsibility, and environmental taxes. IPP has now been debated within the European Union (EU) for a few years. Environmental product policies and product management strategies are emerging across Europe but these activities are rather patchy (EC DGXI, 1998a). Increasing unity in these approaches is one rationale for the involvement of the European Commission (EC) in this issue, another being the expectation that product policy could play a positive role in stimulating competitiveness (EC DGXI, 1998a). The EC has ordered several studies on product-oriented environmental policy (e.g., Oosterhuis et al., 1996; EC DGXI, 1998a, 2000) in order to get a better insight into the different approaches taken in different countries, and to investigate possibilities for introducing a European policy on products' environmental characteristics.

A workshop was organised in December 1998, to initiate discussions between interested parties and to collect ideas for the further development of IPP within the EU (Kärnä, 1999), followed by two workshops in February 2000 (Schmidt, 2000). An earlier study[31] on IPP analysed national and international developments in Integrated Product Policy with the aim of providing elements for a European policy (EC DGXI, 1998a). The workshop attracted many participants, representing different stakeholders such as public authorities, industries, consumers, and environmental organisations. An aim of the workshop was to initiate a brainstorming discussion on definitions, objectives and priorities for the development of IPP in the EU (EC

[31] This study, and a consecutive one in 2000 (EC DGXI 2000), was conducted by the consultancy firm of Ernst & Young together with the University of Sussex, Science and Policy Research Unit (SPRU).

DGXI, 1998b). Through a number of working groups, different elements of IPP were discussed[32].

However, no definition of IPP had yet been agreed. It has been proposed to define IPP as "public policy which explicitly aims to modify and improve the environmental performance of product systems" (EC DGXI, 1998a: 9). According to Kärnä (1999), four principles of IPP are: life-cycle perspective, stakeholder involvement along the product chain, emphasis on voluntary and market-based instruments (without excluding legal instruments), and an emphasis on increased environmental information, communication and education between product chain actors. To further develop insights for the preparation of a policy document, a new study was commissioned; to seek and provide evidence of the benefits of an IPP approach, and to build and develop supporting arguments for pursuing IPP at a European level (EC DGXI, 2000). Suggestions made in this study included a focus on setting aspirations and targets. "IPP is likely to be a long-term and gradual process, where objectives need to be clear and effects need to be measured and evaluated. As this process of implementation unfolds, an important aspect of it will be consultation with stakeholders" (EC DGXI, 2000: 2). Schmidt (2000) notes that IPP clearly follows life cycle thinking, encourages the use of tools, and could become a political umbrella for co-operative approaches throughout the life cycle. The parallels with Dutch policy on POEM as discussed earlier are evident.

2.5.2 Extended Producer Responsibility (EPR)

Another related concept is Extended Producer Responsibility (EPR). Introduced in the early 1990s, EPR encompasses the notion "that producers bear some responsibility for the environmental impacts of their products, throughout the products' life cycle, including upstream impacts arising from choices of materials, from manufacturing processes, and especially from the management of the wastes arising at the end of the product life" (Lindhqvist & Lifset, 1997: 6). The concept of responsibility and a chain perspective are clear in this concept, and the relationship with a concept such as life cycle management can be seen. In its most basic form, EPR could be referred to as 'product take-back' (Gertsakis et al., 1998). EPR is closely related to waste management policies, such as product take-back, and to design issues that influence the product's end-of-life, such as Design for Environment. In various industries, forms of product take-back have been developed. Well-known, and often debated, examples include the recycling of old vehicles in the automotive industry (den Hond, 1996), and of waste from electrical and electronic industries (Kärnä, 1999; Mayers & France, 1999). Producer responsibility is gradually finding its way into environmental policies, covering an ever increasing range of product categories (Mayers & France, 1999).

[32] In one of these workshop sessions, a representative of the Dutch employers' federations presented the Dutch approach to POEM, thus underlining the stakeholder involvement in this approach.

As Lindhqvist and Lifset (1997) note, the President's Council on Sustainable Development in the USA has altered the definition of EPR from extended *producer* responsibility to extended *product* responsibility, thus making EPR more synonymous with product-oriented environmental policy. These authors argue that this shift in definition could imply that nobody assumes any responsibility at all. They argue that products cannot be held responsible, only people and the organisations that they form can. Fishbein (1998) considers that this redefinition of EPR has defined the concept more broadly, since emphasis is not laid on the producer's unique position and responsibilities, or on the post-consumer stage. However, "Whether referred to as EPR, Product Stewardship or Product Take-Back, the objective remains focussed on developing sustainable systems that eliminate or minimise environmental impacts across the product's entire life-cycle, from cradle to grave" (Gertsakis et al., 1998: 5). Emphasising 'product' above 'producer' could highlight the fact that different actors during a product life cycle could influence a product's environmental impact, and therefore could be attributed a form of responsibility.

One initiative that could be considered as a part of EPR is the way in which different industrial associations in the electrical and electronic industries are anticipating take-back regulations as part of the pending European Waste Electrical and Electronic Equipment directive (WEEE). In the various industries involved, return logistics are being organised, in close co-operation with customers and recyclers, while links to product development are also being established (Kärnä, 1999; Mayers & France, 1999; Maslennikova & Foley, 2000). Some of these aspects are touched upon briefly in chapter 6, as some of the case study companies are actively engaged in product take-back.

Meanwhile, the concept of Product Stewardship (PS) could also be considered to be part of EPR. This concept originates from the chemical industry as an element of the Responsible Care programme. This programme is a voluntary initiative of the chemical industry, consisting of six codes of practice, aimed at continuously improving performance, and communicating this improved performance. PS could be defined as the management of environmental, health and safety effects of products over their entire life cycle. Often industrial associations drive this programme. In the Dutch chemical industry, the industrial association VNCI is actively involved in a voluntary programme that includes 'Product Stewardship'. The concept of Product Stewardship bears clear similarities with POEM, which has also been investigated on behalf of VNCI (KPMG, 1997). In chapter 6, this initiative will be discussed further, with two of the case studies stemming from the chemical industry. The strong similarities between the international concepts discussed and the Dutch approach suggest that, even in an international context, taking the Dutch situation as a starting point is justifiable.

2.6 An overview of the insights gained

In this chapter, the development of the POEM concept has been presented and placed within the perspective of business and the environment. Growing environmental awareness was outlined, and three important factors were identified: the changing properties of environmental problems, the changing character of environmental regulations, and the growing concept of sustainable development. Environmental problems are accepted as a serious societal concern, in regulations attention has shifted towards internalisation and target group policies, while the concept of sustainable development explicitly involves and addresses a wide array of stakeholders, with business being prominent.

Under the influence of this changing environmental awareness, the relationship of business to the environment was also changing. To characterise this relationship, several strategic postures that a firm can take towards environmental management have been identified, as have different types of such management. In this research, the focus is on the organisation of POEM within large, proactive firms. Proactivity has been defined as emphasising a firm's own initiatives in environmental management, including an acknowledgement of environmental demands as providers of business opportunities (Magnusson, 2000). "The challenge for the emerging field of strategic environmental management is (…) to reframe the "environment" from being seen only as a source of corporate threats, problems, and liabilities to a source of opportunities, solutions, and assets" (Hart, 1999: 78). In this research, POEM has been defined as a systematic approach to organising a firm in such a way that improving the environmental performance of its products over their life cycles becomes an integrated part of operations and strategy. Different policy approaches have been outlined to further illustrate the concept of POEM.

To better understand POEM organisation within a firm, it is useful to consider the possible motives that a firm could have to engage in POEM. In this research, a distinction is made between competitive requirements and stakeholder requirements. From a competitive point of view, POEM might play a part in transforming environmental problems into business opportunities, as it offers an additional competitive element: the product's environmental performance. These competitive arguments are one motive for firms to engage in POEM. POEM is an issue in which many stakeholders are involved, necessitating firms to reconsider their existing relationships with stakeholders and possibly to develop new ones, as this type of environmental management requires them to broaden their outlook to encompass the product's life cycle. A third element that has become apparent during this chapter is the continuous character of environmental management. The progress from cleaning technology towards POEM is part of a continuous process, directed towards more sustainable modes of business. Firms therefore need to maintain flexibility in dealing with environmental issues[33]. Viewing environmental management as a process of

[33] In a wider sense, this flexibility is also required to deal with the process of sustainable development, which requires strategic and operational re-orientations.

continuous improvement can deliver additional insights into the organisational process of POEM. Building on these insights, in the next chapter, three theoretical areas – a resource based view / capability-building perspective, a stakeholder approach, and continuous improvement / total quality management - are investigated to determine their applicability to the research question, leading up to the construction of research frameworks in chapter 4. These frameworks are then applied in the empirical part of the research.

In addition to these links to the three theoretical areas noted above, another relevant development is the sharing of responsibility, among government, businesses and consumers, for a product's environmental impacts. Given the specific attention to the organisational aspects of POEM and the role of management, as argued in the previous chapter, the concept of responsibility should also be addressed in the analysis of the process of organising POEM. This is also discussed in chapter 4. Several other aspects that have been addressed in the present chapter will be returned to briefly in chapter 7. The recent evaluation of POEM in the Netherlands (Brezet et al., 2000) provides an opportunity to compare my research with other findings. To view the findings on the concept of POEM in a broader perspective, as stressed in this chapter, the relationship of the concept to the broader idea of sustainable development is outlined further in chapter 7.

3.

Capabilities, Stakeholders and Quality

"As they learn new capabilities, organizations draw on the society around them for both means and ends."

(Winter, 2000: 994)

3.1 Introduction

In the previous chapters the motives for this study were outlined, attention was paid to the increasing focus on POEM, and the main theoretical inputs for this research briefly identified. POEM is defined as a systematic approach to organising and operating a firm in such a way that improving the environmental performance of its products through their life cycles becomes a logical part of operations and strategy. A firm's efforts to balance the environmental characteristics of its products over their life cycle is considered to be a continuous dynamic process, influenced by a variety of stakeholders. The environmental demands imposed upon products by different stakeholders seem to be in constant flux, and firms have to find ways to respond to these changing demands. Developing and implementing POEM can thus be regarded as a capability-building process. Several theoretical perspectives that may contribute to a better understanding of the organisational capabilities that a firm requires for POEM are discussed in this chapter.

As noted in chapter 1, the main theoretical areas identified are: (1) the resource-based view of the firm and the capability perspective, (2) stakeholder approaches, and (3) quality management literature. An underlying goal of this research project is to contribute to theory development by applying and integrating these theoretical insights. A central position is thus attributed to the resource-based view of the firm (RBV), and especially to the related capability perspective. The other two theoretical areas will supplement this capability perspective. The position of POEM relative to these three areas is illustrated in figure 3.1. In this chapter these different inputs are discussed in more depth, and their relationship with the concept of POEM is examined. The three theories are discussed[34] in this chapter in similar formats. First, attention is paid to the reasons why a theory has been selected, and then a characterisation of it is presented. This is followed by an application of the theory in the area of 'products and the environment'. The final section of this chapter presents an overview of the insights gathered from the discussions on the different theories. These insights are carried forward to the next chapter, where the theoretical frameworks that will guide the empirical part of the research are outlined, based on an integration of the theoretical viewpoints.

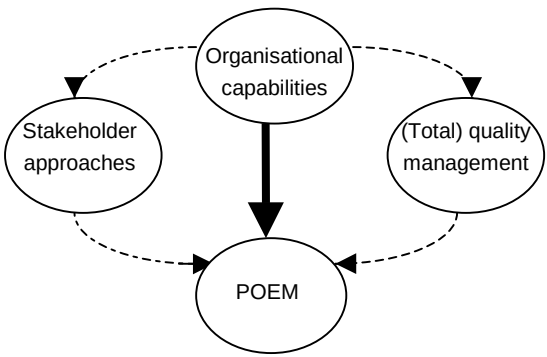

Figure 3.1 *Relationships between theoretical areas*

[34] Ideas and analysis of theoretical areas described in chapters 3 and 4 are to an extent based on earlier conference papers (de Bakker, 1999; de Bakker et al., 1999a, 1999b; de Bakker & Nijhof, 2000).

3.2 Products and the environment: a capability perspective

A central question in this research, on the organisational aspects of POEM within firms, is how individual firms develop and maintain methods for dealing with products' environmental characteristics. Manufacturing firms that control their own new product development processes are in a strong position to influence their products' environmental characteristics (Kärnä, 1999). Investigating the characteristics of individual firms can therefore reveal some interesting details about how they organise for POEM. With this focus on an individual firm's characteristics, it seems useful to apply insights from the resource-based view of the firm (RBV). The RBV proposes that differences between firms' performances are the result of their different resource endowments. The extent to which firms are capable of organising for POEM, building on their specific resource bases, could be considered as an element of their performance. The organisational capabilities of firms, working proactively on the organisation of product-oriented environmental issues, receive attention in this research. This section therefore deals with the RBV, the closely related capability perspective, and ways of applying these perspectives to 'products and the environment'.

The resource-based view of the firm has emerged over the last 15 years as an influential theory of the firm[35], given significant attention by Wernerfelt (1984) and Rumelt (1984), although several earlier considerations can be found in the literature[36]. This view has a number of characteristics that make it a useful theory for this thesis, as outlined in section 3.2.1. In the second subsection, 3.2.2, a general overview of the RBV is presented, briefly embedding this perspective within strategic management literature. Since this research is directed at the implications of the process of organising POEM, attention focuses specifically on *organisational* capabilities and on the *dynamic* features of the RBV. In section 3.2.3, an overview of the terminology applied within resource-based literature is given. After this outline of the RBV in general, attention in 3.2.4 turns towards the process of developing and maintaining capabilities, building on literature that investigates the links between the RBV and product development. Finally, to emphasise the focus on firms' and products' *environmental* performances, the fifth subsection concentrates on applications of a natural resource-based view of the firm (Hart, 1995). This approach looks at the link between competitive advantage and a firm's relationship with the natural environment. It predicts that innovative environmental strategies can lead to the development of firm-specific capabilities that can be sources of a firm's competitive advantage. These final subsections thus highlight specific elements of

[35] As Wernerfelt (1997: xvii) notes: "Today, it is very difficult to imagine teaching business strategy without more or less explicitly relying on some insights from the resource-based view of the firm; at least to the degree that one espouses the maxim that resources are a major determinant of strategy."

[36] Often this view is connected to the work of Selznick (1957) and Penrose (1959). In a reader on the resource-based perspective, Foss (1997) provides an overview of the 'historical origins of the RBV', including work by Richardson (1972) and Nelson and Winter (1982).

POEM: first, a focus on products and capability-building, and then attention on the environmental characteristics of firms and products.

3.2.1 Reasons for applying a resource-based view of the firm

Various reasons for applying a resource-based perspective when studying the organisational aspects of product-oriented environmental management can be given. Five important reasons are: a focus on individual firms, the attention to performance, the integrative possibilities, the theoretical and practical applicabilities, and the relevance to environmental management. These reasons are briefly discussed below.

Firstly, an important element of this research is the attention given to the way individual firms deal with organising regarding their products' environmental characteristics. The RBV focuses on an individual firm's characteristics, but without totally ignoring the firm's surroundings as discussed later. Applying a theoretical viewpoint that combines internal and external factors is useful to this research as, in POEM, the interplay between the different stakeholders concerning the product life cycle is important, alongside firm-specific internal capabilities.

A second reason is the link between a firm's resources and performance as advocated within the RBV. In studying POEM – or environmental management in general – this notion of performance can be extended. The possibilities of gaining a competitive advantage are often considered to be one of the motives for firms engaging in proactive environmental management. As indicated in chapter 2, Berry and Rondinelli (1998), for instance, discern four forces that drive proactive environmental management: regulatory demands, stakeholder focus, cost factors, and competitive requirements. In my view, regulatory demands could be considered as specific stakeholder interests, while cost factors and competitive requirements could be regarded as related to each other. Improved anticipation of these competitive requirements could lead to improved performance. If stakeholders demonstrate a growing concern for the environment, then better addressing their demands might lead to improved performance. On issues of proactive environmental management, a firm's performance could thus be seen in a broader perspective. The RBV's emphasis on performance (in terms of the competitive positions of firms) thus provides another reason for applying this theory. Such reasoning also suggests a linkage to stakeholder approaches, as discussed in section 3.3.

Thirdly, resource-based research "encompasses an unusually broad range of topics and approaches. It is both content and process oriented. It draws on both economic and behavioral perspectives" (Peteraf, 1994: 153). This broad characteristic of the RBV stream of literature allows one to combine different viewpoints. According to Mahoney and Pandian (1992: 363), the RBV is attracting increased attention "precisely because the framework encourages a dialogue between scholars from a variety of perspectives." Where some publications propose a distinction between a more economic resource-based theory and a more behavioural dynamic capability approach (or content versus process) (e.g., Schulze, 1994), others increasingly call for more integrative approaches, viewing these two approaches as

blending naturally together (Mahoney & Pandian, 1992; Mahoney, 1995). I intend to apply and integrate insights gained from different streams of literature in order to better understand organisational aspects of POEM. Using a theory that allows such a treatment is thus helpful. Interest in the organisational process is supported by a growing stream of RBV literature that studies more dynamic approaches (e.g., Hamel & Prahalad, 1994; Stoelhorst, 1997; Teece et al., 1997; Deeds et al., 1999; Bhatt, 2000; Eisenhardt & Martin, 2000).

Fourthly, the RBV encourages a combination of theory and practice and its "appeal to academics would seem to be a matter of combining relative analytical rigor with apparent managerial relevance, and doing so more successfully than alternative approaches" (Foss, 1998: 134). Developments within RBV thinking stem from both scholarly theoretical contributions and from more practical-oriented publications[37]. As I want this research to contribute to both a better theoretical insight and to an improved practical insight, this combination of inputs closely matches my objectives, providing yet another reason for applying this perspective.

Finally, over recent years, several publications have appeared that apply a resource-based perspective to issues of environmental management and strategy, demonstrating the usability of the RBV in this area (Hart, 1995; den Hond, 1996; Russo & Fouts, 1997; Judge & Douglas, 1998; Marcus & Geffen, 1998; Rugman & Verbeke, 1998; Sharma & Vredenburg, 1998; Christmann, 2000). These studies range from theoretical constructs through to empirical applications and tests of RBV-related concepts. They form a useful point of reference for this thesis. In relation to this, quite a few studies report on the relationships between environmental management, competitiveness, and financial performance (Shrivastava, 1995; Klassen & McLaughlin, 1996; Berry & Rondinelli, 1998). These are relevant since competitive advantage is a central element within the RBV. In section 3.2.5, insights on the application of the RBV in environmental management are further discussed.

3.2.2 An outline of the resource-based view of the firm

To understand resource-based perspectives' focus on an individual firm's characteristics and performance, it is useful to briefly consider the position of the RBV within strategic management literature, and to examine some central concepts within the RBV. The performance of firms, and sources of competitive advantage, are central to strategic management. A well-known definition of strategy is "the match an organization makes between its internal resources and skills [...] and the opportunities and risks created by its external environment" (Hofer & Schendel, 1978: 12). In studying strategy, both internal and external elements are thus important. Yet, in strategic management literature, emphasis on these orientations

[37] Prahalad and Hamel's (1990) paper in the management journal 'Harvard Business Review' was very influential in drawing broad attention to RBV thinking (Wernerfelt, 1995).

has changed over time[38]. The resource-based view of the firm (Rumelt, 1984; Wernerfelt, 1984; Barney, 1986), as proposed from the early 1980s onwards, can be regarded as a reaction to the then dominant approaches in strategic management that were based upon industrial organisation (IO) economics, which built upon the structure-conduct-performance (SCP) model (e.g., Bain, 1956; Porter, 1980) and emphasised the effect of an industry's structure on a firm's performance. According to the SCP model, the industry in which a firm competes determines its competitiveness. As Barney and Ouchi (1996) note, critical performance-enhancing attributes of an industry structure in the SCP approach are industry concentration, level of product differentiation, and barriers to entry. The IO focus on a firm's external environment as accounting for its success could thus be seen as an 'outside-in' approach to strategy.

The resource-based view of the firm has been developed to focus on the internal characteristics of individual firms after early resource-based theorists found the IO view to be unrealistically limited (Russo & Fouts, 1997). The RBV argues that differences in the competitive positions of firms can be understood from the firm-specific organisational resources. Although the focus has shifted from 'outside-in' towards 'inside-out', the RBV has both similarities with and distinctions from the various streams of IO economics literature (Conner, 1991; Mahoney & Pandian, 1992). Therefore, the RBV is sometimes presented as complementary to IO approaches (Collis & Montgomery, 1995; Barney & Ouchi, 1996). The initial focus on a firm's endogenous resource endowments now seems to be broadening out to include linkages to the firm's surroundings as well, with several studies considering the interplay between internal and external features (Amit & Schoemaker, 1993; Levinthal & Myatt, 1994). Stressing this connection, Maijoor and van Witteloostuijn (1996: 550) note that RBV and IO theories "are Siamese twins, as *both* factor and product market imperfections are crucial and *both* the firm and the industry level of analysis are important."

The overall objective of the RBV is to account for the creation, maintenance and renewal of competitive advantage in terms of the resources of a firm (Foss, 1998). Its focus is on the idiosyncratic, costly-to-copy, resources controlled by an individual firm - resources whose exploitation may give that firm a competitive advantage (Barney, 1997). Resources are considered to be heterogeneously distributed among different firms and to be sustainable over time. For resources to constitute such a source of sustainable competitive advantage, they must meet a number of criteria as indicated by many theorists (e.g., Barney, 1991; Amit &

[38] Hoskisson et al. (1999) describe theoretical developments in strategic management literature as 'swings of a pendulum', identifying the alternating foci on 'outside-in' and 'inside-out' approaches. Industrial organisation (IO) economics highlighted the external focus, evoking the resource-based approaches that subsequently emphasised an internal focus. "Later research paradigms have benefited from earlier ones, thereby enriching the field's total body of knowledge. These pendulum swings help accumulate newer theories and methodologies" (Hoskisson et al., 1999: 447). Considering these literature streams in detail is beyond the scope of this research. Some useful references include Conner (1991), Mahoney and Pandian (1992) or Barney (1997).

Schoemaker, 1993; Peteraf, 1993; Collis & Montgomery, 1995). Some of these criteria are that resources have to be valuable, rare, difficult to imitate, hard to substitute, complementary, immobile, durable, and their value has to be appropriable by the firm. It is not appropriate here to address all these features in detail. According to Fahy (2000), these diverse characteristics can be considered under three headings: value, barriers to duplication, and appropriability[39]. Value is related to a resource's potential to be a source of competitive advantage; duplication is related to the possibility of a firm keeping valuable resources to itself, while appropriability considers a firm's options in reaping the benefits of its possession of these valuable, hard to duplicate resources. These headings, often supplemented with notions such as path dependence or causal ambiguity, underline the relevance of a dynamic approach within the RBV.

In the RBV, firms are considered to be bundles of resources (Wernerfelt, 1984), as "the RBV sees companies as very different collections of physical and intangible assets and capabilities. No two companies are alike because no two companies have the same set of experiences, acquired the same assets and skills, or built the same organizational structures" (Collis & Montgomery, 1995: 119). Firms could be seen as performing activities for which resources are required. Such a view was earlier proposed by Richardson (1972: 888), who considered industry "as carrying out an indefinitely large number of *activities,* (…) these activities have to be carried out by organisations with appropriate *capabilities*, or, in other words, with appropriate knowledge, experience and skills." Although the exact terms applied vary, such reasoning is found in much RBV literature[40].

In fact, many different applications of the RBV have been published and the terminology applied within these publications varies. Within this field there are subtle variations in terminology, which make communication more difficult (Peteraf, 1993). Foss (1998) argues that *the* resource-based view does not exist. Terms such as resources, assets, competencies and capabilities are all commonly used within this stream of literature but often with slightly different meanings and contexts. Influential publications deal with core competencies (Prahalad & Hamel, 1990), core capabilities (Stalk et al., 1992; Leonard-Barton, 1992), or organisational capabilities (Nelson & Winter, 1982; Collis, 1994). Conceptual differences even lead some authors to identify different streams of literature[41]. In the remainder of this section

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39 Similarly, Barney (1997) proposes the 'VRIO framework'. This encompasses four questions required to conduct a resource-based analysis of a firm's internal strengths and weaknesses: the questions of Value, Rareness, Imitability, and Organisation.

40 As noted in several publications on the RBV (e.g., den Hond, 1996; Foss, 1999), treating firms as collections of activities was also recognised by Porter (1991: 102), who notes that: "A firm is a collection of discrete, but interrelated economic activities." Yet, in his approach, the composition of these collections of resources is mainly attributed to a firm's responses to its external competitive environment, hence choosing an 'outside-in approach'. Both the IO and the RBV streams acknowledge the importance of internal and external elements in competitive advantage: it is their points of departure that differ.

41 Foss (1999), for instance, calls the capabilities view a theoretical ally of the RBV. In den Hond's (1996) view, a capabilities perspective uses the resource-based view to analyse sources of

three central concepts of resource-based terminology are characterised. This will help justify the specific attention in this research on capabilities, and distinguish that concept from other RBV concepts. An overview of the terminology frequently applied within the RBV is presented in table 3.1, which is intended to give an impression of the huge diversity in terminology, while stressing the need of clear definitions in applying such terms.

Resources, obviously, are a central element in the resource-based view of the firm. They can be defined as all assets, capabilities, organisational processes, firm attributes, information, knowledge etc. controlled by a firm that enable this firm to conceive of, and implement, strategies that improve its efficiency and effectiveness (Daft, 1983 in Barney, 1991). Resources are an 'overall' category, encompassing tangible assets, intangible assets, competences and capabilities. *Tangible assets* could be financial or physical assets, while *intangible assets* could be seen as organisational and human ones. Tangible assets are classical production factors such as land or capital, whereas intangible assets comprise resources such as contracts, trade secrets, intellectual property rights (Hall, 1992), and reputation. Stoelhorst (1997) therefore notes that assets could be regarded as the result of past action and hence provide a fairly static outlook on competition. They are linked to ownership (Hall, 1992) and hence relatively easy to identify (Stoelhorst, 1997). As the focus of this research is on organisational processes, relatively little attention is paid to the role of these assets. To access the harder to identify resources, involving such processes of organisation, attention is paid to the notions of capabilities and competences, which address issues such as know-how, learning or skills.

corporate profits; transaction cost economics for explaining why a firm needs control over some resources and not others; and evolutionary economics to analyse how capabilities develop over time. As these streams are closely linked, others have pleaded for more integrated approaches (e.g., Barney, 1991; Peteraf, 1994). In this research the RBV is addressed from an integrated point of view, yet its attention on both structures and processes (Schulze, 1994; Seibert, 1997) and the differences in vocabulary are acknowledged.

Table 3.1 *Examples of terminology applied within the resource-based view of the firm, adapted from Seibert (1997)*

	Resource	Capability	Competence
Authors	Wernerfelt (1984: 172): "anything which could be thought of as a strength or a weakness of a given firm. More formally, a firm's resources at a given time could be defined as those (tangible and intangible) assets which are tied semi-permanently to the firm"	Ulrich and Lake (1990: 40): [Organizational capability] is "a business's ability to establish internal structures and processes that influence its members to create organization specific competencies and thus enable the business to adapt to changing customer and strategic needs"	Snow and Hrebeniak (1980: 317): [distinctive competencies are] "those things that an organization does especially well in comparison to its competitors"
	Barney (1991: 101): "Firm resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness"	Amit and Schoemaker (1993: 35): "A capability can be defined as "a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end"	Prahalad and Hamel: (1990: 81-82): "Core competencies are the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies"
	Hart (1995: 988): "Resources are the basic units of analysis and include physical and financial assets as well as employees' skills and organizational (social) processes"	Stoelhorst (1997: 99): "Organizational capabilities are the stuff of coordination. Capabilities are underwritten by mechanisms within the firm that help organize its processes so that they contribute to differential quality in the firm's products. They are the domain of managers"	Markides and Williamson (1994: 341): "Core competences can (…) be viewed as the pool of experience, knowledge, and systems, etc. that exist elsewhere in the same corporation and can be deployed to reduce the cost or time required either to create a new, strategic asset or expand the stock of an existing one"

Many different applications of the terms *capabilities* and *competences* can be found, and the terms have some overlap; what some define as competences, others see as capabilities. For example, den Hond (1996: 54) defines a competence as "the organizational capability to combine and renew the firm 's assets and capabilities in such a way that the firm obtains and sustains a competitive advantage." Stoelhorst (1997) provides a useful distinction between the two notions, distinguishing between them by viewing core competences as concerning technology, and organisational capabilities as involving co-ordination. Competences he considers to be the domain of specialists, capabilities that of managers. Day (1994: 38) notes that "capabilities are complex bundles of skills and accumulated knowledge, exercised through

organizational processes, that enable firms to coordinate activities and make use of their assets." I agree with this interpretation of capabilities since considering co-ordination to be the organisational response of a firm to POEM could be seen as a process that requires co-ordination and the balancing of different stakeholder demands in a continuous effort. The term competence, on the other hand, Day (1994: 39) reserves for "capabilities of a corporation that span multiple lines of business." Competences are often associated with technological strengths, and with issues of diversification across different lines of business[42]. According to Stoelhorst (1997), the concepts of competences and capabilities are complementary, the first focussing on specialisation, and the second on co-ordination. As the scope of this thesis is organisational issues regarding POEM, which involves co-operation and co-ordination between different actors, this research focuses on capabilities.

3.2.3 Aspects of capabilities

Over the last decade, attention in literature to the notion of capabilities has burgeoned, for instance through applications such as core capability (Leonard-Barton, 1992; Stalk et al., 1992), organisational capability (Collis, 1994; Kusunoki et al., 1998), and dynamic capability (Teece et al., 1997; Deeds et al., 1999; Eisenhardt & Martin, 2000). According to Leonard-Barton (1992: 113) a *core capability* is "the knowledge set that distinguishes and provides a competitive advantage." She argues that this knowledge set encompasses four dimensions. The knowledge set is represented in employee knowledge and skills, and embedded in technical systems. The processes of creating knowledge and of control are guided by managerial systems. The fourth dimension, values and norms, covers "the value assigned within the company to the content and structure of knowledge (…), means of collecting knowledge (…) and controlling knowledge" (Leonard-Barton, 1992: 114). These four dimensions are depicted in figure 3.2, drawing together both structural and social-dynamic aspects[43]. Furthermore, Leonard-Barton (1992) indicated that, for a capability to be *core*, all four dimensions have to be addressed as an interconnected set of knowledge collections. This combination of structural and cultural elements within the notion of organisational capabilities is an important element in my line of reasoning, as considered later in more detail.

[42] Diversification concerns the motives for firms to participate in different, but related, markets or businesses. Under the RBV, firms for instance are considered to diversify in response to excess capacity in productive factors (Montgomery, 1994). It is beyond the scope of this thesis to look at diversification strategies.

[43] This combination of structural (or system-technical) and cultural (or social-dynamic) elements is also applied when discussing quality management in section 3.4, and in crafting the theoretical frameworks in chapter 4.

To co-ordinate and deploy its resources, a firm should ideally command the appropriate *organisational capabilities*. Collis (1994: 145) defines these as "the socially complex routines that determine the efficiency with which firms physically transform inputs into outputs." According to Day (1994), these capabilities are closely entwined with organisational processes, deeply embedded within the organisation and their knowledge component is tacit and dispersed. Also, "organisational capabilities are not only manifestations of observable corporate structures and processes, but also reside in the corporate culture and network of employee relationships" (Collis, 1991: 145). Again, the mixture of structural and cultural elements is emphasised. Organisational capabilities need to address both of these aspects, and to do this dynamically as the composition and quality of a firm's resource base need to be continually maintained. This demands continuous realignment of existing capabilities to those preferred or required. In the next subsection this process is discussed.

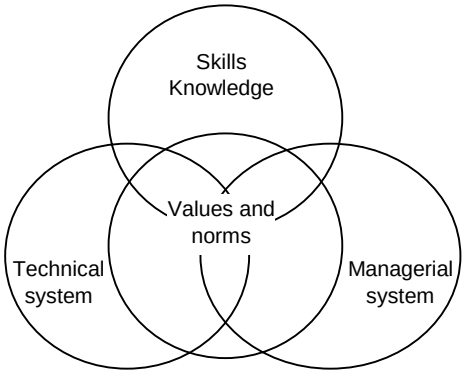

Figure 3.2 *Dimensions of a core capability (Leonard-Barton, 1992)*

Collis (1994) distinguishes between three categories of organisational capabilities. The first category, *functional* capabilities, indicates a firm's ability to perform basic functional activities more efficiently than its competitors. Next, the category of *dynamic* capabilities covers the issue of dynamic improvement, denoting a firm's ability to change and advance its activities. Finally, and closely related, *creative* capabilities comprise of a strategic insight "to recognize the intrinsic value of other resources or to develop novel strategies before competitors" (Collis, 1994: 145). This distinction could be reworded as a firm's ability to perform value creation activities competitively (and thus co-ordinate the resources needed), the ability to renew and maintain these activities, and finally the ability to develop new, but related, activities. Similarly, Teece et al. (1997) make a distinction between static, dynamic and transformational roles in organisational processes. Eisenhardt and Martin (2000: 1111) view dynamic capabilities as "specific organizational and strategic processes (e.g., product innovation, strategic decision making, alliancing) by which managers alter their resource base."

In organising POEM, balancing, weighing and addressing a variety of interests, both internal and external to the firm, is important. Therefore, in this research, an organisational capability is defined as the ability to continuously co-ordinate, deploy

and legitimate resources to intentionally perform tasks[44]. The notion of legitimisation is added to emphasise the relationship with balancing different (stakeholder) interests regarding a product's environmental characteristics. In capability development, management plays an important role: "The manager is a 'creative entrepreneur' (Spender, 1993), who seeks competitive advantage by creating unique sources of profits" (den Hond, 1996: 52). The role of management is important, "for it is managers that are able to understand and describe the economic performance potential of a firm's endowments. Without such managerial analyses, sustained competitive advantage is not likely" (Barney, 1991: 117). If one also bears in mind that competitiveness and the addressing of stakeholder demands could be regarded as important motivations for firms, and thus their managers, to engage in product-oriented environmental management, an additional reason for addressing a firm's organisational capabilities through its managerial positions is found. After all, for management: "the challenge is to identify, develop, protect and deploy resources and capabilities" (Amit & Schoemaker, 1993: 33). I return to this point in the next subsection.

In identifying organisational capabilities, caution should however be applied. Much RBV literature focuses on the protection of existing resources and capabilities, for example through barriers to imitation. Yet, core capabilities can also turn into core rigidities (Leonard-Barton, 1992). What at one time could be considered as valuable capabilities and useful knowledge, can turn into an inappropriate knowledge set, thus hindering innovation and the development of new knowledge. This once again underlines the dynamic character of organisational capabilities, and the need to also look beyond an individual firm's characteristics, as firms do not operate in isolation. The usefulness of a knowledge set should be reconsidered regularly, as capabilities cannot function in isolation (Iansiti & Clark, 1994). Rather, they have to fit with the broader organisational context. A valuable characteristic of capabilities may therefore be in their ability to serve as flexible strategic options (Moorman & Slotegraaf, 1999). Overall, cautiously applying a dynamic perspective to organisational capabilities is useful for aligning a firm's resource base with frequently changing stakeholder demands, product characteristics and additional business requirements.

3.2.4 The capability-building process

To get a better insight into the process of developing capabilities, one could turn to studies on product development from a resource-based perspective. Such literature addresses relationships between a firm's different organisational capabilities and the outcome of product development processes in terms of process efficiency and

[44] From a multinational perspective, Buller and McEvoy (1999: 327) define ethical capability as "an organization's ability to identify and respond effectively to ethical issues in a global context." In chapter 4 issues of responsibility are further discussed, as attention to products' environmental characteristics could be regarded as being related to responsibility.

product effectiveness (Verona, 1999). Attention is thus paid to both product and process characteristics. This links well to this study on the process of organising product-oriented environmental management. Besides, as in POEM, in product development research many different functions are involved (design, manufacturing, marketing, etc.) and a broadening (chain) perspective is increasingly applied[45]. Over the last decade, in research on product development and innovation, attention has increasingly been paid to a firm's specific resource endowments and organisational arrangements (e.g., Henderson & Clark, 1990; Teece et al., 1997, Kusunoki et al., 1998; Davies & Brady, 2000).

To focus on the process of capability-building, the model of Iansiti and Clark (1994) is used. This model is based on product development research but has also been applied to environmental management (den Hond, 1996). In line with Leonard-Barton (1992), Iansiti and Clark (1994: 560) view a capability as a knowledge set, which implies that an "effort to build capability must be grounded in processes to build new knowledge." To develop their capability-building process model, these authors studied new product development in turbulent environments, since such conditions require firms to engage in activities that are considered important in capability-building, such as learning and implementing new ideas and concepts[46]. They address these dynamics and the complexity by empirically grounding their model in product development within the automobile and computer industries. The motor industry is an example with changing customer demands, the second with technological uncertainty. The first step in the model is to relate problem-solving activities to organisational capability-building. In their view, problem-solving cycles should consider a firm's ability to perform activities based on organisational capabilities, which in turn are founded on the firm's knowledge base (Iansiti & Clark, 1994). That knowledge base is then represented using the four dimensions of core capability identified earlier (employee knowledge and skills, technical systems, managerial systems, and values and norms (Leonard-Barton, 1992)). A firm's problem-solving strategies trigger learning to fill the gaps between desired and actual performance (e.g., Dosi & Marengo, 1993 (in Verona, 1999)). In the model a distinction then is made between *concept development* and *implementation* phases. In the concept development phase, problem framing takes place, comparing different possible courses of action, conceptualising the desired outcomes and laying out a

[45] The study of the context of New Product Development (NPD) is increasingly studied, for instance in terms of NPD systems (de Weerd-Nederhof, 1998; Fisscher & de Weerd-Nederhof, 2000) or in terms of its managerial and organisational context (McQuarter et al., 1998). The growing literature on ecodesign also explicitly pays attention to chain perspectives, paying attention to both product development and environmental management (e.g., Karlsson, 1997; van Hemel, 1998; Magnusson, 2000).

[46] The idea of studying capability-building in dynamic and complex settings is increasingly applied, for instance when considering new product development in biotechnology firms (Deeds et al., 1999), or learning and capability development in high technology complex product systems (Davies & Brady, 2000).

structure to create and implement specific types of knowledge[47] (Iansiti & Clark, 1994). The capabilities thus perceived necessary are compared with existing ones in order to determine which capabilities should be renewed or newly developed as a solution to an identified problem. Based on such insights, the required knowledge types can be determined, and ways to gather that knowledge can be developed. In the subsequent implementation phase the actual development and implementation of the selected solutions takes place, leading to new, or renewed, organisational capabilities. To achieve this "the firm creates and captures new knowledge in the form of additional skills, new technical systems or modifications to the managerial systems within the firm" (Iansiti & Clark, 1994: 562).

Underlying the capability-building process model is the notion of integration, both internal and external to the firm. According to Iansiti and Clark (1994: 565), external integration takes place in concept development, when a firm "moves beyond what it knows how to do and frames capability-building activities that are needed to respond to new external contingencies." In their view, internal integration is required for implementation, and is associated with co-ordination, leadership and organisational routines. Within the capacity for external integration, they distinguish between customer integration and technology integration to capture the dynamics and complexity of the industry studied.

Closely related to these insights, Verona (1999) distinguishes between functional and integrative capabilities. Functional capabilities extend a firm's technical knowledge base (e.g., Prahalad & Hamel, 1990; Amit & Schoemaker, 1993). In product development, these capabilities could include technological and marketing capabilities (Verona, 1999), indicating how mainly technical knowledge sets could contribute to competitiveness. Integrative capabilities on the other hand enable a firm to absorb and disseminate new knowledge (e.g., Cohen & Levinthal, 1990; Henderson & Clark, 1990; Teece et al., 1997). A firm's absorptive capacity (Cohen & Levinthal, 1990) for instance "enables a firm to recognize valuable new information, assimilate it, and apply it to the development and refinement of dynamic capabilities" (Deeds et al., 1999: 215). Getting new knowledge sets into the firm and updating the existing set of knowledge, and the subsequent implementation of the insights gathered is thus highly important in the process of developing capabilities. "The term 'capabilities' emphasises the role of strategic management in adapting, integrating and reconfiguring internal and external organisational skills and functional capabilities in response to changing external conditions" (Davies & Brady, 2000: 935). Table 3.2 presents an illustrative overview of internal and external integrative capabilities.

[47] As Kusunoki et al. (1998: 700) stated: "organizational capability consists of various types of knowledge that are created and accumulated within the firm." They see organisational capabilities as 'multilayered knowledge' and foresee an important role for the dynamic interaction of knowledge for 'process capabilities'. This seems to be similar to notions such as 'combinative capabilities' (Kogut & Zander, 1992) and 'integrative capabilities' (Iansiti & Clark, 1994; Verona, 1999).

Table 3.2 *External and internal integrative capabilities, adapted from Verona (1999)*

External integrative capabilities	Internal integrative capabilities
▪ *Managerial processes* – external communication, socialisation	▪ *Managerial processes* - internal communication, integrative strategies, political and financial support, performance measurement
▪ *Managerial systems* – empowerment, incentives, recruiting	▪ *Managerial systems* - job training, collective brainstorming, incentives
▪ *Absorptive structures* – collaborative networks	▪ *Integrative structures* - process integration, organisation reengineering
▪ *Culture* and *value* for external absorption	▪ *Culture* and *value* for internal integration

The important role of managers thus is highlighted again. Verona (1999) continues his analysis of product development from a resource-based perspective by proposing an 'agent-resource model' in order to analyse a combination of factors influencing product development performance. Through this model he proposes considering both the role of agents[48] and the role of organisational capabilities on performance, as well as their mutual relationship. These agents could include team members, project leaders, senior managers, customers and suppliers. Within the capability-building process model different agents are also addressed. Iansiti and Clark (1994), for instance, refer to the roles of integration groups or project managers. Such suggestions lend support to the idea of studying capability-building from an agency perspective. As in product development, within the organisation of POEM a variety of actors in different functions could influence performance, that is, the way POEM is organised. However, this thesis is focussed on obtaining a better understanding of the process of organising POEM from an individual firm's perspective. The way organisational capabilities, in terms of a product's environmental characteristics, are developed and maintained at a company level is central. Within the RBV, organisational capabilities can be considered to be the domain of managers (Stoelhorst, 1997). The role of managers thus forms a suitable starting point for empirical research. By addressing managerial decision-makers one can illuminate a firm's motivations for engaging in POEM, as well as gaining an insight into how perceived problems lead to the selection and implementation of capabilities[49]. Moreover, table 3.2 also emphasises management's role in translating external signals into internal actions and in assessing present and required

[48] This concept stems from agency theory, which is concerned with organisational consequences of goal disagreement between different 'agents' and issues of compensation. Originally focussed on the relationship between managers and stockholders, this theory is now also broadening out to include stakeholders (Barney & Ouchi, 1996), and is also applied to environmental management (Lenox, 1999).

[49] This does not necessarily mean that *only* managers will be involved in the empirical research. They form a good starting point but might indicate other relevant members of their firm involved in POEM.

capabilities. Fahy (2000: 101), for instance, mentions "the moderating interventions of managerial choices in the identification, development, protection and subsequent deployment of resources in product markets."

However, Amit and Schoemaker (1993) warn that it is difficult for management to identify, develop and deploy an appropriate mix of strategic assets. They contend that uncertainty, complexity and intraorganisational conflicts hamper decisions concerning resources and capabilities. Despite these warnings, getting a better insight into the concept development and implementation stages remains relevant and could reveal further insights in capability-building processes and the role of managers in these. Focussing on managers also fits a stakeholder approach, in which they are viewed as balancers of stakeholder interests. In section 3.4 stakeholder approaches are discussed, and the relationships between the different theoretical insights are examined in chapter 4.

3.2.5 A natural resource-based view

Following this extensive discussion on the importance of capabilities in co-ordinating a firm's activities, and the outline of the capability-building process, it is time to look at the relationship between capabilities and environmental management. An increasing number of publications have appeared recently that apply a resource-based perspective to issues of environmental management and strategy. In linking environmental considerations with the RBV, Hart's (1995) conceptual paper on the natural resource-based view of the firm (N-RBV) has been influential. Competitive advantage is seen as being based upon a firm's relationship with the natural environment. Central to the argument is the idea that natural resources will increasingly be constrained in the future, and that those firms that better handle this constraint will command a sustainable competitive advantage (Judge & Douglas, 1998). The N-RBV thus predicts that innovative strategies can lead to the development of firm-specific capabilities that can be sources of competitive advantage (Sharma & Vredenburg, 1998). According to Judge and Douglas (1998: 257), this view "challenges the conventional view that environmental concerns cost the firm more than it benefits (Walley & Whitehead, 1994)."

Within the N-RBV, Hart (1995) distinguishes between three interconnected strategies: pollution prevention, product stewardship and sustainable development[50]. Pollution prevention considers with reducing pollution during the production process, product stewardship aims at integrating environmental concerns in product development and design, and sustainable development broadens the firm's scope to include the negative links between economy and ecology, and also considers the developing world (Hart, 1995). Sustainability "implies core technology and business concepts that solve social and environmental problems rather than making them

[50] Earlier, Roome (1992) distinguished between three successive implications for organisational change in firms working on environmental management: clean technology techniques, organisational structure and systems, and organisational and individual values/ethics.

worse" (Hart, 1999: 81) and thus is concerned with longer-term perspectives and global transitions. For firms working proactively on strategic environmental management, developing a vision towards sustainability and building appropriate capabilities is important. Increasingly, ideas are proposed that will bring a firm's operations and strategies more in line with the principles of sustainable development (e.g., Welford et al., 1998; Ehrenfeld, 1999; Vellinga & Herb, 1999). Yet, for addressing product-oriented environmental management in the shorter term, the strategy of product stewardship seems to be most appropriate. "Firms that adopt product-stewardship strategies will evidence inclusion of external stakeholders in product-development and planning processes" (Hart, 1995: 1001). The strategy that he calls Product Stewardship (PS) is comparable to POEM, although PS is usually regarded as taking a broader outlook than just the environment, considering a product's environmental, health and safety aspects[51]. Hart (1995: 1001) also argues that "firms with demonstrated capability in cross-functional management (socially complex skills) will be able to accumulate the resources necessary for product stewardship more quickly than firms without such prior capability." So, in PS, combining structural and social-dynamic aspects is again considered relevant, as in capability-building.

Hart's (1995) paper is conceptual in nature. Recently, several more empirical studies have appeared, applying resource-based thinking to environmental strategy. Judge and Douglas (1998), for instance, find that firms with a better-developed capability of integrating environmental management concerns into their strategic planning process obtain a better financial and environmental performance. Some other studies that have applied a resource-based perspective to environmental management have focussed on financial performance (Russo & Fouts, 1997), on the relationship between corporate strategies and environmental regulations (Rugman & Verbeke, 1998), or on the role of complementary assets in the relationship between environmental practices and firm performance (Christmann, 2000). This latter study suggests a relationship between competitiveness and certain specific capabilities, as not all capabilities have a direct, unconditional, impact on cost advantage. "Firms should not blindly follow the recommendations in some of the environmental management literature and try to implement the best practices of environmental management with the expectation that these practices will help them to automatically become green and competitive" (Christmann, 2000: 676). This links to the earlier remarks made regarding capabilities. Specific capabilities are needed to achieve a specific performance, and the implementation stage should certainly not be neglected.

Thus, firms are likely to develop their own unique solutions. According to den Hond (1996) the solutions a firm could choose, that is, the capabilities a firm could develop, are evaluated on three criteria: complementarity, appropriability, and technological options. The first two criteria have already been addressed in this

[51] Product Stewardship is one of the six codes of the Responsible Care Program, a chemical industry voluntary initiative, aimed at continuously improving performance and communicating this improved performance (Howard et al., 1999). In Appendix A this concept is outlined further.

chapter. The third comprises of the technological options present to improve a firm's capabilities. These three criteria are considered to influence the choice a firm makes for an environmental strategy. Den Hond (1996: 76) tries to illuminate "how firms develop environmental strategy from a capabilities perspective." My research is focussed on the organisational aspects of POEM, looking from a more individual firm-based viewpoint, and addressing both strategic and operational levels. Therefore, it is useful to turn to Sharma and Vredenburg (1998), who have studied the development of competitively valuable organisational capabilities concerning environmental responsiveness in several individual firms. In their study, they find the emergence of organisational capabilities in terms of stakeholder integration, higher-order learning, and continuous innovation in firms with proactive environmental strategies. Furthermore, they suggest that these unique organisational capabilities may lead to competitive advantage. This leads them to conclude that the RBV "may provide increasing guidance to the development of competitive strategies" (Sharma & Vredenburg, 1998: 749). In addition, Marcus and Geffen (1998) view 'competency acquisition' as a social process of complex learning that crosses organisational boundaries. Although all the above studies have warnings about the applicability of their findings, they demonstrate the possibilities of applying resource-based thinking to proactive environmental management strategies, and relating these strategies to competitive advantages. This again suggests that developing and maintaining the appropriate organisational capabilities for organising POEM might also lead to a competitive advantage.

3.3 Integrating interests: stakeholder theory

Although the RBV emphasises a firm's idiosyncratic resource endowments, firms do not operate in isolation. As the character of environmental management in western firms has changed over the recent decades, the attention by firms to the societal implications of their activities has increased. In the case of product-oriented environmental management, taking responsibility for a product's environmental impact throughout its life cycle could be regarded as a firm demonstrating its social responsibility. Issues concerning a firm's corporate social responsibility in general are gaining increasing prominence within management literature (e.g., Wood, 1991; Werhane & Freeman, 1999; Lozano, 2000). In order to better understand the choices firms (or rather, their managers) make in developing and maintaining capabilities concerning issues of social responsibility in general and concerning POEM in particular, an insight into their underlying motives is useful. Looking for possible motives, one can identify several pressures from a firm's surroundings that trigger the 'greening' of business. Hill (1997) lists some of these pressures: the supply chain, legislation, internally generated environmental concern related to corporate culture and beliefs, and insurance, investment, and liability issues. Firms might consider these pressures as threats or opportunities to their business and develop a response.

A firm's efforts to deal with issues of social responsibility, such as product-oriented environmental management, could be regarded as processes in which different groups of stakeholders play a role. "A stakeholder in an organization is (by definition) any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984: 46). In the next chapter, further attention is given to the concept of responsibility. This section highlights stakeholder approaches[52] (e.g., Freeman, 1984; Donaldson & Preston, 1995; Mitchell et al., 1997; Jones & Wicks, 1999), as these can offer valuable insights into a firm's motivations for engaging in POEM, hence complementing the capability-building process. Firstly, reasons for applying this theory are discussed, followed by a general outline of stakeholder theory. The section concludes with an application of stakeholder theory in the organisation of POEM.

3.3.1 Reasons for applying a stakeholder approach

Over the last fifteen years, an increasing amount of literature has focussed on the concept of stakeholders. Freeman (1984) advanced the stakeholder perspective, sketching out the concept in his seminal book 'Strategic management, a stakeholder approach'[53]. In studying the organisation of POEM from a capability perspective, it seems useful to apply insights from stakeholder theory for at least three reasons.

First, in product-oriented environmental management, many different stakeholders are often involved, given its focus on the entire product life cycle. In environmental management, Polonsky (1995), for instance, distinguishes between groups of stakeholders that include customers, competitors, employees, government, suppliers, special interest groups, and the media.

Secondly, within capability-building processes, external integration is an important element. This helps firms to adapt, integrate and reconfigure internal and external organisational capabilities in response to changing external conditions (Davies & Brady, 2000). A growing environmental awareness among its stakeholders can also be one reason for firms to further address such demands. This might lead to an improved performance, as was argued in section 3.2.1. Applying insights from stakeholder theory can assist one in getting an overview of interests that affect decision-making processes within individual firms regarding the capability-building process for POEM. Issues such as the type and number of interests involved can illuminate these organisational processes.

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[52] Mitchell et al. (1997: 855) indicate that there is a difference between stakeholder theory and stakeholder approaches: the first attempts to "articulate a fundamental question in a systematic way: which groups are stakeholders deserving or requiring management attention, and which are not?" The latter intends "to broaden management's vision of its roles and responsibilities beyond the profit maximisation function to include interests and claims of non-stockholding groups." Despite this, these terms are used interchangeably in this thesis.

[53] The concept however has earlier roots: Freeman (1984) traces it back to a 1963 memorandum of the Stanford Research Institute.

Finally, and related to the previous reason, in stakeholder theory the role of management is highly relevant, as it is within the capability-building process model. Managerial decision-makers are in a position to weigh and balance different interests and to act accordingly. Getting a better insight into the characteristics of stakeholders is useful in understanding a manager's position in these processes that influence capability-building.

3.3.2 An outline of stakeholder theory

Although many different definitions of what stakeholders are have been proposed, some central elements within these definitions can be identified. According to Donaldson and Preston (1995: 67), "stakeholders are persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity", while Clarkson (1995: 106) defines stakeholders as: "persons or groups that have, or claim, ownership, rights, or interests in a corporation and its activities, past, present, or future." Also, stakeholders "are identified through the actual or potential harms and benefits that they experience or anticipate experiencing as a result of the firm's actions or inactions" (Donaldson & Preston, 1995: 85). Thus one can view stakeholders as having a specific relationship with a firm, although the exact nature of that relationship is often debated[54]. Firms have such relationships with many stakeholders and can therefore be seen as operating within a network of relationships. Broadly speaking, a stakeholder perspective allows organisations to consider a wide range of influencers when developing a strategy (Polonsky, 1995).

In literature the stakeholder perspective is used in many different ways and the theoretical backgrounds to the concept are the subject of many discussions. Donaldson and Preston (1995), for instance, argue that stakeholder theory has three different theoretical bases: descriptive/empirical, instrumental, and normative. Jones (1995: 406) explains these three bases as follows: "Descriptive/empirical formulations of the theory are intended to describe and/or explain how firms or their managers actually behave. Instrumental theory purports to describe what will happen if managers or firms behave in certain ways. Normative theory is concerned with the moral propriety of the behaviour of firms and/or their managers." He briefly summarises this with three questions: what happens? what happens if? and what should happen? One current debate in stakeholder theory focuses on the desirability of converging these different theoretical bases[55]. As Freeman (1999: 234) notes: "stakeholder management is fundamentally a pragmatic concept. Regardless of the

[54] In debates on the relationships between firms and their stakeholders, often a distinction is made between a 'power' perspective and a social justice perspective as the two extreme positions. The first perspective sees stakeholders' relationships purely based on power structures, while the second takes a normative position in which firms should take all possible stakeholder interests into account (Nijhof, 1999). Often, a position in between these extremes is taken (Nijhof, 1999; Werhane & Freeman, 1999).

[55] A recent special issue of the 'Academy of Management Review' for instance contains a number of articles debating the theoretical basis of stakeholder theory (Jones & Wicks, 1999).

content of the purpose of a firm, the effective firm will manage the relationships that are important." In this research, a practically applicable use of stakeholder approaches to the capability-building process is aimed for. As an illustration, table 3.3 presents an example of stakeholder management, aimed at managing stakeholder relationships and integrating stakeholders into business activities.

Table 3.3 *Overview of stakeholder management (Polonsky, 1995 based on Freeman, 1984)*

Stakeholder management	
1.	Identify the relevant stakeholder groups in relation to the issue being addressed
2.	Determine the stake and importance of each stakeholder group
3.	Determine how effectively the 'needs' or 'expectations' of each group are currently met
4.	Modify corporate policies and priorities to consider stakeholder interests

Firms need to satisfy at least some stakeholder (e.g., employees, shareholders, government) interests to be able to operate. Therefore, they first have to perceive or recognise their stakeholders' demands (de Bakker & Nijhof, 2000). A first step in managing stakeholders is thus to identify the relevant groups as such. many discussions have focussed on what makes a stakeholder. According to Fineman and Clarke (1996), a stakeholder's power depends on the nature and level of the threat they it is posing to the firm, and the stakeholders' perceived legitimacy. Determining attributes that identify stakeholders is one step, determining the way in which a firm responds to these attributes is another. Mitchell et al. (1997: 854) propose the concept of salience, "the degree to which managers give priority to competing stakeholder claims." In their view, stakeholder identification and salience could be seen as being based on the stakeholder attributes of power, urgency, and legitimacy. They argue that these attributes are variable and socially constructed, and a stakeholder may or may not be aware of possessing such an attribute. The notion of salience stresses the role of managerial decision makers: "although groups can be identified reliably as stakeholders based on their possession of power, legitimacy, and urgency in relationship to the firm, it is the firm's managers who determine which stakeholders are *salient* and therefore will receive management attention" (Mitchell et al., 1997: 871). As Werhane and Freeman (1999) note, such a prioritisation of stakeholders is rather instrumental, and hence deals only with part of what is important in stakeholder theory. They state that "the intent of stakeholder theory is to combine normative claims about stakeholders with instrumental and descriptive claims about the best way to manage a corporation" (Werhane & Freeman, 1999: 8). In the next chapter this line of thinking is expanded as, within the balancing and weighing of different interests, ethical deliberations might be an element (Litz, 1996). Firstly, applying stakeholder theory on environmental management is discussed, paying attention to descriptive and normative elements of stakeholder theory.

3.3.3 Applying a stakeholder perspective on POEM

In this subsection, stakeholder theory is applied to environmental management to demonstrate how this specific theory can assist in obtaining a better understanding of the process of building and maintaining capabilities for POEM. Some of the important stakeholders will be identified. This identification is in general terms, since a specific firm has to deal with specific stakeholders. The stakeholder perspective is not rigid, new stakeholders can emerge and others can fade away. Stakeholder salience hence has a dynamic characteristic.

Describing the status of the range of relationships in which a firm is involved depends on the viewpoint that is chosen. According to some literature, virtually everyone and everything could be a stakeholder[56], so the number of stakeholders can be vast. Different classifications have been proposed to identify the relative importance of different stakeholders. Clarkson (1995), for instance, distinguishes between primary and secondary stakeholders. Based on their three attributes power, legitimacy, and urgency, Mitchell et al. (1997) propose eight classes of stakeholders in three different categories: latent, expectant and definitive. The latter category consists of stakeholders exhibiting power, legitimacy and urgency. Although such categorisations are useful in describing and comparing stakeholders, it is a firm's response to its interpretation of the different stakeholders that is crucial. In terms of environmental management, many firms view governments as the most important stakeholders, followed by customers (Garrod & Chadwick, 1996; Henriques & Sadorsky, 1996). Other stakeholders are not usually considered as very influential. In POEM though, firms might react to additional stakeholders' appeals. Such appeals to a large extent may come from governments and/or customers (e.g. product safety, product liability, or take-back policies). However, the fact that firms increasingly address other stakeholders within the product life cycle, such as suppliers, special interest groups or investors, indicates a widening view of stakeholders and an acknowledgement of the relevance of involving broader groups of stakeholders within an issue related to social responsibility.

Through a firm's response to its interpretation of stakeholders and the concept of responsibility, the normative side of applying stakeholder theory to POEM becomes evident. A description or classification of stakeholders alone does not directly contribute to salience. The normative level of stakeholder theory concerns the establishment of values and norms, the explicit and implicit standards, which are acted upon. Business policy thus forms a (formalised) normative element by setting certain standards. Making policy is, in part, influenced by stakeholder identification and salience. According to Fineman and Clarke (1996), managers often can be considered as crucial balancers of stakeholder influence, as they are important in the identification of stakeholders. Donaldson and Preston (1995) argue that a

[56] In a critique of stakeholder theory, Sternberg (1997: 4) names "terrorists and competitors, vegetation and nameless sea creatures, and generations yet unborn" as possible business stakeholders.

stakeholder perspective does not necessarily presume that managers, or the management function, are the only rightful locus of corporate control and governance. Depending on, for example, the organisational structure of a firm, its shareholders could act as such balancers of interests, or managers might have no choice in the face of strong legislative action. Hence, a firm's norms can emanate from various stakeholders and be influenced accordingly. In environmental management, Post and Altman (1994) distinguish between compliance, market-driven, and value-based environmentalism. Likewise, three groups of norms can be identified: legal norms, market norms, and 'moral' norms. Legal and market norms are mainly 'dictated' from outside the firm and need to be addressed to enable one to remain legally or economically in business. 'Moral' norms are concerned with a firm's own set of values. These three sets of norms influence the way in which a firm responds to issues such as POEM, or to broader issues of social responsibility[57].

The fact that many firms consider government to be the most important stakeholder relates to the legislative authority a government possesses. In setting *legal* norms for product safety, governments directly interact with a firm's activities. As more product-oriented environmental policies are developed, both nationally and internationally (e.g., Oosterhuis et al., 1996; Reijnders, 1996; Mayers & France, 1999), the anticipation of legislation is one driving force for firms to engage in activities such as DfE, POEM or Green Concurrent Engineering. Stakeholders inside and outside the firm are then involved. A firm wanting to determine the environmental characteristics of its products will need to know what the exact characteristics of the products from its suppliers are, while both management and employees need to know how to respond to such knowledge. A sales manager for instance has to be able to inform his customers about products' characteristics.

Norms are not only set by legislation, although legal matters do play an important role. The *markets* in which a firm operates can also set norms. For example, according to Menon and Menon (1997: 51), there is now "a general consensus within the business and consumer communities that the environmental or so-called green market appears to be real and growing." Customers appear to have 'green' demands to which firms want to respond. Answering these demands might well deliver them a competitive advantage, but often will also require them to involve further stakeholders. In their business-to-business contacts, firms increasingly demand better environmental performance in the products they purchase from their suppliers.

Finally, norms of course can also be determined by the world-view a firm holds. In corporate environmental management, some firms refer to their *moral* obligation to develop and maintain an environmental strategy. "Many organisations have found that explicitly stating how an organisation intends to relate generally to the natural environment [...] can be helpful for both internal and external purposes" (Starik, 1996: 15). Many firms have developed codes of conduct which increasingly

[57] Similar distinctions are often seen in the literature, for instance by Kaptein (1999), who discerns moral, legal and economic reasons for firms to deal with issues of integrity.

involve a broad range of issues on environmental and social responsibility. Both environmental statements and codes of conduct need to be matched to the environmental sensitive stakeholders that a firm considers relevant. To maintain accuracy, they should be updated regularly. This again relates to the dynamic character of stakeholder management and denotes a need for an external integrative capability. To further relate the ideas on stakeholders to capability-building processes, a capability assessment framework is presented in the next chapter. Before this, the concept of total quality management is discussed as this concept can be linked to both capability-building processes and to stakeholder theory.

3.4 Total Quality Management and continuous improvement

So far the attention has been on the resource-based view, processes for capability-building, and stakeholder approaches. To organise POEM, firms have to identify, develop, and maintain the right capabilities, and address and balance different stakeholder demands. However, since the process of organising for POEM is characterised as dynamic, this indicates a necessity to continually improve and renew the firm's capability base. To consider Continuous Improvement (CI), it is appropriate to turn to quality management, as CI is a central element of this management practice. The relationship between environmental management and quality management has been investigated before (e.g., Welford, 1992; Klassen & McLaughlin, 1993; Lawrence et al., 1998; Kitazawa & Sarkis, 2000). As Lawrence, Andrews and France (1998: 238-239) put it: "Total Quality Management (TQM) provides an ideal vehicle for deploying strategic objectives and ensuring that business and the environment are aligned, focussed and integrated within organisational activities." In this section, further attention is first given to reasons for applying insights from Total Quality Management (TQM) to the organisation of POEM. Then, the concept of TQM is outlined, followed by a section in which different elements of this concept are integrated into one framework. The final subsection contains a discussion on the application of TQM perspectives on capability-building for (product-oriented) environmental management.

3.4.1 Reasons for applying Total Quality Management (TQM)

Environmental product performance could be regarded as an issue that adds to the perceived quality of a product. Several further reasons issues can provide support for applying TQM in the organisation of POEM. Welford (1992), for example, stated that given the conceptual similarity between pollution prevention and TQM, it might be possible to accelerate the accumulation of resources in the former by integrating it into the latter. Several reasons for applying insights from TQM in the study of POEM are given below.

First, like environmental management, TQM concerns both processes and products. In quality management attention originally focussed merely on products

but has gradually developed to also include processes and systems. In environmental management, this situation developed the other way around, attention used to be on processes but has now broadened to include products, systems and functions. Both concepts thus increasingly focus on integrating products and processes.

A second reason that quality management insights are applicable to the organisation of POEM is that both concepts aim at prevention. Both work towards more pro-active attitudes, either on quality (TQM), or on product-oriented environmental issues (POEM). The quality management concept of continuous improvement hence seems useful for both.

Thirdly, both concepts apply a chain perspective, looking beyond the borders of the individual firm in considering the product chain and aiming at more integrated ways of addressing quality (TQM) and environmental issues (POEM) within firms. The contention that an individual firm does not determine a product's quality and environmental characteristics alone is important to these concepts. Both concepts also go beyond the mere development and application of tools, and the interplay of technological and organisational changes is important to both management practices.

Fourthly, the application of quality management principles might make some firms more receptive to POEM-like ideas. Since many firms are, at least, generally aware of the principles of quality management, this might help proactive firms and their chain partners become familiar with ideas such as POEM. In the Dutch Ministry of the Environment's guidebook on POEM (VROM, 1999a), the plan-do-check-act cycle (or Deming-cycle) is used as a guiding principle, demonstrating the applicability of TQM ideas in POEM.

Finally, TQM considers stakeholders. The 'Impact on Society' is, for instance, one of the elements of the European Quality Management Model. Issues of responsibility and the weighing of different (stakeholders') interests hence have a role in quality management (e.g., Olian & Rynes, 1991; Fisscher et al., 1996), as they did in POEM (see section 3.3.3). The possibilities to address stakeholders and the role of managerial decision-makers through TQM are another reason for applying this concept.

3.4.2 An outline of total quality management

During the 1980s, the concept of TQM surfaced although the early onset of TQM could be dated several decades earlier (Powell, 1995; Martínez-Lorente et al., 1998), brought forward by quality practitioners such as Crosby, Deming, and Juran. The so-called Deming-cycle, or plan-do-check-act cycle (Deming, 1986), is one of the well-known concepts in quality management. It uses a problem-solving circle to systematically assess interventions to achieve a desired quality. TQM has now become very popular and found its way into very diverse applications, even though the concept is not without its critics and its uniqueness has been debated (Tuckman, 1994; Dean & Bowen, 1994; Hackman & Wageman, 1995; Boaden, 1996). Many firms have been experimenting with TQM-like concepts and a large body of literature has evolved. Although much of this material has been based on case

studies, not all TQM studies are empirical in nature. To further examine the concept and to look for any guidance it could offer for organising POEM, one can consider some conceptual studies (Olian & Rynes, 1991; Dean & Bowen, 1994; Spencer, 1994; Hackman & Wageman, 1995; Powell, 1995). Attention is given to definitions of TQM, the relationship between this concept and different organisational models, the origins of the concept and the way these have evolved into what is now termed TQM.

Many definitions of TQM have been coined, often involving similar central issues. Sohal et al. (1998: 506) for instance state: "Total quality management (TQM) involves the design and operation of systems and technology, and fostering a work-force commitment to quality, in order that a company can consistently produce goods and services which satisfy customer requirements. It also involves the skills, and engaging the efforts, of all members of an organization to enable them to contribute to the problem-solving and pursuit of zero defects demanded by this philosophy of continuous improvement in all activities." Furthermore, according to Taylor and Pearson (1994), TQM can be defined as systematic organisation to ensure efficient execution of appropriate tasks to achieve total quality. Total quality is then defined as a firm's co-ordinated commitment to achieving quality at each stage of the lifespan of a product or service, with quality being a relative measure of performance. Dean and Bowen (1994) briefly summarise the main TQM factors under three principles: customer focus, continuous improvement, and teamwork.

Often these three main principles are supplemented with additional attention to both structural and cultural aspects: "Quality management is as much a matter of cultural and philosophical change within an organization as the introduction of techniques and processes" (Sohal et al., 1998: 507). The broad attention given to cultural aspects within quality management research underlines this sentiment (Olian & Rynes, 1991; Tuckman, 1994; Fisscher & de Weerd-Nederhof, 2000). Within TQM, a balance must be found between system-technical (or structural) and social-dynamic (or cultural) elements (Fisscher, 1994). Alongside system-technical aspects such as guidelines, control procedures or standards, attention must also be paid to employees' thoughts, feelings or interests in order to address the entire potential of human qualities within an organisation (van de Water, 2000). Integrating these structural and cultural elements is thus important in balancing the process of organising TQM. It seems reasonable to assume that this also applies to the capability-building process regarding POEM. Therefore in section 3.4.3 such an integrated approach is discussed in greater detail.

Total quality management can be related to several models of the organisation. To reconcile TQM practice and management theory, Spencer (1994) examined the relationship of TQM with three organisational models in management theory: namely mechanistic, organismic and cultural models. She found that different ideas within the concept can be associated with different models, as TQM has links with all three models of organisation. Olian and Rynes (1991) for instance point out TQM's insistence on looking at processes and systems, rather than at individuals. Yet, "When theorists attempt to study the properties of social systems, however, they must also attend to the lessons of the cultural model" (Spencer, 1994: 468). The

cultural model takes a broader perspective of organisational goals and also of organisations, which are seen "as a collection of co-operative agreements entered into by individuals with free wills (Chaffee, 1985)" (Spencer, 1994: 462). This again provides clear links with stakeholder theory. Considering these observations, strict adherence to a single organisational model is implicitly rejected, as cross-fertilisation between the various management theory approaches might be more fruitful or even necessary. Or, as Dean and Bowen (1994) advance, in some areas TQM is consistent with management theory, in other areas it should be informed by this theory, and sometimes TQM suggests new directions for management theory. This view also provides support for the attempt to apply TQM to POEM, and to combine different theoretical inputs in that effort.

3.4.3 An integrative approach - the TQM matrix

The development and maintenance of organisational capabilities concerning POEM is a central element in this research. As a dynamic viewpoint has been chosen, the continuous improvement of organisational processes is important. From a quality management perspective, the concept of continuous improvement can then assist. In addition, the balancing of system-technical and social-dynamic elements within the organisation of TQM can also be useful. To make the application of quality management more feasible to the concept of POEM, a way to integrate the elements considered important in quality management is discussed in this section.

Powell (1995) notes a range of critical TQM factors, including executive commitment, open organisation, closeness to customers and suppliers, and employee empowerment. He concludes that firms should focus on creating a culture within which these procedures can flourish. Furthermore, he finds that TQM alone apparently is not enough for success; rather than an adoption of 'quality language', firms should try to capture "the underlying intangible resources that make TQM implementation successful" (Powell, 1995: 31). Again, specific capabilities thus seem to be required to achieve a specific (quality) performance[58]. Olian and Rynes (1991) and Hackman and Wageman (1995) point to similar social-dynamic issues. The successful application of TQM apparently requires more than just adhering to its main principles and procedures. Obtaining a good understanding of the social-dynamic component of organising TQM might also support the more successful organisation of the system-technical part. Similarly, the changing view of TQM contrasts a "functionalist-positivist approach, viewing TQM as a set of tools, techniques and procedures, with a more interpretative-constructivist approach that frames TQM as a vehicle to enact change processes within the organization" (Debackere et al., 1997: 201). They suggest seeing TQM "as a rallying point, whose meaning, boundaries and deployment are constructed *gradually*, via an *iterative* process, and *interactively* by the actors involved in and continuously drawn into the

[58] This resembles Christmann's (2000) results on environmental management as described in section 3.2.5.

process" (Debackere et al., 1997: 201, italics added). None of the 'original' quality systems meet all the requirements of a complex organisation and many companies have adopted composite approaches (Taylor & Pearson 1994). Such statements can all be interpreted as appeals for an *integrative* approach to TQM, rather than sticking rigidly to a single organisational model. Moreover, such remarks also relate to the capability-building process, in this case capabilities to develop and renew TQM as a continuous effort. A call for integration is also reflected in the Total Quality Matrix (Fisscher, 1994). An adapted version of this matrix is shown in figure 3.3. The three notions that Dean and Bowen (1994) identify as central to TQM (teamwork, continuous improvement and customer focus) have been put at the heart of the matrix.

TQM	*System-technical organisation*	*Social-dynamic organisation*
Operational level	· Quality management systems · Control techniques / data-driven processes ('management by fact') · Phasing and structuring projects	· Communication and consultation · Motivation and commitment · Team building · Increased (quality) training
	Teamwork Continuous improvement Customer focus	
Strategic level	· Long range planning / strategic orientation · Division of tasks, responsibilities and authorities · Vertical deployment	· Shared norms and values · Dynamics in decision making · Employee empowerment · Leadership · Supplier partnerships

Figure 3.3 *Total quality matrix, adapted from Fisscher (1994) and Fisscher and de Weerd-Nederhof (2000)*

The matrix considers TQM from both a system-technical and a social-dynamic organisational viewpoint, and at operational and strategic levels[59]. This matrix can serve as a framework for organising or analysing quality management. Its system-technical side addresses the organisational design, which can be "viewed as a process for continually identifying key tasks and modifying the reporting

[59] As Fisscher and de Weerd-Nederhof (2000: 410) note: "for the sake of clarity, the intermediate adaptive level is left out." Although other research proposes including an adaptive level in the matrix (van de Water, 2000), I maintain a distinction between two managerial levels for analytical reasons.

relationships, responsibilities, and coordinating mechanisms to accomplish those tasks" (Buller & McEvoy, 1999: 339). The idea behind the matrix is that, in order to achieve good quality management, attention must be paid to both system-technical elements and social-dynamic processes in the organisation. The social-dynamic, or cultural, side of the matrix deals with social-dynamic processes, with "people, their relations and interactions, based on their ideas, emotions and interests, and especially their – often latent – qualities" (Fisscher & de Weerd-Nederhof, 2000: 410). By including both social-dynamic and strategic dimensions, the matrix emphasises that there is more to quality management than having an appropriate operational management system in place. To stress the centrality of teamwork, customer orientation and continuous improvement in TQM literature, I have added these elements at the core of the matrix. These three elements affect every quadrant. Ideally, a firm using TQM pays attention to all quadrants of the matrix and also its core in aiming for a balance. The different elements of the matrix are not discussed individually as this thesis is not about quality management. However, in the next chapter, this matrix is transformed into a POEM matrix. There, the elements in the different quadrants are addressed in greater detail.

3.4.3 Relating TQM to environmental management

Total quality management proponents claim "that improving quality can decrease rather than increase, costs and facilitate the attainment of other demands and objectives" (Spencer, 1994: 447). One such objective could be the organisation and incorporation of POEM. Getting a firm to not only control its products' technical and economic performance but also its environmental performance, could make a valuable contribution to both quality and environmental management. After all, environmental characteristics can be regarded as elements of product quality. According to Berry and Rondinelli (1998), in the late 1980s proactive environmental management and the TQM movement began to converge. Several approaches have indeed considered a combination of quality management and environmental management. TQM for instance has been extended into TQEM (total quality environmental management). According to Shrivastava (1995), TQEM applies a total systems perspective, and principles of quality management, to environmental problems. Also, a broad range of standards and certification schemes has been developed, such as the ISO 14000 series[60] and EMAS, the European Eco-Management and Audit Scheme. Among the most well-known environmental standards is ISO 14001 which "has been designed to help organizations in the creation of structured mechanisms for continuous improvement in environmental performance" (Kitazawa & Sarkis, 2000: 225). However, as these authors note, the ISO 14001 requirements only give general guidelines and do not pay much attention

[60] In addition to the well-known ISO 14001 standard for environmental management systems, this series also provides guidelines for environmental auditing, environmental labelling, performance evaluations, life-cycle assessment, and product standards (Rondinelli & Vastag, 2000).

to cultural aspects. They therefore stress the importance of empowerment, commitment, leadership, and teamwork and their managerial implications, viewing ISO 14001 as a helpful tool. The combination of system-technical and social-dynamic elements hence also seems useful in the application of TQM to environmental management.

Many of the above approaches are concerned with environmental management in general, often focussing on production *processes* or operations management (e.g., Klassen & McLaughlin, 1993; Angell & Klassen, 1999). In studying organisational aspects of POEM, such a focus might be less appropriate. Some recent publications have focussed on combining quality and environmental management from a product perspective (Karlsson, 1997). In such studies, new product development is mainly highlighted, as in studies on ecodesign. However, POEM considers environmental characteristics throughout the entire product life cycle. Alongside product development, topics such as end-of-life treatment and supply chain management are addressed. This wider scope could imply a further set of stakeholders. This directly relates to a comment Roome (1992) made on combining quality management and environmental management: customers are the final arbiters in quality issues, while environmental issues do not have such easy to identify customers. These issues are stakeholder led. He also pointed to the more complex nature of environmental issues. Whereas ideas about quality might be converging, peoples' conception of environmental issues is rather diverse. A final caveat could be the fact that many TQM recommendations seem to be context independent, building on rhetoric and broad applications (Dean & Bowen, 1994; Hackman & Wageman, 1995), whereas in this research, the unique situations of individual firms in terms of POEM are central. Given these comments, how can quality management thinking contribute to the organisation of POEM?

The remarks above indicate that there are linkages between quality management and environmental management, but that there is more to it than simply infusing quality systems into environmental management. To use these linkages for the benefit of *product-oriented* environmental management, further support is needed from other areas. Firstly, the TQM matrix extends the quality management scope to explicitly address social-dynamic organisational elements, answering concerns regarding cultural aspects. As noted, this matrix is transformed into a POEM matrix in the next chapter, adjusting the elements to specific (product-oriented) environmental issues. Furthermore, in considering POEM, it is necessary to include a broader view of stakeholders. Improving the perception of stakeholders' demands can facilitate the balancing and weighting of these demands, potentially resulting in a better organisational response. A firm's efforts to balance its products' environmental characteristics during their life cycle are thus considered to be part of a continuous, dynamic process that is influenced by a variety of stakeholders. Firms therefore have to develop and maintain organisational capabilities. In the next chapter, further frameworks will be used to consider the assessment of relevant organisational capabilities. Likewise, Welford (1992: 34) argues "… environmental improvement, like the culture of total quality management needs to be firmly embedded at all levels of the organisation. Central here is a need for a proactive

stance and an evolutionary approach to the improvement of environmental performance." Hence, POEM could benefit from ideas taken from quality management, but should keep a broad perspective, paying attention to both structural and cultural elements of the specific firm, and considering the changing set of stakeholders involved.

3.5 An overview of the insights gained

In this section, the main insights gathered from the discussions on theoretical perspectives are presented. As important reasons for firms to engage proactively in organising POEM, a stakeholder orientation and competitive requirements have been identified. Since this research focuses on ways in which individual firms organise for POEM, three different theoretical frameworks are applied: a resource-based view and capability perspective, a stakeholder approach, and total quality management and continuous improvement. The capability perspective is thus put central. Building on that perspective, the organisation of POEM is considered to be a process of building and maintaining relevant organisational capabilities. These capabilities are defined as a firm's ability to continuously co-ordinate, deploy and legitimate resources in order to intentionally perform tasks. With a capability-building process firms can gather, develop and implement the new sets of knowledge required to continually organise POEM. This immediately links to the other theoretical areas. First, within POEM, attention is paid to the entire product life cycle, hence affecting a broad range of different interests. Firms working on the organisation of POEM thus have to deal with a variety of stakeholders. The identification and salience of stakeholders, as perceived by a firm's managers, could be considered to depend upon stakeholders' power, urgency and legitimacy (Mitchell et al., 1997). Insights from stakeholder theory thus can assist in obtaining an overview of interests involved, and the role of managers is emphasised. Furthermore, such efforts have to be carried out continuously. Quality management can assist here, since it delivers ideas on continuous improvement and on the organisational implications of working towards such an improved quality.

None of the three theoretical areas fully accounts for the organisation of POEM by itself. So, if the capability perspective could be infused with insights from the other areas, the strong points from the different areas could be combined and a relevant theoretical approach to POEM developed. In literature it has been suggested that a capability perspective, stakeholder integration, learning and continuous innovation can all be related (Sharma & Vredenburg, 1998). These authors further suggest that organisational capabilities may lead to a competitive advantage. A firm's efforts to balance its products' environmental characteristics over their life cycles might also be seen as a continuous, dynamic capability-building process, that is influenced by a variety of stakeholders and stimulated by the firms' aim of having a competitive advantage. Figure 3.4 illustrates the coherence between these different elements and highlights the importance attributed to managerial decision-makers in

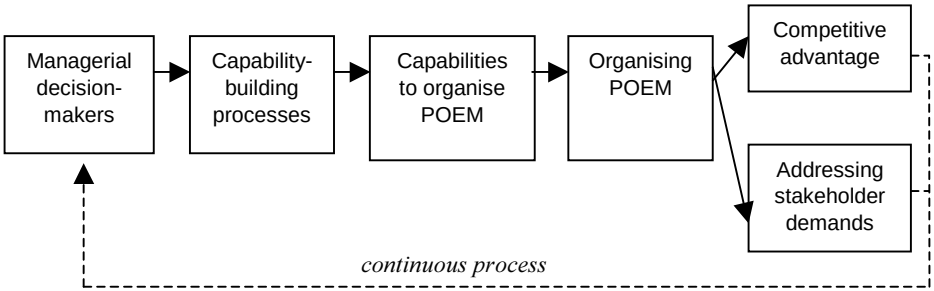

Figure 3.4 *A schematic representation of the linkages between managers, capabilities and performance in considering POEM (adapted from de Bakker et al., 1999b)*

the capability-building process for POEM. This process results in a certain performance regarding POEM, which again could be related to obtaining a competitive advantage and/or addressing the (perceived) relevant stakeholder interests. The outcomes of this process form an input to the decision-making processes concerning POEM in a continuous manner. The relationships between the different theoretical inputs are investigated further in the next chapter, where the research frameworks are developed.

4.

From Theory To Practice

"Good science (good theory) is produced through the interplay of creativeness and the skills acquired through training."

(Strauss & Corbin, 1990: 47)

4.1 Introduction

In this chapter theoretical frameworks that will guide the empirical part of the research are constructed, building on the theoretical areas that were identified as central inputs to this research: a resource-based view/capability perspective, a stakeholder approach and TQM/continuous improvement. Here, the links between the theoretical areas are outlined, using the TQM matrix as a guide in developing a framework for empirical research on POEM. A relationship between the different theoretical areas is thus sought using the concept of responsibility.

In this research, the process of organising for POEM is considered to be a capability-building process in which balancing different interests and expectations in a continuous effort is essential. Managers play an important role in balancing these expectations, which in POEM include a product's environmental characteristics. In the next section, the capability cycle is introduced as a way of combining insights into capability-building processes, stakeholder orientation and continuous improvement regarding POEM . Subsequently, building on that cycle an illustrative capability assessment framework is presented which shows a possible way of evaluating and assessing a firm's organisational capability base. The assessment framework emphasises the important role of managerial decision-makers in developing and maintaining capabilities for internal and external integration. Capability-building in a context which includes different stakeholder interests and expectations in a continuous process of improvement can be regarded as a managerial responsibility in both a professional sense (executing managerial tasks in a professional way) and in a moral sense (taking into account legitimate interests and expectations of stakeholders)[61].

At the heart of this research are the organisational aspects of POEM. According to the TQM matrix introduced in the previous chapter, when organising and managing the process of TQM, attention should be paid to both system-technical and social-dynamic aspects at the operational and strategic levels, and this should take place in a continuous and integrated way. A similar reasoning is applied in this chapter, where the TQM matrix is transformed into a POEM matrix. This new matrix highlights the interrelationship between different organisational aspects of POEM. The matrix is the central research framework that guides the empirical part of this study and is discussed in section 4.3. The main elements of this matrix are the three central theoretical areas, in all of which aspects of responsibility play a role. The final section provides concluding remarks.

[61] Comparably, in the previous chapter 3, groups of norms were distinguished: legal norms, market norms, and 'moral' norms. In chapter 6 further consideration is given to this distinction.

4.2 Introducing the capability cycle

In this thesis, a stakeholder orientation is considered to be an important element of POEM organisation. According to stakeholder theory, relationships with stakeholders have to be managed in such a way that various interests are taken into account. Fineman and Clarke (1996: 715) view managers as "crucial mediators of stakeholder influence." Such a viewpoint is useful when reasoning from a firm's perspective, as the way firms organise responses to stakeholder demands are likely to be guided by the managers' perceptions of the issues involved. Such an approach could shed light on a firm's motivations for engaging in POEM, and on the ways in which POEM is brought into practice. In the previous chapter, the position of managers in the process of organising POEM and in balancing stakeholder interests has already been characterised as influential.

To further link the role of managers to the three central theoretical areas of this research, the concept of responsibility[62] is applied. Etymologically, to be responsible is to be answerable (Lucas, 1993), to be able and willing to answer. Responsibility can be seen as being based on expectations to act in a desired way (Lenk, 1992). In terms of POEM a continuous alignment of internal and external expectations is necessary. Interpreting responsibility in terms of fluctuating expectations leads to a continuous reconsideration of different stakeholders' views, and thus requires dynamic organisational capabilities. Lenk (1992) considers responsibility to be the other side of competence. Being competent of doing something is connected with being accountable or answerable for what you do (or do not do). It is important to note that responsibility can be based both on the expectations that stakeholders have of an organisation ('being held responsible') and on the expectations an organisation considers it has to live up to, which are influenced by the interpretations of managerial decision-makers[63]. Depending on the identification and salience of stakeholders, the perceptions of what is considered legitimate and responsible can change over time (Mitchell et al., 1997). Management's identification of stakeholder interests will determine a firm's response to these signals (Fineman & Clarke, 1996). A firm requires organisational capabilities to perceive, reflect and respond to the demands of its stakeholders. The stakeholders that are perceived to be relevant in part depends on a firm's specific situation but, in general, when considering POEM, stakeholders such as customers, suppliers, shareholders, employees, government, special interest groups, and society at large, can be distinguished.

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62 The discussion of responsibility and capabilities builds on a paper on responsible chain management (de Bakker & Nijhof, 2000). In a broad sense corporate social responsibility is an element of business ethics. For current overviews of discussions in this field, see for instance Werhane and Freeman (1999) or Lozano (2000).

63 Fisscher and Nijhof (2000) addressed the difficulty of attributing responsibility to an organisation, arguing that conditions for responsibility that affect individuals could also be applied to organisations. These conditions could include conscious and intentional acting, ability to foresee, options to enable responsible acting and skills to make a conscious evaluation.

Given these observations, it is useful to examine links between the position and role of managers, and issues of responsibility, stakeholder orientation and social and ethical dimensions of organisational resources and capabilities (Litz, 1996). Managers are important in perceiving stakeholder interests, balancing the different interests[64] and managing the selected response. The way firms deal with issues of stakeholder interests and responsibility could also form a source of competitive advantage. "To the extent the firm is able to recognize its interdependence, reflect upon the ethical standards appropriate to the situation, and react in a timely and responsive manner, it possesses valuable, rare, inimitable, and non-substitutable assets, that is, it possesses strategic resources" (Litz, 1996: 1360).

To describe and analyse the capability-building process in terms of POEM, a further division of this process into four interconnected stages is helpful. Building on ideas on responsible chain management, de Bakker and Nijhof (2000) combine the concepts of capabilities, stakeholders, and continuous improvement into a capability cycle as presented in figure 4.1. This cycle is similar to the 'plan-do-check-act' cycle familiar in quality management[65]. Capabilities are considered to result from a continuous process of addressing and interpreting stakeholder interests. Within the cycle, the three central theoretical areas are closely linked and responsible behaviour becomes an overarching element. The entire process of capability-building can be seen as a process of continuous improvement. The different stages of the capability cycle are discussed briefly below.

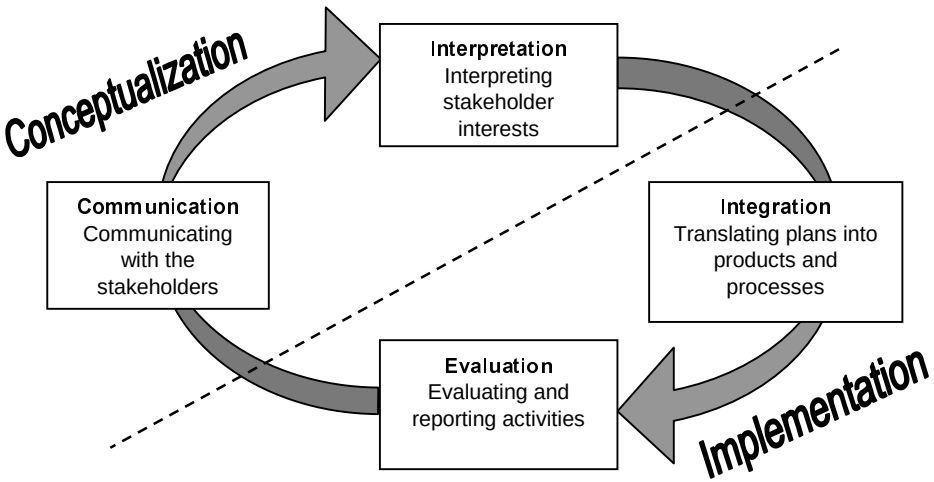

Figure 4.1 *The capability cycle (de Bakker & Nijhof, 2000)*

64 Litz (1996) calls these 'ethical deliberations' since, to achieve responsible behaviour, attention must be paid to moral implications. Yet, in balancing stakeholder interests, the deliberations are not always that ethical: "An appeal to the ethical instincts of managers is less effective than pointing out the market opportunities to them" (Cramer, 1998a: 165).

65 Within the Dutch governmental policy on Product-Oriented Environmental Management, the Deming cycle also plays an important role (VROM, 1999a) as discussed in chapter 2.

In the first stage, ***interpretation***, signals from stakeholders are considered and balanced. During this stage, capabilities such as responsiveness, knowing how to act (for instance guided by a code of conduct), and moral deliberation play a role. During the interpretation stage, the different expectations are translated into organisational activities and goals. An organisation, at this stage, plans how to respond to different stakeholders' demands: the 'plan' stage of the Deming cycle.

Subsequently, the second stage, ***integration***, turns plans into actions. Processes and products are assessed, focussing on the entire product life cycle. A way has to be found to meet the objectives that were set during the previous stage. Here, the problem-solving activities described in the capability-building process model (Iansiti & Clark, 1994) take place. Solutions may be found from within the individual firm, but, given the chain perspective, these also could be located elsewhere within the product chain. Even if a solution is found outside of the firm, it remains a task of the firm's management to ensure that the set objectives are met. After all, *their* stakeholders' interests are involved and addressed. This is comparable to the 'do' stage in the Deming cycle.

In the ***evaluation*** stage, actions undertaken in the integration stage are monitored, evaluated, and reported upon – a 'check' in terms of quality management. Have the set objectives been met? Has the response been adequate? Such monitoring could be carried out internally or externally. Certification schemes may play a role in this process, for instance through requirements and standards.

In the fourth stage, a dialogue with stakeholders occurs: ***communication***. During this stage an organisation can determine whether problems have been sufficiently resolved. If so, new objectives can be set, if not, the original plans can be adjusted. This equates to the fourth element in the plan-do-check-act cycle. Either option results in the start of a new cycle, emphasising the continual character of this capability-building and maintenance process.

In their capability-building process model, Iansiti and Clark (1994) emphasise the importance of considering both internal and external integration in developing capabilities. In the capability cycle, the scope is broadened beyond mere integration. However, within the other three stages of that cycle, making a distinction between internal and external dimensions is also relevant, as the brief description of the capability cycle above also suggests. Each category in the cycle can be regarded as having internal and external dimensions, each including a set of capabilities. To illustrate this, in table 4.1, a capability assessment framework is proposed that is based on the capability cycle. This framework provides a structure for assessing a firm's capability base, required to address issues of responsible chain management such as POEM. By considering how well each of the cells of this framework is met by the firm's capability base, an overview of the strengths and weaknesses in terms of organisational capabilities during the different stages of the capability cycle can be obtained.

Table 4.1 *An illustration of a capability assessment framework (de Bakker & Nijhof, 2000)*

	Internal	External
Interpretation	▪ Determining a clear mission statement and company policy ▪ Developing a code of conduct ▪ Determining organisational responsibilities	▪ Discussing organisational responsibilities with, for example, customers, suppliers, or special interest groups ▪ Organising a stakeholder debate to develop a code of conduct
Integration	▪ Translating responsibilities into processes (e.g., selection and training of employees; information management; sales structure) ▪ Taking responsibility by changing characteristics of products (e.g., product safety, impact on the environment)	▪ Getting other parties in the product chain to take responsibility ▪ Assisting suppliers to meet their responsibilities, for instance by giving them advice or financial support
Evaluation	▪ First party auditing: an organisation audits itself ▪ Keeping track of relevant data concerning responsible chain management	▪ Second party auditing: an organisation audits its suppliers and customers ▪ Third party auditing: audits performed by an independent auditing body
Communi-cation	▪ Internally justifying organisational behaviour ▪ Establishment of and communication about management systems ▪ Making relevant information available	▪ Dealing with questions or complaints from stakeholders - being held accountable ▪ Labelling of products to demonstrate that products meet certain criteria

Although such a framework indicates a range of related capabilities that are relevant for the organisation of issues of responsible chain management and addressing stakeholder interests, it does not translate these capabilities into concrete organisational aspects. To consider the organisational implications of organising POEM in greater detail, in the next section the POEM matrix is presented which provides an overview of internal organisational processes relevant to the organisation of POEM.

4.3 Introducing the POEM matrix

The TQM matrix introduced in the previous chapter is used as the basis for the POEM matrix. Several reasons for applying insights from quality management to this research have already been given in section 3.4.2. An additional reason is that the

TQM matrix has been applied to products before. Fisscher and de Weerd-Nederhof (2000) introduce the 'NPD matrix' that focuses on the application of quality management to new product development (NPD) and also builds upon the TQM matrix.

The focus of this research is on the organisational aspects of POEM, and on the position of managerial decision-makers. The POEM matrix is proposed as a framework that can identify important organisational elements involved in the process of developing POEM, and further integrate environmental management insights and organisational theory. Presented in figure 4.2, the matrix seeks to provide guidance to practitioners by categorising a variety of factors that are considered influential in the process of organising POEM. The interrelationship of the different elements in the matrix may help convince managerial decision-makers of the need to engage in an integrated and dynamic approach when dealing with a product's environmental characteristics. Firms that rely solely on formal systems and management practices are less likely to achieve a competitive advantage, as such practices and systems are imitable and transferable to other firms (Barney, 1997). A combination of the system-technical aspects and the social-dynamic aspects, as indicated in the matrix, may result in a more balanced and unique approach to organising POEM. Such an approach could give a competitive advantage and be tailored towards the firm's specific set of stakeholders.

POEM	*System-technical organisation*	*Social-dynamic organisation*
Operational level	· Information management systems · Performance measurement · Environmental management systems · Budgeting	· Increased (environmental) training · Cross-functional consultation and communication · Motivation and commitment
Strategic level	· Planning & strategic · orientation · Division of tasks and responsibilities · Vertical deployment · Formal interface management	· 'Transformational' leadership · Shared norms and values · Employee empowerment · Chain partnerships

Responsibility:
Capability-building
Stakeholder orientation
Continuous improvement

Figure 4.2 *Product-Oriented Environmental Management Matrix (de Bakker, 1999; de Bakker et al., 1999b)*

As both the TQM matrix and the POEM matrix consider many aspects of the management of organisational processes, some identical elements are included. The focus on continuous improvement for instance justifies the inclusion of elements such as training and performance measurement, while applying insights on the division of tasks and responsibilities is helpful in employee empowerment. To stress the interrelationship of the four quadrants, only a dotted line is used, indicating that the quadrants should not be seen as rigid or as independent[66]. Elements in one quadrant are related to, and influenced by, elements in other quadrants. The interrelationship between the four quadrants, and the importance of an integrated implementation of all four of them is therefore emphasised (Fisscher, 1994; Fisscher & de Weerd-Nederhof, 2000). After all, the idea behind the matrix was to link system-technical and social-dynamic approaches at different managerial levels in a balanced manner.

At the core of the matrix, the central elements of this research are represented: capability-building, stakeholder orientation, and continuous improvement. The system-technical quadrants of the matrix mainly highlight the **structures** required (or desired) to organise POEM. The social-dynamic quadrants predominantly deal with **processes**, using the system-technical elements that can support the building and maintenance of organisational capabilities. The different quadrants are discussed and explained in the subsections that follow. These descriptions are necessarily short, as many of these elements are extensive research areas in their own right, such as leadership or performance measurement. Therefore, the purpose is not to fully discuss all possible details, but merely to sketch out the integrative framework that this matrix is, emphasising some of the relationships between the elements involved. A managerial point of view is thus taken.

Such an approach relates to the dimensions of core capabilities: systems, structures, and individual learning within an organisation are intertwined, while values and norms are introduced through these three dimensions (Leonard-Barton, 1992; Mahoney, 1995). To highlight the central position of the three theoretical areas that are applied in this research these are addressed in the core of the matrix. The concept of responsibility provides a link between these areas, as noted in the previous section. The matrix is based on earlier applications of the TQM matrix, combined with insights gathered from POEM in practice. It should be noted that the elements included in this matrix are conceptual, other elements might be added in a specific firm's situation. As a reminder, in each of the following subsections, the quadrant discussed is depicted.

[66] It should also be noted that the elements included in the matrix are also not rigid - they are based on elements in the TQM matrix and have been adapted to fit this POEM matrix. Yet, as van de Water (2000) for instance indicates, additional elements (and extra organisational levels) can be included in such a matrix. The matrix thus indicates an illustrative, but not exclusive, set of organisational elements important in the management of a process, be it TQM or POEM. Hence, the idea behind this matrix could also be applied to other organisational topics in which an integrated approach and issues of responsibility are relevant.

4.3.1 Core of the matrix

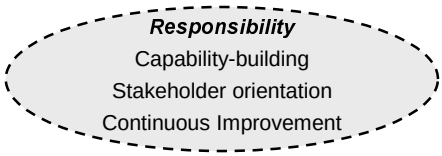

Figure 4.3 *Core of the POEM matrix*

The core of the matrix, presented in figure 4.3, addresses three elements that all affect both the system-technical and social-dynamic aspects at both operational and strategic managerial levels: *capability-building*, *stakeholder orientation*, and *continuous improvement*. This is in line with earlier research. In their study on organisational capabilities for environmental management, Sharma and Vredenburg (1998) identify similar categories: capabilities for higher-order learning, for stakeholder integration, and for continuous innovation. Hart (1995) refers to continuous improvement, stakeholder integration and shared vision as key resources supporting the respective strategic capabilities of pollution prevention, product stewardship, and sustainable development.

A central theme in this research is that firms need to build and maintain organisational capabilities in order to be able to address the organisation of POEM. As noted when discussing the capability cycle in the previous section, to work on an issue of responsible chain management, such as POEM, firms have to interpret signals from stakeholders and develop accurate responses, integrate these responses into the firm's activities, monitor their performance on these activities, and communicate the results to the stakeholders. This has to take place continuously in order to keep activities aligned with stakeholder demands. Hence, the capabilities needed to do this have to consider both internal and external integration, as illustrated by the capability assessment framework. Capability-building and maintenance can thus be regarded as a core element of the POEM matrix, since, to develop capabilities, interplay between the different quadrants of the matrix is required.

In the POEM matrix, the TQM term 'customer focus' is broadened to *stakeholder orientation.* As argued before, within POEM a variety of different stakeholders are involved. Where as TQM highlights customers' interests, POEM considers a broader range of stakeholders. As Sharma and Vredenburg (1998) point out, environmental stakeholder integration could be an important organisational capability for organising environmental management within firms. In their view, underlying this element are a firm's abilities to collaborate with stakeholders, to communicate with them, and to steer new developments effectively through the public consultation process. Addressing stakeholder demands has also been identified as a reason for firms to engage in POEM. Again, interaction between the elements of the different quadrants of the matrix is useful.

The third core element of the matrix is *continuous improvement (CI)*, which applies to all four quadrants. CI involves "a commitment to constant examination of technical and administrative processes in search of better methods" (Dean & Bowen, 1994: 395). Retaining sufficient flexibility and dynamics in decision-making are

related to CI. A firm's ability to adapt to changing demands and situations is important when aligning the organisation of POEM with its broader strategic orientation. Savolainen (1999) hence concludes that CI implementation is a cyclical, gradual, and complex learning process that reveals company-specific cycles. Firm specificity is also emphasised by Sharma and Vredenburg (1998: 741): "a capability of continuously generating a stream of innovations enables an organization to stay a step ahead of competitors who do not possess this capability." CI hence also is related to organisational learning[67]. Higher-order learning has been proposed as an important organisational capability that involves the development of different interpretations of new and existing information (Sharma & Vredenburg, 1998). These authors argue that such learning could trigger a capability of continuous innovation. Yet, in building or renewing organisational capabilities for environmental management, some 'unlearning' of what has been ingrained over time also has to take place (Hoffman, 1999). This is needed to retain the required flexibility.

Finally, the POEM matrix has been modified from the TQM matrix in that the term teamwork has been excluded. In the POEM matrix this term could have been broadened to become 'co-operation' in order to emphasise the larger scale at which POEM applies. However, since this topic is already represented in several elements of the matrix (e.g., cross-functional consultation and partnerships), it has not been included as a separate core element.

4.3.2 Operational system-technical quadrant

In dealing with a firm's performance, the system-technical operational level is important. Considering the environmental performance of products, system-technical elements include systems, guidelines, and standards or specifications. Hence, in this quadrant, elements are found that track a firm's performance, and process relevant information on POEM, as shown in figure 4.4. *Information management systems* and *environmental performance measurement* could be supportive. Both elements emphasise a need for compliance with, or conformity to, set objectives. These objectives can be set at different levels of

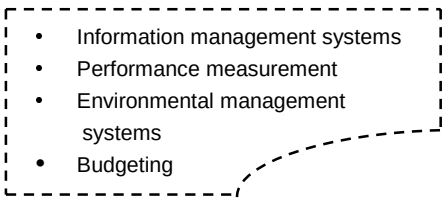

Figure 4.4 *Operational / System-technical quadrant*

[67] Within corporate environmental management literature, several studies have focussed on learning processes (e.g., Clarke & Roome, 1995, 1999; Sharma & Vredenburg, 1998). "Organizational learning theory can show us precisely how learning processes to utilize resources may be carried out" (Mahoney, 1995: 98). Although the capability-building process might also be seen as a learning process, learning is not addressed further in this research as its focus is on organisational aspects of POEM and on the position of managerial decision-makers.

aspiration. Several tools and instruments are available to provide management and others involved with information regarding a product's environmental performance. Life Cycle Assessment (LCA) is one such tool. Gathering this sort of information can lead to processes of diagnosis, realising that change is necessary, and the determination of what actions are to be taken in response to critical external signals (Hoffman, 1999). From a capability-building perspective, these elements are helpful in both the concept development and the implementation stages.

Environmental management systems (EMS) provide an integrated approach to managing the environmental implications of a firm's activities. Such a management system "will provide the organization with appropriate data and tools to design, implement and improve its environmental programs and performance" (Epstein & Roy, 1998: 292). This definition clearly highlights the system-technical character of EMS. Kitazawa and Sarkis (2000: 243) suggest that more attention should be paid to cultural or social-dynamic elements: "ISO 14001 EMS requirements only present general guidelines, and do not necessarily recommend, much less require, a 'cultural' change." The POEM matrix aims to combine these different elements.

Finally, although this element also has a strategic angle, *budgeting* is included here within the operational quadrant. If one wants to work with cross-functional teams (as is advocated in the operational social-dynamic quadrant), placing budget responsibilities at this level could be beneficial due to the enhanced commitment and improved empowerment. Motivating people to apply a concept such as POEM could thus include the attribution of responsibility for the financial implications of their activities.

4.3.5 Strategic system-technical quadrant

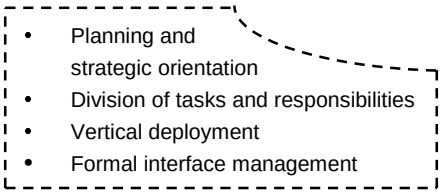

Figure 4.5 *Strategic / System-technical quadrant*

The development of objectives that a firm intends to achieve within a given period is positioned in this quadrant (see figure 4.5): namely *planning and strategic orientation*. Related to this is the term strategic posture: "the organization describes its orientation towards how it will develop 'green' characteristics" (Starik et al., 1996: 16). Measurability is important in order to compare a firm's performance with its goals, including environmental ones. Concerning goal setting, the resource-based idea of applying a 'stretch' perspective (Hamel & Prahalad, 1994) is also useful in environmental management (Cramer, 1998a). Applying such a 'stretch' perspective implies that a substantial misfit is deliberately created between a firm's (internal) organisational capabilities and its (external) environmental requirements and objectives. The goals thus set are beyond the current capability base. In this way, learning and capability-building can be triggered. To set such 'stretched' environmental goals, people from different

organisational levels will need to be convinced of the feasibility of the formulated goals. Also, in setting the goals a good alignment with the firm's surroundings is important, as is information on the attainment of the firm's environmental goals. Operationally, information systems could assist with this. Starik et al. (1996) propose an approach in which one regularly aligns a firm's environmental strategy with signals from its surroundings. Within such a process adequate flexibility is required, as is discussed further in section 4.3.5.

Further strategic, system-technical elements of the matrix involve management in setting *tasks and responsibilities.* Outlining tasks and responsibilities is interconnected with employee empowerment, and influences the motivation and commitment of people working on POEM. Closely related to this is the organising of the *vertical deployment* of POEM. Vertical deployment is intented to bring a firm's strategy to effective action, spreading the plans and policies throughout the entire organisation. In this way, the structures needed to organise POEM, and to develop and maintain the required capabilities, can be strengthened and aligned with the strategic goals.

The final element in this quadrant is *formal interface management*, both internally and externally. "Interfaces are observed at the point where two or more separate entities need to be joined together in order to achieve a certain output" (Brockhoff et al., 1996: 27.2). Internal interfaces (cross-functional activities), and external interfaces (joint operations, such as integrated chain management and strategic alliances), both require a certain systematic approach in order to develop and align the required supportive structures within the firm. Formal interface management is thus complementary with aspects such as shared norms and values and empowerment, included in the social-dynamic quadrants. In paying attention to interface management firms need to consider the structural implications of internal and external co-operation such as information management.

4.3.4 Operational social-dynamic quadrant

To apply POEM in an organisation, one of the elements in the operational social-dynamic quadrant (figure 4.6) is *increased training*, such as on handling environmental information. Collecting and processing information is one thing, learning to interpret and apply such information is another. Learning to consider the environmental implications of, for example, material selection, packaging design or energy efficiency in product development (Kärnä, 1999) requires training. Bringing in advisors could be one way to reduce unfamiliarity and increase relevant knowledge. According to van Hemel (1998), such advisors played an important role in the success of new Design for Environment (DfE) strategies in the small and medium sized companies she

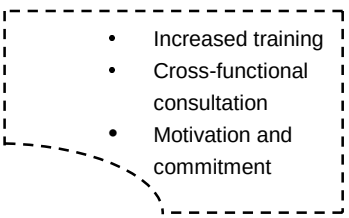

Figure 4.6 *Operational / Social-dynamic quadrant*

studied. Raising the environmental awareness and the acquired knowledge and skills through systematic training can support employee empowerment (Kitazawa & Sarkis, 2000), one of the strategic social-dynamic elements.

Furthermore, *cross-functional consultation and communication* is important. POEM involves a whole range of different functions, from product development to sales. As all of these functions can influence a firm's performance in terms of POEM, communication and consultation between them is needed. An example is the concept of Green Concurrent Engineering, which entails the organisation of 'green' product development activities within all the involved functions in a parallel process (Karlsson, 1997). Teamwork is one important element. Communication on a product's environmental characteristics should not only take place internally but also externally, with chain partners and other stakeholders. This is further addressed in the core of the matrix.

A third element in this quadrant is *motivation and commitment*. Employees assigned the task of developing and applying POEM need to be motivated to do so. Again, support from different quadrants is helpful, for instance to get an insight into their performance and to receive managerial support. In addition, the personal motivation of people for working on an issue such as POEM could be helpful. In this respect it should be noted that several firms work with 'environmental champions' (Veroutis & Fava, 1997), filling a similar role to 'product champions' in product development. Such champions are individuals who take a leading role in working on new issues such as the development of a possibly revolutionary new product, or the endorsement of a new concept such a POEM. They thus provide the synthesis required to make links between existing and desired practices (Roome, 1999). However, the use of such champions could make the process of organising for POEM rather dependent on one or a few persons. Spreading the responsibility across a team might create further support and stimulate the distribution of the insights gained (de Bakker et al., 1999a). A clearly identifiable champion can act as a team motivator and a link between different functions and levels working on a new issue.

4.3.5 Strategic social-dynamic quadrant

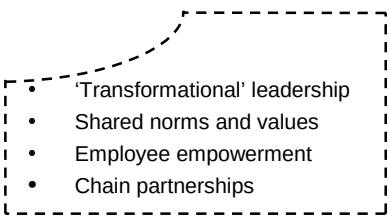

Figure 4.7 *Strategic / System-technical quadrant*

The final quadrant is presented in figure 4.7 and addresses strategic, social dynamic, elements. In some environmental management literature, *transformational leadership* is promoted in which the management level develops green norms and values within a firm and keeps these norms and values alive (Cramer, 1998a). "Transformational leaders articulate a vision (…), communicate this vision in a compelling way, and demonstrate consistent commitment to the vision over time" (Tichy & Devanna, 1986 in Buller & McEvoy, 1999: 333). With environmental

management such inspiration at senior management levels might not be that self-evident (Cramer, 1998a). Before managers actually demonstrate such commitment to a vision, they often need to be convinced of its contents. Alongside stakeholder demands, system-technical elements such as measurement and strategic orientation could help convince such managerial decision-makers. Moreover, as Hoffman (1999: 252) notes, managers do not necessarily need to be real transformational leaders: "the business manager need not believe in the validity of environmental issues to take them seriously as a business concern. What matters is that key constituents [stakeholders] possess that concern and are translating it through core business channels." So, although the transformational character of such leadership can be debated since managers might not always be inspired intrinsically, demonstrated senior management support and vision of POEM is important, for instance by paying attention to employees' and stakeholders' motivation on this topic. In the matrix the adjective 'transformational' is therefore put in quotation marks.

Related closely to this element of 'transformational' leadership is the accomplishment of *shared norms and values* in terms of a product's environmental characteristics. Shared mindsets must be created among a firm's internal and external stakeholders regarding its strategic goals and the processes to reach those goals (Ulrich & Lake, 1990; Buller & McEvoy, 1999). Working on POEM to improve the firm's stakeholder orientation and/or its competitive advantage could be such a strategic goal. Shared mindsets must be reinforced by management practices that govern employees' behaviour in an organisation (Buller & McEvoy, 1999). To accomplish this, they propose using various human resource management practices such as training, selection, and appraisal.

Employee empowerment is another element, closely related to both training and leadership. Empowerment could involve management's conscious efforts to create an atmosphere in which employees have the ability, motivation and organisational support (Buller & McEvoy, 1999) to work relatively independently, for instance on an issue such as quality management or POEM. Empowerment can be demonstrated through the delegation of authority, the assignment of responsibility, or the provision of technical and managerial support (Ahire & O'Shaughnessy, 1998).

In the TQM matrix, supplier partnerships are positioned in this quadrant, to emphasise their influence on quality. In the POEM matrix this element is broadened into *chain partnerships*. In POEM, the entire product life cycle is considered, taking in more than customers and suppliers. Integrated chain management (ICM) is "the integrated management of a product chain in terms of the environmentally, socially and economically responsible management of the production, consumption, distribution and ultimate disposal of a product" (Cramer, 1996: 39). Such a partnership might address suppliers, recycling or logistics issues, or partnerships between firms and particular stakeholders[68]. Improving communication and participation could benefit from the creation of such networks of stakeholders

[68] An example is the occurrence of partnerships between firms and environmental movements, such as McDonalds and the Environmental Defence Fund (Polonsky, 1995).

(Roome, 1992; Clarke & Roome, 1995), which is regarded as one of the motivations for firms to engage in POEM.

4.4 Concluding remarks

In this chapter, the theoretical inputs discussed in the previous chapter have been integrated together in order to apply them in the empirical part of the research. First, the capability cycle was introduced, intended to link the central issues of this research by describing the continuous process of developing and maintaining capabilities in order to address stakeholder demands. The concept of responsibility was addressed to highlight the important role of managerial decision-makers in perceiving and balancing different stakeholder interests. To achieve a form of responsible chain management, such as POEM, a well-balanced set of organisational capabilities is required at each stage of the capability cycle. The capability assessment framework considers the four stages of the capability cycle from both internal and external orientations. This framework can assist in assessing a firm's capability base, and provides a provisional illustration of capabilities relevant to issues of responsible chain management.

However, this capability assessment framework does not directly indicate the actual organisational elements underlying these organisational capabilities, which is the central goal of this research. Therefore, the TQM matrix was transformed into a POEM matrix. This matrix addresses system-technical (or structural) and social-dynamic (or cultural) organisational aspects at both operational and strategic managerial levels. In addition to the four quadrants, at the core of the matrix are capability-building, stakeholder orientation, and continuous improvement. An integrated approach to these different elements is important in balancing the process of organising POEM.

If competitive advantage and the addressing of stakeholder demands are considered to be important drivers of a proactive firm's environmental activities, the question in this research is what these drivers mean for the way in which a firm organises its response. Cramer (1998a) notes that the level of a firm's desire to work on increasing its environmental performance in a competitive way[69] is the result of three factors: (1) the degree of coincidence between environmental efforts and market opportunities, (2) the internal structure and culture of the company, and (3) the pressure from the immediate and wider social environment to take environmental

[69] Cramer (1998a) refers to the concept of eco-efficiency here, which should lead to economic and ecological efficiency through a process of innovation and value enhancement through the minimisation of resource input (Schot et al., 1997). The World Business Council on Sustainable Development (WBCSD) also endorses this concept. On the Internet, they note that "eco-efficiency is reached by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing ecological impacts and resource intensity, throughout the life cycle, to a level in line with the earth's estimated carrying capacity" (http://www.wbcsd.ch accessed December 2000).

actions. The first factor deals with competitiveness, the third with stakeholder demands. In this research these two factors are considered to be important drivers for firms to work proactively on organising for POEM. The organisation of POEM is clearly also related to the second factor. As Cramer (1998a: 165) notes, "structure and culture is also one of the main reasons why similar companies in the same sector can respond so differently to the environmental issue." Den Hond (1996: 79) likewise comments: "environmental strategies may differ among firms in the same industry that face the same issue, because these firms assess differently a set of potential solutions." By studying the process of organising POEM in firms that take a proactive approach to environmental management, it is hoped to get a better insight into the building and maintenance of organisational capabilities associated with POEM.

It should be noted that this research is not aiming to produce a falsifiable theory, but rather a framework for analysis that indicates how firms could effectively develop and implement POEM. This framework, the POEM matrix, is used to investigate several salient cases in firms working proactively on the organisation of POEM. The framework hence guides the empirical research, and the elements in it serve as important inputs to the interviews conducted during the empirical part of the study. At the same time the framework is improved with the outcomes of the empirical research leading to adjustments as necessary. In the next chapter, the methodological considerations underlying the chosen approach are presented. Chapter 6 contains the results of the case studies.

5.

Methodological Considerations

"It remains the supreme paradox of research that we proceed by attacking the things which other people's research leaves unsatisfactorily explained. Research which ties things up too neatly and leaves no loose ends should be viewed with great suspicion!"

(Bechhofer, 1974: 87)

5.1 Introduction

This study seeks to contribute to the understanding from a firm's perspective of organisational aspects of Product-Oriented Environmental Management (POEM), by describing and analysing current practices regarding POEM within large firms that are proactively involved in the process of developing and applying POEM. This study aims to contribute to theory development in corporate environmental management and management studies, while also seeking practical applicability from the insights gathered. So far, attention in this thesis has been focussed on recent developments concerning 'products and the environment', and on three relevant streams of theory. This has led to the construction of theoretical frameworks. Before applying these frameworks to empirical data in chapter 6, it is important to determine the correct approach. This chapter thus discusses methodological considerations relevant to this research.

As Whitley (1984: 369) observed: "Management research or 'science' is often understood to refer to the study of managerial problems by scientific methods or principles." As the subject of management studies, managerial problems have clear ties with practice. The relationship between management theory and management practice is often debated (e.g., Reed, 1984; van der Zwaan & van Engelen, 1994; Amundson, 1998; van Riemsdijk, 1999). A closely related topic is the question as to how research in management studies should be conducted. In literature, theory development and methodology are both recurrent topics of interest[70]. Publications focus on issues such as underlying paradigms ("the underpinning values and rules - that govern the thinking and behavior of researchers" (Gummesson, 1991: 2)), differences in methodologies, or in research strategies. Such discussions indicate that there are many different ways of conducting research in the field of management studies, and that opinions on what constitutes 'good' research vary among researchers.

Yet, despite these warnings, the extent of attention to methodological deliberations in the area of management studies varies. In some studies a full justification of methodological approaches is presented, while other researchers confine themselves to some general remarks on the methods used. If one is conducting research on an issue that can be approached from several directions, as is often the case in management research, presenting a detailed account of methodological considerations is important. It can clarify a researcher's viewpoint of management studies, of what management studies could aim at, and how the studies are to be conducted. The choices a researcher makes obviously influence the research process. Therefore, in this chapter, extensive details are provided of the

[70] For instance, in the Netherlands there are intense debates on the status and application of methodology in management studies. In the 1990s, two special issues of the Dutch management journal 'Bedrijfskunde' were devoted to discussions on methodological issues. Other recent publications also highlight such issues (e.g., van Riemsdijk, 1999; van Triest, 1999), while theory development from practice is an issue also often debated (e.g., Eisenhardt, 1989; Sutton & Staw, 1995; Schuring, 1997; Wacker, 1998).

methodological considerations underlying this research. In the following sections, the choices made concerning paradigms, methodology and research strategies are discussed. These sections explain why case studies are a suitable research strategy for this research. After this broad discussion of methodological considerations, the implications of these choices are concretised, leading to further details of the empirical part of this research. In the final section, concluding remarks are made. To highlight the specific position of environmental management, the role of theory and methodology in corporate environmental management literature is first briefly examined in the next section.

5.2 Methodology and environmental management research

An aim of this research is theory development, an aim striven for by combining insights from different fields, centred on product-oriented environmental management. In methodological considerations for such a topic, not only management literature but also corporate environmental management literature could be included. It is useful to consider the methodological aspects from an environmental management angle.

As van Hemel (1998: 13) noted: "From the late '80s onwards, academic business literature began to devote more attention to the integration of environmental initiatives in the business organization." She was referring to the growing number of international journals focussing on this specific area. In addition to these publications, an increasing number of conferences were providing outlets for presentations on 'business and the environment' and products' environmental characteristics, while the number of research programmes and research networks was also growing[71]. From an academic direction, the attention to corporate environmental management is thus increasing. According to Hoffman and Ehrenfeld (1998: 55) "Universities are assuming an important role in the evolution of environmentalism in general and the integration of environmental management into corporate practice in particular." The attention to this relatively young field of management also poses questions, for example on its demarcation and on its methods. Hoffman and Ehrenfeld (1998) wonder what the exact focus of corporate environmental management research is, and how it relates to general management. Attention should thus be paid to methodological concerns involved in corporate environmental management research. Gladwin (1993) produced a list of critical observations on the state of scholarship on 'the greening of industry.' These included a lack of precise definitions, and of high-quality empirical findings, and of causal directionality. He

[71] A good example is the 'Greening of Industry Network' (GIN), founded in 1991. The mission of this network's is "to stimulate, coordinate and promote research of high quality and relevance to ensure that the activities of industry - including business, labour, consumers, government and other - are consistent with building a sustainable future" (Schot et al., 1997). Another example is the Academy of Management's working group on Organisations and the Natural Environment (ONE).

also indicated a failure to employ cumulative research (building on previous work) and a lack of attempts to place such work in the broader streams of organisational research.

Although aspects of corporate environmental management have been studied over a few decades, methodological issues related to managerial issues in this specific field are debated less often. As noted in chapter 2, research in the field of 'products and the environment' often focuses on the development of methodologies or guidelines (Lenox & Ehrenfeld, 1997), or on 'illustrative case studies' as such (Stone, 2000). The research presented in this thesis is concerned with theory development on the organisational aspects of POEM from a firm's perspective. Links with theoretical inputs from management studies are thus clearly present *and* necessary. Gladwin (1993: 44-45) advocates such a connection with management studies as "scholars of greening have much to gain from linking with, and borrowing from, a broad array of organizational theories that are already well developed or rapidly advancing." Many directions are possible when applying organisational (or management) theories to environmental management. Gladwin (1993: 44) applies similar arguments to the ones used to construct theoretical frameworks: "Without theory it is difficult to organize existing findings, to produce important generalizations accurately, to generate new ideas, to carefully shape and guide empirical inquiry, and to produce useful corporate and public policy interventions. If our work is to have greater impact, then it must become more theory-driven." He continues by indicating ways in which different organisational theories could be applied in environmental management. These remarks provide additional support to my decision to link a corporate environmental management problem (the organisation of POEM) with organisational theories (on capability-building, stakeholders and continuous improvement)[72].

Following Gladwin's (1993) remarks, I am not aiming for yet another new theory, but rather a link to organisational theory is explicitly sought. Theory development is aimed at in two ways, firstly, by combining insights from three diverse streams of literature. These streams have been combined in two theoretical frameworks as discussed in chapter 4. Now, in this chapter it is indicated how these frameworks can be 'translated' towards empirical situations. In addition to this combination of theoretical insights, the research also aims to develop some further insights on the actual *process* of organising for POEM. Based on the improved theoretical findings, practical implications of the findings will be sought. Different goals are thus set. Finally, as Hart (1995) notes, designing research for testing the natural resource-based view of the firm requires both methodological flexibility and patience.

[72] "Good theory and method will enable us to organize knowledge on greening into a pattern of relationships, will help us to summarize diverse findings about it, and will allow us to differentiate between important and trivial questions for future research" (Hamner & Organ, 1978 in Gladwin, 1993: 55).

5.3 The choice of an interpretative paradigm

Underlying the discussions on methodological considerations and theory development are choices and assumptions that researchers make when considering paradigms, a concept introduced by Kuhn (1962). A paradigm can be defined as "the basic belief system or worldview that guides the investigator" (Guba & Lincoln, 1994: 105), thus constituting researchers' ideas of the ways the world can be understood, and how such an insight is to be achieved. Different researchers, working in different traditions have developed different worldviews[73]. Although many labels and classifications are available, one general division into two extreme positions considers the positivist paradigm versus the interpretative paradigm. The positivist paradigm, following the tradition of natural sciences, "posits that the study of organizations can occur through a value-free scientific approach" (Wicks & Freeman, 1998: 125). As Cassell and Symon (1994: 2) summarise: "the assumption behind the positivist paradigm is that there is an objective truth existing in the world where the focus is on measuring relationships between variables systematically and statistically." Conversely, in the interpretative paradigm, "social reality, although possessing order and regulation, does not possess an external concrete form. Instead it is the product of intersubjective experience" (Hassard, 1991: 277). In this paradigm, the emphasis is on understanding the processes through which people concretise their relationships to their world (Morgan & Smircich, 1980). The choice for a particular paradigm - a choice every researcher implicitly or explicitly makes - has implications on the way research is conducted. As Gummesson (1991: 17) summarises Myrdal (1970): "If academic researchers are aware of their paradigm, it is naturally desirable that they discuss it at the outset of their work." Following this advice, such an account is presented here at the start of the chapter on methodological considerations.

This research sets out with an interpretative paradigm. Emphasis is placed on *understanding* the organisational processes that concern a product's environmental characteristics. Firms have to develop and/or maintain specific organisational capabilities to be able to continually balance the different stakeholders' interests regarding POEM. To gain an insight into the way firms deal with such changing situations, and in how the different demands, opportunities and threats involved are

[73] Discussions on paradigms could be characterised by the different fundamental assumptions about "the nature of organizational phenomena (ontology), the nature of knowledge about these phenomena (epistemology), and the nature of ways of studying those phenomena (methodology)" (Gioia & Pitre, 1990: 585). Considering the scope of this research, it is unnecessary to go into detail on these concepts. A wide variety of literature in this field is available (e.g., Burrell & Morgan, 1979; Hassard, 1991, Guba & Lincoln, 1994). As Guba and Lincoln (1994: 116) indicate: "A resolution of paradigm differences can occur only when a new paradigm emerges that is more informed and sophisticated than any existing one. (…) Continuing dialogue among paradigm proponents of all stripes will afford the best avenue for moving towards a responsive and congenial relationship." De Leeuw (1996) adds that the continuing discussions about paradigms in management studies correspond with the need for heterogeneity in this field.

perceived, the focus in this research is on the perceptions of managerial decision-makers. Their ideas and interpretations of the organisational process of POEM are considered as important input for this research, and this supports the choice of an interpretative paradigm. Such a focus may lead to detailed descriptions of the process of developing capabilities for POEM. These insights could then be compared with theory using the theoretical frameworks introduced in the previous chapter. Based on such a comparison, conclusions could be drawn that could contribute to theory development.

In choosing a paradigm, alongside the characteristics of the issue under investigation, the role of the researcher within the research process is relevant as well (Nijhof, 1999). To uncover a decision-maker's interpretations and opinions, it is not sufficient to merely collect their motivations and comments (Nijhof, 1999). These findings have to be interpreted. Strauss and Corbin (1990) also emphasise the importance of interpretative procedures in research processes. The researcher's impact on this process can go beyond the interpretation of findings. "Rather than being an uninvolved bystander observing the organisational action, the researcher is a social being who has an impact on the behaviour of those around. The research process is conceptualised as a social process which is heavily influenced by the choices made by the researcher as the research progresses. Consequently, the researcher is seen as a craftsperson – skilled not just in the nuts and bolts of research but in his or her ability to interact with others" (Cassell & Symon, 1994: 6)[74]. In this research the interpretation of actions by managerial decision-makers is central, but it is important to be aware of the researcher's role in interpreting the data[75].

Although the interpretative paradigm can be seen as the point of departure in this study, this does not mean that a rigid paradigmatic stance has been taken. "The paradigms for conducting social research seem to be shifting beneath our feet, and an increasing number of researchers now see the world with more pragmatic, ecumenical eyes" (Miles & Huberman, 1994: 5). Interactions between different paradigms occur and methods previously considered to belong strictly to one paradigm are increasingly applied in other paradigms. Moreover, during the course of a research project one's interpretation of a paradigm could change (Gummesson, 1991). In that sense, the interpretative paradigm can be seen as guiding the research process, although part of the desired outcome of the research, contributions to theory building in a more general sense, aim to reach beyond the specific situations studied. As Lee (1999: 11) notes: "I am advocating a middle position between (a) the assumption of an objective reality (in the physical science sense) and (b) an ongoing

[74] Strauss and Corbin (1990) also emphasise the role and skills of the researcher, while Denzin and Lincoln (1994: 2) refer to the concept of the bricoleur, who "produces a bricolage, that is, a pieced-together, close-knit set of practices that provides solutions to a problem in a concrete situation." Such concepts emphasise the creative, developmental and hence influential role of the researcher in the research process.

[75] The role of a researcher's interpretations is also important in other paradigms and attention should be paid to the validity and reliability of research in every type of study. This is discussed further in section 5.4.2.

and constant process of interpretation, sense making, and social construction of organizational settings." Starting from an interpretative paradigm, such a middle position could enrich the views applied and fit well with the investigated situation. After all some generalisation is necessary in order to contribute to theory development.

5.4 The choice for a qualitative research methodology

In literature, the term 'methodology' is used in many different ways, applied to denote very diverse meanings. Van der Zwaan and van Engelen (1994) for instance recognise four meanings of 'methodology' in theory development: technical, methodological, theoretical and organisational. Similarly, Lehaney and Vinten (1994) identify six uses of the term 'methodology' as listed in table 5.1. The fact that there are so many different uses of this term indicates that it is a difficult term to define precisely. As Hoover (1995: 716 in van Triest, 1999: 67) notes, "Most [scientists] recognise methodology or methodological argument when they see it, but few - even few professed methodologists - have a credible definition at their fingertips." Here the term methodology is used mainly to mean the possible methods of research that can be applied to investigate a particular problem.

Table 5.1 *Different uses of the term 'methodology' (Lehaney & Vinten, 1994)*

Uses of the term 'methodology'
▪ Ways in which hypotheses become theories (scientific methodology)
▪ Ways in which techniques are selected to address a particular problem
▪ Ways in which problems are chosen
▪ Methods or techniques
▪ The modelling process, including ways in which relevant variables are selected for a model and how reality is simplified
▪ The chronological planning of events (research programme)

Often a distinction is made between qualitative and quantitative methodologies. Following the choice of an interpretative paradigm, the methodology most appropriate to address the research question posed would seem to be a qualitative one as interactions and interpretations form an important element in the research. Strauss and Corbin (1990: 17) define qualitative research as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification." However, the distinction between quantitative and qualitative research goes beyond this simple contrast of 'numbers' versus 'no numbers'. In table 5.2 important differences between these two methodologies are listed.

Table 5.2 *A comparison of quantitative and qualitative research methods, based on Jones (1988), Cassell and Symon (1994), and Lee (1999)*

Quantitative research methodology	Qualitative research methodology
▪ Quantification	▪ Interpretation
▪ Objective and finely calibrated descriptions but limited to investigate what can be readily hypothesised and tested through instruments	▪ Subjective interpretations but limited in comparability across setting and not repeatable
▪ Rule-driven research process using detailed, pre-specified designs: using imposed categories	▪ Flexibility in the research process: using inherent and emergent categories, peculiar to the situation
▪ Predicting organisational outcomes: aimed at establishing general trends or correlations between dependent and independent variables	▪ Orientation toward understanding organisational processes rather than outcomes: aimed at uncovering meanings in particular settings
▪ Presented as context-free and generalisable	▪ Grounded within the local context - generalising possibly problematic
▪ No research process effects assumed	▪ Explicit recognitions of the impact of the research process on the research situation (reflexivity)

Reflecting on these differences, a qualitative methodology indeed seems the most useful for various reasons. This research wants to understand the organisation of POEM within the local context of the firms studied. Interpretations, both of the people in the investigated case situations, and of the researcher are important. It is the *process* of organising POEM that I am interested in. As Cassell and Symon (1994: 5) stated: "Only qualitative methods are sensitive enough to allow the detailed analysis of change." The flexibility such a methodology allows the researcher in the process (that is, if well motivated and documented) could be helpful in better understanding the process of organising POEM.

Furthermore, the theoretical frameworks constructed in this thesis place an emphasis on a firm's unique characteristics and on the perceptions of managerial decision-makers. To gain an insight into such idiosyncrasies and interpretations, a view from the inside of the investigated firm is useful. To meet this objective, qualitative methodology also seems suitable, since "qualitative research tends to focus upon individual motives and to ascertain the community of shared symbols, sentiments, and meanings" (Jones, 1988: 33).

In such an 'inquiry from the inside' (Evered & Louis, 1981), the role of the researcher has already been specified as being of influence when identifying the paradigm. Qualitative methodologies acknowledge the important role a researcher plays in the research process. In Jones' (1988: 34) words: "The qualitative researcher is likely to experience the situation in which others are immersed, whether directly through participation or indirectly through extensive and intensive interviewing." Interviewing had an important role in this thesis, as outlined in section 5.6.

So, in this research, there are many reasons for opting for a qualitative research methodology. It should be noted though that this choice does not render quantitative methodologies irrelevant. Although often presented as two very different streams of research, belonging to different paradigms, combinations of these methodologies have been advocated. As Lee (1999: 9) notes, "it is sometimes alleged that qualitative research is better suited for theory creation, whereas quantitative research is better suited for theory testing (…) the larger literature indicates that both qualitative and quantitative research methods can be appropriately applied to create or to test organizational theories." Using qualitative research for theory testing purposes is proposed by several authors (e.g., Yin, 1994; van der Zwaan, 1995), while combinations of qualitative and quantitative methodologies are regularly advocated, often with the aim of improving research validity and reliability[76]. Meanwhile, Denzin and Lincoln (1994: 3) note that qualitative research "has no theory, or paradigm, that is distinctively its own (…). Nor does qualitative research have a distinct set of methods that are entirely its own." Different research strategies and methods can be applied, as discussed in the next section.

5.5 The choice of a case study strategy

A research strategy[77] is the approach taken in order to address and answer the research questions in a study. Different research strategies will be employed to address different types of research questions and generate different types of insights. Paying sufficient attention to the selection of the appropriate research strategy is thus important. According to Yin (1994), three factors are important in determining which strategy to use: (1) the type of research question, (2) the extent of control an investigator has over actual behavioural events, and (3) the degree of focus on contemporary as opposed to historical events. In addition, van der Zwaan (1995) identifies how research strategies could be related to different forms of research such as explanation or exploration. In table 5.3 these approaches to selecting a research strategy are combined, resulting in an overview of the relationships between research strategies, research questions and forms of research.

[76] Combinations of different methodologies are considered in the concept of 'triangulation' that is often used in qualitative research (Denzin, 1978; Jick, 1979; Eisenhardt, 1989). According to Denzin (1978: 304) "Methodological triangulation involves a complex process of playing each method off against the other so as to maximize the validity of field efforts." Quantitative and qualitative methodologies then could be viewed as complementary rather than as rivals (Jick, 1979). Yet, "Triangulation is not a tool or a strategy of validation, but an alternative to validation" (Denzin & Lincoln, 1994: 2).

[77] As Ruffini (1999) notes, concerning the term 'research strategy', differences in terminology exist. Yin (1994) refers to 'research strategy', while van der Zwaan (1995) uses 'research type' and Jonker and Pennink (1999) apply the term 'research design'. Here, for uniformity the term research strategy is used throughout.

Table 5.3 *Relationships between research strategies, questions and types of research, based on Yin (1994) and van der Zwaan (1995), adapted from Kerssens-van Drongelen (1999)*

Research strategy	Form of research question (Yin, 1994)	Form of research (van der Zwaan, 1995)			
		Exploration	*Descrip-tion*	*Explanation*	*Validation*
Experiment	How, why (what)			0	000
Case study	How, why (what)	000	0	0	
Longitudinal case study	How, why (what)	0	000	00	
Survey	Who, why, where, how many, how much		00	00	
Longitudinal survey	Who, why, where, how many, how much			00	00
Evaluation	*Not identified*			0	000
Action research	*Not identified*		0	0	0
Simulation research	*Not identified*	00	00	0	0
Archival analysis	How, what, where, how many, how much	*Not identified*	*Not identified*	*Not identified*	*Not identified*

Legend:
0 : this research strategy is occasionally used for this type of research
00 : this research strategy is regularly used for this type of research
000 : this research strategy is frequently used for this type of research

Opting for a qualitative research methodology still leaves open many different choices for research strategy. In a research strategy, the approach for the empirical part of a study is identified. Depending on the theoretical areas the research builds upon, the methodological choices that are made, and the research questions a study aims to address, an appropriate strategy can be selected. In figure 5.1 the position of a research strategy among theory, methodology, and research questions is represented. This figure illustrates the important topics a research strategy has to address: (1); *research questions*: how to select the right research questions in a given context; (2) *theory*: how to relate these research questions to appropriate theory (or theories); and (3) *methodological issues*: how to position oneself as a researcher (paradigm), and how to address the research questions (methodology) (Jonker & Pennink, 1999, 2000). Given the range of available research strategies, a specific choice has to be made for a strategy, or for a combination of strategies. In the next subsection the choice made for this study, a case study strategy, is justified. Naturally, this strategy also has some limitations. These are discussed in the second subsection.

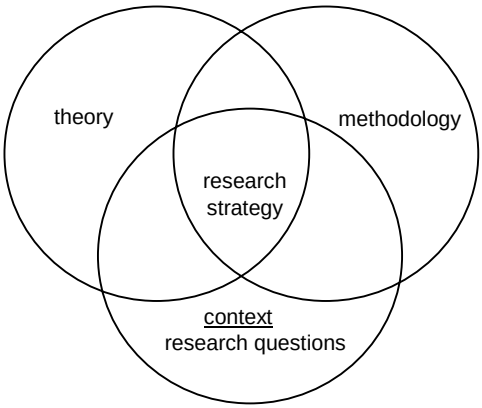

Figure 5.1 *Position of the research strategy (Jonker & Pennink, 1999)*

The process of developing and executing a research strategy is an iterative one (Miles & Huberman, 1994; Verschuren & Doorewaard, 1995), involving an ongoing interplay between theory and practice. Iterations take place over the entire research: first in developing the research strategy, later in analysing data to develop new theoretical insights. In the latter situation, "researchers constantly compare theory and data - iterating toward a theory which closely fits the data" (Eisenhardt, 1989: 541). One aim of this research project is to deliver insights into the process of organising POEM through a contribution to theory development. There are different opinions on the way case study research can contribute to theory building. These are briefly addressed in the final subsection.

5.5.1 Reasons for applying case study strategies

Different types of research questions are best addressed with different research strategies. The central research question of this thesis - '*why and how do large, proactive firms develop and maintain product-oriented environmental management, both at a strategic and an operational level?'* – is obviously a why and a how type of question, seeking to describe and explain a firm's organisation of POEM. From table 5.3, this leaves many possible strategies open, but case studies and surveys seem particularly useful ones. As argued earlier, a qualitative methodology, in which interpretations play an important role, is seen as useful for this study. As de Ruyter (1993: 141) states: "We would like to hear and see what is done and what not and why and why not. Personal interviews are necessary then. Moreover, we would like to interview various people to research our questions from various perspectives and detect links, relationships and find explanations." A case study strategy thus seems to be an appropriate strategy, as it "allows for a processual, contextual and generally longitudinal analysis of the various actions and meanings which take place and which are constructed within organizations" (Hartley, 1994: 211). Abundant literature on case studies and their methodological implications is available, both in management studies (Eisenhardt, 1989; Gummesson, 1991), and in a wider social research context (Hutjes & van Buuren, 1992; Vaughan, 1992; Hartley, 1994; Yin, 1994). According to Yin (1994: 13), "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."

Hutjes and van Buuren (1992) consider case studies to be appropriate if the situation under investigation is difficult to isolate from its context, and/or if the

number of units under investigation is relatively small in relation to the number of factors considered. Put differently, case studies can be used to explore social processes as they unfold in organisations, can be useful where it is important to understand those social processes in their organisational and environmental context, can be tailor-made to explore new processes or behaviour, and are suitable for social processes which are little understood (Hartley, 1994). Building on de Ruyter (1993), some further arguments to justify a case study strategy in this research include:

- The research is aimed at *theory building*, trying to determine the descriptive and explanatory value of the theoretical frameworks proposed in the previous chapter.
- Relatively close relationships between the researcher and the respondents may allow better *access* to information about a firm's organisational processes concerning a product's environmental characteristics.
- Case studies allow a phenomenon – product-oriented environmental management, in this case – to be studied from different angles and levels. *Data triangulation*, "the use of different sources for data-collection, offers more comprehensive insight into the subject matter that the use of a single data source" (de Ruyter, 1993: 142).
- The research aims not only at theory development, but also at providing *practical insights*. The flexibility of case study strategies enables a better insight in the practical situation into its 'natural' context.

Ample arguments for choosing a case study strategy thus seem to exist. The importance of the context in which the studied firms are gaining experience with aspects of POEM, the attention within the research to organisational processes[78], and the importance of interpretations, are important factors. The explorative and, to a lesser degree, explanatory character of the strategy, in combination with the type of research questions ('why' and 'how') supports the choice of this research strategy. However, a case study strategy does have its limitations as discussed below.

5.5.2 Limitations of case studies

Discussing possible limitations of case study strategies, de Ruyter (1993) points to their *time-span*, *validity* and *reliability*. Considering their time-span, he notes that a case study strategy could be very time consuming. Initial contacts with a potential case study firm have to be made, access must be gained and information collected. Often, in case study research, many different factors are involved, thereby limiting

[78] The case studies were undertaken while the firms were actively developing their specific approaches towards this novel demand. This is discussed in more detail in the next section.

the number of studies that can be carried out within a limited time-span[79]. These difficulties were avoided in this research by organising the case studies well in advance, by gaining an overview of available information beforehand, and by selecting cases on both theoretical grounds and on pragmatic grounds to ensure an adequate theoretical contribution and sufficient practical co-operation. The other two limitations, validity and reliability, are often discussed in the literature on methodology, especially qualitative ones (e.g., Gummesson, 1991; Yin, 1994; de Leeuw, 1996; Lee, 1999). The ways these issues have been dealt with in this research are discussed below. Yin (1994: 33) discerns between:

- "*Construct validity*: establishing correct operational measures for the concepts being studied
- *Internal validity*: establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships
- *External validity*: establishing the domain to which a study's findings can be generalised
- *Reliability*: demonstrating that the operations of a study – such as the data collection procedures can be repeated, with the same results."

Concerning *construct validity* Yin (1994) proposes the use of multiple sources of evidence, the construction of a chain of evidence, and having key informants reviewing the draft case study report as tactics to improve this validity. In my research different sources have been used, and the verification of case reports has been secured, as discussed further in section 5.6. To maintain a chain of evidence, the idea is "to allow an external observer – the reader of the case study, for example – to follow the derivation of any evidence from initial research questions to ultimate case study conclusions" (Yin, 1994: 98). This has also been attempted throughout the research leading to this thesis. On *internal validity*, Yin (1994) proposes tactics such as pattern matching, explanation building and time-series analysis. Deriving strong causal relationships from interpretative, qualitative research can be difficult, but it is possible to suggest relationships from a combination of theoretical and empirical insights. *External validity* concerns the generalisability of case study findings, for instance to a larger or an alternative population (Lee, 1999). Using a replication logic in multiple-case studies can enhance external validity (Yin, 1994). Generalisations are then made relative to theory, "generalizing from one case to the next on the basis of a match to the underlying theory, not to a larger universe. The choice of cases is usually made on *conceptual* grounds, not on representative grounds" (Miles & Huberman, 1994: 29). The use of theoretical frameworks can support external validity. Finally, regarding the concept of *reliability* or replication,

[79] This in contrast to quantitative research strategies in which large databases frequently are the input of the research, providing a much larger number of respondents.

Steenhuis (2000) argues that this concept fits more with a quantitative methodology. However, Yin (1994) proposes the use of case study protocols and the development of case study databases. Clarifying how the study has been conducted, which data have been gathered, and how these have been interpreted is thus important. By giving a detailed account of the methodological considerations in this chapter, supplemented with clear representations and analyses of the empirical data in chapter 6, contributes to the reliability of the research.

These four criteria are widely applied and accepted, and much interpretative research is also framed in such terms. In addition, to highlight specific elements of interpretative approaches, Gummesson (1991) proposes a set of alternative quality research criteria. These criteria bear some similarities to Yin's (1994) criteria, but several additional elements are included. These criteria are not addressed extensively here, but their essence is borne in mind during the research process. Within this thesis, many criteria are addressed explicitly or implicitly. They include the following, drawn from Gummesson (1991: 160-162):

- A research project should be conducted in a manner that allows *the readers to draw their own conclusion.*
- Researchers should present their *paradigm*.
- The research should possess *credibility*
- The researcher should have adequate *access*
- A statement should be made regarding the *validity* of the research
- The research should make a *contribution*
- The research process should be *dynamic*
- The researchers should have *commitment* and *integrity*
- As an *individual*, the researcher should satisfy certain requirements

5.5.3 Theory development from case studies

The choice of a qualitative methodology, using a case study strategy has now been justified. Attention has now to be paid to the way in which such a research strategy could contribute to the development of theory, as this is an important goal of this research. Theory in general is important "because it shapes how the researcher (or practising manager or observer) interprets phenomena of interest" (Amundson, 1998: 357). Theory development[80] then "provides a framework for analysis, facilitates the efficient development of the field and is needed for the applicability to practical real

[80] This term is also referred to as theory building, theory elaboration or theory extension. For instance: "Theory elaboration is a method for developing general theories of particular phenomena through qualitative case analysis. (…) By elaboration, I mean the process of refining a theory, model, or concept in order to specify more carefully the circumstances in which it does or does not offer potential for explanation" (Vaughan, 1992: 175). Here, all these subtleties in terminology are labelled theory development.

world problems" (Wacker, 1998: 361). This is relevant here as this research aims to further theoretical insights *and* to deliver a practical application of these insights. Opinions about the role of theory in developing further theory from case studies vary. Steenhuis (2000) summarises three standard approaches: the grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1990), Yin's (1994) case study (testing) approach, and a case study approach specifically for theory development (Eisenhardt, 1989). These three approaches are briefly discussed here, indicating why the last one seems most appropriate for this thesis.

Grounded theory is an approach in which theory is "inductively derived from the study of the phenomenon it represents. That is, it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon" (Strauss & Corbin, 1990: 23). Field research, guided by so-called 'sensitising concepts', results in data that are subsequently coded. Based on that coding, theory can be developed inductively 'from the data'. Hence in this approach prior theory development is not required. As Steenhuis (2000) notes, an advantage of this approach is that it enables a deep understanding of the phenomenon under study. A disadvantage is in the assumption that a researcher has no prior knowledge of the topic of the research. In this thesis, the empirical research has deliberately been based on theory through the application of theoretical frameworks as guidance. Therefore grounded theory is not an appropriate strategy for this research.

Another approach to develop theory from case studies is proposed by Yin (1994: 27), who states that "theory development as part of the design phase is essential, whether the ensuing case study's purpose is to develop or to test theory." In contrast to grounded theory, the development of theory takes place prior to the collection of data. Yin (1994: 30) continues "theory development does not only facilitate the data collection phase (…). The appropriately developed theory also is the level at which the generalization of the case study results will occur." His approach is thus far more structured than the grounded theory approach. He advocates 'analytic generalisation' meaning that "a previously developed theory is used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same theory, replication may be claimed" (Yin, 1994; 31). Although, in this thesis, five cases are studied, Yin's replication logic might not fully apply since, for theory development, such a previously developed theory could be somewhat obstructive. As the concept of POEM is still under development, narrowing the research to a set of factors that fit within one theory in order to generalise might be both difficult and undesirable ('which factors to choose, which to leave out?'). Theoretical frameworks are applied in this research, as "without a theoretical framework, the researcher is in severe danger of providing description without meaning" (Hartley, 1994: 210). However, these frameworks do not initially have the status of a full-grown theory[81]. A case

[81] Gummesson (1991: 53) speaks of 'preunderstanding' with which he refers to 'knowledge by acquaintance' and to an attitude and commitment that researchers must have. Preunderstanding

study strategy that provides structure to the research process, but leaves sufficient room to react to practical situations would be most useful. In part, analytic generalisation is thus applied in this research to address external validity concerns.

Another structured way to develop theory from case studies has been proposed by Eisenhardt (1989). Her approach is depicted in table 5.4, providing a detailed outline of the methods she has followed in theorising from case study research. She noted that "the theory-building process relies on past literature and empirical observation or experience as well as on the insight of the theorist to build incrementally more powerful theories" (Eisenhardt, 1989: 548). As strengths of this approach Eisenhardt (1989) gives: (1) the likelihood of generating novel theory, (2) the emergent theory is likely to be testable with constructs and hypotheses[82], and (3) the resultant theory is likely to be empirically valid. Weaknesses she identified include the fact that an intensive use of empirical evidence can yield theory which is overly complex, and the fact that theory developed from case studies can be narrow and idiosyncratic. Another disadvantage is the difficulty in determining when theoretical saturation is achieved, especially when time constraints apply. Steenhuis (2000: 22) dealt with this by choosing the depth of his case studies in such a way that an acceptable level of saturation would be reached, since "the 'strength' of the conclusions of the research is dependent on the achieved saturation." Eisenhardt (1989) argues for multiple (between 4 and 10) case studies to generate theory with sufficient complexity. Her approach could be positioned between Yin's approach and grounded theory (Steenhuis, 2000).

"involves their *personal experience* as an essential element in the process of collecting and analyzing information. Moreover researchers (…) must demonstrate *theoretical sensitivity*."

[82] Eisenhardt (1989: 546) thus operates in a positivist tradition, noting that "the process described here adopts a positivist view of research. That is, the process is directed toward the development of testable hypotheses and theory which are generalizable across settings."

Table 5.4 *The process of developing theory from case study research (Eisenhardt, 1989)*

STEP	ACTIVITY	REASON
Getting started	Definition of research question	Focuses efforts
	Possibility of a priori constructs	Provides better grounding of construct measures
	Neither theory nor hypotheses	Retains theoretical flexibility
Selecting cases	Specified population	Constrains extraneous variation and sharpens external validity
	Theoretical, not random sampling	Focuses efforts on theoretically useful cases - i.e. those that replicate or extend theory by filling conceptual categories.
Crafting instruments and protocols	Multiple data collection methods	Strengthens the grounding of theory by triangulation of evidence
	Qualitative and quantitative data combined	Synergistic view of evidence
	Multiple investigators	Fosters divergent perspectives and strengthens grounding
Entering the field	Overlap data collection and analysis, including field notes	Speeds analyses and reveals helpful adjustments to data collection
	Flexible and opportunistic data collection methods	Allows investigators to take advantage of emergent themes and unique case features
Analysing data	Within-case analysis	Gains familiarity with data and preliminary theory generation
	Cross-case pattern search using divergent techniques	Forces investigators to look beyond initial impressions and see evidence through multiple lenses
Shaping hypotheses	Iterative tabulation of evidence for each construct	Sharpens construct definition, validity, and measurability
	Replication, not sampling, logic across cases	Confirms, extends, and sharpens theory
	Search evidence for the 'why' behind relationships	Builds internal validity
Enfolding literature	Comparison with conflicting literature	Builds internal validity, raises theoretical level, and sharpens construct definitions
	Comparison with similar literature	Sharpens generalisability, improves construct definition, and raises theoretical level
Reaching closure	Theoretical saturation when possible	Ends process when improvement becomes marginal

Not everyone agrees with her point of view. Dyer and Wilkins (1991: 615) comment that "Although such studies can provide certain flashes of insight and can raise important issues and questions, they tend to neglect the more tacit and less obvious aspects of the setting under investigation. They are more likely to provide a rather distorted picture, or no picture at all, of the underlying dynamics of the case." In line with this search for dynamics and tacitness, Dyer and Wilkins (1991) also dispute Eisenhardt's (1989) use of a thoroughly structured approach, claiming that

better stories are needed instead of better constructs. In a response, Eisenhardt (1991: 626) comments that such open-structured case studies often also apply a rigorous construct and "employ the comparative multiple-case logic of replication and extension to develop theoretical insight." I concur with Eisenhardt's arguments on the need to apply sufficient rigour in the methodological approach, although the explorative quality of this research imposes limits. Aiming for the middle ground between a structured and an open approach thus seems the most appropriate position for this research.

Given the focus of this research on an interpretative paradigm, not all the steps in the process outlined in table 5.4 can be completely followed. For instance, 'shaping hypotheses' and methodological triangulation (qualitative and quantitative approaches) aimed at generalisation are not key issues in this research, as emphasis is on gaining an insight into the organisation of POEM within the local context of the case study firms. This process, however, can guide the process of connecting case study findings to theory development. Eisenhardt (1989: 536) also notes: "it is impossible to achieve this ideal of a clean theoretical slate. Nonetheless, attempting to approach this ideal is important because preordained theoretical perspectives or propositions may bias and limit the findings." As Nijhof (1999) noted, instead of hypotheses, sensitising insights could be drawn from the case study findings. Such insights will encompass the salient characteristics of the case studies. In his research, he defines sensitising insights as empirically observed patterns that form the basis for insights gained from the case studies. In the discussions on the case study findings in the next chapter, such insights are presented as points of interest.

5.6 The case studies for this research

After the extensive discussion of the motivations for applying a case study strategy in order to develop theory, the application of these general remarks to my research is now made. In this section attention is given to the selection of case studies (sampling), and the ways in which access was obtained. The data collection process is then discussed, followed by the process of analysing the case studies and reporting. The individual case study characteristics are discussed only briefly here. In the next chapter an overview of each case is presented, indicating their distinct features.

5.6.1 Sampling and gaining access

When conducting case studies in order to develop theory, cases have to be selected. "Sampling is crucial for later analysis. As much as you might want to, you cannot study everyone everywhere doing everything" (Miles & Huberman, 1994: 27). Many different types of sampling strategies have been proposed (e.g., Bernard, 1988; Miles & Huberman, 1994; Yin, 1994), both within and across cases. As Miles and Huberman (1994) note, within-case sampling concerns decisions on which activities,

processes, events, times, locations, and role partners to sample. They also note that such sampling must be theoretically driven, and that it has an iterative quality. This is discussed in the section on analysis and reporting. Across-case sampling concerns the selection of appropriate cases. Often a further distinction is made between two types of sampling: statistical and theoretical. In statistical sampling "Samples are used to estimate the true values, or parameters, of statistics in a population, and to do so with a calculable probability of error" (Bernard, 1988: 79, bold removed). Such sampling is particularly useful in theory testing and quantitative methodology. Theoretical sampling can be defined as "sampling on the basis of concepts that have proven theoretical relevance to the evolving theory" (Strauss & Corbin, 1990: 176). In such sampling "cases may be chosen to replicate previous cases or extend emergent theory, or they may be chosen to fill theoretical categories and provide examples of polar types" (Eisenhardt, 1989: 537). In my study, cases were selected using theoretically driven sampling, although existing personal contacts and networks also played a role in selecting the cases and gaining access. Information gathered from discussions with many different people[83], and from scientific and professional publications, was also important in getting a good insight into the activities regarding POEM of a potential case study firm. In addition to the fact that a selected firm had to develop and make *products*, given the focus on POEM, hence excluding service providers, several further sampling criteria were identified.

Two criteria are indicated directly by the research question. This research focuses on *large* and *proactive* firms engaging actively in product-oriented environmental management. Large firms have been selected because in such firms a stronger diversity of functions and departments often can be found, and this could facilitate the study of the interactions between such different functions and departments concerning POEM. This is useful for obtaining an insight into the way people deal with the organisation of POEM. The case companies also had to have a proactive attitude towards POEM. Essentially, proactivity means having an active approach to environmental management that goes beyond environmental regulation. The case study firms all had to engage actively in organisational measures directly related to aspects of POEM. Size and proactivity were thus important initial criteria.

The cases were selected from two different *types of industry*: the chemical industry and the electronics and electrical industry since, in both industries, initiatives concerning POEM were under development. In the chemical industry, Product Stewardship has been developed as part of the Responsible Care Program, while product takeback has gained importance in the electronics and electrical industries. Two cases, DSM Powder Coating Resins and DSM Structural Resins, were conducted in the chemical industry, where the approach to POEM-related issues tends to be rather centralised through the guidance of industrial associations. Although differences in the ways individual firms address the Responsible Care Program are reported (Howard et al., 1999), it was decided to expand the industry

[83] Next to the five case study firms discussed extensively in this thesis, many representatives from different firms and further stakeholders have been interviewed to gain a further insight in the issues relevant to individual firms working on the organisation of POEM.

focus beyond the chemical industry. The 3M case spans both industries, as this company produces both chemical and electronic products, alongside many other products. The other two cases, Xerox Europe and IBM, were selected from the electronics and electrical industries as many product-related environmental efforts were being made in these industries, partly due to pending regulations on product takeback.

In relation to the previous point, the *position* of the case study firms *in the product life cycle* formed an additional criterion. Although developments in the Netherlands in terms of POEM were taken as a point of departure in this research, the case studies were not limited to Dutch firms. The product life cycle is important in POEM, and firms in different countries often influence a product's environmental characteristics. Therefore, the case study firm's nationality was not considered a decisive factor, but rather its position in the life cycle, since this is likely to affect a firm's opportunities to influence the product life cycle. The two firms in the chemical industry produce intermediary products that form a resource for other products (resins, for instance, are an important ingredient of paints). The electronics and electrical companies on the other hand produce end products for the consumer and business-to-business markets. Although the focus in this research is on a firm's individual organisational responses to POEM, by choosing cases from these two industries, some of the effects of a firm's position in the product chain on its possibilities of organising for POEM may also be captured. In addition, both these industries have received significant attention in the literature, including with respect to product-oriented environmental management (e.g., Cramer, 1998b; Howard et al., 1999; Kärnä, 1999; Maslennikova & Foley, 2000). This availability of additional information provides further possibilities for the use of multiple sources.

Related to the sampling process, and recognising the fact that differences among the cases exist, some general remarks should be made about the way access to the case study firms was gained. Access was gained through contacts and orientating interviews, which lead to the identification of key people, within each firm, regarding the organisation of POEM. Through these people access was gained and maintained. As Hartley (1994: 217) indicated: "Gaining access is one thing but maintaining it requires continual attention. (…) access has to be worked for. Regular reporting back and discussion with the principal sponsor in the organization can be useful." To emphasise the importance of these issues, the way access was obtained in each case is presented in the next chapter.

5.6.2 Data collection

To collect data for the case studies, various methods were applied but interviews were a central element. After contacts were established within a firm with a key person in the organisation of POEM, the case study procedure was usually fine-tuned in consultation with this person. Generally, together, a list of possible interviewees was drawn up, focussing on both the aims of the research and the case specifics. This selection of interviewees was later confirmed through cross-referencing when

interviewees were asked who else should be interviewed on this issue[84]. Interviewees were selected on the basis of their direct or indirect involvement with POEM. Most of the interviewees were in senior or middle management positions (e.g., product manager, R&D manager, or managing director).

Semistructured interviews formed a core element of the data collection process. Such interviewing "has much of the freewheeling quality of unstructured interviewing, and requires all the same skills, but semistructured interviewing is based on the use of an interview guide. This is a written list of questions and topics that need to be covered in a particular order. The interviewer still maintains discretion to follow leads, but the interview guide is a set of clear instructions" (Bernard, 1988: 204-205, bold removed). An example of an interview guide, as used in this research, is included in appendix B. The research process has already been characterised as a parallel iterative process and the schematic research overview (figure 1.1) also indicates that the initial cases are partially intended to nurture the research frameworks. During the research, the interview guide was thus modified slightly to include topics that emerged during the first case studies, and to adjust to the change of scope in moving from the chemical to the electronics and electrical industry. Although these interview guides all had the same central themes, minor adjustments were occasionally made to capture the details of individual case studies, and to a lesser degree each interviewee[85]. The interview guide in the appendix is a generalised version. Most interviews typically lasted 1 to 1,5 hours, with exceptional ones lasting up to 3 hours. Some interviews were recorded on tape. All interviews were transcribed and sent to the interviewees to allow verification. This provided a check on the validity of the results.

The information gathered from an organisation consisted not only of the transcribed interviews, written documentation such as annual reviews, product information brochures, public presentation material and sometimes internal

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[84] Mostly, this cross-referencing confirmed the correctness of the selection of interviewees made beforehand, and provided an additional check on validity. Occasionally a new potential interviewee was identified, who then could be approached. As Miles and Huberman (1994: 27) note: "Samples in qualitative studies are usually not wholly prespecified, but can evolve once fieldwork begins. Initial choices of informants lead you to similar and different ones; observing one class of events invites comparison with another; and understanding one key relationship in the setting reveals facets to be studied in others. This is conceptually-driven sequential sampling." These views accurately describe the process of sampling in this research and the evolving composition of the interview guidelines.

[85] An interview with a managing director was thus 'flavoured' more towards strategic issues and processes, and less towards specific elements of the manufacturing processes which could be elaborated upon in interviews with people in manufacturing. Not only in interview questions did some variety exist but, in the semi-structured setting, respondents were also given room to tell their stories. "Allowing interviewees to digress usually results in useful information" (Simon et al., 1996: 37). Also "Semi-structured interviewing works well in projects in which you are dealing with managers (…) - people who are accustomed to efficient use of their time. It demonstrates that you are fully in control of what you *want* from an interview but leaves both you and your informant free to follow new leads. It shows that you are prepared and competent but that you are not trying to exercise excessive control over the informant" (Bernard, 1988: 205).

documents were also obtained. Additional documentation was gathered from the scientific and professional press, and through the Internet. Guided tours or video presentations were occasionally conducted. This entire set of data collected provided the input for the analyses, both within the cases and across the cases.

5.6.3 Analysis and reporting

Miles and Huberman (1994), and others, have developed and gathered an extended collection of methods and techniques for analysing qualitative data, and drawing valid meanings from such data. In the next chapter further comments are made on the analytical methods applied in this research. Here a brief overview is presented.

Analyses can be made on individual cases (within-case analysis) and across different cases (cross-case analysis). In within-case analyses "the overall idea is to become intimately familiar with each case as a stand-alone entity. This process allows the unique patterns of each case to emerge before investigators push to generalize patterns across cases" (Eisenhardt, 1989). In this research most cases were analysed and reported upon individually[86]. A draft report was sent to the contact person in the firm for verification. After feedback on the draft report was received, a final version of the report was sent to the firm. In some cases this final report was distributed to all interviewees, in others only the people most directly involved in POEM received a copy. This was determined in consultation with the contact person. The reports were built up analogously to the interview guides: first a general overview of the case study firm, followed by an indication of the products involved in the case study. Then attention focussed on (product-oriented) environmental management and the role of the different interviewees. Finally, my interpretation of the findings was presented. In the next chapter, these elements are dealt with on a case by case basis.

The cases can be divided into two types: 'full' case studies and 'mini-cases', where these latter cases are not as extended as the full cases. In the three full case studies (DSM 1, DSM 2 and Xerox), around ten interviews were conducted for each case and considerable time was spent within the firms. Attention in these cases focussed on the entire organisation of POEM within the studied firm. In the other two case studies (IBM and 3M), the number of interviewees was about five, and the cases were conducted in a relatively short time. In these case study firms, attention was given to one specific organisational initiative regarding POEM. Each case delivered a wealth of information concerning POEM. In two of the full case studies (DSM 1 and Xerox), the preliminary findings were explained in a presentation to the respective firm. The resulting issues discussed, and the responses to the presentation, formed yet another input to the research, and to the individual case analyses as

[86] In the DSM cases, the reports were written in the form of conference papers (de Bakker et al., 1999a, 1999b). Draft versions of these papers were sent to the company contact persons for verification. In the Xerox and IBM cases, reports were written in which the cases were analysed individually. These reports were sent to the firms for verification and their reactions.

discussed in chapter 6. The other full case study (DSM 2) came to a premature closure, limiting the options for verifying the findings.

Building on the findings of the individual case studies, the cross-case analysis seeks some more general concepts. The relationships with the theoretical framework are critically examined and salient points of attention are highlighted. Two important reasons for performing cross-case analyses are enhancing generalisability and deepening understanding and explanation (Miles & Huberman, 1994). Yin's (1994) replication strategy already gave one approach for cross-case analysis. According to Eisenhardt (1989: 541), the idea behind cross-case analysis "is to force investigators to go beyond initial impressions, especially through the use of structured and diverse lenses on the data." In the next chapter such cross-case analyses are presented.

This research has had a parallel-iterative character. Analyses were not only conducted after all the data had been collected, but also during the data collection process. In this way, small adjustments could be made, for instance because of an improved understanding of processes within the company. Miles and Huberman (1994: 50) "strongly recommend early analysis. It helps the field-worker cycle back and forth between thinking about the existing data and generating strategies for collecting new, often better data. It can be a healthy corrective for built-in blind spots. It makes analysis an ongoing, lively enterprise that contributes to the energizing process of fieldwork." In using the case study findings in conference papers, at a relatively early stage, close connections to theory had to be sought. The insights gained from that, and the comments received during the subsequent presentations were helpful in the following case studies. This all concurs with Eisenhardt's (1989: 546) remarks that "The process of building theory from case study research is a strikingly iterative one. While an investigator may focus on one part of the process at a time, the process itself involves constant iteration backward and forward between steps."

5.7 Concluding remarks

In this chapter, on methodological considerations, some final points still need to be made. Although much attention has been given to the choices made during this research and their justification, it is important to note that these are my *choices*. The same topic could well have been approached from a different angle. As Eisenhardt (1989: 540) notes: "there are probably as many approaches as researchers." Given the multiple alternative approaches, the advice of de Leeuw (1996) to 'work neatly' is timely. In this chapter, I have attempted to provide a thorough account of the choices and considerations I made in developing this research. Firstly, the research was to be focussed on the interpretations and perceptions of managerial decision-makers in the studied firms. Therefore, an interpretative paradigm was selected as the most appropriate point of departure. Then, a qualitative research methodology was selected to enable a better understanding of the organisational processes regarding POEM within the local context of the firms to be gained. Case studies

were a suitable research strategy as they allow the study of a contemporary phenomenon within its local context, while considering a broad range of factors. A case study strategy that is structured in such a way that sufficient flexibility is guaranteed is beneficial in studying an issue undergoing development such as the organisation of POEM within firms. Such an approach can deliver both theoretical and practical insights.

Finally, concerning the aspiration to contribute to theory development, it is important to note that in such a developmental process not only do contributions to 'grand theory' count[87], but intermediary products in the process of developing theory are also important (Weick, 1995; Schuring, 1997). In line with Nijhof (1999), in the attempt to contribute to theory development, the relevant sensitising insights gained from the case studies are noted in the following chapter. In the final chapter these insights are confronted with the theoretical frameworks. By doing this, the possible contributions of this research to theory development are made explicit.

[87] Sutton and Staw (1995: 378) advocate such a position, indicating that "Strong theory, in our view, delves into underlying processes so as to understand the systematic reasons for a particular occurrence or nonoccurence." Here, in accordance with Schuring (1997), a more modest contribution is seen as potentially relevant.

6.

Case Studies

"With theory-driven empirical research, theories are viewed essentially as 'work-in-progress.' They are constantly being refined and changed with features being added and dropped as the researcher interacts with the empirical data. The result of this ongoing interaction is an 'improved' theory. It is this theory that the researcher then shares with the practitioner."

(Melnyk & Handfield, 1998: 312)

6.1 Introduction

"Multiple cases are extraordinarily helpful in both generating explanations, and testing them systematically. In a real sense, they are our best resource for advancing our theories about the way the world works" (Miles & Huberman, 1994: 207). The case studies presented in this chapter seek to gain a better insight into the organisation of POEM within selected, large, proactive firms. This insight is sought by the application of theoretical frameworks, which have been developed on the basis of three theoretical areas: a resource-based view and a capability perspective, a stakeholder approach, and total quality management and continuous improvement. The theoretical frameworks, the POEM matrix, and the capability cycle, are applied. The five case studies consist of three 'full' case studies and two 'mini-cases'. As noted in the previous chapter, in the full case studies, attention focuses on the entire organisation of POEM within the studied firm, while in the mini-cases attention is given to a specific organisational initiative regarding POEM.

In the next five sections, the individual case studies are presented in a consistent way. Each case study analysis starts with an overview of the general characteristics of the case investigated, followed by information about the firm and its products, to illustrate the main activities and settings of the investigated firm, and to place the case study in perspective. The central part of these sections deals with the entire organisation of POEM within the case study firm, or, in the mini-cases, with one organisational initiative. Then the case analysis is presented, focussed on the elements of the POEM matrix. This matrix also guided the preparation of the questionnaire used (see appendix A). In the first case study analysis, the elements of the matrix are discussed extensively, to illustrate its applicability. In the other cases the analyses are conducted at a more aggregated level, highlighting the three central theoretical areas which have also been included in the core of the POEM matrix. All five sections conclude with an overview of points of interest, formulated in terms of the theoretical frameworks. Following this, a cross-case analysis is presented - a consideration of the insights gained from the different cases to search for significant elements. The points of interest play an important role and the empirical findings are related to the theoretical frameworks. In the final section concluding remarks on the empirical research are made.

Before the case studies are discussed, it is important to note that in addition to these cases, other firms, with a variety of backgrounds, working on product-oriented environmental issues were contacted. These contacts form an additional point of reference, but are not discussed here as they have not been a systematic part of the empirical research. Furthermore, not all the case studies have been identical, as attention was focussed on the investigated firms' specific organisational situations. The distinction between full and mini cases also highlights this. This is in line with the capability perspective, which also considers such differences between cases. In spite of these differences, the five cases together can deliver an insight into the organisation of POEM within large firms, that are working proactively on this concept. The case studies come from two different types of industry and from different positions in the product chain. It should be noted that these case studies

consider the situation within the firms at one moment in time, they are not based on a longitudinal study. The analyses therefore do not necessarily represent the current situation in these firms.

6.2 Product Stewardship at DSM Powder Coating Resins

The first full case study was conducted within the chemical industry, and closely related to the second. At the time of these case studies, two different business units within DSM Resins were developing and implementing ideas to organise Product Stewardship (PS), one of the elements of the chemical industry's Responsible Care Program[88]. PS is comparable to POEM and therefore it is useful to consider this concept in this research. The first case was conducted at the Coating Resins business unit, where the process of organising PS had already been set in motion. In terms of the capability-building process, the implementation stage could thus be studied during this case study. The second case study was still in the concept development stage, as attention was focussed on the initial development of POEM. This second case study is discussed in the next section. As both cases are closely related, it is worthwhile to compare them. In section 6.3.4 some initial comparisons are made, while a more detailed cross-case analysis, covering all five case studies, is presented in section 6.7.

I was referred to this case through DSM's Corporate Environmental Management. The technology manager of the business unit guided the process of organising PS within this business unit and acted as the key sponsor of the case study. With the assistance of this manager, 11 people were selected for interviews, based on their direct involvement with, or responsibility for, PS. Nearly all of them were in managerial positions, and were well acquainted with the firm. The interviews were transcribed and returned to the interviewees for verification. In addition, several documents were studied, a company tour was conducted and considerable time was spent at the business unit's headquarters to get a deeper understanding of the company. A presentation of the case study findings was given to the team responsible for organising PS. This case has been further analysed in two conference papers (de Bakker et al., 1999a, 1999b). Draft versions of the papers were sent to the key sponsor and to the product manager for verification. These papers form an important input to this section. Key characteristics of the case study are presented in table 6.1. In the following subsections, attention is given to the general characteristics of the firm and its products, followed by a discussion of the organisational implications of PS within the firm. The fourth subsection contains an

[88] This voluntary industry initiative was described briefly in section 2.4.2. and in Appendix A. In the Netherlands, a study by the consultancy firm KPMG (1997) indicated the close similarities between POEM and PS. The Association of Dutch Chemical Industry (VNCI) also treats the concepts as similar (VNCI, 1998). For further information about PS, see Simmons and Wynne (1993), or Howard et al., (1999).

extensive analysis, based on the POEM matrix, while the section concludes with some further points of interest from this case study.

Table 6.1 *Characteristics of the DSM Powder Coating Resins case*

Company	DSM
Specific part of the company	DSM Resins - Powder Coating Resins
Type of industry	Chemical industry
First access to case study firm	DSM Corporate Environmental Management
Key sponsor	Business Unit Technology Manager
Time of the case study	1998-1999; overlapping with the DSM Structural Resins case
Number of interviewees	11
Selection of interviewees	Direct involvement with / responsibility for Product Stewardship
Verification of results	Interview transcriptions sent to interviewees for verification Presentation to the team responsible for the product market combination (pmc) studied Research papers sent to key sponsor for verification
Additional information sources	Annual reports, company tour, internal documents, promotional materials, Internet, trade press, frequent visits

6.2.1 DSM Resins - a brief background

The first two case studies were conducted, in 1998 and 1999, at one of the business groups of DSM, which presents itself as a highly integrated chemicals and materials group of companies that is active worldwide[89]. This Dutch group currently has annual sales of EUR 6.3 billion and employs about 22,000 people at more than 200 sites worldwide. The DSM group focuses on advanced chemical and biotechnological products, and on performance materials, aiming for global leadership.

At the time of the case study, DSM consisted of 13 business groups. One of these groups, DSM Resins, specialised in the development, manufacturing and sales of structural resins, moulding compounds, coating resins and resins for optical fibres[90]. DSM Resins had three business units: Coating Resins, Industrial Resins and Compounds (IRC), and Radcure Products. Coating Resins produced resins for coating systems, IRC for industrial products and Radcure for optical glass fibres, as

[89] The description of the first two cases is partly based on the DSM website (http://www.dsm.nl) as visited in December 2000 and additional information sources as noted in table 6.1.

[90] By now, DSM Resins has been split up in two different business groups: DSM Coating Resins and DSM Composite Resins. As this happened after the case studies had been completed, no further attention is paid to this fact.

used in telecommunications. The entire business group had a workforce of about 1800 people, generating NLG 1.5 billion in sales in 1997.

DSM Resins was geographically dispersed, with production plants located across Europe, the US and Asia, and sales offices in many parts of the world. At its headquarters in the Netherlands, the business group management, most of the business units' management, and a technical centre were located. This was the main location for this case study, supplemented with one of the production facilities. In this case study, attention focussed on one part of the product-market combination[91] (pmc) Powder Coating Resins. This pmc was part of the Coating Resins business unit. The other two pmcs in this unit were 'Can and Coil' and 'Decorative'.

6.2.2 Powder Coating Resins

The primary functions of coatings are to protect and to decorate surfaces. According to Misev (1991: 362) "The major driving forces in the development of industrial coatings come from the market requirements combined with environmental compliances." As regulatory pressures increased on solvent-based paints, alternatives such as water-borne coatings and powder coating resins were developed. Over recent decades, powder coatings have competed successfully on price with solvent and water-borne coatings. At the time of the case study, the powder coating market was a growth market. The demand for powder coatings worldwide had increased from less than 260 kilotonnes in 1989 to 450 kilotonnes in 1996 (Howard, 1998). In the 1990s, the annual growth rate of powder coatings is however slowing, as the maximum substitution levels for conventional coatings seem to be being approached (Misev & van der Linde, 1998). Resins are an important element of powder coatings, which usually also contain a cross linker[92], pigments and several additives (Overeem et al., 1999). The pmc studied produces such resins.

To improve co-operation between the different functions such as product development, manufacturing and marketing, the Coating Resins business unit created 'operational teams' (OTs). These OTs included functional representatives from research and development (R&D), marketing and sales, purchasing, manufacturing and logistics, and controlling. They bore profit and loss responsibility, and were meant to improve market-orientation, while focussing on short to mid-term operational decisions. The idea behind this organisational structure was to transfer operational responsibilities to a lower level in the organisation, and closer to the market. It also was expected that, in this way, communication between the various disciplines would improve (both faster and better), while team member commitment would grow.

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91 A product-market can be defined "as the *set of products* judged to be substitutes, within those usage situations in which similar patterns of benefits are sought, and the *customers* for whom such usages are relevant" (Day et al., 1979: 10, italics in original).

92 A cross linker is an ingredient of coatings, which links all the ingredients together into a coating. As Misev (1991: 108) notes, cross linkers "exert an influence on the production, storage, application and exploitation properties of the coatings."

The OT was considered an appropriate level within the business unit at which to organise PS. The Powder Coating Resins pmc served as a pilot project within the firm to gain experience with the concept of PS. This pmc has a strong market position, is a world leader in these resins and aims for further growth. The OT studied is focussed on the European market and many of its customers are relatively large firms. The pmc traditionally has a strong technological position, based on a thorough knowledge of the polymer chemistry involved. R&D activities are hence considered to be an important capability. This strong technological orientation provides another reason for installing the OT structure: to develop a stronger market-orientation. To emphasise this, the product manager (a marketing function) serves as team manager.

According to the interviewees, in this growing technological market, the main product demands are quality and consistency, delivery time, and cost. the quality and price of the powder coating resins are seen as strong points of the product. A third strength is the worldwide availability of the product through the large sales structure. The environmental characteristics of powder coatings are another strong point[93], as discussed further in the next section. Delivery reliability however needs improvement. Also, the fact that not every substrate can be treated with powder coatings should be seen as an opportunity, as suggested in the literature (Misev & van der Linde, 1998).

6.2.3 Organising Product Stewardship at Powder Coating Resins

In this section, the process of organising PS at Powder Coating Resins is described, based on the case study findings. An analysis in terms of the POEM matrix follows in the next subsection. Various reasons for engaging in PS were identified during this case study. The involvement of DSM with the European Chemical Industry Council (CEFIC) sped up the process by creating senior management commitment. Member organisations of the CEFIC were stimulated to actively take part in the Responsible Care Program. As DSM wanted to present itself as a responsible firm, its business groups were encouraged to participate. DSM Resins volunteered to carry out a pilot study and suggested the Powder Coating Resins pmc. This was a relatively transparent pmc, operating in a growth market and therefore of strategic importance to the business group. PS also fitted with the customer structure of this pmc, as many of its larger customers were also CEFIC members. They were involved in Responsible Care too, making discussions of these matters along the chain easier.

[93] The importance of the environmental characteristics of powder coatings is often emphasised in the literature (e.g., Misev & van der Linde, 1998; Overeem et al., 1999). For instance, according to Misev (1991: 362), "The major driving forces in the development of industrial coatings come from the market requirements combined with environmental compliances." In addition to their solvent-free basis, powder coatings are highly efficient in use, generating little waste. A possible environmental problem of powder coatings could be the use of one type of cross linker, TGIC (triglycidyl isocyanurate), for which environmental and health risks have been reported (Misev & van der Linde, 1998; Overeem et al., 1999).

Other reasons for this pmc engaging in PS included getting acquainted with the concept, being proactive, and obtaining a potential competitive advantage by performing well on product-oriented environmental issues. Some of the interviewees stressed their own moral considerations, indicating that they would not like to work for a firm that acted irresponsibly towards the environment. This reflects the influence of managerial decision-makers and of ethical deliberations as advocated in chapter 4.

The DSM group developed centrally a corporate methodology for organising PS, proposing to form 'PS teams' consisting of representatives from the various functional areas. At Powder Coating Resins, responsibility for PS was given to the OT. The team manager co-operated with the technology manager of the business group to develop a PS approach for his team, that followed the corporate methodology. Through workshops with team members and the environmental manager, a set of PS projects was defined. Communication and risk management were seen as key issues, while internal practices concerning environmental management were regarded as relatively well understood. Nearly all of the projects, therefore, were externally oriented, mainly targetting customers and suppliers. Most team members were assigned a project, and deadlines were determined. Projects were selected because they fitted with current expertise. In terms of the organisation of PS, most interviewees considered that sufficient knowledge was available. However, at the time of the case study, there was little experience with PS. The concept should get clearer, more tangible. Additional expertise would be acquired if necessary, for instance on life cycle assessments. The type of resins this pmc produces, and the markets, already had a good environmental reputation, which was used as a competitive selling point.

After the business group management had approved this approach, the PS process got halted for a short period due to personnel changes. The project was restarted, partly with new people. This case study took place while initial experiences with the selected approach were assessed within the firm. Senior management was involved in PS in several ways. They initiated the project by proposing this specific OT as a pilot study for the DSM Group. Also, an OT reports through its team manager to the business unit management on its daily activities. Management approval of new plans, including PS ones, is needed for the OT to proceed. Furthermore, a platform has been established which assesses on Safety, Health, Environment and Quality (SHEQ) issues on a regular basis. This platform consists of business unit and business group senior management and the business unit SHEQ managers. Moreover, many of the people directly involved in the process of organising PS were themselves in a management position, so managerial involvement was clearly present.

On the whole, interviewees were reasonably well aware of PS and its main characteristics. A chain perspective, pro-activity and taking responsibility were often mentioned during interviews. Some stressed that many of the activities now termed PS were, in fact, already taking place beforehand. The idea that PS should be seen more as a process than as a one-off project was recognised by most people. A strong senior management commitment however was felt to be helpful in this. Most

interviewees felt they had an influence on the PS project. According to the interviewees, the added value of PS could be in making better choices, working on the right issues, and possibly delivering a competitive advantage.

Environmental issues, in general, are important to the OT's customers as the environmental characteristics of powder coatings are one of their major selling points. PS as such however is not yet considered as very relevant to customers, although environmental issues are increasingly seen as a competitive factor. On these issues, there is no real co-operation with competitors, although regular contacts do exist, for instance, through industry associations such as CEFIC. On further stakeholder interests there was less unanimity among interviewees. This again highlights the fact that, in identifying stakeholder interests, the interviewees' own perceptions are important. Opinions on the relative importance of different interests vary among interviewees. Similarly, different views exist on the business unit's abilities to influence its chain partners. In general, there was little active exchange of information with suppliers and customers on PS related issues. Stakeholders such as local communities, shareholders, and governments were not involved in the firm's environmental management on a pro-active basis. Information is, for instance, provided through corporate Environmental Health and Safety reports.

In discussing stimuli and barriers to engaging in PS, a distinction was made between internal and external stimuli. As important *internal stimuli*, the guidelines of the DSM group and the business group itself were mentioned, as these demand responsible work on safety, health and environmental issues. Also mentioned were gaining a better insight into the products and processes, and generating possible cost reductions. PS was also seen as a tool for good chain management. The main *external stimuli* indicated were the image of DSM and the entire chemical industry, and the CEFIC membership which provided peer pressure. Increasing market demands and further stakeholder demands were also mentioned. The main *barriers* mentioned were costs (economic barriers), time (balancing priorities) and limited understanding of the topic. Some people also saw company culture as a possible barrier since decisions are made but often superseded quickly by new ones or not followed through completely for various reasons. These company dynamics might hinder giving priority to organising PS. Yet, asked for a prediction, most interviewees expected the importance of PS to increase. It offered a better insight into the product life cycle and supply chain, and could result in improved consciousness within the entire chain. Some interviewees stressed the ongoing and incremental character of PS, and expected little change from the present situation. They regard PS rather as a gradual process of continuous improvement.

6.2.4 Applying the POEM matrix – a case analysis

The POEM matrix consists of four quadrants and a core, together addressing a variety of related elements relevant to the organisation of POEM. To demonstrate the applicability of this matrix, in this section, the case study findings are analysed in detail per quadrant. For clarity, the elements in the matrix are italicised. The

discussion of these four quadrants leads up to discussing the core elements of the matrix.

Regarding **system-technical, operational** elements, various *management systems* are in place at this business unit. The production facility visited is ISO 14001 certified. Alongside such certification, risk management is central in the corporate safety and environmental management system, although this had not yet been fully 'translated' into procedures for application to products. Further, DSM has corporate requirements that all of its business groups have to live up to. *Data management* is the task of a separate unit within DSM Resins which monitors all regulations regarding the business group's products. Reviewing product data management is one of the projects addressed as part of PS. Another system-technical element concerns vendor rating on safety, health and environment *performance*. By using such criteria in purchasing decisions, the environmental performance of products over their life cycle could improve. Finally, *budgeting* is relevant at this level because the OT has profit responsibility, and PS expenditures must be funded out of present budgets. Some interviewees pointed at possible cost reductions that PS might generate, such as "not wasting time and money by working on the wrong issues" or sub-optimisation in the chain. Such expectations help justify the allocation of additional budgets to PS.

An important feature in this case study with regard to **social-dynamic operational** elements is the parallel between the PS organisation, and the organisational structure. PS teams did not have to be created, since the OT already was responsible for operational decisions concerning the product. Product-oriented environmental issues thus fitted in with the team's activities. The team structure enabled *communication* and *teamwork* concerning PS. It was explicitly decided not to appoint one single 'Product Steward', as that would place responsibility for PS on one person's shoulders. However, in organising PS, the OT manager plays an important role. This manager has to keep the issue on the team agenda, and also serves as a link to higher management. Co-operation with the environmental manager can result in an extra feedback loop to senior management through the platform on safety, health, environment and quality. This again can improve senior management's understanding of, and support for, PS. The technology manager of the business group provides additional support, but PS primarily remains a task for the OT. *Motivation* for, and *commitment* to, PS appear to be present, although for a range of reasons. Some interviewees stressed the increasing transparency of the chain, while others focussed on the firm's environmental performance. A demand for continuing, demonstrated, commitment from higher management was also expressed during the case study. At the time, the focus in *training* was mainly on health and safety issues. Ideas to provide environmental training were also being developed, as part of maintaining the ISO 14001 certification.

In the **social-dynamic strategic** quadrant of the matrix, '*transformational' leadership* is included. Interviewees considered that demonstrated support by senior management to be important for the organisation of PS. For senior managers to demonstrate such support, they had to be convinced of the contents, and usefulness, of PS. System-technical elements, such as performance measurement and strategic

orientation can assist in this. The active involvement of DSM senior management in CEFIC, through the chairman of the board, and the subsequent demand that all business groups engage in PS, can be seen as elements of transformational leadership. This ensured some peer pressure to organise PS, both within DSM (between business groups) and beyond the company (between competitors). Business unit senior management frames the problem, evaluates proposals from the OT, and influences which interests are addressed. Senior management also guides the implementation stage, as the OT requires management approval for their plans and budgets. Management support is also needed to spread the insights gained across the business unit, by allocating resources, by keeping PS on the agenda, and addressing the subject informally. *Shared norms and values* regarding environmental issues were observed. Most interviewees believe that, in a market leadership position, acting responsibly with regard to the environment is important. In this respect, they often refer to company culture. Some interviewees also pointed to their own norms and values towards the environment. The creation of OTs can also be regarded as an act of *employee empowerment*, making those who are closest to the product responsible for its performance. Most people interviewed considered themselves to have an influence on the further success of PS. Regarding *partnerships* and *chain management* ideas were being developed. As the powder coating resins market is highly competitive, and small differences in cost structures are important, it appeared to be difficult to get much data on a chain partner's environmental characteristics. Suppliers, for instance, were afraid that such information would give an insight into their cost structures. The business unit was reluctant to push too hard as they did not want to end up with too few suppliers, as that might force them into an unfavourable cost position. Communication and trust are important. This also applies to the relationship with customers and to inform them about PS, sales people will need PS training. Overall, there are many contacts with chain partners, but environmental issues were not yet regularly discussed[94].

The elements in the **system-technical strategic** quadrant of the matrix clearly demonstrate a coherence with the other quadrants. For example, *vertical deployment* relates to leadership, commitment and empowerment, formally bringing the firm's strategy into effective action. The OT structure was rather new, and seemed to be appropriate for improving market orientation. At the same time, it promised to be a good carrier to introduce and implement PS. The facts that people often change positions, and that the business unit frequently changes its organisational structure, make a good transfer of knowledge necessary. Having the knowledge spread across a team makes the process less vulnerable, thus improving its continuity. A formal *division of tasks* between different organisational levels can also be conducive, such as is achieved by the presence of a data management department. In this case study, *planning and strategic orientation* were addressed in a broad sense. The business unit strategy was defined quite clearly, including reference to 'sustainable

[94] This is in contrast with safety issues, that are discussed regularly, and for which the required capabilities have already been developed. Safety has a relatively high priority throughout chemical industry.

technology', although PS as such is not included. However, most interviewees expected PS to increase in significance, provided that other issues did not surpass it. The fact that it was intended that all of the company's business groups would implement PS was seen as an extra motivator. Alongside social-dynamic partnerships, more formalised system-technical structures to deal with different stakeholders could be identified under the label *formal interface management*. In addressing environmental issues that can affect the entire industry, such as environmental regulations, industrial platforms and associations play a role. CEFIC and the Association of Dutch Chemical Industry (VNCI) promote Responsible Care and PS. Most members of such associations have their own codes of conduct regarding these programmes, which could lower the barriers to discussions on related issues with customers, suppliers and competitors. However, as such issues could be rather sensitive, it might be easier to discuss them at a platform level than at a bilateral firm level. Such platforms are also important lobbying organisations, often playing an active role in both formal and informal interface management.

The elements at the **core of the matrix** affect all of the four quadrants discussed earlier, and deal with the heart of this research. In terms of the *capability-building* process, this case study can be considered as relating to the implementation stage. Plans, concerning products' environmental characteristics, and aimed at different stakeholders, had been developed and set in motion. To address aspects of PS, several capabilities were identified as important, such as getting a better insight into the environmental characteristics of one's own products, better grasping the concept of PS, and integrating PS considerations in the firm's operations and strategy. The role of managers, as balancers of stakeholder interests, and as decision-makers in the capability-building process, was also emphasised. Managers thus are important in framing the relevant aspects of PS, and in providing support. To get them to endorse the further implementation of this concept throughout the firm, a good interplay between the quadrants of the matrix is necessary.

With a *stakeholder orientation* the emphasis is on communication. From a capability-building process viewpoint, having a clear view of the available and required knowledge is important in problem framing. A more open approach towards the 'general public', neighbours, and interest groups, ties in with the PS approach where communication is a key issue, alongside actually improving the performance on products' environmental, health and safety aspects. Communication and stakeholder involvement can assist in melding the quadrants and the core of the matrix together. An example is partnership building, increasing mutual dependence among different stakeholders. Building trust and developing shared norms are then important, which can also be considered as organisational capabilities.

Finally, *continuous improvement* indicates that PS should be regarded as a process, in which firms need to build and maintain organisational capabilities in a continuous effort. In this study, a threat to the organisation of PS is the danger of process discontinuity, which fits with barriers such as time and money. Another threat is losing the strategic perspective of PS, viewing it too much as an operational issue. A tight coupling between operational and strategic activities, and between those carrying these out, is needed. People such as OT managers, technology

managers and environmental managers can serve as intermediaries between different managerial levels. In the longer term, PS should also focus on internal issues, for example through the inclusion of a PS paragraph in new project descriptions, referring to product development, manufacturing and handling. Furthermore, in a setting where people often change roles, ensuring that such a process can continue, even if an important actor 'disappears', the need for co-operation is highlighted. Giving a team responsibility can spread insights and create better support, while senior management must also guard process continuity.

6.2.5 Points of interest

Several interesting points were uncovered in this case study that are considered to be relevant to the study of the organisational aspects of POEM, which, here, has been addressed as PS. Firstly, using a cross-functional team structure, which is in close touch with the market and the different functional representatives involved, can create a solid basis for PS. Care should be taken to preserve continuity, and to obtain and maintain support from senior management. Although a team structure seems favourable for both the organisation of PS, and for contacts between production and market, it could lead to conflicts. Disagreements could arise over the team's scope, or over which decisions should be left to higher management. Clearly establishing tasks and responsibilities is important.

Secondly, in developing and maintaining the capabilities to organise PS in a continuous effort, balancing external and internal integration (concept development and implementation) is important. Actively searching for interfaces with suppliers, customers, and other stakeholders, can improve external support. This might require additional skills, training, commitment and mutual trust (social-dynamic elements), supported by management systems and reporting structures (system-technical elements). Potentially, PS might create stronger bonds between the firm and its stakeholders, and could thus lead to a competitive advantage over competitors without such bonds.

Finally, balancing short and longer term projects could increase the motivation to work on PS. If there are no short term results, the project could loose its momentum. The scope of the projects selected by this OT therefore varied, and all of them were given a realistic deadline. Some 'quick wins' were included. Related to motivation are issues of responsibility. PS is a challenging issue, needing continuous, integrated attention. Managerial decision-makers need to play an important role, taking responsibility both in a business sense and in a moral sense. Interviewees' references to their own moral norms illustrate this, supporting the presumption that legitimisation is an important element in this process of environmental capability-building. An ultimate consequence of such a stance might be to decide to no longer serve certain customers, because of their weak environmental performance. More likely, however, would be to offer such customers assistance in POEM, for instance through technical service support. This again links to strengthening the bonds between a firm and its customers, illustrating the chain perspective.

6.3 Product Stewardship at DSM Structural Resins

The second case study was carried out within another business unit of DSM Resins. This case concerned the Structural Resins pmc, which was part of the Industrial Resins and Compounds business unit. The two case studies at DSM Resins were initiated at the same time and overlapped to an extent. Although the products involved had clear similarities, this case study was more complex than the first one, and only concerned the initiation of the organisation process of PS. These differences make it a valuable addition to the first case study.

In the second case, the business unit technology transfer manager was assigned the task of initiating and guiding the process of organising PS within his business unit, Industrial Resins and Compounds. He acted as the key sponsor of this case study and assisted in selecting 11 interviewees in management functions. They were selected on the basis of their involvement with, or responsibility for, PS within the pmc. Interviews were transcribed and returned to the interviewees for verification. Afterwards, this case was briefly analysed and reported in a conference paper (de Bakker, 1999b), a draft of which was sent to the key sponsor for verification. Case study characteristics are presented in table 6.2. As this case study originates from the same company and business group as the first one, for an overview of DSM Resins on can refer back to section 6.2.1. In the next subsection, attention is given to this specific pmc and its products, and the organisational implications of PS within the firm are discussed. The third subsection contains an analysis, focussed on core elements of the POEM matrix, while learning points from this case study conclude this section.

Table 6.2 *Characteristics of the DSM Structural Resins case study*

Company	DSM
Specific part of the company	DSM Resins - Structural Resins
Type of company	Chemical industry
First access to case study firm	DSM Corporate Environmental Management
Key sponsor	Business Unit Technology Transfer Manager
Time of the case study	1998 - 1999 (overlapping with DSM Powder Coating Resins case)
Number of interviewees	11
Selection of interviewees	Direct involvement with / responsibility for Product Stewardship
Verification of results	• Interview transcriptions sent to interviewees for verification ▪ Research paper sent to key informant for verification
Additional information sources	Annual reports, company tour, internal documents, promotional materials, Internet

6.3.1 Structural Resins

This section provides an overview of the Structural Resins product-market combination (pmc) and its products. This pmc was part of the Industrial Resins and Compounds business unit, which produced resins for industrial applications. The Structural Resins pmc developed, produced and sold unsaturated polyester resins that as in glass fibre-reinforced composites. the other pmcs in this business unit were Sizings and Binders, Gelcoats, Compounds, and Distribution. The latter three pmcs are examples of vertical integration in practice; Structural Resins sold resins to Compounds and to Distribution. The case study was conducted at the business unit's headquarters in the Netherlands.

In general, the Industrial Resins and Compounds business unit was organised in a different way to Coating Resins. Structural Resins was a large pmc, which was divided into four sub-pmcs, that dealt with different market segments in terms of types of activities and products, and the sizes of customers varied. Marketing activities were clustered centrally around these sub-pmcs, while sales and technical service were organised more regionally. The organisational structure was thus rather functional. The business unit was geographically spread, which was also reflected in its organisational structure and culture.

Most products of the Structural Resins pmc were in a mature market phase, where acquisitions and mergers were important growth mechanisms for firms. The business unit had recently been involved in a number of acquisitions and a merger, leading to several organisational changes. Hence, at the time of the case study, its strategy was not aimed at pursuing further growth, but rather at embedding these changes. Structural Resins is a European market leader, manufacturing and selling a mix of commodity-type and speciality products. Its sub-pmcs have been established to improve the firm's market-orientation. New ways of distinguishing the products from those of competitors have to be found, for example by adding more value in logistics or service, or by improvements through PS. As important product characteristics; quality (both performance and consistency), cost price, services, delivery time and 'fitness for use' were identified by interviewees. In addition, environmental properties could be considered as elements of quality. A threat might come from competing materials.

Among the important trends as indicated by the interviewees were environmental issues. In this pmc, the use of styrene is an important issue, as health concerns have been raised about this solvent. As regulatory pressures to reduce styrene exposure levels build up, alternatives are increasingly being investigated. DSM Resins has developed INSERT resins, that is INtrinsic Styrene Emission Reduction Technology. These give a 35% reduction in styrene emissions compared to standard low styrene emitting resins, though at a higher cost. Another trend, related to the maturity of the market in which this pmc operates, is the changing composition of that market. the number and size of competitors are changing, and a drive towards globalisation is anticipated. Related to this, further cost reductions and larger scale production are also mentioned as trends.

An operational team structure, as in the previous case, was not present in this pmc. However, there was much communication, both through formalised meeting structures and, when required, on an ad hoc basis, to deal with projects or acute problems. The organisational structure of this business unit made it more difficult to establish an OT-like structure, as different parts of the business unit worked on different product aspects. The central product managers of sub-pmcs, for instance, had to deal with sales managers for a country or region. This business unit's customers were also rather diverse in terms of size and technological position. Ideas to move towards a more OT-like structure, however, were being developed, although such a structure might look different to that at Coating Resins, given the differences between the two business units and their markets.

As strong points of the pmc, interviewees mentioned a good knowledge of the technology, such as strengths in R&D (chemistry) and in technical service (customer support). Structural Resins had strategic partnerships with other companies, which allowed them access to a valuable pool of knowledge, for instance on technology and manufacturing. For a long time technology had driven innovations in the development of new products and applications. Increasingly, the pmc was becoming more market driven, reflecting the mature market state. Perceived market (customer) needs were increasingly guiding the developments, resulting, for instance, in different technology concepts. An entrepreneurial spirit and a good knowledge of the markets were mentioned as other strengths. On the other hand, logistics and marketing needed improving, according to the interviewees. The fact that restructuring following the merger needed to embed further could be seen as a challenge, although 'functional' thinking and bureaucracy could prove to be a hindrance to that process.

6.3.2 Organising Product Stewardship at Structural Resins

Several reasons for engaging in PS were put forward in the interviews. The involvement of DSM with CEFIC was mentioned, together with the role of DSM senior management, and the corporate support for this issue. It was also argued that this pmc was already engaged in many activities that could be seen as elements of PS, even before this concept had been launched within the company. Examples included the development of the INSERT resins, looking for ways to recycle products, and the product information provided to customers through material safety data sheets. Applying the corporate PS methodology might reveal additional points for attention. Further reasons given in the interviews were; being proactive, a general tendency of firms to take a broader responsibility for their activities, and anticipating new product demands, for instance from regulators regarding solvent emission levels. PS might also be a way of distinguishing a firm from its competitors, which is important in a mature market. Hence, the added value of PS could be in gaining a better knowledge of one's own products, improving customer relationships and, in a wider sense, the image of the pmc and the chemical industry as a whole. Some interviewees indicated that added value might also come from demonstrating (social) responsibility and possibly from cost reductions.

Most interviewees were aware of PS and its main features. Paying attention to environmental, health and safety issues during the entire product life cycle was often mentioned, along with taking responsibility. Points for attention could be transport and packaging, and informing customers and the wider company surroundings. Co-operating with customers, helping them to solve their problems with the pmc's products, and with safely applying these products were regarded important. Here again the issue of styrene emissions is relevant, as these emissions mainly occur during the use of the resins. Trying to reduce such emissions is also important for the entire chemical industry, since the styrene issue could form a threat to its long time survival[95]. Views on the relevance of PS to customers varied though, and was dependant on the size of the customers. Most of the interviewees felt that they had an influence on the PS project, which they often described as stimulating or facilitating, allocating resources, or bringing in ideas. They thought that sufficient knowledge was available, but that PS was also a matter of raising awareness.

Management support for PS, at the time of the case study, was provided in several ways. Resources were allocated, and management had assigned the task of initiating the PS process to the business unit technology transfer manager. Management would have to approve of the PS approach developed within the business unit. A related role for management was to agree upon priorities between the different projects proposed, and to convince and stimulate people to participate in these projects. As this business unit was also involved in the business group's safety, health, environment and quality (SHEQ) platform, further feedback on environmental issues to management was provided. In terms of PS, links with management systems such as ISO 14001 and further reporting systems on SHEQ had not yet been established, although all the production facilities were expected to become ISO 14001 certified within a few years.

With chain partners, some information was exchanged, though not often specifically on PS related issues. In general, regular contacts with customers occurred, for instance through product management, sales and technical service, and material safety data sheets were provided with the products. Contacts with suppliers also were available. Through industrial sector projects, industrial contacts were maintained on relevant issues. Most interviewees felt that their pmc did have an influence on its chain partners because the firm was an important player in the market. On the supplier side, this influence depended on which supplies were involved. In some raw materials markets, other industries purchased larger volumes, and thus had more influence. Several further stakeholders were mentioned: some interviewees highlighted the role of governments, others indicated the important position of industrial associations such as CEFIC. In addition, local communities were mentioned as stakeholders, as were contacts with the firm's surroundings in a broader sense.

[95] CEFIC has a polyester sector group in which DSM Resins is involved. This group deals with a range of issues across their industrial sector and issues guidelines for the distribution of styrene. Further information can be obtained through the CEFIC website (http://www.cefic.be).

Important *internal stimuli* for engaging in PS were the corporate policies of DSM and the business group. Also, getting a better insight into one's own products, generating possible cost reductions, and demonstrating one's role as a responsible player in the market were mentioned. The main *external stimuli* identified by the interviewees were market pressure due to increasing environmental awareness, governmental and societal pressure, the image of DSM and of the entire chemical industry, and CEFIC membership which provided peer pressure. The main *barriers* were costs (allocating resources; investment), time (balancing priorities), and limited acquaintance with the topic, or sometimes even ignorance. Some people also saw the firm's culture as a possible barrier, while others pointed to the maturity of the industry and its low profitability. Asked for a prediction, opinions and expectations of most interviewees concerning PS were mixed. PS was under development and although positively valued by most interviewees, it still had to prove itself, and had to compete with other relevant topics for attention and resources. Translating the concept into tangible actions and projects would be a next step. To maintain support, some progression would have to be evident in these projects. Finally, PS should be integrated within regular business activities, and communication on this issue should improve.

A mixed impression emerged over the remainder of this case study. In spite of the positive interview results, establishing PS within this pmc appeared to be rather complicated. At the time of the case study, the scope of the project was yet to be defined. In this process, the business unit's technology transfer manager acted as a facilitator, while the corporate PS methodology and experiences at Coating Resins provided guidance to this process. In several workshop sessions, functional representatives of different sub-pmcs and further related functions, such as R&D, purchasing, technical service, logistics, and manufacturing, gathered to define specific PS projects for each pmc. It was expected that this approach might lead to new ideas for addressing PS within the pmc. However, differing opinions on the relevance of PS existed among workshop participants, making its formulation and eventual implementation more difficult. Several proposals for PS projects were formulated, and a small group of participants would discuss the different options. In a subsequent workshop, the most suitable projects would then be selected. However, due to shifts in priorities within the business unit, and new restructurings, PS activities were postponed until after a strategy development process was completed. The PS project was thus halted and extended beyond the time schedule of my research. Therefore, this case study resulted in only a partial overview of the project definition stage, and the initial expectations of several key players at various managerial levels. In terms of the capability-building process, this case study involves the problem framing or concept development phase. Thus, it forms a valuable contribution to this research. In the next section, a brief analysis of the interview results is presented, based on the three core elements of the POEM matrix.

6.3.3 Applying the POEM matrix – a case analysis

In this section, the analysis of the second case study is presented. Instead of focussing on the entire set of elements of the POEM matrix, only the core elements of that matrix are used as ordering concepts, as these three elements are directly linked to the theoretical areas applied in this research. The different quadrants of the matrix, however, do provide support in discussing these core elements, and are addressed implicitly in this section. Grasping the concept of PS, and identifying relevant stakeholders, were some of the central elements in this case study.

At the time of the case study at Structural Resins, the PS process was in a start-up phase, focussed on conceptualising the issues involved, and convincing representatives from different functional areas of the relevance of PS. In terms of the *capability-building* process, issues needed to be framed, projects had to be defined and agreed upon before solutions could be implemented. As the processes of concept development and PS initialisation PS were postponed within the pmc, it is almost impossible to identify the relevant capabilities developed or applied. Only the initial opinions of the interviewees could be determined, as no actual projects had been set in motion at the time of the case study. A primary concern at this pmc would thus be to conceptualise projects in such a way that sufficient support for PS could be created, and then transformed into actual implementation of projects. At Structural Resins, the main concern was thus to get the PS capability-building process started.

Opinions on the importance and influence of different *stakeholders*, as well as views on DSM Resins' abilities to influence its chain partners, varied strongly among the interviewees. This illustrates that in determining stakeholder interests perceptions are important. Some information on PS related issues was exchanged with suppliers and customers. The importance of environmental issues to the customers of this pmc varied. Products' environmental characteristics were more important to customers, where strong governmental regulations applied. Such regulations could place Structural Resins in a twofold position: on the one hand the company was involved in voluntary agreements such as the industrial PS code, and therefore mostly in favour of such agreements; while, on the other hand, stronger regulations could improve market opportunities for their alternative products, such as INSERT resins, as customers might be forced to meet more stringent emission standards. In the longer run, the solvent issue was regarded as a serious threat to their industry. Although this issue was discussed at an industry level, differences existed throughout the chain in firms' attitudes towards such topics[96]. Co-operation with competitors on environmental issues was limited, with each firm developing its own way of dealing with PS. With chain partners, some information was exchanged, although not often specifically on PS related issues. Overall, stakeholder involvement at this pmc could be characterised as modest.

Based on the interviews, and given the fact that this pmc was in the concept development stage of the capability-building process, it is hard to address *continuous*

[96] The size of competitors and customers could influence their involvement in PS-related issues.

improvement (CI). Yet, most interviewees expected PS to increase in importance, and some stressed its ongoing character. They regarded the organisation of PS as a process of gradual, continuous improvement: a process of continuously reassessing the firm's capability-base while continuing its day-to-day operational activities. One aspect of CI that was mentioned was helping customers to handle the products in a better way, and providing relevant environmental information to customers and other stakeholders, such as transport companies involved in shipping the products. Another related aspect is in the organisation of PS itself, which should result in a recurrent process of formulating projects, executing them, and reporting the results. This resembles the capability cycle, as discussed in the previous chapter. In addition, incorporating PS into existing managerial systems, which would also require reporting structures and active managerial involvement, could secure process continuity and managerial involvement. Stakeholder pressures are regarded as influential on the firm's engagement in this topic, even though the actual stakeholder involvement is limited. This again demonstrates the coherence of the three central elements of the POEM matrix.

6.3.4 Points of interest

In the process of capability-building, this second investigation concerned the concept development phase. This is in contrast with the first case study at Powder Coating Resins which concerned the implementation phase. Both cases' activities were in intermediate products (resins), both had large market shares and strong market positions, and both were working on improving their market orientation. Both pmcs also had a strong technological position. Structural Resins, for instance, had strategic knowledge partnerships, while both pmcs had a long-standing tradition of R&D, which provided a strong capability. Differences between the cases included the market state (growth vs. maturity), market composition, and the organisational structures of the business unit. These differences are likely to affect the opportunities a pmc has in organising PS. Given the close similarities between the two cases, it is interesting to compare the observations from this case study with those from the first. A more extensive cross-case analysis is discussed in section 6.7, covering all five case studies.

Firstly, expecting to gain a form of competitive advantage appeared to be a motive for engaging in product stewardship in both case studies. The advantage could be in strengthening bonds with customers or in getting a better knowledge of one's own products and processes. A related motive concerns the image of the company as, by developing its own approach to PS, the company could present itself as a responsible player in its market. This fits in with the RBV and the capability perspective, as these theories emphasise the role of firm-specific organisational resources and capabilities in determining a firm's competitive position.

Secondly, a need for cross-functional co-operation was demonstrated in both cases, and differences in such co-operation appeared to affect the organisation of PS. Lack of a single team that was fully responsible for a certain product, or pmc,

seemed to make it more difficult at Structural Resins to involve representatives from different functions in PS. Most people had their own functional areas for which they bore responsibility, and not everyone was convinced of the need to participate proactively in PS. However, most of the interviewees did acknowledge the concept. The absence of a product team at Structural Resins, such as the OT at Powder Coating Resins, also implied the lack of a team manager. The business unit technology manager and the environmental manager together initiated the organisation of PS. Having someone with an overview of all product-related aspects, and with sufficient authority among the team members involved, could further facilitate PS organisation. This could also provide an additional link with senior management. Such findings suggest the relevance of having PS organised by a team with representatives from different functions, and which is sufficiently embedded in the firm's organisational structure.

Finally, to maintain such organisational processes, it is important to have sufficient support from management. Making PS part of review structures and managerial systems could assist, as could providing clear managerial directions and vision (leadership). Many interviewees pointed out the role of the chairman of the board of the DSM group. The acknowledgement of a need for a firm to act responsibly within society could thus provide support to the further organisation of PS. As one interviewee indicated, it is important not to treat PS and related issues as a threat, since this would force the company into a defensive position. Rather, seeing PS as part of the correct way of doing business could provide support for team members in working on this issue. Paying attention to the different elements of the POEM matrix could then be helpful. Determining projects, executing them, and communicating the results to the stakeholders that are perceived to be relevant could assure continuous attention to products' environmental characteristics, as is also suggested by the capability cycle.

6.4 Product-Oriented Environmental Management at Xerox Europe

The first two case studies were conducted in the chemical industry. To include another industry that is actively involved in POEM, the third full case study focussed on organisational aspects of POEM at Xerox Europe, a company in the electrical and electronics industry. At this company, environmental management increasingly seems to be focussed outwards, looking at ways to further involve suppliers in environmental management, and to help customers with environmental issues. This case study, conducted in 2000, considered organisational aspects of POEM within Xerox, the way capabilities to organise POEM were developed and maintained within this company, and the way different stakeholders were involved in this process.

The initial contacts were made through Xerox' environmental management in the Netherlands. An environmental researcher at Xerox Europe in the UK acted as the key sponsor of the case study. Nine people have been interviewed at different

Xerox facilities in the UK and in the Netherlands. Together with the key sponsor, these people were selected for their direct involvement with product-oriented environmental issues, ranging from remanufacturing and asset recovery to marketing, environmental management, and product management. Most of them had been working at Xerox for a considerable time, had been active in different functions, and were currently in a managerial position. They could thus give good insights into POEM at Xerox. Interviews were supplemented by document studies. Case study findings were presented to the people directly involved in environmental management. A case study report and a summary of the presentation were sent to all interviewees to enable verification and feedback. Table 6.3 presents the key features of this case study. In the following subsections, attention is paid to general characteristics of the company and its products, followed by a discussion of the organisational implications of POEM. The fourth subsection provides a case analysis, while the section concludes with several important points uncovered.

Table 6.3 *Characteristics of Xerox Europe case study*

Company	Xerox Corporation
Specific part of the company	Xerox Europe
Type of company	Electronics and Electrical Industry
First access to case study firm	Xerox Environmental Manager
Key sponsor	Environmental researcher
Time of the case study	2000
Number of interviewees	9
Selection criteria for interviewees	Direct involvement with / responsibility for product-oriented environmental management issues
Verification of interview results	• Interview transcriptions sent to interviewees for verification • Presentation to those directly responsible for environmental issues (summary sent to all interviewees)
Additional information sources	Annual reports, internal documents, company video (environmental), promotional materials, Internet, scientific literature and trade press

6.4.1 Xerox Europe – a brief background

Xerox Europe manufactures and sells document processing products and services throughout Europe, Asia and Africa, generating around £3.5 billion in annual revenues[97]. At the time of the case study, Xerox Europe employed about 20,000

[97] Part of the information presented here is based on the Xerox website (http://www.xerox.com) as visited in December 2000, supplemented with additional information sources (Xerox, 1999, 2000), as also shown in table 6.3. Due to current restructurings, these figures will have changed.

people in 36 countries. The company is part of the U.S. based Xerox Corporation, which had an annual revenue of over $19 billion and employed over 90,000 people in 1999 (Xerox, 2000). Xerox is transforming from a copier company into a document company, aiming to provide solutions and services to its customers. These solutions involve the integration of equipment and software for management practices into complete management systems. "The Xerox Corporation is […] moving away from the image of manufacturer and seller toward that of a provider of document services across all aspects of document-life-cycle-management, from creation and manipulation to distribution, printing and storage" (Maslennikova & Foley, 2000: 226)[98]. At the time of the case study, the company was involved in a large restructuring process to realign its business, and to focus more on market and customer requirements. These restructuring operations addressed both system-technical and social-dynamic aspects, as styles of management and ways of working were also taken into account. Important trends for Xerox were the change towards providing solutions, the move towards digital and multifunctional products, and an increasing use of colour in documents, which also had implications for the company's asset recovery operations. The increasing importance of partnering, and of Xerox' brand image, were other trends identified in the interviews.

The development and production of documents, building on its technical competencies in engineering and materials design, software skills, manufacturing, sales and servicing was considered to be a key strength of the company. The 'solutions' approach was regarded as another strength, as was the firm's position in knowledge management and its strong involvement in R&D. Xerox also had a good knowledge of its industry, and was involved in many networks and partnerships. According to some interviewees, the company had an ability to change and evolve with changing markets. Other strong points, mentioned in the interviews, were the presence of many procedures and processes, and Xerox' quality management philosophy. 'People' were also mentioned as a strength, given the company's focus on teamwork and employee motivation.

As weaknesses of the company, the speed of resolving problems, the speed of responding to internal changes and to market changes, and the speed of taking products to market, were mentioned, as was the cost base. Some interviewees observed that the 'Time to Market process' (TTM), used in product development, tended to be rather autocratic, and slowed things down. Finally, some interviewees indicated that Xerox could sell itself more on its financial and environmental achievements on POEM, and that the company could be more 'aggressive' towards its competitors.

At the time of the case study, company culture within Xerox was described as progressive and forward-looking: there was a broad orientation and a certain ambitiousness. 'Xeroids' set themselves demanding tasks and requirements, and were concerned with how the company presented itself. Self-assessment and

[98] This reference is a paper by two Xerox Europe employees, published in a special issue of the management journal *Interfaces*.

benchmarking, maintaining internal quality standards and a tendency towards constructive rivalry between similar functions were mentioned in the interviews. Furthermore, the firm was striving for high levels of empowerment, enabling people to directly take initiatives themselves. However, the firm's culture was also challenged by the changes and restructurings, becoming more results-driven and less focussed on teamwork.

6.4.2 Xerox products

Xerox is in a highly competitive industry that is constantly changing, and so the company has to retain sufficient flexibility. Major product characteristics, indicated in the interviews, are technological advancement and high quality levels. The nature of Xerox' markets is close links with customers. Improving customers' perceptions of the company and its products has been an important reason for implementing forms of product stewardship, covering all stages of a product's life cycle (Maslennikova & Foley, 2000).

Several product strengths, as noted by interviewees, are their functionality and the shift towards digital products, Xerox' asset management operations, the broad product range, the stability and longevity of the firm, the worldwide service coverage and the total satisfaction guarantee[99]. Resource-wise, product upgradability is seen as important as it enables the adding of features and software to a product, rather than changing the entire machine, hence reducing waste. Using new software, the diagnosis and sometimes even the upgrading of products can be done remotely, saving on transport and increasing service. Product reliability, ease of use and longevity were also mentioned as product strengths.

Weaknesses of the products, as indicated in the interviews, were the expensive cost base and the fact that digital technology is not always very user-friendly. Displays, for instance, can be too complicated. Another weakness could be the 'solutions software' that the company was providing to its customers which could be improved. Xerox was working on this together with its vendors.

Major product demands, as determined by customers, include; cost price, reliability, service quality and supplies provision, and, especially for digital machines, functionality. Interviewees indicated that in product demands, acceptable quality was a given, costs, and availability of the latest features were essentials. Chemical emissions and effects, safety, and an awareness of environmental concerns could be important additional demands. Within Xerox, the main product demands were summarised as 3R+V: Reliability, Relationship, Responsiveness and Value. The drivers of innovation varied in the different market segments, so less unanimity among interviewees was visible here. Yet, both the pursuit of technological advances, and the development of market needs, were consistently mentioned.

[99] This is a three-year guarantee on products containing reprocessed parts, the same length as the guarantee given on new equipment (Maslennikova & Foley, 2000).

6.4.3 Product-Oriented Environmental Management at Xerox

Xerox has a long-standing tradition in environmental management, dating back to the early 1960s when recovery, reuse and recycling programmes were initiated (McIntyre et al., 1998). End-of-life product take-back and quality management have been influential in shaping Xerox' product-oriented environmental management, resulting in attention to both Design for Environment (DfE), and waste minimisation and remanufacturing. Various reasons for starting with POEM were identified in the interviews, ranging from customer and legislative pressures and brand image, to employee satisfaction, motivation and empowerment. POEM also fits in well with Xerox' quality management concept, as embodied in the Xerox Management Model (XMM), "a methodology used to deploy Xerox' vision, goals and objectives, and to manage the business" (Witcher & Butterworth, 1999: 329). There also was a tendency for environmental management systems (EMS) to be implemented by quality groups within the company, with the support of environmental groups. Certification of EMSs at major manufacturing sites and operations, for instance through ISO 14001 or the Eco Management and Audit Scheme (EMAS), was targetted. These EMSs could be an additional marketing point, according to some interviewees.

Within the company, environmental issues were seen as an important part of doing business. In the XMM, environmental and social responsibilities were part of the 'Management Leadership' section. The company had an 'Environmental Leadership Program', in which waste minimisation was a central issue. Active management support for POEM-like initiatives was partly created through dialogues with senior management. Management had to show approval of proactivity and commitment, and demonstrate leadership over environmental management. Compliance and cost avoidance were often important to management. That management ratios and POEM performance measurement could be developed further, in order to get environmental issues more into the management's perspective, was proposed by some interviewees.

POEM also influences product design and development, so by defining requirements, understanding risk management, and getting such information across to the product development function, the Environment, Health and Safety department (EHS) could stimulate attention to POEM-related issues. Customers could also be made more aware of the environmental benefits of Xerox' products, while in 'operating review meetings' environmental aspects were addressed. Meanwhile, raising environmental issues through corporate EHS could further integrate environmental affairs into corporate strategy-making processes.

Furthermore, from an environmental point of view, Xerox' main products are pieces of electrical equipment, but these concern materials such as paper and toner. Due to the transition towards digital products[100], colour printing and networks; light

[100] In digital photocopying "the image is electronically scanned and stored in memory prior to printing. This means that numerous prints can be made from one scan, as compared to

lens copiers are in a declining market stage. More of such hardware returns to the company than is sent out, while at the same time Xerox has to maintain its service obligations for these products. Remanufacturing and asset recovery have historically enabled Xerox to remain competitive and to save money, building on the lease-tradition in its business. This requires effective return processes[101]. As Kerr and Ryan (2001) note, remanufacturing has helped Xerox to enhance its image as an environmentally conscious company, while the integration of remanufacturing into the overall business strategy has been essential to its success. Developments in new digital technology promise options for paper and energy savings, upgradability and remote diagnosis, but experience in remanufacturing and recycling with these rapidly changing digital product families, needs further development.

Most interviewees believed that there was enough knowledge within the company to organise POEM, although doubts existed whether there was sufficient time and interest in the issue. Several environmental network structures were in place, in which employees from different Xerox Europe facilities were involved. These networks were intended to provide a platform to disseminate relevant information, forming a competence group on environmental issues. Most interviewees were involved in such a network, although they were not working full-time on environmental issues. Regarding their own role, interviewees used qualifications such as facilitating, informing and 'being aware and making aware'. Other roles indicated were identifying prospective areas, and helping to shape and prioritise legislation.

POEM could act as a product differentiator. The concept fitted well with Xerox' code of ethics and corporate culture, and asset recovery was also financially important to Xerox. Also mentioned as added value of the concept were; POEM could support the company's brand image, help meet competitive pressures and consumer demands, address employee contentment and satisfaction, legislative reasons, increased efficiency, and decreasing energy use and emissions. POEM is seen as an opportunity to reduce costs, for instance by eliminating redundant activities. Environmental issues can be regarded as a competitive factor since customers required their suppliers to have an EMS, and such issues were increasingly incorporated in bids and tenders. Some interviewees did not think that these issues were real competitive factors as yet, core environmental problems were not always properly understood, and customers in general were motivated more by acute problems than by long-term environmental responsibility. Overall, interviewees regarded POEM as an important concept for their business and for customers, and that it should be a framework, a set of tools, that leaves room for different approaches and solutions. As one interviewee noted, POEM had to be seen as a process. A pragmatic approach was considered helpful, since POEM could

analogue photocopiers where the image is rescanned for every copy. This makes digital copying faster and more efficient, reducing the amount of residual toner and the need to continuously charge and discharge different surfaces" (Kerr & Ryan, 2001: 77).

[101] This not only applies to entire products but to supplies as well, such as copy and print cartridges and toner containers, as new developments also enable toner remanufacturing.

succeed through cost reduction in service, cost avoidance for customers, and recycling. The concept is increasingly important, but can only develop through people understanding and accepting the issue as another way of doing things. Communication, knowledge and awareness were regarded as crucial elements. On environmental issues, communication was pursued through different strategies such as environmental reporting, lecturing, workshops, and staff structure meetings, and also through partnerships, knowledge sharing and excursions. Some co-operation with competitors took place through industrial associations.

Concerning stimuli and barriers, some interviewees indicated that many issues cut across both these dimensions. Important *external stimuli* identified were customer and industry requirements, and legislative drivers. Environmental issues were among the conditions for doing business in a global marketplace, and Xerox uses a single set of compliance criteria worldwide. Marketing opportunities and technology trends were other stimuli. Relevant, both internally and externally, is Xerox' brand image. The main *internal stimuli* were a commitment to environmental initiatives, company culture, employee satisfaction and motivation, and marketing and sales' recognition of POEM as a relevant issue. POEM was also linked to Xerox' customer orientation, and fitted in with corporate environmental policy and strategy. Further, the company's drive to succeed was noted, as environmental activities were associated with financial goals such as saving money and being more efficient, both to Xerox and its customers, and with feeling responsible. Cost reductions, by reducing energy use, materials and resources, were other important internal stimuli. A *barrier* to organising POEM was the lack of understanding in the financial communities, as it was difficult to translate environmental issues into value. Other barriers were the difficulty of organising a coherent environmental policy across very diverse functional backgrounds, the inability to deal with a conceptual entity such as POEM, and legal requirements[102]. Company size, structure and speed could be barriers, as could the current restructurings. People sometimes used their workload as an excuse for giving environmental issues a low priority. Some interviewees indicated that Xerox' processes could impede POEM, pointing at their autocratic tendency, while others viewed these processes rather as a stimulus. Finally, a barrier could be customers' perception of remanufactured products as being inferior products.

6.4.4 A brief case study analysis

In the previous subsection, the organisation of POEM at Xerox Europe has been described. In this section, the case study findings are analysed, focussing on the core

[102] One legal barrier was legislation on transboundary transportation of take-back products, as laws usually consider this as waste transport, hence requiring specific permits. For Xerox, these products are collections of reusable parts, hence representing value. In the following two cases, similar problems are encountered and discussed.

elements of the POEM matrix, as this enables the findings to be related to the theoretical frameworks selected.

During the interviews, many *capabilities* that are considered necessary to organise POEM were indicated, ranging from senior management commitment to provide drive and impetus, to having recognised environmental champions in key areas. In addition, a committed workforce, a clear set of standards, best practices and processes, and a clearly defined and communicated position on environmental issues were regarded as important. A dedicated group on EHS issues was considered useful to keep track of relevant changes, to gather knowledge of relevant legislation across the world, and to consider the entire product life cycle. Communication from cradle to grave is needed, including participation at the front end during the design stage, having good customer feedback, and an ability to tackle forthcoming issues in advance. An environmental network could play a role in this. Furthermore, monitoring developments in technology and legislation, being able to influence the supply chain, and having a good infrastructure were regarded as important capabilities.

As POEM focuses on products across their entire life cycle, it is important to consider interactions within the product chain where different *stakeholder interests* are involved. Knowledge, for instance, was exchanged with both suppliers and customers, and Xerox was in a position to influence its chain partners on environmental issues. POEM provided an imperative to talk to suppliers about modifications of supplies, and to establish partnerships with suppliers. At the time of the case study, Xerox did not require its suppliers to have ISO 14001 certification, as that was regarded too restrictive. Instead, requirements and certification processes tended to be tailored to each situation, partly to allow time for implementation at the supplier level. Being a supplier to customers itself, Xerox regularly felt similar pressures. particularly challenging in this respect were original equipment manufacturers (OEMs)[103], because Xerox bears the responsibility for end-of-life recycling or disposal of OEM products, even though the company does not manufacture these themselves. Xerox was also motivated to exchange knowledge with its customers, because the ‘use phase’ of its products was a large contributor to their environmental impact. The XMM focussed strongly on customers. Helping customers in their environmental, health and safety efforts was considered to be a logical consequence of that model. Customers valued and accepted such guidance. Xerox also provided environmental and safety information in its product manuals. Furthermore, the company discussed environmental matters with a broader range of stakeholders, including governments, competitors, non-governmental organisations (NGOs), local communities and academics. On product-related issues, contacts with industrial partners were sought, for example on the European Union decision-making process regarding the directive on Waste Electrical and Electronic Equipment (WEEE). Such industrial coalitions were often quite successful in influencing legislation. There also were relationships with NGOs, and with the local

[103] Such OEMs produce equipment that is used in Xerox products, or sold as a Xerox product.

communities surrounding Xerox' facilities[104], and academic projects are regularly sponsored. Xerox' environmental reports and brochures were seen as important in maintaining contacts with stakeholders and in sharing information.

According to its corporate environmental policy, Xerox is dedicated to *continuous improvement* (CI) in its performance in terms of the environment, health and safety. Learning how to manage the environmental characteristics of its products is an important element of this. CI regarding POEM could be enhanced through the environmental network's target monitoring, both of its own targets and corporate targets such as energy savings. Targeting, measuring and reporting could be achieved by making environmental issues part of the overall management assessments. According to the interviewees there were no quick fixes to environmental issues, these take sustained commitment, effort and time. Empowerment and more formal procedures, targets, expectations and legal requirements were regarded as important in supporting these processes. Sufficient feedback of information between different functions, such as from remanufacturing to design, was seen as necessary. Some interviewees commented that, to maintain continuity, the staff members involved in such environmental activities should be people who saw a long-term career in this field. Interviewees expected POEM to be increasingly regarded as a competitive and marketable issue, since customers were getting more aware of environmental issues. More coherence in POEM was expected to arise if Xerox could have a sensible dialogue with all its stakeholders on what the essential elements of the concept are. Better communication was thus important. Interviewees thought Xerox could work on this issue by improving the availability of information, and by presenting it in a coherent way. Some expected Xerox to increasingly focus on product remanufacturing and reclaim. Choices of materials and the determination of life cycles would then be an essential influence.

6.4.5 Points of interest

The main points drawn from this case study at Xerox Europe can be summarised as balancing system-technical and social-dynamic elements. Many factors play a role in determining a product's environmental characteristics, and many different functions are affected, both within the firm and along the product chain. This requires the presence of structures and systems to guide the different activities. Within Xerox, a variety of processes and instruments, such as TTM and XMM, guide the operational and strategic implications of, for example, product development and quality management. Many further organisational arrangements for POEM are in place, such as environmental networks and product take-back structures.

In addition to these system-technical elements, balancing social-dynamic processes is also necessary. In these, the role of managers especially is relevant. One

[104] Regarding NGOs, Xerox co-operated with Friends of the Earth on an 'EcoSpace audit' (Buitenkamp et al., 1999). Examples of local community initiatives include supporting environmental awards for schools and establishing Green Business Clubs.

barrier identified in this respect was whether people had sufficient time for, or interest in, POEM. Henriques and Sadorsky (1999: 97) note that if a firm "wishes to make environmental issues a priority, it may want to hire managers who react positively to stakeholders who represent the values the company wants to espouse." If POEM is to be advanced, such managers have to be developed. Raising managers' awareness of their specific role in the process of building capabilities regarding POEM, and further stakeholder-related issues, seems to be a fruitful approach. Developing a better insight into POEM, for instance through performance measurement, could contribute to a higher awareness. To work on these social-dynamic processes, a committed workforce is needed. This takes time, effort and leadership, which are important challenges for a company when restructuring towards market and customer requirements. Most interviewees acknowledged a need to work on POEM, and could thus contribute to meeting this challenge, both on their own, through their managerial functions, and in mutual co-operation.

A related point involves several challenges to the organisation of POEM, such as recognising employees' skills and capabilities, including environmental issues in performance measurement, being aware of management's role, enhancing further cross-sharing and communication, and improving the implementation of POEM in a continuous effort. Required capabilities have to be formulated, as well as ways to monitor the company's performance. Efforts on POEM must be made more visible, both internally and externally (financial markets, customers, employees, other stakeholders), and sufficient flexibility has to be maintained to be able to react to changes in relevant stakeholders' opinions. Attention therefore must be given to the strongly intertwined issues of structures, processes and flexibility. Expectations on the development of POEM have hence emphasised a need for more communication, and more coherence in balancing the activities.

6.5 Environmentally Conscious Products at IBM

In this section, attention is given to an organisational initiative that concerned POEM at International Business Machines Corporation[105] (IBM). IBM is a large corporation, engaged in the creation, development and manufacture of advanced information technologies, including computer systems, software, networking systems, storage devices and microelectronics. As with the other case study firms, IBM has demonstrated a proactive approach towards environmental issues.

This case study consisted of interviews with representatives of IBM's Engineering Center for Environmentally Conscious Products (ECECP) in the US, plus a further interview with an IBM environmental manager in the Netherlands. The

[105] At the request of IBM, the following statement is included: "IBM has not reviewed or attested to the accuracy of the information." As in all five case studies, the interpretations of the case study are my own responsibility. A draft version of the case study report, and the Dutch interview, however, have been verified.

case study was conducted in 1999 and 2000. Access was gained through a former employee of the ECECP, who is currently working as an environmental researcher. Insights gained from the interviews have been supplemented with additional documentation, all of which has been used to prepare a case study report, which was sent to the ECECP for verification. Together with the Dutch interview, this report forms the main input to this section. Key characteristics of this case study are presented in table 6.4. In the following subsections, attention is paid to the general characteristics of IBM and its products, followed by a discussion of IBM's product-oriented environmental efforts. This discussion focuses on the position and role of the ECECP. To illustrate its activities, in the third subsection, some projects of this Center are presented, followed by a brief case study analysis, based on the core elements of the POEM matrix. The section concludes, as usual, with points of interest uncovered.

Table 6.4 *Characteristics of the IBM ECECP case study*

Company	IBM (International Business Machines Corporation)
Specific part of the company	Engineering Center for Environmentally Conscious Products
Type of company	Electronics and Electrical Industry
First access to case study firm	ECECP, USA
Key sponsor	Environmental researcher at the ECECP
Time of the case study	1999-2000
Number of interviewees	5
Selection of interviewees	Direct involvement with product-oriented environmental management issues / cross-reference
Verification of results	Case study report sent to the ECECP to allow verification
Additional information sources	Annual reports, internal documents, promotional materials, Internet, trade press

6.5.1 IBM – a brief background[106]

IBM was incorporated in 1911, although its origins can be traced back to 1890. Before introducing the first 'large' computer in 1952, the company manufactured and sold a broad range of machinery. IBM introduced its first large family of computers that used interchangeable software and peripheral equipment in 1964. A change in marketing policy led to the development of the software and services industries: rather than offering complete packages of hardware, software and

[106] This characterisation of IBM is partly based on an overview of IBM's history, as found on the IBM website (http://www.ibm.com), when visited in December 2000. Further information was obtained from annual reviews and 'environment & well being progress' reports (IBM, 1998, 1999).

services, such components were offered individually. In 1981, IBM introduced the Personal Computer (PC). Together with the introduction of the client/server concept (linking PCs to larger computers in the background), this revolutionary development transformed the way customers viewed, used, and bought technology. Businesses' purchasing decisions were increasingly put in the hands of individuals and departments - places where IBM did not have long-standing customer relationships. This created a period of struggle for the company, resulting in large losses and turned cost management and streamlining into major concerns. Large restructurings took place. Still, the ability to provide 'integrated solutions' for customers was regarded as a key strength of IBM. Splitting the company, as was considered, would have destroyed that advantage. Choosing integrated solutions enabled the company to anticipate the Internet and networked computing. The focus of customers also changed towards integrated business solutions, and networked computing became a core issue in IBM's vision. Through acquisitions in the mid 1990s, the company turned more towards services, and currently attention focuses on e-business and providing solutions for customers. According to the company website, in 1999, IBM employed over 307,000 people and its revenue was $87.5 billion.

The company can also be characterised through its ISO 14001 certificate, which covers all global manufacturing and hardware development operations. According to this certificate, the organisational scope of IBM is "the development and manufacture of information technology products, including computer systems, software, networking systems, storage devices, microelectronics technology, networking and related services worldwide." An environmental report adds that "these advanced technologies are translated into value for its customers through IBM's professional solutions and services businesses worldwide" (IBM, 1999: 10).

6.5.2 Engineering Center for Environmentally Conscious Products

In 1991, within IBM, an International Task Force on Environmental Considerations was formed, and an initiative was taken to consider further the environmental effects of the company's products. IBM's corporate environmental affairs policy calls for the company to develop, manufacture and market products that are safe for their intended use, efficient in their use of energy, protective of the environment, and that can be reused, recycled or disposed of safely (IBM, 1998). Aspects of POEM are dealt with through IBM's Environmentally Conscious Products (ECP) programme. This programme provides a proactive and strategic approach to the worldwide environmental management of products. Established in 1992, the programme has a broad technical scope and has led to the development of new practices in Design for Environment (DfE), product recycling technologies and product-related environmental metrics. The ECP programme has established a set of environmental design objectives for IBM products, including upgradability, reuse and recyclability, safe product disposal, use of recycled materials (where technically and economically justifiable), and providing improvements in energy efficiency with reduced energy consumption. ECP requirements have also been incorporated into IBM's Integrated

Product Development process, which is a strategic tool used to ensure a consistent and efficient product design process (IBM, 1998).

Within IBM, core environmental competencies have been located at the corporate level to minimise duplication between different hardware development divisions, and to standardise goals, tools, and deliverables. A dedicated group within IBM supports the ECP programme. This 'Engineering Center for Environmentally Conscious Products' (ECECP) acts as the centre of competence for DfE activities for the whole of IBM, and as a resource for divisional environmental specialists, product development and procurement engineers, suppliers, and product recycling centres (IBM, 1998). At the time of the case study, the ECECP had a staff of 8 people. Several other people also work within the ECP programme, for example by representing IBM in various trade associations environmental initiatives. The vice president of IBM's Integrated Supply Chain group directs the ECP programme, thus providing senior management commitment.

During its initial years, the ECECP had to gain credibility, demonstrating within IBM "that we could do good things." Occasionally, scepticism is still met in several projects. Several people need to be convinced of the possibilities of using recycled plastics in IBM's new products[107]. Therefore, staff members of the ECECP are encouraged to give presentations on environmental possibilities and initiatives at various occasions, both within and outside the company. Marketing assistance is provided to IBM divisions to inform sales people of the products' environmental characteristics. Information is also shared at meetings of trade associations or engineers[108], or at presentations to suppliers or competitors. Thus, the ECECP is clearly engaged in many external communications to demonstrate IBM's involvement with products' environmental characteristics. Moreover, IBM's corporate environmental policy also requires the company to participate in efforts to improve environmental protection and understanding around the world, and to share appropriate technology, knowledge and methods. Through such information exchange, IBM hopes to gain a reputation as an environmental leader, which will position the company well for influencing this arena with policy makers and the industry at large.

In addition to these communication issues, the ECECP specialises in environmental issues such as packaging, ISO 14001, DfE, product environmental profiles, life cycle assessment (LCA), and recycling and product end-of-life management[109]. The ECECP also monitors developments in environmental

[107] To demonstrate the possibilities, as a pilot project, all the major plastic parts of a desktop computer were made entirely of recycled plastic resin. The 1998 recycling targets were not met because of a switch to another resin, and a lack of commercially available recycled grades of that resin. This illustrates the chain perspective of such initiatives.

[108] Some trade associations that the ECECP is involved in include the American Plastics Council, the International Association of Electronics Recyclers, the National Recycling Coalition, and the American Society of Testing and Materials. The ECECP also participates in the International Symposium on Electronics and the Environment.

[109] Product end-of-life management activities involve product take-back programmes. IBM operations include re-utilisation and material recovery centres, which share dismantling and

legislation. Much work has still to be done within the different divisions. Implementation of DfE guidelines, for instance, is the responsibility of divisional teams, consisting of designers, technical experts and managerial 'strategy owners' (Brinkley et al., 1997). Divisions and operating units within IBM all have such strategy owners for ECP, who are actively involved in product development, and have to deal both with IBM's corporate goals and their divisions' own goals. They support their local product development activities on environmental issues, for instance through DfE assessments of product designs, reporting divisional performance on environmental metrics, and maintaining ISO 14001 procedures and records related to ECP activities. The ECECP works closely with them to accomplish these goals. Each year, strategies and goals regarding ECP are determined. Projects are then selected and deadlines determined. Progress on strategies and goals is monitored, and the ECECP plays a central role in transferring knowledge and information, guiding people to the information they need. Through newsletters, networks and an annual symposium, information and knowledge on these matters is exchanged.

The key programme areas of the ECECP in 1997 "included development and qualification of recycled materials, identification and development of new technologies for reuse and recycling of information technology equipment, presentation of IBM's environmental design objectives to original equipment product manufacturers, and development of design criteria and tools to support DfE and life cycle activities" (IBM, 1998: 14). As one interviewee put it, the ECECP tries to "capture environmentally conscious products and to measure how we do it." This also implies developing and using metrics for a product's environmental characteristics, for which the ECECP has to deal with different divisions, different products, and other corporate metrics. The metrics developed focus on landfill reduction, recycled plastic usage, product energy efficiency, and the development and integration of DfE assessments into IBM's product design process. For tracking its progress with DfE, IBM has developed product assessment and rating tools (Brinkley et al., 1997). The rating scheme was applicable to all IBM hardware products and could be used either as a self-assessment tool in the early phases of product development, or to produce a final product rating for comparison with predecessor or follow-on products. A new corporate standard for environmentally conscious design has also been established, providing a source document for both internal and external environmental design requirements, and guidelines, regulations and standards for IBM products and packaging (IBM, 1998). The ECECP also makes use of laboratory experiments, on issues such as product end-of-life management and usage of alternative materials. Possible future developments are also investigated, often in co-operation with suppliers. To an extent, these

recycling expertise to increase recycling efficiencies, and to reduce the amounts of waste sent to landfill. Experiences, concerns and recommendations are also shared with product development teams, thus providing suggestions for design improvements (IBM, 1998). Asset recovery operations also face organisational problems such as transboundary transport and internal transfer of products.

experimental developments are used to build and maintain an environmentally conscious image of IBM. However, image building is not their only reason for working on these issues, IBM also wants to operate as a good corporate citizen.

6.5.3 Some ECECP illustrative projects

Within IBM, POEM affects many functional areas. In product design, attention focuses on issues such as product energy efficiency, product upgradability, material reductions, and savings on supplies. In addition to design-related issues, product end-of-life management and packaging programmes are important. As the focus of my research is on ways to organise POEM, and the involvement of different stakeholders, as an illustration in this subsection two ECECP projects are briefly discussed: product environmental profiles (PEPs) and purchasing specifications.

Product environmental profiles (PEPs) have been developed to document the environmental attributes of IBM products and sub-assemblies. The PEP system is a key element of the ECP programme (Ching et al., 1999). PEP documents are a tool for evaluating and tracking a product's compliance with IBM environmental standards, and determining progress of the ECP programme as part of the ISO 14001 certified Environmental Management System (ECECP, 1999). PEP completion is integrated into IBM's Integrated Product Development process (Ching et al., 1999). The PEP documents provide information concerning chemical and environmental characteristics of products, which can be used to respond to customer inquiries. Although these documents highlight a significant part of a product's bill of materials, they do not account for the entire material contents of a product. One objective of a PEP is to document hazardous components that may need special handling at the end-of-life. Each product carrying an IBM logo should have such a document. Formal responsibility for these documents resides with product managers, responsible for the product design process. PEP co-ordinators are appointed to co-ordinate the submission and review of PEP documents. Six to ten experts from different backgrounds (e.g., materials lab, chemical control, distribution, ECECP, marketing) typically review the PEP documents. The PEP is based on a groupware system (Lotus Notes) and therefore the documents can easily be shared electronically with other people within IBM, enabling collaborative work. According to the ECP programme, information in PEPs should be kept up to date. Material safety data sheets provided by suppliers can also be incorporated in the PEP database. The quality of the information in the PEP documents seems to be related to with the length of the development cycle: a short development cycle (3-6 months) tends to result in information of lower quality. Training packages, documentation and group meetings are provided to assist authors in becoming acquainted with completing PEP documents.

Another ECECP project aims to expand DfE within the supply chain, as IBM wants to be better informed on the environmental properties of its products. A corporate standard for purchasing products, parts and assemblies has therefore been developed for use in a pilot project. This standard contains a list of banned or

restricted substances, and additional requirements placed on suppliers. The restrictions and requirements stem either from regulation, or from corporate policy[110]. Corporate Procurement already uses databases, so expanding these to include an environmental module could follow. Environmental issues could thus become part of the system for parts qualification during procurement. Looking for ways to integrate such supplier information into PEP documents could be a next step. IBM used to be vertically organised but is becoming more and more reliant on suppliers. Therefore, the information needed to complete a PEP document has increasingly to be obtained from outside of the company. Obtaining such information is sometimes difficult as suppliers do not want to give away any competitive information[111]. Suppliers need direction and standard requirements in order to comply. One option might be to partly share databases with suppliers. However, this could involve issues such as proprietary rights, sharing knowledge, standardisation, commitment, and information systems.

After this illustration of some ECECP projects, it is useful to consider stimuli and barriers within IBM to engagement in the ECP. Several *stimuli* were identified. First, IBM wants to deliver value to its customers, and issues that could contribute to this aim are usually supported. Creating products that consume less energy, for example, is important to customers and is also environmentally beneficial. Environmental characteristics are increasingly expected to become a potential competitive advantage. Firms therefore try to use environmental issues as a differentiator. Developments are also driven by corporate goals, such as increasing the recycled content of products, or increasing the use of powder coatings. These goals are partly based on anticipated regulations. Finally, the issue of corporate citizenship plays a role, demonstrating a social responsibility implies obeying the law, and being a positive contributor to the community. *Barriers* could also be discerned. First, the PC market is a highly competitive, low profit, market in which it is hard to add costs to a product to enhance its environmental performance. It is also sometimes hard to convince people within the company of the need or possibility to produce environmentally conscious products. Environmental strategy owners within the divisions are important in this process of convincing, and the ECECP assists them with training, communications, metrics reporting, and resolving technical issues. Also, both inside and outside the company, recycled plastics are often seen as inferior. To change this image, the ECECP is working with engineers and designers within IBM to convince them otherwise, and with suppliers of recycled plastic resins to improve these products. Finally, anticipated changes in material use, for example due to regulations or voluntary labelling programmes, could be regarded as challenges.

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[110] Some substances were restricted in use but could not be completely banned because no alternative was available. An example is mercury in LCD screens.

[111] Phrasing questions differently might assist in overcoming such problems. If it is asked whether the quantity of a substance is above a certain amount, suppliers do not have to reveal exact amounts or specific formulations.

6.5.4 A short case study analysis

In analysing this mini-case, the core elements of the POEM matrix are again central, related to the position of the ECECP. Turning to the core elements of the matrix, in terms of *capabilities*, management commitment and structures, and processes, appeared to be very important. This especially holds true if environmental issues are involved that could reduce IBM's competitiveness, or generate extra costs. IBM is centrally organised and the firm's culture is that people very much follow the rules and the processes. As one of the interviewees put it: "nobody wants to be embarrassed." For instance, when ISO 14001 certification was desired, resources had to be allocated to a goal (i.e. certification) that in reality only formalised practices already in place. However, a requirement for better documentation of existing processes was identified in the certification process: feedback and 'closure' processes had to be formalised between initiatives with shared areas of responsibility, such as DfE ratings and PEPs. Defining such linkages in shared responsibilities assisted in tying processes together, making them more efficient and eliminating redundancies. The ISO 14001 certificate thus led to increased formalisation, this supported environmental policy by providing some clear checkpoints and the 'stick' of auditing. An additional capability of the ECP lies in working closely with suppliers. In terms of the procedural approach, at the time of the case study, the ECECP was recommending that suppliers obtain an ISO 14001 certificate, although this was not a requisite. Not only within IBM, but also for suppliers, the ECECP acts as a centre of competence. The ECECP also takes initiatives to define project goals within the ECP programme, and to engage the appropriate stakeholders to develop action plans. In conceptualising and implementing the required capabilities, the ECECP plays and important role, both by guiding social-dynamic processes, and by developing system-technical instruments and tools. Different elements of the POEM matrix are thus combined within this centre.

As noted in the discussion on drivers and barriers, important *stakeholder* demands are both regulatory and market based. Other stakeholders also influence the ECP programme. Growing supplier involvement and frequent contacts with trade associations are examples. IBM relies on information obtained from its suppliers in order to issue its material declarations, as are requested by its customers. Although such information could be used as a qualifier in the purchasing process, suppliers are not always very willing, or able, to provide such information. The PEP document may be proposed as a possible industrial standard. A trade association is investigating the harmonisation of the requirements of information technology equipment-makers, so that common suppliers can more readily meet the needs of industry. If the IBM approach of PEP is selected as a standard, this could deliver IBM a competitive advantage. However, standardisation of information requirements also demands consensus among the users of that information, and this might negate the competitive advantage. Besides, if working on PEP-related activities improves a company's cost position, this could be an argument for not sharing such information too widely. Most other stakeholder groups are not that involved in ECP issues.

Within IBM, the Corporate Environmental Affairs organisation is responsible for most of the company's environmental compliance reporting, and for process-oriented controls on business operations. Such operational and compliance aspects of business operations are important for raising awareness among top executives, and the environmental affairs team therefore periodically presents the status and emerging issues of its programmes to an advisory council of management executives. Product-oriented environmental issues, however, require a longer-term focus, as they rarely have immediate impacts on business operations and controls.

Finally, concerning *continuous improvement*, incorporating products' environmental characteristics into a firm's processes is generally expected to become more important. To benefit from its efforts, interviewees thought that IBM needed to demonstrate its approach to its customers. Increased involvement of the supply chain is considered another important issue. Issues related to information sharing therefore need to be resolved: what information is needed from suppliers, what information could be shared with them, how to act if information is not available or not given? The ECECP is, therefore, creating engineering specifications to give suppliers the information they need from IBM, and questionnaires to obtain relevant information back from those suppliers, thus facilitating the collection and availability of information. However, the enforcement of supplier requirements remains a responsibility of the corporate procurement organisation. Furthermore, an infrastructure for recyclable products has to be created, which implies educating people to get such a system in place, and auditing that system. The incorporation of recyclability issues has implications on product design, such as upgradability and modularity. Product take-back is an emerging issue, following regulation, which brings end-users into the picture as well, and possibly requiring another product infrastructure.

6.5.5 Points of interest

In this mini-case, the focus was on IBM's ECECP as an organisational initiative towards POEM. The first point of interest from this case study is the important role such a competence centre can play in initiating and supporting POEM. It can assist in co-ordinating activities regarding a product's environmental characteristics within the entire company, and design implications for the entire product life cycle can be considered. This ranges from product development, through procurement, and manufacturing to product recycling issues. It is important to note that many of the activities on ECP issues need to be carried out within the different divisions. The role of the ECECP can thus be seen as supportive and facilitating, taking new initiatives, and balancing environmental projects on products. This seems to be best accomplished if there is a clear infrastructure for such a programme, if senior management is committed, and if social-dynamic processes and system-technical structures are balanced.

In addition to meeting regulatory and market demands, maintaining the company's environmental performance, and the accompanying image, can be

important drivers for engaging in POEM related activities. Environmental performance is thus seen as an element of good corporate citizenship, which can be interpreted broadly, to include regulatory compliance, philanthropy, and ethical behaviour towards employees and the local community. These developments involve a growing number of stakeholders, requiring the company to regularly adjust its way of organising for ECP. This means that a capability to monitor and anticipate current and forthcoming developments, and to react appropriately to these developments, is important. Issues of responsibility thus play an important role in ECP programme initiatives. This could be expressed by using different metrics, such as the 'avoidance of materials' through modifying product designs or increasing the recycled content of products. This could lead to a different perception of product-oriented environmental characteristics.

6.6 Life Cycle Management at 3M

To investigate the organisational implications of POEM, the second mini-case considered an organisational initiative on POEM within the Minnesota Mining and Manufacturing Company, better known as 3M, which is a global, diversified, industrial and consumer products company (Shrivastava, 1995). It has a long tradition of environmental management initiatives, dating back to the early 1970s. In environmental management literature references are often found to these initiatives (e.g., Hart, 1995; Shrivastava, 1995; Berry & Rondinelli, 1998; Christmann, 2000). As 3M is involved in developing, manufacturing, and marketing a wide range of products for different markets, including activities both in the chemical and electrical and electronic industries, this company links well with the other four case studies. Initial contacts with 3M were made through a fellow researcher who was doing research within this company, albeit on a different topic. The case study was conducted in 1999 and 2000.

3M deals with products' environmental characteristics through the concept of Life Cycle Management (LCM). To gain an insight into this concept, and into other product-related environmental management, four people were interviewed, all of whom were either directly involved with, or responsible for, this concept within their part of the company. Interviewees were selected through cross-referencing, and three of them worked for the Dutch subsidiary. They all were well acquainted with the firm. The interviews were transcribed and returned to the interviewees for verification. To complement this input, various company publications were studied, and a few other people within 3M were talked to briefly, although not in structured interview settings. The characteristics of the case study are listed in table 6.5. As this case study was not focussed on a specific product or business group, the discussion in this chapter is organised slightly differently. In the following subsections, attention is given to the general characteristics of 3M and its products, followed by a discussion on the implications of LCM within the firm, and the organisational arrangements made in response. The fourth subsection contains an analysis in which

the core elements of the POEM matrix are addressed. The final subsection focuses on the learning points gained.

Table 6.5 *Characteristics of the 3M Life Cycle Management case study*

Company	3M (Minnesota Mining and Manufacturing)
Specific part of the company	3M Europe
Type of company	Diverse manufacturing industry (including chemical and electrical and electronics industries)
First access to case study firm	3M Netherlands
Time of the case study	1999-2000
Number of interviewees	4
Selection of interviewees	Direct involvement with product-oriented environmental management issues / cross-reference
Verification of results	Interview transcriptions sent to interviewees for verification
Additional information sources	Annual reports, internal documents, promotional materials, Internet, trade press

6.6.1 3M - a brief background[112]

As the 3M concept of Life Cycle Management was central, the description of the firm and its products is rather general. ever since 3M was founded in 1902 by a group of five businessmen who "by mistake bought a mountain containing worthless mineral to start a business to mine corundum to manufacture sand paper (…) considerable efforts have been made to create an atmosphere that will support innovation" (Brand, 1998: 17). Currently, 3M is an important manufacturing company with about 40 business divisions, and many departments and subsidiaries. "In addition to the core businesses, which manufacture tapes and abrasives, the company also produces and sells products in markets as diverse as printing, health care, automotive, construction and home improvement, office supplies, transportation, and speciality materials" (Alldredge & Nilan, 2000: 134). 3M employs over 70.000 people, sells its products in nearly 200 countries, and has operations in over 60 countries. In 1999 its revenue was $15.7 billion (3M, 2000). The company is known for its innovations, and one of its objectives is to become the most innovative company in the world (Brand, 1998). Currently the company has a product base of about 50,000 different products. About 30% of sales come from products created within the past four years. Innovation is supported in several ways. Scientists are encouraged to spend 15% of their time working on their own ideas. 3M operates with more than 30 technology platforms, involving core technologies such

[112] In part, this description is based on the 3M website (http://www.3m.com) as visited in December 2000, annual reports and further company documentation (e.g., 3M, 1994, 1999b), supplemented by insights from literature.

as optics, electronics, and precision coating. About 7% of sales revenues each year are spent on research and development projects. As Shrivastava (1995) noted, due to the continuous stream of new products, 3M's environmental problems are diverse and constantly changing. The company's environmental management is discussed in the next subsection.

6.6.2 Environmental management at 3M

As noted earlier, 3M has a history of environmental management. Although earlier involvements in safety issues and water and sanitary engineering can be traced, an active approach towards environmental issues has truly been developed within the company since the 1970s. A corporate environmental policy was issued in 1975 and has since played an important role in the firm. This policy was applied to all operations worldwide and formed a tool for corporate leadership (3M, 1999a). Based on this tool, many programmes, policies and guidelines have been developed. Also in 1975, the Pollution Prevention Pays (3P) programme was adopted. This programme aims to prevent pollution at source, conserve natural resources , and to encourage continuous improvement (Shrivastava, 1995; Christmann, 2000). According to the 3M website, between years 1975 and 1999, the 3P programme saved the company $827 million, and avoided 807,000 tons of pollutants. 3P provided a basis for the environmental, health and safety programmes within the company, and preventive approaches became central issues, together with employee involvement. These programmes were supported by policies and management systems. For example, 3M has a policy on environmental marketing claims, which states that a special committee has to review all product claims to ensure they are technically accurate, clear, well documented and not misleading (3M, 1999b). Over time, the 3P programme has been extended to include new emission reduction goals, and programmes to accelerate the rate of emission reduction have also been set in motion.

3M is a multinational corporation and, although the company wants to comply with local policies, it does not develop country-specific environmental methodologies. The company is organised in business units. With a range of over 50.000 products, differences between the business units do exist, some are more proactive on environmental issues, while others are moving at a slower speed. All these businesses are relatively independent, and can thus place their own interpretation on environmental management, provided that they remain within the law and meet 3M corporate environmental policies. The 3M environmental management system is intended to ensure such compliance, and to support continuous improvement. The organisational structure within the company is product-oriented due to its businesses structure, and this could be an advantage in organising POEM. A further corporate goal was for all 3M manufacturing facilities to achieve ISO 14001 certification by the end of 2000 (3M, 1999b).

In 1990, a Corporate Product Responsibility staff group was created to promote life cycle reviews and to provide training and technical help (3M, 1993). Product

responsibility had to be taken up at every business level and within every subsidiary. Some of its characteristics include; compliance with product-related laws, wider regulations, and 3M internal standards, and meeting expectations from customers, and, more generally, from society as a whole. Product responsibility co-ordinators, in each business unit, support life cycle reviews at a technical level. Alongside this, in each unit, an executive is made 'product responsibility champion' to provide management support. Building networks of liaisons across all businesses and subsidiaries is also important. These liaison networks are assigned by managers, and although these networks began with people working part-time, they gradually developed into full-time product responsibility networks, with representatives from each market centre. In the Product Responsibility Life Cycle Model, five crucial life cycle phases were identified: material acquisition, R&D operations, manufacturing operations, use, and disposal. The related Life Cycle Management (LCM) process is discussed in the next section.

From a life cycle perspective, product recovery services form a related issue for attention, as does resource recovery. An example of product take-back activities is the contract 3M has with a service company to recover 3M drums from its customers. The service company collects these drums from customers' sites and reconditions them. In this way, customers' packaging problems are solved, and 3M outsources an activity that is not its core business, while still taking responsibility for establishing a solution. Other firms in the chemical industry have similar service contracts. Regulations sometimes make such activities complicated, as was also noted in the previous two case studies[113].

6.6.3 Life Cycle Management

Life Cycle Management (LCM) is a process used at 3M for understanding and managing environmental, health and safety impacts, and energy and resource utilisation in 3M products throughout their design, development, production, use and disposal. In the development of LCM, an overview was first made of all the different tools and instruments that were already available within the company. One of the main ideas behind LCM is that 3M businesses should take care of the environment, but not by mechanically applying one standard tool. Adopting a thoughtful attitude towards environmental issues and the instruments used is thus propagated. The goals of LCM are to identify environmental, health and safety (EHS) opportunities and competitive market advantages, and to characterise and manage risks, resources and energy use. The information gathered through this process is depicted in an orderly

[113] In Belgium, 3M produces chemical substances that are used in fire extinguishers. The company offers to take back these liquids after use, to clean and possibly re-use them. Yet, to take such substances back, different transboundary waste transport regulations apply and many permits are needed. These regulations make a more integrated treatment of products more difficult, and do not encourage firms to take such steps. In this case, 3M obtained the required waste permits to allow take-back from European customers. This is offered as a service to customers, in which their co-operation is sought to keep products in a recyclable condition.

matrix, the LCM screen, which is a relatively simple tool that covers the main areas. LCM is thus also an organisational tool, intended to support an active involvement instead of merely being a standard procedure.

Cross-functional teams of employees developing new products have to complete the LCM process, trying to take a holistic and systematic look at how to address EHS issues at each stage of the product life cycle (3M, 1999b). Usually this process is carried out by a small number of people, although they can decide that additional information is required. To facilitate such an additional information gathering process, an overview is available of departments within the company that could provide information on a specific quadrant of the matrix. In this way, the range of expertise that is present within 3M can be utilised. Collecting and sharing information is supported through the use of groupware.

The LCM process aims to give systematic attention to EHS issues during all stages of the product life cycle. The businesses are expected to demonstrate an improvement in at least one product life stage, while an assessment of the impacts of different choices in design materials has also to be made. Furthermore, the LCM approach is intended to change the attitudes of employees, and create a wider vision. In Europe, this has led to increased co-operation with customers and suppliers, combined with an increased understanding of government. One feature of LCM is that it follows the products, hence cutting across sites and functions. This is the opposite to 'traditional' EHS approaches, which are often process-related and based on one site.

In 1997, the LCM process was formalised for new product development activities. To obtain, and maintain, sufficient senior management support, getting relevant information to these managers is important. They could act upon such information for several reasons, such as vision and leadership, past experiences, or being forced to by corporate policy. Furthermore, best practices are an instrument that can be used to demonstrate the possibilities of LCM to these managers. Environmental affairs are relatively important at a corporate level. 3M's CEO supported the development of LCM within the businesses, thus providing further senior management commitment and demonstrating leadership[114].

Considering other tools that support products' environmental characteristics, some differences do exist among the businesses. They can make their own decisions regarding LCAs, which are performed only in a limited way. According to an interviewee, a problem with tools such as LCA is the pre-set values that are included in these models, often representing different national policies or different interpretations. For an international company such as 3M this could create difficulties. Therefore, 3M encourages its employees to be more open and to use tools that fit their needs, which, for instance, could be to answer a specific customer question. Obtaining and sharing information is sometimes a problem, due to

[114] The CEO had demonstrated his involvement with environmental issues earlier by being an active member of the World Business Council on Sustainable Development, and co-authoring a book on eco-efficiency in industry (DeSimone & Popoff, 1997).

confidentiality. Important factors when applying DfE to hardware development are customer questionnaires, lists of relevant substances, and ISO 14001 certification. On eco-labelling 3M is reserving judgement. Only when there will be substantial improvements are such labels considered, this is similar to the company's position on environmental claims. Occasionally, marketing departments are interested in using such labels. This again relates to the link between environmental management and possible competitive advantages.

6.6.4 A brief analysis of the case study

As in most of the case study analyses, here again attention focuses on the core elements of the POEM matrix. The *capabilities* of people carrying out the LCM process within their businesses are considered to be highly important. Within each business, a LCM champion is sought to provide support for this process and to guide its progress. According to some interviewees, to work on issues such as LCM and resource recovery, people need to have a broad view and pay attention to broad, long term, organisational goals. Concerning the organisational capabilities needed to organise LCM, several issues are identified. These include having visionary people in the right places, demonstrating proactivity, attitude and motivation, being aware of business ethics, and creating an understanding situation in which there is credibility for such an approach. Alongside these more social-dynamic capabilities, having a good structure in place is also important. To stimulate support for LCM, an LCM champion is needed, as well as staff functions to guide and organise operational LCM activities. To facilitate the further use of LCM, tools and instruments are considered to be supportive, for instance for directing people to relevant information sources within the firm, or by providing assistance through software tools. These issues were being developed at the time of the case study.

LCM is seen as an issue that should be framed in terms of the entire supply chain, so different *stakeholders* will play a role. Important stakeholders are customers and regulations. The fundamental stimulus to LCM, however, has been the evolutionary development of environmental awareness within the company. "Things happen because of observations", as one interviewee put it. Employee involvement is an important element of 3M's environmental management: someone sees something and wants to act upon it. This approach is encouraged. As Shrivastava (1995) noted, this fits in with the tradition of innovation at 3M, and the important role of champions in this. Issues such as motivation, business ethics and mentality are therefore important. A barrier to LCM could have been starting too early. The issue might not have been received well, because people were not ready for it. It took some time to prepare the concept, and to develop sufficient integration of wider environmental considerations in assessing products' life cycles.

Regarding *continuous improvement*, at the time of the case study, the intention was to have LCM fully implemented within 3 years. Some interviewees indicated that a longer period might be needed, and might also be more realistic. Yet, starting the implementation of this process would still be a significant improvement. To

facilitate the organisation of LCM, a software tool was developed to guide businesses through the LCM process. To be able to use this tool, businesses still have to give adequate thought to their products' environmental implications – it is not just a case of filling out checklists. Groupware is used to improve co-operation and information sharing on individual LCM projects. Interviewees stressed that, although the number of full LCM studies carried out was limited, this did not mean that nothing else was being done about the products' environmental characteristics. POEM is broader than LCM alone, and many other activities could be covered by this concept. For instance, 3M is actively involved in resource recovery operations, changes in packaging, and product innovations that could contribute to environmental improvements. Furthermore, according to the interviewees, LCM is a tool that is useful at this moment, but is only one step within the evolutionary development of environmental management within the company. Eventually, attention to life cycle issues should become a part of the firm's culture, of daily practice. This does not mean that LCM will disappear - rather it has to be incorporated into such practices. The continuity of such a process is guarded by having a network of product responsibility liaisons in place, by appointing LCM champions, by creating more understanding for this issue across the company, and by having motivated people who are committed to work on such issues.

6.6.5 Points of interest

In this case study, the focus was on the concept of LCM, which is a process to deal with products' environmental characteristics. Based on this mini-case, a few key points of interest have been identified. Although the LCM process is a tool, a range of functions have to be involved in order to use it. The process goes beyond 'simply' filling out the LCM matrix, and this can enhance commitment to working on such an issue. This case study demonstrated the applicability of a tool, a process, in developing an approach to POEM. Meanwhile, the emphasis is on the need to look beyond the structural characteristics of this tool, and address social- dynamic processes as well. A cross-functional team structure therefore is considered helpful in conducting LCM. Completing the matrix properly requires information on many different stages of the life cycle. The networks of product responsibility liaisons across the different businesses and subsidiaries ensure further knowledge sharing among these businesses. This is important in a company with such a diverse product portfolio. Central staff functions can stimulate and facilitate these processes, while managerial support is needed to empower people to participate in such activities.

A second key point is that LCM must be seen in a wider perspective. Related to continuous improvement, the concept can be regarded as just one step in the evolving environmental policy within the company. One of the required capabilities is thus to be able to maintain a longer-term perspective. This requires an interplay between social-dynamic and system-technical elements of the POEM matrix, to get the right processes going at the right time, supported by systems and structures. Managerial decision-makers can play an important role by, taking responsibility, demonstrating leadership, and empowering people to take initiatives. POEM is a

dynamic concept that needs continuous, integrated attention. It is subject to change and a range of stakeholders can have an impact on its shape and success. The longer-term perspective demonstrated by LCM also relates to viewing POEM as a step towards sustainable development, as advocated in chapter 2.

6.7 Cross-case analysis

After having analysed the five case studies individually, and having determined key points of interest from these analyses, it is useful to consider the case studies at a more aggregated level. Therefore, in this section, a cross-case analysis is presented, in which the case study findings are reconsidered and compared with the theoretical frameworks. As Eisenhardt (1989) noted, cross-case analyses stimulate researchers to look beyond their initial impressions and to see evidence through multiple lenses. The analysis is developed in three steps. In the first subsection, attention is given to common stimuli and barriers as identified in the individual case studies, in order to consider the firms' reasons for engaging in POEM. In the second subsection the cases are compared on a number of organisational elements, to present an organisational overview of POEM within the different companies. The third step of the analysis is to relate these empirical findings to the theoretical frameworks developed in this research. Alongside the POEM matrix, which has guided the empirical part of this research, the capability cycle is applied, and then these two theoretical frameworks are combined. Placing the empirical findings in a theoretical perspective enables the central research question to be answered, as is discussed further in the final chapter.

6.7.1 Reasons to engage in POEM

To understand the motivations underlying the different ways of organising POEM, it is useful to consider the main stimuli and barriers to engaging in this concept as encountered in the case studies. Therefore, before the organisation of POEM is discussed and analysed, these factors are considered. Five main stimuli were observed in the case studies, as presented in table 6.6.

Table 6.6 *Overview of main stimuli*

Main stimuli for engaging in POEM
▪ corporate environmental policy and guidelines
▪ gaining a possible competitive advantage, also through cost reductions
▪ stakeholder pressure (including customer and regulatory pressure)
▪ getting a better insight into one's own products and the concept of POEM
▪ demonstrating responsibility / concern for the company's image

The fact that, in all five case studies, corporate environmental policies were important in guiding the process of organising POEM is no surprise, as the case study firms have been selected for having a proactive attitude towards environmental management. Having a clear environmental policy is a logical element of proactive environmental management, emphasising the firm's own initiatives in environmental management. In all the case study firms, such a policy was established and was receiving clear management support.

The suggestion that both a competitive advantage and stakeholder pressure stimulate firms to engage in POEM was confirmed by the case studies, agreeing with the literature (Garrod & Chadwick, 1996; Henriques & Sadorsky, 1996). Competitive advantages of engaging in POEM could include cost reductions and gaining a better market position, possibly through better bonds with chain partners. Stakeholder pressures include legislative, customer and industrial requirements, including gaining a competitive advantage, meeting legal and industrial standards, delivering customer value, and addressing broader societal demands. To organise POEM, co-operation with various chain partners was often necessary, for example to determine a product's environmental characteristics across its life cycle. This widening focus of environmental management is an important characteristic of POEM.

A related motivation for POEM participation was to get an improved insight into the impact of the concept, and one's own products. The investigated firms acknowledged the relevance of the concept, and were looking for ways to further incorporate its implications in their organisations. One way of doing this was by developing and applying specific guidelines, tools and processes, such as Life Cycle Management (3M), Product Stewardship (DSM and Xerox), and Product Environmental Profiles (IBM). Links with more general processes, such as ISO 14001 certification and quality management, were also investigated by the companies studied. Further experience with product-oriented environmental issues, however, still needed to be gained. Attention was also given to social-dynamic aspects of organising POEM, such as establishing cross-functional co-operation, assuring sufficient management support and guidance, and looking for ways to determine relevant stakeholders, and to balance their demands.

A further stimulus to engage in POEM was to demonstrate corporate responsibility, and to work on the company's image as being an environmentally benign manufacturer, a responsible player in society. Dealing actively with these responsibility issues might also contribute to better stakeholder relationships, and possibly to a competitive advantage. Some examples are the co-operation between Xerox Europe and Friends of the Earth (Buitenkamp et al., 1999) and the attention all cases give to corporate responsibility. POEM could, for instance, be used as a qualifier in purchasing decisions. In addition, several interviewees regarded their own moral norms as an important driving force in working actively on this issue.

Table 6.7 *Overview of main barriers*

Main barriers to engaging in POEM
▪ costs involved
▪ convincing people inside and outside the company
▪ company dynamics and structure
▪ legislation

In addition to stimuli, barriers to engaging in POEM were also identified, as presented in table 6.7. Important barriers are the costs involved, which makes it harder to get sufficient support to initiate new initiatives in POEM. Allocating resources to environmental issues is sometimes viewed with suspicion. On the other hand, if environmental initiatives can be demonstrated as being financially viable, they have a good chance of getting implemented. A way of dealing with this is to link the responsibility for POEM directly to that for profit and loss, as is done in the operational team structure at DSM Powder Coating Resins. Similarly, Shrivastava (1995: 192) noted that, at 3M, most environmental projects are designed to save money: "for a project to be undertaken, it must show environmental improvement *and* economic savings." Links between financial and environmental performance thus are investigated and established.

A second barrier can be the difficulty of convincing people, both inside and outside the company, of the need for, and usefulness of, POEM. Financial communities do not always value a firm's involvement in environmental issues, and customers' appreciation of using refurbished parts or recycled materials also varies. Also, within the company, many people also need to be convinced about POEM and the benefits of applying a product life cycle perspective. By balancing elements from the POEM matrix, such as performance measurement, management systems, training, motivation and leadership, the concept of POEM could be better explained to these people, and a more integrated approach could be developed. A cross-functional team that supports the organisation of POEM, as present in most the case study firms, is useful in convincing people and propagating the POEM concept.

Related barriers are a company's dynamics and its structure. It sometimes appears to be difficult to organise and implement POEM across the many different parts of large companies, convincing people in different functions of the need to pay attention to products' environmental characteristics, and not letting the organisation of POEM get dominated by other topics. Ensuring sufficient priority for POEM is important. Alongside these aspects of dynamics, the company's structure has also been indicated as a possible barrier. If processes are applied too rigidly they can obstruct the further development of POEM, having the flexibility to respond to changes in the product life cycle is important.

Legal requirements are a final barrier. Although such requirements can support the proactive approaches taken by firms, they can also hinder the further propagation of POEM. An example, indicated in several case studies, is the problem of transporting products and materials in their end-of-life stages across country borders.

Also, for firms operating in many countries, as were the ones investigated in this research, the many different laws and regulations in different countries can cause co-ordination problems. One way of dealing with these is to apply single compliance criteria worldwide, complying with the most stringent regulations.

6.7.2 Organisational aspects of POEM

The stimuli and barriers indicated in the previous subsection give an indication of the reasons *why* a firm could engage, and possibly be successful, in organising POEM. They do not indicate *how* firms were organised for this concept. Therefore, in table 6.8, a further comparison between the case study firms is made. The categories in this table highlight several relevant characteristics of the firms, their products, and the way they organise POEM. However, in this table, stimuli, barriers and the central elements of this research (capabilities, stakeholders and continuous improvement) are not included, as these are addressed elsewhere in this section. The table is intended to be an illustrative overview of organisational aspects of POEM. More detailed discussions on each case study were included in the previous sections.

The investigated firms were in different industries, dealing with different types of products. Yet, several links between them were also evident. Two of the case studies dealt with resin development and manufacturing, two with electronic and electrical products, and one with a diverse range of products, including chemicals, and electronic and electrical products. The products within the case study firms thus ranged from intermediate products through to end products, and the case studies encompassed all stages of the product life cycle, from product development through to the end-of-life stage. The environmental characteristics of the products varied, and in most of the case study firms these were, at least in part, considered to be a business opportunity, be it through cost reductions, adding value to the customer, or opportunities to introduce new products. All the firms had developed a corporate environmental policy on products.

Table 6.8 *Cross-case comparisons of some central organisational issues concerning POEM*

		DSM Powder Coating Resins	DSM Structural Resins	Xerox Europe	IBM ECECP	3M LCM
Characterisation of firm and products	Type of industry	Chemical industry	Chemical industry	Electrical and Electronics industry	Electrical and Electronics industry	Diverse manufacturing industry
	Type of products	Intermediate products	Intermediate products	End products	End products	Mixed products
	Influence in product chain	Modest to high	Modest	High	Modest to high	Modest to high
	Environmental pressure	Modest to high	High	Modest	Modest	Modest to high
	Environmental product characteristics	Opportunity (selling point)	Mixed (opportunity and threat)	Opportunity (selling point)	Mixed (opportunity and threat)	Opportunity (cost savings and image)
	Corporate environmental policy on products	Yes	Yes	Yes	Yes	Yes
Organisation of POEM	POEM facilitator	Technology manager + OT manager	Technology Manager	Environ-mental network	Engineering Center on Environmentally Conscious Products	Product Responsibility department
	Level of POEM organisation	Operational Team	Sub-pmc	Functions	Product lines	Divisions
	Managerial support for POEM	Modest to high	Modest	Modest to high	Modest to high	High
	Cross-functional co-operation on POEM	High	Low to modest	High	High	Modest to high

Most of the case study firms had a relatively high influence in their product chain. They are large firms, purchasing often large volumes of materials and supplies. Thus, they often could not only modify their own products' environmental characteristics, they could also influence the actions of chain partners, for instance through co-operating with them, or through requiring a certain environmental performance from suppliers. For example, in some of DSM Structural Resins' raw

materials markets, other industries purchased larger volumes, making it harder for the company to influence the respective suppliers, also on the product's environmental characteristics[115]. Most of the case study firms, present their activities and products as providing solutions to their customers, an approach that could also be taken with POEM: "we need to help our customers with our product and its environmental characteristics." Proactive firms thus seem to take an active role in shaping the characteristics of POEM, both by helping suppliers and customers to deal with the products' environmental characteristics, and by trying to influence regulations on this concept. As Shrivastava (1995) noted, proactive practices such as POEM can set new standards of environmental performance for the businesses in which a firm operates. This highlights the increasing importance of stakeholders, and the widening set of stakeholder interests that are relevant to a firm's environmental management. The influence in the chain, and the perceived relevance of different stakeholder demands, are important to the way in which a firm could organise POEM. As argued before, managerial decision-makers could play an important role in balancing these different interests. The approach taken to corporate environmental policy in all five cases supports such developments. In the next section further consideration is given to the role of stakeholders.

In most of the case study firms, environmental pressure could be characterised as being modest. their products' environmental characteristics were usually not considered as a threat by these firms, but rather as an opportunity. Such characteristics could be used as a selling point, and could result in cost reductions and in a better image. As one manager indicated, viewing POEM solely as a threat would force a company into a defensive position. Within the company, seeing the concept as an opportunity, and as part of a correct way of doing business, could provide support for working with this issue[116], and for setting corporate environmental goals beyond the company's current organisational capability base.

Organisational structures seemed to make a difference in the ease of facilitating the organisation of POEM and related concepts. For instance, the cross-functional operational team structure, as established at DSM Powder Coating Resins, and the environmental network at Xerox, enhanced regular co-operation and communication between people from different functional backgrounds at virtually all stages of the product life cycle. Meanwhile, the absence of such a structure made it more difficult to initiate Product Stewardship at DSM Structural Resins. The levels at which POEM was organised varied, depending on the company's organisational structures. However, in all the case studies, the role and position of process facilitators appeared

[115] In an evaluation of 55 Dutch POEM projects, Brezet et al. (2000) noted that many of the companies they studied considered themselves to be a small link in the chain. In the next chapter further attention is given to this evaluation study.

[116] This fits with the definition of proactive behaviour as "organising one's business so as to be able to use the company's potential to benefit from opportunities and to avert threats, which may be anticipated in the environmental field" (Partidário & Vergragt, 2000: 201), and also relates to the 'stretch' perspective (Hamel & Prahalad, 1994; Cramer, 1998a), in which a substantial misfit is deliberately created between a firm's organisational capabilities and its environmental requirements and objectives.

to be very important. Co-operation between people, or teams, that were to implement POEM, and people or groups guiding this implementation, was essential. Facilitators aimed to support the people who were actually working on POEM with information and methods, and provided a link to senior management. This link was necessary to achieve sufficient support and impetus for POEM.

6.7.3 A cross-case analysis: applying the capability cycle

In the previous subsections, stimuli and barriers, and key points of interest have been presented to illustrate the motivations of firms that engage in POEM, and to briefly compare the case study firms on organisational issues regarding POEM. The core elements of the POEM matrix, capability-building, a stakeholder orientation, and continuous improvement, have been central in the case studies. In this subsection, they are considered once again to establish a link between the empirical findings and the theoretical models developed in this research. The case study findings, discussed earlier in terms of the core of the POEM matrix, are now related to the capability cycle, since these frameworks are combined to present an analysis of the process of organising POEM within large, proactive firms. The core theoretical elements of this research are reconsidered for each stage of the capability cycle, as illustrated in figure 6.1. To summarise the four stages of the cycle: in the first stage, *interpretation*, signals from stakeholders are interpreted and balanced, resulting in company plans. In the second stage, *integration*, these plans are turned into actions within the firm. In the *evaluation* stage the actions undertaken in the previous stage are evaluated and reported upon, while in the fourth stage, *communication*, a dialogue with stakeholders is held, and the achieved outcomes discussed. This cycle should be treated as a continuous process, in which new initiatives are started, or existing ones adjusted as necessary. In this way, a company's response to POEM can be adequately attuned to the varying stakeholder demands imposed on it.

In addition to framing the core elements in terms of stages of the capability cycle, a distinction can also be made between internal and external integration. As noted in chapter 4, the communication and interpretation stages of the capability cycle encompass the concept development phase of the capability-building process model of Iansiti and Clark (1994). The integration and evaluation stages comprise the implementation phase of that process model. Communication and interpretation thus address external integration, when a firm "frames capability-building activities that are needed to respond to external contingencies" (Iansiti & Clark, 1994: 565). Integration and evaluation are more internally oriented, and are associated with the co-ordination, leadership and organisational routines that are needed to develop an internal organisational response to the perceived relevant external stakeholder demands. Although a stakeholder orientation is thus strongly involved in the concept development stage, it is also worthwhile paying attention to the three core elements in all stages of the capability cycle. Since the process of capability-building is considered to be a continuous effort, in the implementation phase attention must also be paid to concept development.

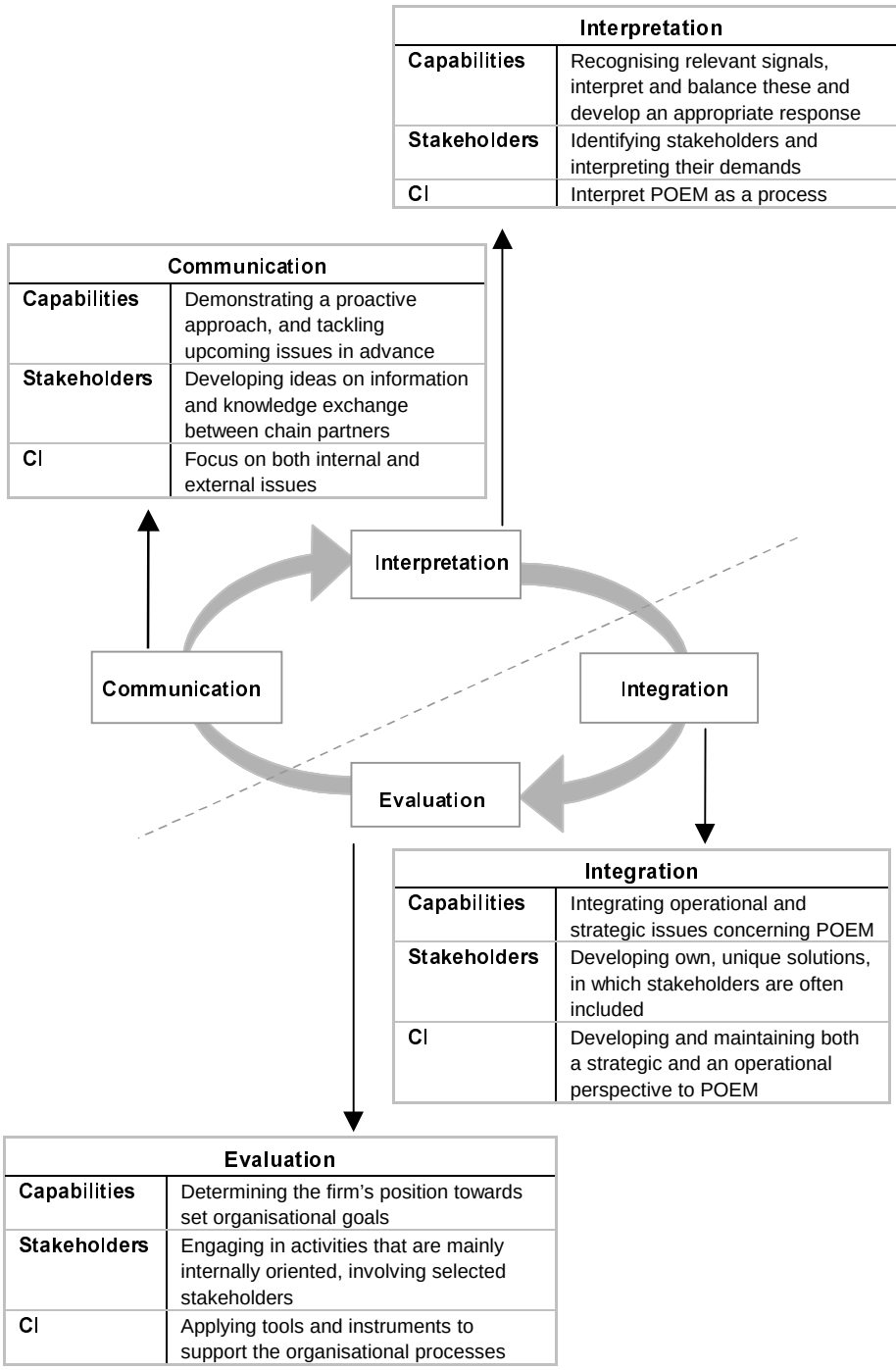

Figure 6.1 *Combining insights from the POEM matrix and the capability cycle*

The studied initiatives on POEM could be classified into different stages of the capability cycle. The POEM matrix consists of an integrated set of elements that can be closely linked to the capability cycle, that address the issues relevant to the process of building and maintaining the required organisational capabilities in a continuous effort, while at the same time address the perceived relevant sets of stakeholders. Therefore, the case study findings, based on this POEM matrix, can be related to the capability cycle. Balancing the core elements throughout the stages of that cycle can ensure a good interplay between the two phases in the capability-building process model, and can hence support the continuous adjustment of a firm's activities on POEM to the stakeholder requirements perceived as relevant. In the remainder of this subsection, the three core elements are discussed, paying particular attention to all four stages of the capability cycle.

Regarding the core element, **capability-building**, different capabilities have been identified in the case studies, and which have been clustered into the four stages of the capability cycle. The first is the *interpretation* stage of the capability cycle, focussing on the specific role and position of managerial decision-makers in organising POEM. Senior management commitment is an important element here, as is a clearly defined and communicated company position on environmental issues, for instance through a clearly formulated corporate environmental policy. This links to the idea of transformational leadership, as included in the POEM matrix. Having visionary people in the right position is important for creating a good overview of current and anticipated developments, both inside and outside the firm. Central to this stage is the ability to recognise relevant signals, interpret and balance these, and develop an appropriate response. These are all tasks that require managerial involvement. The second stage addresses the *integration* of POEM within operations and strategy. In this stage, all four dimensions of the POEM matrix are addressed. Having system-technical elements in place, such as clear standards, tools and processes, and having a good organisational infrastructure are important, while social-dynamic elements are also relevant. These can include having a dedicated team to support POEM, providing training, and accumulating and sharing knowledge. Also, recognising the role of 'environmental champions' and the need for a committed workforce are important. The third stage, *evaluation*, deals with determining a firm's position relative to the goals that have been set. This stage is closely related to system-technical elements of the POEM matrix, although social-dynamic issues, again, are also important. Important elements include achieving clarity in the objectives that have to be met, making goals measurable, and formalising the selected approach into company processes. Identifying a set of best practices could provide a point of reference. The fourth stage considers *communication*, both inside and outside the company. Internally, this involves communication between different functions within the company, such as feeding back end-of life information into the product design process, establishing linkages between these functions, and sharing responsibilities. issues that are more externally oriented include monitoring developments in technology and legislation, and creating a good customer feedback on POEM. These issues can be helpful in demonstrating a proactive approach, and can result in an ability to tackle

forthcoming issues in advance. Furthermore, communicating and working with chain partners, having an ability to influence these chain partners, and understanding the increasing reliance on these partners with POEM are important at this stage. In addition, in all four stages of the capability cycle, an awareness of business ethics is necessary, both image-wise and to be able to build and maintain the relationships inside and outside the company required to take responsibility and co-operate on an integrated issue such as POEM.

The second core element in the POEM matrix, **stakeholder orientation**, is linked closely to the barriers and stimuli for firms to engage in POEM. In the first stage of the capability cycle, the identification of stakeholders, and the *interpretation* of their demands, is central. In considering products' environmental characteristics, a broad view of the firm's stakeholders is needed: who to acknowledge as a stakeholder? Interviewees' perceptions on this issue varied, partly dependant on their positions and functions. This illustrates the range of managerial perceptions which will influence the interpretation of POEM within a firm. Customers and regulations are often identified as the most influential stakeholders, although a growing importance is now placed on suppliers. The role of industrial associations in POEM was also clearly visible. However, real co-operation with competitors on environmental issues is limited. Firms mainly develop their own unique solutions during the *integration* stage. In these solutions, stakeholders are often included. For example, IBM worked together with plastic resins suppliers to address their products' environmental characteristics, and Xerox worked with an environmental organisation on developing a new way of determining products' environmental impacts. The third stage, *monitoring*, involves activities that are mainly internally oriented, hence involving fewer stakeholders. However, initiatives such as vendor-rating, product environmental documents, and helping customers, set out to both monitor company progress, and involve stakeholders in POEM activities. A clear emphasis was placed on *communication*. For the organisation of POEM, developing ideas on information and knowledge exchange between chain partners was an important issue in all cases. This had various implications such as: should supplier requirements be tailored or standardised, and how to deal with proprietary information? Standardised 'product declarations' could serve as an alternative to eco-labelling methodologies, provided that they are recognised by a company's customers and other supply chain partners. In determining a firm's position, the communication stage is closely linked to the integration stage, emphasising the cyclical character of the capability cycle.

Finally, regarding **continuous improvement** (CI), an overall theme in terms of the capability cycle is to *interpret* POEM as a process. Addressing products' environmental characteristics must be treated as a recurrent activity. Continuity could be ensured by providing supportive structures, such as managerial systems or target monitoring, and by sharing responsibility among different functions. Organising POEM takes sustained commitment and time. In order to *integrate* these activities within the firm's processes, it is important to develop and maintain both a strategic and an operational perspective on POEM, and to provide links between the different managerial levels. Having an environmental policy that supports these

issues, establishing issue-related networks, and solving issues of information sharing and communication, are important. To *evaluate* progress and continuity, the application of tools and instruments that support these organisational processes seems to be necessary. A challenge in several cases was to develop performance measurements for POEM. A final theme is the need to focus continuously on both internal and external issues through *communication*, for instance by demonstrating the approaches developed for POEM to employees, management, customers, and wider stakeholders. Helping customers and suppliers organise of POEM can best be done if such an approach is well supported and understood within the firm.

6.8 Concluding remarks

This research started from the presumption that in organising POEM, a balance must be struck between system-technical and social-dynamic elements, at both the strategic and operational levels. These elements together contribute to the effective organisation of POEM in terms of enabling the development and maintenance of capabilities, and the adjustment of these capabilities to perceived relevant stakeholder demands. This highlights two further significant characteristics of the POEM organisation: a need to keep the required organisational capabilities up to date, through a process of continuous improvement as also proposed in the capability cycle, and the element of responsibility that is in decisions regarding POEM. As noted in chapters 3 and 4, one can discern between business, or economic, responsibility, legal responsibility, and moral responsibility (Post & Altman, 1994). For proactive companies, meeting its legal responsibilities concerning their products' environmental characteristics is usually a minimum requirement. Economic motivations for engaging in POEM have been regularly suggested in the literature (e.g., Elkington, 1994; Hart, 1997), while moral considerations with respect to issues of social responsibility, such as POEM, are also frequently discussed (e.g., Litz, 1996; Buller & McEvoy, 1999). In dealing with POEM, all three of these issues of responsibility are involved: creating a legally permitted product, driven by the possibilities of gaining a competitive advantage, and addressing the prevalent moral norms, both inside and outside the firm. The fact that, in the case studies, several references were made to all three types of responsibility emphasises this. So, alongside systematic, organisational attention to decreasing the environmental burden of products across their life cycles, POEM also involves issues of responsibility. As argued in chapter 4, this additional dimension of the concept is useful in tying the core elements of this research together. In the following chapter, further consideration is given to this finding.

To conclude, it is useful to return to the various key points of interest identified in the different case study analyses. First, the use of a cross-functional team or network structure when organising POEM is considered to create a solid basis. Such a team can assist in implementing and spreading the concept within the firm, and contribute to the gathering and cross-sharing of relevant information. It can also

deliver inputs to the concept development phase of capability development because of its broad functional composition. In this way, a balance between internal and external integration can be maintained.

A second finding is that competitive advantage is a strong driver for engagement in POEM. This can be achieved through stronger bonds with customers, suppliers, and wider stakeholders, through a better insight into one's own products and processes, or through an improved company image. This is closely linked to receiving sufficient managerial support, since such support is often partly based on opportunities to gain a competitive advantage. Issues of leadership and vision also play a role in obtaining support.

A third point of interest, related to the POEM matrix, is that, in all the case studies, a balance between system-technical and social-dynamic elements had to be maintained. In most of the case studies, system-technical solutions were developed (processes, measurements or tools), but attention was also given to the social-dynamic aspects of implementing a solution, such as recognising employees' skills and capabilities, and working on motivation and commitment. A 'translation' of POEM into these elements could lead to the organisation of POEM being addressed mainly at the operational level, possibly losing out on the strategic angle that is part of the concept. If POEM becomes part of 'normal' business processes, then feedback into strategic processes is more likely to be maintained, for instance through operational review meetings. Attention to the strategic implications of POEM must however be maintained.

This relates to the fourth point of interest: viewing POEM as part of an evolutionary development. POEM is an issue that needs to receive adequate attention, that is fairly new to most firms, and for which new capabilities need to be developed. Yet, it is also an issue that could be seen as part of a larger development, which could include a drive towards more industrial sustainability, or increasing attention towards a firm's social responsibility. To be able to view POEM from such a perspective, a firm must retain sufficient flexibility to be able to adjust to changing situations, such as stakeholder demands and product characteristics. POEM can thus be considered as a process, in which the balancing of different interests and inputs in a continuous way is required. Including both short and longer term projects could assist in this. Following the perceptions of influential decision-makers within a firm is one way of identifying a firm's position on POEM. Although several of the pressures concerning a product's environmental characteristics are external to the firm, it also is important to note the relevance of managerial decision-makers' choices concerning POEM. The breadth of the concept is determined by the boundaries one sets for it - what aspects do people within a firm regard as part of their product-oriented environmental responsibility? This again relates to managerial commitment, but involves employees and a wider set of stakeholders.

7.

Conclusion and Discussion

"Sustainable technologies will need to be developed in a co-evolutionary way that integrates societal concerns into technology designs as well as building constituencies in their support and in support of the necessary restructuring of incentives and behaviours."

(Weaver et al., 2000: 28)

7.1 Introduction

In this research, product-oriented environmental management (POEM) has been defined as a systematic approach for organising a firm in such a way that improving the environmental performance of its products over their life cycles becomes an integrated part of operations and strategy. This chapter concludes the research which was intended to obtain an insight into the organisation of POEM in large, proactive firms. In this section, a brief overview of the arguments as developed in this thesis is presented.

In chapter 1, the importance to a firm of considering the environmental characteristics of its products was outlined. Kärnä (1999) provided four reasons to focus on the environmental characteristics of products at the individual firm level. Products can be regarded as a source of environmental burden, environmental policies increasingly focus on products, a variety of stakeholders in the product life cycle have an influence on a product's environmental characteristics, and manufacturing firms are in a position to influence these characteristics. In literature, relatively little attention has been paid to organisational aspects of dealing with a product's environmental aspects within a company. The central research question was therefore formulated as:

"Why and how do large, proactive firms develop and maintain product-oriented environmental management, both at a strategic and an operational level?"

Before different theoretical perspectives were applied to address this central question, in chapter 2, the development of the concept of POEM was outlined in the broader view of corporate environmental management. This discussion concluded that POEM is a relatively new concept, for which a firm needs to develop and maintain specific organisational capabilities, and in which various stakeholders' interests have to be continually addressed. The third chapter therefore presented the appropriate central theoretical perspectives for application in this research; a resource-based view (RBV) and a capability perspective, a stakeholder approach, and insights from total quality management and continuous improvement. All these perspectives can be related to environmental management, as was demonstrated in chapter 3. In chapter 4, these three perspectives were combined through the construction of two central theoretical frameworks that were used in conducting the empirical part of this research: the POEM matrix and the capability cycle. The POEM matrix combines system-technical and social-dynamic organisational elements at both operational and strategic levels, while the capability cycle describes a continuous process of developing and maintaining capabilities in order to address stakeholder demands. The concept of responsibility is important when combining the theoretical areas, and was addressed in order to highlight the important role of managerial decision-makers in perceiving and balancing the different stakeholder interests.

The empirical part of this thesis was presented in chapters 5 and 6. Chapter 5 contains the methodological considerations behind this research, justifying the choice of a case study strategy, and highlighting the process of selecting case study firms. In chapter 6, the case study findings are presented and analysed; the case studies were first analysed individually, followed by a cross-case analysis in which the two theoretical frameworks are combined and applied to the empirical findings.

In this final chapter, conclusions are drawn from this research to answer the central research question, and the results are placed in a wider perspective. In the next section, the insights gained from this research that lead to an answer to the research question are presented, combining the theoretical and empirical insights. In section 7.3, the research is discussed, looking at both the selected theoretical perspectives and the methodological considerations. Possible alternative approaches are also addressed. Finally, a look forward towards further research is presented in section 7.4. There, the concept of POEM is broadened in the directions of responsibility and sustainable development, and the process character of the POEM concept is emphasised.

7.2 Answering the research question

The main conclusion that can be drawn from this research is that it is critical to consider the organisation of POEM, at the individual company level, as a process in which it is necessary to balance different stakeholder interests in a continuous way. To accomplish this it is helpful to involve a cross-functional team and balance system-technical and social-dynamic organisational aspects. In addition to these stakeholder interests, when organising POEM, it can be conducive for a firm to obtain a clear view of the potential competitive advantages associated with the concept, and to maintain a broader perspective within which POEM is considered in terms of corporate responsibility and sustainable industrial development. Managerial decision-makers have a central role in this process. If they view the POEM concept as an opportunity, and as part of a responsible business practice, this will provide support for setting the corporate environmental goals beyond the company's current organisational capability base.

To discuss these concluding remarks in some more detail, I return to the central research question. This question was posed in order to gain insights into the organisational implications of POEM at the individual company level, both at strategic and operational levels. In the research question, two main elements can be discerned; *why* are firms engaging in POEM, and *how* are they organising for this? In the following subsections, these questions are addressed in order to provide an overall answer to the central research question. In addition, in section 7.2.3, the capability cycle, as proposed in this thesis, is applied to the research process to illustrate its applicability.

7.2.1 Reasons for engaging in POEM

In this research, attention focussed on large, proactive firms that were actively engaged in POEM. Proactivity can be defined as placing an emphasis on a firm's own initiatives in environmental management, including an acknowledgement that environmental demands can be providers of business opportunities (Magnusson, 2000). To better understand the organisation of POEM within a firm, it is useful to consider the possible motives a firm could have to engage in POEM. In literature, important reasons given for a firm to engage in proactive environmental management are expecting to obtain a competitive advantage (including cost reductions), and better addressing stakeholder demands (including regulatory demands). The different theoretical perspectives that have been applied in this research address these two reasons. These perspectives are briefly reconsidered below.

The resource-based view, and the related capability perspective, suggest that a firm can obtain a competitive advantage on the basis of its unique resources and capabilities. In the derived natural resource-based view of the firm, competitive advantage is seen as being based upon a firm's better relationship with the natural environment (Hart, 1995). To obtain a competitive advantage, based on its approach to the natural environment, a firm needs to develop, or possess, specific resources and capabilities. As this research focuses on the organisational implications of POEM, specific attention is given to organisational capabilities, which are defined as the ability to co-ordinate, deploy and legitimate resources to intentionally perform tasks. The process of organising POEM could thus be considered to be a capability-building process, and desiring a competitive advantage could be one reason for a firm to engage in this process. Following the capability-building process model of Iansiti and Clark (1994), firms can gather, develop and implement the new organisational capabilities required to organise POEM. Balancing expectations and demands, both inside and outside the firm, and implementing organisational initiatives are important phases in this model. This is one useful way of tackling the central research question, addressing both the 'why' and 'how' parts.

Within POEM, attention to the entire product life cycle is central. Therefore, the broad range of stakeholders involved over that life cycle can affect, and be affected by, the organisation of POEM. For a firm, it is important to balance, weigh and address this range of both internal and external interests. In this process of balancing, managerial perception of stakeholders' power, urgency and legitimacy is important to their identification and salience (Fineman & Clarke, 1996; Mitchell et al., 1997). Addressing such varying stakeholder demands could therefore be seen as another motive for engaging in POEM. To highlight the important role of managerial decision-makers in perceiving and balancing stakeholder interests, the concept of responsibility is applied. This is interpreted in terms of fluctuating expectations (Lenk, 1992) and can link the theoretical perspectives. Identifying different stakeholder demands, and balancing these in a continuous effort, will be influenced by the interpretations of managers. Insights from stakeholder theory can assist in obtaining an overview of the interests involved, and of the roles of managers (e.g., Henriques & Sadorsky, 1999). Efforts to develop the capabilities required to

organise POEM have to be continuous, as changes in stakeholder demands and product characteristics occur frequently. Quality management and continuous improvement can provide insights on the *process* of organising POEM, and in the balancing of system-technical and social dynamic elements, as addressed further in the next subsection.

In the empirical part of the research, which was conducted by applying the theoretical frameworks built on these theoretical perspectives, the suggestions deduced from theory, that a stakeholder orientation and competitive requirements are important reasons for firms to engage proactively in organising POEM, have been confirmed. Building on the five case studies, important stimuli for a firm to engage in POEM were identified as; gaining a possible competitive advantage, stakeholder pressures, executing corporate environmental policies, demonstrating responsibility, and obtaining a better insight into the concept of POEM. Cramer (1998a) argued that a firm's desire to work on increasing its environmental performance in a competitive way depends on its competitive opportunities, on stakeholder pressures, and on company structure and culture. In this research, the first two of these factors were seen to be important motives for firms to engage in POEM, while firm structure and culture is related to the other three stimuli: a proactive corporate environmental policy, obtaining a better insight into the organisation process of POEM, and showing oneself to be a responsible player in the market. The theoretical perspectives selected for this research are thus consistent with these findings.

Predominantly people in managerial positions were involved in the empirical part of this research. Their varying perceptions of stakeholders' interests, and the different approaches taken in the individual firms, illustrate the influence of such managerial perceptions on a firm's response to POEM. The enthusiasm to work on such an issue, the willingness for cross-functional co-operation, and the desire for gaining a competitive advantage are important factors in this. Stakeholders are important for a firm that wants to obtain insights into its own products, not only through exerting pressures, but also because instruments such as life cycle assessments and product environmental profiles require fairly detailed information from stakeholders.

Overall, a firm's efforts to balance its products' environmental characteristics over their life cycles can be seen as a continuous, dynamic capability-building process, that is influenced by a variety of stakeholders and stimulated by the firm's desire to have a competitive advantage. The barriers to engaging in POEM identified in this research strengthen this view. The main barriers are; the costs involved, convincing people both inside and outside the company of the need to engage in POEM, legislative barriers, and the internal structure and dynamics of a firm. They are essentially complementary to the stimuli identified; costs versus competitive advantage, and convincing people and legislative barriers against stakeholder pressures. These barriers are also linked to the organisational issues addressed in the POEM matrix.

These findings are in line with a recent evaluation of Dutch product-oriented environmental policy (Brezet et al., 2000), which found that the main reasons for firms to engage in POEM included: financial incentives (grants and subsidy

schemes), improving their understanding of the POEM concept, legislative pressures, and possibilities for environmental innovations. The most important barriers identified were demands on time and money. Obtaining the required information, grasping the implications of organising POEM, and a lack of tools and instruments were other barriers, as was the longer term perspective that was needed when engaging in POEM. My approach to the organisation of POEM, as a continuous, dynamic capability-building process, influenced by a variety of stakeholders, and stimulated by the firms' aim of acquiring a competitive advantage, clearly relates to these findings. In the next subsection, attention is given to ways in which POEM can be organised at the individual company level.

7.2.2 Ways of engaging in POEM

The question of how large proactive firms organise POEM, has been addressed in this research through the application of two theoretical frameworks: the POEM matrix and the capability cycle. The POEM matrix is a process matrix which focuses on the organisational processes, at both the strategic and operational levels, that have to be balanced both system-technically and social-dynamically. Strategic decisions, affecting both the organisational structure and the processes involved, need to be linked to operational practice in a continuous way. At the core of this matrix, three theoretical areas are therefore included; capability-building, a stakeholder orientation, and continuous improvement. These are brought together under the heading of responsibility.

Building on the elements contained in the POEM matrix, a case study questionnaire was developed (see appendix B) which addressed the integrated aspects of organising POEM. As suggested by this matrix, attention in the organisation of POEM, on the one hand, focuses on system-technical solutions, such as management systems, instruments, and tools, while, on the other, the need for social-dynamic processes is also acknowledged, such as training, and raising motivation and commitment. The second research framework, the capability cycle, emphasises the process character of POEM, highlighting continuous development; one stimulus for the investigated firms, for example, was to improve their understanding of the evolving POEM concept.

The key points identified from the case studies also highlighted the need to see POEM as a process, in which attention must be paid to both structure and culture. Together, these key points provide an answer to the 'how' part of the central research question. Firstly, the use of a cross-functional team, or network structures, is helpful when organising POEM. Because POEM involves the product's entire life cycle, a variety of functions is involved. Such a team or network can assist in implementing and spreading the concept within the firm, and can contribute to the gathering and sharing of relevant information. Having different functions involved will help maintain contacts with those different stakeholders that are perceived to be relevant. As Karlsson (1997: 107) stated: "A firm must form a cross-functional team that presents an image reflecting the product life-cycle and the actors involved."

Through such a structure, because of its broad functional composition, inputs to the concept development phase of capability development can be delivered. In this way, a balance between external and internal integration, as advocated in the capability-building process model, can be achieved.

A second finding is that the desire for a competitive advantage is a strong driving force for engaging in POEM. Such an advantage could be achieved through stronger bonds with customers, suppliers, and wider stakeholders, through a better insight into one's own products and processes, or through an improved company image. Competitive advantage is also closely linked to assuring sufficient senior managerial support, since that support is often partly conditional on the anticipated opportunities to obtain a competitive advantage. Alongside performance measurement and other system-technical elements, social-dynamic issues of leadership and vision play a role in obtaining such managerial support.

A closely related key point is that, in all the case studies, a balance between system-technical and social-dynamic elements had to be maintained. In the case study firms, system-technical solutions were often developed (processes, measurements or tools), and the need to also pay attention to the social-dynamic aspects of implementing a solution was also recognised. Such aspects include recognising employees' skills and capabilities, and working on motivation and commitment. 'Translating' POEM into these elements could lead to the organisation of POEM being addressed mainly at the operational level, hence possibly losing out on the strategic angle that should also be part of the concept. Some interviewees indicated such a concern. However, if POEM becomes part of 'normal' business processes, feedback into strategic processes is likely to be maintained, possibly through operational review meetings. Attention to the strategic implications of POEM must however be given. In addition to the distinction between system-technical and social dynamic aspects, organising POEM can thus also be seen as an interplay between strategic and operational issues. The POEM matrix emphasised this viewpoint.

This relates to the final point of interest identified from the case studies: viewing POEM as part of evolutionary development. POEM is an issue that needs to receive adequate attention, that is fairly new to most firms, and for which new capabilities need to be developed. However, it is also an issue that could be seen as part of a larger development, which could include a drive towards more industrial sustainability, or giving increased attention to a firm's social responsibility. To be able to view POEM in such a perspective, a firm requires the flexibility to be able to adjust to changing situations, such as stakeholder demands, product characteristics and social concerns. Considering this broader extension of the concept, and the necessary managerial attention, it is important that a firm is able to view the POEM concept in a wider perspective, as part of a process.

The evaluation of Dutch product-oriented environmental policy (Brezet et al., 2000), again, resulted in similar conclusions. From that evaluation it can be deduced that both system-technical and social-dynamical elements need to be combined in the organisation of POEM. According to that report, in firms actively engaged in POEM, multidisciplinary project teams were often used, having a quality management

system in place appeared to be an advantage in organising and implementing POEM in a structured manner, and, the more extensive the POEM project, the more positive its effect was perceived to be. However, in its current form, the POEM concept is not suited to every firm, and firms require assistance with its execution, for instance from consultants (Brezet et al., 2000). Emphasis on research and development was an important characteristic of the firms they studied, demonstrating a high level of innovativeness. Maintaining contacts along the product chain was considered to be difficult, and the economic yields the firms expected from engaging in POEM were neutral to negative. Simplification of the tools, and harmonisation of the applicable legislation, are considered to be important by industrial associations for engagement in organising POEM. The similarity between these conclusions and the observations in my research contributes to the validity of my research outcomes.

7.2.3 Applying the capability cycle to POEM

In addition to the answers to the central research question provided in the previous two subsections, a third way of addressing this question is by applying the capability cycle to the research process presented in this thesis. The capability cycle consists of four different stages; interpretation, integration, evaluation, and communication. Here, my research is considered in terms of these stages.

The first stage, ***interpretation***, requires the formulation of what POEM is considered to encompass. In this research, POEM has been defined as a systematic approach to organising a firm in such a way that improving the environmental performance of its products across their life cycles becomes an integrated part of operations and strategy. Because a life cycle perspective is applied, a variety of stakeholders are addressed over that life cycle. Interpreting and balancing the different stakeholder demands is important in this stage. These demands have been addressed through the perceptions of the interviewees, and through looking at how these different expectations were translated into organisational activities and goals.

The second stage, ***integration***, turns plans into actions. In this stage attention focussed on the organisational arrangements that were in place within the investigated firms for organising POEM. Which structures, processes, and instruments were applied, how were system-technical and social-dynamic elements balanced; how were the objectives that were set during the previous stage met? Active stakeholder involvement, and the relationship between strategic and operational levels, were other important aspects addressed through the POEM matrix.

Regarding the ***evaluation*** stage, attention was paid to monitoring, evaluation, and internal reporting structures. This stage was still under development in many of the case study firms, which in part was due to the need to obtain a better understanding of the POEM concept itself, and of stakeholders' expectations of this concept. Certification schemes and standardisation may play a role in this process. This agrees with the observations of Brezet et al. (2000) that simplification of the tools, and harmonisation of the applicable legislation, are important.

Finally, the ***communication*** stage, addresses a firm's contacts with its stakeholders. Consultation with stakeholders is gradually developing, partly due to the mutual dependence; suppliers need to know what a firm's environmental requirements are, while a firm needs information from these suppliers to determine its own products' environmental characteristics. In the case study firms, these aspects are, in part, dealt with by system-technical solutions such as document management systems, but the need to also address social-dynamical elements is recognised, for instance through working actively with suppliers on developing alternative products, or assisting consumers with their product handling. In a wider sense, communication is also important in showing oneself to be a responsible player in the market, and in dealing with issues of responsibility. The increasing attention to environmental and social reporting highlights this.

7.3 Discussion

In discussing the approach followed in this research, attention is given to both theory and practice. A decision was made to consider organisational aspects at the individual company level, achieved by taking a capability perspective in which balancing stakeholder demands was considered central. Therefore, three different theories were applied; and two theoretical frameworks, the POEM matrix and the capability cycle, have been developed. These frameworks have been used in the empirical part of this research, during which five case studies were conducted. Based on a combination of theoretical and empirical inputs, the central research question has been answered, as discussed in the previous section. The approach taken in this research, however, could itself also be discussed, both in terms of the theoretical viewpoints taken, and the way the empirical research has been conducted.

7.3.1 Theoretical considerations

In this research, three different theoretical areas have been combined in order to deliver an integrated insight into the organisation of POEM at the level of an individual firm. This combination of theories immediately raises the first issue for debate. As Hardin (1998: 623) noted: "A final word about interdisciplinary work – do not underestimate its difficulties. The more specialities we try to stitch together, the greater are our opportunities to make mistakes – and the more numerous are our willing critics." Bringing together three areas as diverse as the resource-based view and capability perspective, stakeholder approaches, and quality management and continuous improvement, requires thoughtful reflection on the advantages and disadvantages of such an approach. Because the organisation of POEM is considered to be a continuous, dynamic capability-building process, that is influenced by a variety of stakeholders, and stimulated by the firms' aim of acquiring a competitive advantage, such a combination of different theoretical perspectives could enable a more integrated overview of the organisation of POEM at the individual company

level to be achieved. All three of the central theoretical perspectives, individually, could be valuable in increasing the understanding of certain aspects of POEM. However, each of them considers only specific elements. The capability perspective highlights organisational capabilities, focussing on a firm's individual organisational processes; stakeholder approaches illustrate the interrelationships of firms with a wide range of stakeholders, specially in an issue such as POEM; and quality management and continuous improvement reflect elements of continuity, systems and structures. All three perspectives thus may give an insight into a part of POEM organisation. This research did not aim to elucidate each and every characteristic of these different approaches, but rather to deliver an integrated approach for organising dynamic issues that are subject to changing insights and perceptions; namely POEM. The fact that firms are increasingly assuming a position in which they attempt to demonstrate responsible behaviour, and the fact that these positions relate to different stakeholders, affecting a broad variety of organisational issues (both system-technical and social-dynamic), demonstrate the interrelatedness of these issues. As such, this provides a justification for such an integrated approach, since it makes it unfeasible to address all the related issues in the matrix in full detail. Working with such a 'collection' of different theoretical insights will invite many criticisms. The flaws in the separate approaches might be carried over into this integrated approach, but, hopefully, the mix will smooth out the disputed points, by not relying solely on one flawed theory.

Other theoretical approaches could also contribute to investigating parts of the organisation of POEM, as a few examples below illustrate. Building on institutional theory, Hoffman (1999) stresses the importance of organisational change management to environmental decision-making. He indicates elements that are also discussed in the POEM matrix, viewing the organisational change process as consisting of different stages (diagnosis, unfreezing, moving, refreezing (Northcraft & Neale, 1994)). Taking such an institutional viewpoint could further clarify the interrelatedness of different stakeholders in the process of developing and implementing the POEM concept. An illustration of such an institutional approach to product-oriented environmental management was provided by Boons (1995), who pleaded for stimulating alternative technologies and paying attention to the position of different stakeholders. Related to an institutional approach, considering networks of stakeholders that are of influence on the organisation of POEM within firms could also be useful in understanding the organisation of POEM within firms. Considering stakeholder networks can shed light onto the variety of influences on products' environmental characteristics, and on organisational learning processes (Clarke & Roome, 1995). Yet, such approaches often do not reveal much about the actual organisational implications at a company level, and about the links between strategy and operations. Other related areas include environmental strategy formulation (den Hond, 1996; Starik et al., 1996), and the application of tools and instruments regarding products' environmental characteristics (Karlsson, 1997). Although all these approaches could contribute to the understanding of parts of the process of organising POEM, and the interests and choices involved, they do not present a

general overview of the implications of organising POEM at an individual company level.

In a reflection on the managerial implications of the transition towards sustainable development, Roome (1998) identifies a number of main priority areas for research. These are; processes of change; mechanisms of learning; integrating economic, environmental, and social aspects of business activities; the transition from products to services; interfirm collaboration; future scenarios and backcasting; technology innovation; and more macrolevel trends such as sustainable consumption and production; global change; and mechanisms of governance. It is barely possible, and probably undesirable, to try to address all these directions in one research project. However, research in the area of corporate environmental management could benefit from taking these priority areas into account. My research addresses several of these priority areas, integration being the central one. As Roome (1998: 272) noted: "Studies are required on how industry and its managers understand and operationalize the integration of economic, environmental, and social aspects of choice and how those choices impact industrial activities." In the literature, a relationship between a capability perspective, stakeholder integration, learning and continuous innovation has been suggested (Sharma & Vredenburg, 1998). In this research, several of these aspects have been integrated in taking a process view. Gladwin (1993) warned against developing new environmental theories, and recommended linking corporate environmental research to existing organisational theories. The approaches indicated above do this, illustrating the usefulness of using different theoretical approaches when studying aspects of organising POEM within firms. However, they only consider parts of what, in my view, should be treated as one process: the development of capabilities to manage products' environmental characteristics at both strategic and operational levels. An interdisciplinary issue such as POEM, which touches upon different theoretical perspectives, therefore, in my view, can best be approached from an integrated viewpoint. This might imply a loss of detail, but it can make the overall picture of the organisational process involved, sharper and more complete.

7.3.2 Empirical considerations

The desired practical objective of this research can be stated as delivering a useable, operational contribution to the self-regulating capacities of industrial firms, by producing insights into, and analyses of, the application of POEM. By translating the integrated theoretical perspectives into two comprehensive theoretical frameworks, this goal was achieved. Alongside this broader societal relevance, a more concrete, practical, relevance was achieved by co-operating actively with the representatives from the case study firms who are actually organising POEM. The individual case study analyses as reported in the previous chapter form this contribution. The empirical part of this explorative research demonstrated the applicability of the POEM matrix for delivering an integrated perspective on the organisation of POEM within various large, proactive firms. The relationships between this matrix, the capability cycle, and the case study findings have been discussed, as have alternative

theoretical approaches. However, the analyses and the assumed relationships between the empirical findings and the theoretical frameworks also require some critical reflections.

The POEM matrix formed a very useful guide in conducting the case studies because it provided a coherent set of points for attention. By using this matrix, as a general framework in a case study approach, the main aspects of organising POEM within a firm can be identified. For use with an individual firm, the elements of the matrix might need to be 'personalised' to better fit the firm-specific situation. Instead of highlighting one specific organisational structure or process, the emphasis of the matrix is on viewing structures and processes in a related manner. It was sometimes hard to attribute case study findings to one single element of the matrix and the distinctive nature of the quadrants in the matrix occasionally caused problems. The distinction between operational and strategic authority, for instance, is not always sufficiently clear in all cases, and therefore could cause problems in terms of the scope of activities between these levels. A strict division into quadrants, therefore, is potentially difficult. However, the real-life situations as found in the case studies were also blurred, and firm specificity was, in fact, one of the underlying assumptions to this research, as is raised by the resource-based view.

As discussed earlier, in chapter 4, the matrix is intended to describe and analyse organisational processes in an *integrated* way. Therefore, the elements included in the current version of the POEM matrix are, to an extent, an 'educated guess' as to the elements that should be in each quadrant. This is, to an extent, influenced by the three selected core theories. It could well be that other elements also require a place in the matrix, since a firm's focus on POEM can evolve and attention can shift to other specific organisational elements. Further development of the POEM concept, and further empirical research, should help clarify this. To further improve the accuracy of the matrix, applications in different situations should be studied.

Some further methodological issues can be raised. The empirical part of the study, although built on specific theories, does not go into detail and determine all the properties of resources and capabilities, stakeholders, and quality and continuous improvements in the case study firms. However, the case studies have indicated that the suggested relationships between these theoretical areas are found in practice. Given the focus on managerial decision-makers, their role in balancing stakeholder interests, and in capability-building processes, further research on managerial capabilities in order to assess stakeholder interests could be beneficial. However, this relationship fell beyond the scope of my research. Further research could relate POEM performance[117] to the presence of specific capabilities for addressing stakeholder interests within different firms. Further investigation of such relationships, and their development over time, could be a useful contribution towards obtaining a more complete overview of organisational aspects of POEM. In the final subsection, additional possible directions for research are discussed.

[117] This also implies a further development of POEM performance measurement.

Another possible methodological concern, related to the empirical part of the research, is the limited number of cases. The case studies were only conducted within four different companies, so generalisation of results can be difficult. However, the intention of the case studies was to validate a theoretical construct using a set of empirical observations, which were, to a large extent, based upon the interpretations of managers within the firms studied. In spite of the limited number of cases, one could argue that all the case study firms are influential players in their markets and that this is important in applying a chain perspective. Also, the unique solutions that these firms have developed for dealing with their products' environmental characteristics have been kept central in this research by focussing on an RBV and a capability perspective. Finally, the cases are also relevant because they consider products in different stages of the product life cycle: from intermediate products through to end products. This emphasises the chain perspective that is at the heart of organising POEM. Therefore, I would argue that these cases *do* provide a good introduction to the many issues involved in organising POEM. Further research could move the focus towards a more longitudinal approach; taking a broader scope and following a product throughout its life cycle could deliver valuable information on how, in consecutive 'links' in the product chain, capabilities and interests are matched. The case studies have been treated as individual cases, and no comparisons have been made with competitors. This could also be a next step, especially by focussing on the role of industrial associations. Evaluation studies (e.g., Brezet et al., 2000) could contribute to this.

7.4 Suggestions for further research

A topic with so many angles provides many different directions for further research. Here, a few opportune directions are highlighted: viewing POEM as part of a process, in which firms reconsider their responsibilities, and consider the concept within the larger context of sustainable development. These issues are briefly discussed below.

Viewing the organisation of POEM as a ***process***, emphasises the need for a firm to continually reconsider its position towards its products' environmental characteristics, and to identify and balance the stakeholder interests and expectations involved. To do this, specific organisational capabilities are required in which social-dynamic and system-technical aspects need to be balanced, and managerial roles need to receive adequate attention. In this research, the focus was on large, proactive firms. As recently noted by Winn and Angell (2000), the type of companies they classify as 'deliberate proactive' are taking a systematic approach to their environmental activities. Top management commitment to environmental management, sustainable development and corporate environmental responsibility are central elements. Firms of this type "possess a general capability for prevention which includes planning, monitoring and anticipating, with systems in place to monitor and respond to internal and external environmental issues" (Winn & Angell,

2000: 1130). Also, in a recent study on quality management, the need to supplement this rather system-technical management approach with social-dynamic aspects was emphasised (Broekhuis, 2001). Obtaining a better understanding of the dynamics that surround such a stakeholder-led issue, and the way a firm could cope with these dynamics, is one fruitful direction for further research.

As part of these dynamics, and the changing demands that are imposed upon a firm, the concept of ***responsibility*** is also becoming more prominent. As Post and Altman (1994) noted, besides legal (compliance-based) and economic (market-driven) responsibility, a firm's moral (value-driven) responsibility is important in dealing with the environmental change process. The increasing attention given to the responsibilities of a company for its products, as through POEM, places new demands on an organisation. To deal with this broadening interpretation of the responsibility concept, a firm needs to develop, apply and maintain specific capabilities and organisational arrangements to interpret and address stakeholder interests. This is stressed by the increasing focus on environmental and social responsibility (e.g., Litz, 1996; de Bakker & Nijhof, 2000; Jonker, 2000). Issues of responsibility therefore are another relevant direction, closely connected to the POEM concept, for further research.

Finally, following on from the process view, POEM can also be seen as part of the larger developments in corporate environmental management towards ***sustainable development***. Hart (1995) distinguished between three stages: pollution prevention, product stewardship, and sustainable development. In these terms, POEM is probably closest to product stewardship, although an acknowledgement of sustainable development is clearly present. In the case studies, some interviewees applied such a wider perspective to POEM, looking towards sustainable technology development and opportunities for innovation, and expected POEM to be of increasing importance. The issues Roome (1998) raised, as presented in section 7.3.1, suggest some interesting issues for further research that would allow further investigation of the link between POEM and sustainable industrial development. In doing so, following the approach taken in this research, I would plead to maintain an integrated viewpoint, looking for possible links between different insights. The breadth of aspects required in sustainable technology development, environmental innovations, and new systems development (e.g., Brezet, 1997; Vellinga & Herb, 1999; Weaver et al., 2000) justifies such an approach. Thus, maintaining an integrated perspective, and balancing system-technical elements such as managerial systems and structures with social-dynamical processes, could together contribute to the attainment of more sustainable industrial development. The examination of the concept of POEM, as presented in this research, provides a contribution through generating a better understanding of the responsibilities a firm has for its products' environmental characteristics, the way it can continually manage these, and viewing this understanding in a wider, sustainable development, perspective.

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SUMMARY

Introduction

Companies are increasingly giving attention to the environmental characteristics of products. In this research, product-oriented environmental management (POEM) has been defined as a systematic approach for organising a firm in such a way that improving the environmental performance of its products over their life cycles becomes an integrated part of operations and strategy. Firstly, the importance to a firm of considering the environmental characteristics of its products was outlined. Kärnä (1999) provided four reasons to focus on a product's environmental characteristics at the individual company level. Products can be regarded as a source of environmental burden; environmental policies increasingly focus on products; a variety of stakeholders in the product life cycle have an influence on a product's environmental characteristics; and manufacturing firms are in a position to influence some of these characteristics. In the literature, relatively little attention has been paid to organisational aspects of dealing with a product's environmental aspects within a company. This research therefore focussed on the ways in which an individual company could organise product-oriented environmental management. The central research question considers the motivations and ways in which large, proactive, firms develop and maintain product-oriented environmental management, both at the strategic and the operational level. This question was formulated as:

"Why and how do large, proactive, firms develop and maintain product-oriented environmental management, both at a strategic and an operational level?"

Background of POEM

Prior to various theoretical perspectives being applied to address this central question in chapter 2, the development of the POEM concept was outlined in the broader context of corporate environmental management. First, the growing environmental awareness was outlined, identifying three important factors in that process: the changing properties of environmental problems, the changing character of environmental regulations, and the growing attention to the concept of sustainable development. Environmental problems are increasingly accepted as a serious societal concern, regulations have shifted towards internalisation and target group policies, and the concept of sustainable development explicitly involves and addresses a wide array of stakeholders, business being a prominent one.

Influenced by this increasing environmental awareness, the relationship of business to the environment is also changing. To characterise this relationship, several strategic postures that a firm could towards environmental management have been identified. In this research, the focus is on the organisation of POEM within large, proactive, firms. Proactivity is defined as emphasising a firm's own initiatives, including an acknowledgement that environmental demands can be providers of

business opportunities (Magnusson, 2000). To better understand POEM organisation within such a proactive firm, it is useful to consider the possible motives for a firm to engage in POEM. In terms of these motives, a distinction is made between competitive requirements and stakeholder requirements. From a competitive point of view, POEM might play a part in transforming environmental problems into business opportunities, as a product's environmental performance can form an additional competitive element. POEM is also an issue in which many stakeholders are involved, necessitating firms to reconsider their existing relationships with stakeholders, and possibly to develop new ones, since this type of environmental management requires them to broaden their outlook to encompass the product's entire life cycle. A third element in the changing relationship of business to the environment is the evolutionary character of corporate environmental management. The development from 'cleaning technology' towards 'cleaner technology' and POEM is part of a continuous process, moving towards more sustainable modes of business. In such a process, firms need to maintain sufficient flexibility to deal with environmental issues.

Theoretical insights

This general view into the background of POEM concluded that it is a relatively new concept, for which a firm needs to develop and maintain specific organisational capabilities, and in which various stakeholders' interests have to be continually addressed. Chapter 3 therefore presented three appropriate theoretical perspectives; (1) a resource-based view (RBV) and a capability perspective, (2) a stakeholder approach, and (3) insights from quality management and continuous improvement. Building on the capability perspective, the organisation of POEM is considered to be a process of building and maintaining relevant organisational capabilities. These capabilities are defined as a firm's ability to continuously co-ordinate, deploy and legitimate resources in order to intentionally perform tasks. Using a capability-building process, firms can gather, develop and implement the new sets of knowledge required to continually organise POEM (Iansiti & Clark, 1994; den Hond, 1996). This immediately provides links to the other theoretical areas. Firstly, within POEM, attention is paid to the entire product life cycle, hence affecting a broad range of different stakeholder interests. Firms working on the organisation of POEM thus have to deal with such a variety of stakeholders. The identification and salience of stakeholders, as perceived by a firm's managers, could be considered to depend upon the stakeholders' power, urgency and legitimacy (Mitchell et al., 1997). Therefore, insights from stakeholder theory can assist in obtaining an overview of the interests involved, and the role of managers is stressed. Furthermore, such efforts have to be carried out continuously. Quality management and continuous improvement literature is of value here, since it delivers ideas on continuous processes, and on the organisational implications of working towards such improved quality, including the balancing of system-technical and social-dynamic elements within organisations. Yet, none of these three theoretical areas can fully account for the organisation of POEM by itself. So, provided that the capability perspective can be infused with insights from the other areas, the strengths of the different areas can

be combined to develop a relevant theoretical approach to POEM. A firm's efforts to balance its products' environmental characteristics over their life cycles then can be considered as a continuous, dynamic capability-building process, and one that is influenced by a variety of stakeholders and stimulated by the firms' aim of acquiring a competitive advantage.

Theoretical constructs

In chapter 4, the three perspectives are integrated in order that they can be applied in the empirical part of the research. This led to the construction of two central theoretical frameworks that were used in conducting the empirical part of this research: the POEM matrix and the capability cycle. The ***POEM matrix*** combines system-technical and social-dynamic organisational elements at both operational and strategic levels, identifying a range of related elements relevant to the organisation of POEM. In addition to the four quadrants, at the core of this matrix are capability-building, stakeholder orientation, and continuous improvement. An integrated approach to the different elements of the matrix is important in balancing the process of organising POEM. Establishing a firm's position in terms of these different elements of the POEM matrix, delivers an insight into POEM organisation within that firm. The ***capability cycle*** describes a continuous process of developing and maintaining capabilities in order to address stakeholder demands, hence combining theoretical perspectives. The concept of responsibility is important when combining these perspectives, and was addressed in order to highlight the important role of managerial decision-makers in perceiving and balancing the different stakeholder interests. In the POEM matrix, this was illustrated by bringing the three core elements of the matrix together under the heading 'responsibility'. To achieve a form of responsible chain management, such as POEM, a well-balanced set of organisational capabilities is required at each stage of the capability cycle. The capability assessment framework considers the four stages of the capability cycle from both internal and external orientations. This framework assists in assessing a firm's capability base, and provides a provisional illustration of capabilities relevant to issues of responsible chain management, such as organising POEM. By studying the process of organising POEM in firms that take a proactive approach to environmental management, it is hoped that a better insight into the building and maintenance of organisational capabilities associated with POEM will be obtained.

Methodology

In chapter 5, a thorough account of the choices and considerations made while developing this research is given. Because the research focussed on the interpretations and perceptions of managerial decision-makers in the studied firms, an interpretative paradigm was selected as the most appropriate point from which to start. A qualitative research methodology was then selected, in order to enable a better understanding of the organisational processes regarding POEM within the local context of the firms to be gained. Case studies were a suitable research strategy as they allowed the study of a contemporary phenomenon within its local context,

while at the same time considering a broad range of factors. A case study strategy, structured in such a way that sufficient flexibility is guaranteed, is beneficial in studying an issue undergoing development such as the organisation of POEM within firms. This research is intended to produce useful theoretical constructs or frameworks for analysis that will indicate how a firm can effectively develop and implement POEM. These frameworks hence guided the empirical research, and the elements within them serve as important inputs to the interviews conducted during the empirical part of the study. At the same time the framework is improved, with the outcomes of the empirical research leading to adjustments as necessary. In an attempt to contribute to theory development, the relevant points of interest identified from the case studies are confronted with the theoretical frameworks. In doing so, the contributions of this research to theory development are made explicit.

Building on the elements contained in the POEM matrix, a case study questionnaire was thus developed which addressed the integrated aspects of organising POEM. As suggested by this matrix, attention in the organisation of POEM should, on the one hand, focus on system-technical solutions, such as management systems, instruments, and tools, and, on the other, acknowledge the need for social-dynamic processes, such as training, and raising motivation and commitment. The second research framework, the capability cycle, emphasises the process character of POEM, highlighting continuous development. This framework has also been used in the analysis of the case study findings. In the case study interviews, people in managerial positions were predominantly involved.

Case studies

In chapter 6, the case study findings are presented and analysed; the five case studies were first analysed individually, followed by a cross-case analysis in which the two theoretical frameworks are combined and applied to the empirical findings. The case studies consisted of three ‘full’ case studies, at DSM Powder Coating Resins, DSM Structural Resins, and Xerox Europe, in which the organisation of POEM was thoroughly analysed. Two additional ‘mini-cases’, at IBM and 3M, considered a specific organisational initiative at each of these companies.

In the empirical part of the research, the suggestions deduced from theory, that a stakeholder orientation and competitive requirements are important reasons for firms to engage proactively in organising POEM, have been confirmed. From the five case studies, important stimuli for a firm to engage in POEM were identified as; gaining a possible competitive advantage, stakeholder pressures, executing corporate environmental policies, demonstrating responsibility, and obtaining a better insight into the concept of POEM. The barriers to engaging in POEM identified in this research strengthen this view. The main barriers are; the costs involved, convincing people both inside and outside the company of the need to engage in POEM, legislative barriers, and the internal structure and dynamics of a firm. These are essentially complementary to the stimuli identified; costs versus competitive advantage, and convincing people and legislative barriers against stakeholder pressures. These barriers are also linked to the organisational issues addressed in the

POEM matrix. The findings are in line with a recent evaluation of Dutch product-oriented environmental policy (Brezet et al., 2000).

Conclusion and discussion

In chapter 7, attention is turned to the conclusions, discussion and directions for further research. The main conclusion that can be drawn from this research is that it is most important to consider the organisation of POEM, at the individual company level, as a process in which balancing different stakeholder interests in a continuous way is essential. To accomplish this it is helpful to involve a cross-functional team in this process and to balance system-technical and social-dynamic organisational aspects. In addition to these stakeholder interests, when organising POEM, it can be conducive for a firm to obtain a clear view of the potential competitive advantages associated with the concept, and to maintain a broad perspective within which POEM is considered in terms of corporate responsibility and sustainable industrial development. Managerial decision-makers have a central role in this process. If they view the POEM concept as an opportunity, and as part of responsible business practice, this will provide support for setting corporate environmental goals beyond the company's current organisational capability base. These concluding remarks provide an answer to the central research question.

Several points for discussion have been raised. In terms of theory, these included the combination of different theories, the selection of the three theories over alternative available approaches, and the relationship of this thesis work to several priority areas for research in sustainable industrial development. The stated practical objective of this research was to deliver a useable, operational contribution to the self-regulating capacities of industrial firms; by producing insights into, and analyses of, the application of POEM. By translating the integrated theoretical perspectives into two comprehensive theoretical frameworks, this goal has been achieved. The empirical part of this explorative research demonstrated the ability of the POEM matrix to deliver an integrated perspective on the organisation of POEM within various large, proactive firms. Here, the discussion concentrated on the applicability of the POEM concepts within an individual firm, the composition of the set of elements in the POEM matrix, and the fact that in this research an integrated approach was taken and therefore no detailed account of all the properties of resources and capabilities, stakeholders, and quality and continuous improvements in the case study firms was presented. Finally the validity of a limited number of cases is addressed.

The thesis concludes with suggestions for further research. A topic with so many facets provides many different directions for research. Three appropriate directions are highlighted: viewing POEM as part of a process, as one in which firms reconsider their responsibilities, and thirdly considering the concept within the larger context of sustainable development. These issues are briefly discussed below.

Viewing the organisation of POEM as a ***process***, emphasises the need for a firm to continually reconsider its position towards its products' environmental characteristics, and to identify and balance the stakeholder interests and expectations

involved. To achieve this, specific organisational capabilities are required. Obtaining a better understanding of the dynamics that surround such a stakeholder-led issue as POEM, and the way in which a firm could cope with these dynamics, is considered to be one fruitful direction for further research. As part of these dynamics, and the changing demands that are imposed upon a firm, the concept of ***responsibility*** is becoming more prominent. The increasing attention given to the responsibilities of a company for its products, places different demands on an organisation. Issues of responsibility are therefore another relevant direction, closely connected to the POEM concept, for further research.

Finally, following on from the process view, POEM can also be seen as part of the developments in corporate environmental management towards ***sustainable development***. Hart (1995) distinguished three stages: pollution prevention, product stewardship, and sustainable development. Further investigation of the link between POEM and sustainable industrial development would be a third relevant direction, which could be achieved by maintaining an integrated viewpoint and looking for possible links between different insights.

Samenvatting

Inleiding[118]

In toenemende mate wordt door ondernemingen aandacht besteed aan de milieu-effecten van producten. Voor individuele ondernemingen kunnen verschillende redenen worden aangegeven om dat te doen: producten vormen een bron van milieubelasting, milieubeleid wordt in toenemende mate gericht op producten, een scala aan belanghebbenden ('stakeholders') in de productlevenscyclus kan de milieu-effecten van producten beïnvloeden en productiebedrijven verkeren in een positie om producteigenschappen te veranderen. In de literatuur is echter relatief weinig aandacht besteed aan de organisatorische aspecten van het door ondernemingen rekening houden met milieu-effecten van producten. Er is behoefte aan studies waarin wordt gekeken naar de wijze waarop managers de integratie van economische, milieu en sociale aspecten van hun keuzes begrijpen en operationaliseren, en naar hoe deze keuzes invloed hebben op industriële ontwikkelingen. De organisatie van productgerichte milieuzorg (PMZ) binnen individuele ondernemingen staat daarom centraal in dit onderzoek. PMZ wordt gedefinieerd als een systematische benadering van de organisatie van een onderneming, zodanig dat het verbeteren van de milieuprestatie van producten gedurende de productlevenscyclus een geïntegreerd onderdeel wordt van de operationele en strategische activiteiten. De centrale onderzoeksvraag in dit onderzoek betreft de redenen voor, en de manieren waarop grote, proactieve ondernemingen PMZ ontwikkelen en onderhouden, zowel op het strategische als op het operationele niveau.

Achtergrond PMZ

Voordat wordt ingegaan op de verschillende theoretische invalshoeken die in dit onderzoek zijn toegepast, wordt in hoofdstuk 2 de ontwikkeling van het concept PMZ geplaatst in de bredere context van milieumanagement in bedrijven. Eerst wordt het toenemende milieubewustzijn bekeken, waarbij drie belangrijke factoren worden onderkend: de veranderende eigenschappen van milieuproblemen, waardoor deze in toenemende mate worden beschouwd als een maatschappelijk probleem; het veranderende karakter van milieubeleid en regelgeving, waarbinnen de aandacht is verschoven naar verinnerlijking en doelgroepenbeleid; en de toenemende belangstelling voor het concept duurzame ontwikkeling, dat expliciet gericht is op een brede reeks stakeholders.

Onder invloed van dit groeiende milieubewustzijn verandert ook de houding van ondernemingen ten opzichte van het milieu. Verschillende strategische posities die bedrijven kunnen innemen ten opzichte van het milieu worden onderscheiden. In dit onderzoek ligt de nadruk op de wijze waarop grote, proactieve ondernemingen

[118] Omwille van de leesbaarheid zijn in deze samenvatting geen referenties opgenomen. Daarvoor wordt verwezen naar de hoofdtekst.

PMZ organiseren. Proactiviteit wordt gedefinieerd als het nadrukkelijk nemen van eigen initiatieven in milieumanagement door een onderneming, inclusief de erkenning van milieu-aspecten als mogelijke bron van concurrentievoordeel. Om de organisatie van PMZ in dergelijke proactieve ondernemingen beter te begrijpen, is het zinvol om ook de motieven die een bedrijf heeft om PMZ te organiseren te bekijken. In dit onderzoek wordt daartoe een onderscheid gemaakt tussen concurrentie-overwegingen en eisen en verwachtingen van stakeholders. PMZ kan een rol spelen in het transformeren van milieuproblemen in concurrentiemogelijkheden, omdat de milieuprestaties van een product een extra onderscheidend kenmerk kunnen vormen. PMZ kan daarnaast ook duidelijk worden gerelateerd aan belangen van verschillende stakeholders. De milieu-effecten gedurende de gehele productlevenscyclus staan centraal en verschillende stakeholders kunnen die effecten beïnvloeden. Voor ondernemingen is het daarom van belang de bestaande betrekkingen met stakeholders regelmatig te evalueren en, zo mogelijk, ook nieuwe betrekkingen te ontwikkelen. Een ander element in de veranderende verhouding van ondernemingen ten opzichte van het milieu vormt het evolutionaire karakter van milieumanagement. De ontwikkeling van saneringsgerichte milieuzorg tot productgerichte milieuzorg kan worden gezien als resultaat van een continu proces richting meer duurzame industriële ontwikkeling. In een dergelijk proces moeten ondernemingen voldoende flexibel zijn om met veranderende milieuproblemen om te kunnen gaan.

Theoretische invalshoeken

Productgerichte milieuzorg is een relatief nieuw concept, waarvoor een onderneming specifieke organisatorische vaardigheden (‘capabilities’) moet ontwikkelen en onderhouden, en waarin verschillende stakeholderbelangen op continue wijze dienen te worden betrokken en afgewogen. In hoofdstuk 3 zijn daarom drie toepasselijke theoretische invalshoeken beschreven: (1) de ‘resource-based view’ en een gerelateerd vaardighedenperspectief, (2) de stakeholderbenadering, en (3) inzichten uit het kwaliteitsmanagement en het ‘continu verbeteren’. Voortbouwend op het vaardighedenperspectief kan PMZ worden beschouwd als een proces, gericht op het ontwikkelen en onderhouden van relevante organisatorische vaardigheden. Deze worden gedefinieerd als het vermogen van een onderneming om hulpmiddelen (‘resources’) op continue wijze te coördineren, organiseren en verantwoorden, om zo doelgericht taken uit te kunnen voeren. Het vaardighedenperspectief geeft aan op welke wijze bedrijven de nieuwe kennis, die bijvoorbeeld het continu organiseren van PMZ vereist, kunnen ontwikkelen en implementeren. Vanuit dit perspectief wordt een direct verband gelegd met de andere theoretische invalshoeken. PMZ besteedt aandacht aan de gehele productlevenscyclus, terwijl een veelheid aan stakeholders een rol speelt gedurende die levenscyclus. In het identificeren van stakeholders en het afwegen van hun belangen spelen managers een belangrijke rol, terwijl ook macht, urgentie en legitimiteit van de betreffende stakeholders van belang zijn. Inzichten uit kwaliteitsmanagement en het continu verbeteren kunnen vervolgens helpen bij het waarborgen van continuïteit in de organisatie van PMZ. Dit kan bijvoorbeeld door het leveren van ideeën over ontwikkelingsprocessen en over de organisatorische gevolgen van het werken aan een verbeterde (milieu-)

kwaliteit van producten. In hoofdstuk 3 worden deze invalshoeken gerelateerd aan milieumanagement. Echter, geen van de benaderingen op zich biedt een volledig inzicht in de organisatie van PMZ. Door een combinatie van deze verschillende benaderingen kunnen de sterke punten van deze theorieën worden meegenomen en leiden tot een relevante theoretische benadering van PMZ.

Theoretische constructen

In hoofdstuk 4 worden de drie theoretische perspectieven geïntegreerd om ze toe te kunnen passen in het empirische gedeelte van dit onderzoek. Dit resulteert in de constructie van twee centrale theoretische constructen: de PMZ-matrix en de vaardighedencyclus. In de ***PMZ-matrix*** worden systeem-technische en sociaal-dynamische organisatorische elementen op zowel operationeel als strategisch niveau gecombineerd. Daarbij worden diverse elementen die van belang zijn voor de organisatie van PMZ met elkaar in verband gebracht. Naast de vier kwadranten die in de matrix kunnen worden onderscheiden, zijn in de kern van deze matrix de drie theoretische invalshoeken van dit onderzoek bijeengebracht. Deze elementen kunnen worden gebruikt om de positie die een onderneming inneemt ten aanzien van de organisatie van PMZ te beoordelen, en om vast te stellen op welke organisatorische elementen daarbij de nadruk ligt. De ***vaardighedencyclus*** beschrijft het continu proces van ontwikkelen en onderhouden van vaardigheden om zo te kunnen reageren op de verschillende eisen van stakeholders. Om een vorm van ketenmanagement, zoals PMZ, te organiseren, is een uitgebalanceerde set van vaardigheden vereist in iedere fase van de cyclus (interpretatie, integratie, evaluatie en communicatie).

Methodologie

In hoofdstuk 5 wordt een overzicht gepresenteerd van de keuzes en afwegingen die in dit onderzoek zijn gemaakt. Om tot een beter begrip van het organisatieproces betreffende PMZ binnen de bestudeerde ondernemingen te kunnen komen, is een kwalitatieve onderzoeksmethodologie gekozen. Case studies vormen daarbij een geschikte onderzoeksmethode aangezien deze het mogelijk maken om een fenomeen in zijn locale context te bestuderen. De case studies moeten dan zodanig worden gestructureerd dat voldoende flexibiliteit aanwezig is om een onderwerp te bestuderen dat sterk aan verandering onderhevig is, zoals de organisatie van PMZ binnen ondernemingen. Voortbouwend op de elementen die in de PMZ-matrix zijn opgenomen is een vragenlijst ontwikkeld waarin veel aspecten van het organiseren van PMZ zijn opgenomen. De aandacht voor de organisatie van PMZ is enerzijds gericht op systeem-technische oplossingen, zoals managementsystemen, instrumenten en hulpmiddelen, terwijl er anderzijds ook een behoefte is aan sociaal-dynamische processen, zoals training van medewerkers en het versterken van motivatie en commitment. De vaardighedencyclus onderstreept het procesmatige karakter van PMZ. Deze cyclus is ook toegepast bij de analyse van de cases. In de case study interviews zijn voornamelijk personen in managementposities betrokken. De relevante inzichten uit de case studies zijn vergeleken met de theoretische

constructen, waardoor de bijdrage van dit onderzoek aan de theorie-ontwikkeling meer expliciet is gemaakt.

Empirisch onderzoek

In hoofdstuk 6 zijn de bevindingen uit de case studies gepresenteerd en geanalyseerd. De vijf case studies zijn eerst afzonderlijk geanalyseerd, gevolgd door een cross-case analyse waarin de theoretische constructen zijn gecombineerd. Het onderzoek omvat drie volledige case studies: DSM Powder Coating Resins, DSM Structural Resins, en Xerox Europe. In deze case studies is de organisatie van PMZ als geheel grondig geanalyseerd. Twee 'mini-cases', bij IBM en 3M, zijn daaraan toegevoegd. Daarin is gekeken naar specifieke organisatorische initiatieven ten aanzien van PMZ.

In het empirische gedeelte van het onderzoek zijn de suggesties die zijn afgeleid uit de theorie bevestigd, namelijk dat een stakeholderoriëntatie en concurrentiemotieven belangrijke redenen zijn voor ondernemingen om de organisatie van PMZ proactief op te pakken. Vijf belangrijke stimuli voor de organisatie van PMZ zijn te onderscheiden: het verkrijgen van een concurrentievoordeel, druk vanuit stakeholders, het uitvoeren van het bedrijfsmilieubeleid, het demonstreren van maatschappelijke verantwoordelijkheid en het beter bekend raken met het concept PMZ. Belangrijke barrières zijn de kosten, het overtuigen van mensen binnen en buiten de onderneming van de noodzaak om aan PMZ te werken, obstakels in regelgeving en beleid, en de interne structuur en dynamiek van een onderneming. In grote lijnen zijn deze barrières dus complementair aan de stimuli die werden onderscheiden. Deze bevindingen komen overeen met de resultaten van een recente evaluatie van het Nederlandse stimuleringsbeleid inzake PMZ (Brezet et al., 2000).

Conclusie en discussie

In hoofdstuk 7 is aandacht besteed aan de conclusies, discussie en aanbevelingen voor verder onderzoek. De voornaamste conclusie die kan worden getrokken uit dit onderzoek is dat het belangrijk is om de organisatie van PMZ te beschouwen als een proces, waarin het afwegen van verschillende stakeholderbelangen op een continue wijze noodzakelijk is. Het inzetten van een crossfunctioneel team bij dit proces, en het balanceren van systeem-technische en sociaal-dynamische organisatorische aspecten, zijn daarbij zinvol. Naast de betrokken stakeholderbelangen is het voor een onderneming ook van belang om een duidelijk inzicht te hebben in de mogelijke concurrentievoordelen die samenhangen met het organiseren van PMZ. Tenslotte is het van belang om PMZ te kunnen plaatsen in een breder perspectief, bijvoorbeeld in termen van de sociale verantwoordelijkheden van een onderneming en van duurzame ontwikkeling. In dit gehele organisatieproces nemen managers een belangrijke positie in, zowel bij het interpreteren van stakeholderbelangen en van het concept PMZ, als bij de ontwikkeling van nieuwe organisatorische vaardigheden en het hanteren van een breder perspectief.

Naast deze conclusies zijn ook verscheidende punten voor discussie aangegeven. Wat theorie betreft, gaat het om het combineren van verschillende invals-

hoeken, de specifieke keuze voor juist deze drie theorieën (waar ook andere theorieën mogelijk waren geweest), en de relatie tussen dit proefschrift en verschillende prioriteitsgebieden in onderzoek naar duurzame industriële ontwikkeling. Wat de praktijk betreft beoogde dit onderzoek een bruikbare, operationele bijdrage te leveren aan het zelfregulerend vermogen van industriële ondernemingen door het geven van inzicht in de organisatie van PMZ. Het empirische gedeelte van dit exploratieve onderzoek geeft de toepasbaarheid aan van de PMZ-matrix binnen grote, proactieve bedrijven. De vaardighedencyclus is bruikbaar gebleken in de analyse. Punten voor discussie betreffende het empirische deel van het onderzoek zijn de bruikbaarheid van de matrix op het niveau van individuele ondernemingen, de precieze samenstelling van de matrix en het feit dat in dit onderzoek een geïntegreerde benadering is gekozen. Daardoor is geen gedetailleerde uitwerking van de eigenschappen van hulpmiddelen, vaardigheden, stakeholders en kwaliteit en continu verbeteren in de case study bedrijven gegeven.

Het proefschrift wordt afgesloten met een aantal aanbevelingen voor verder onderzoek. Een onderwerp met zoveel verschillende invalshoeken levert veel verschillende richtingen voor verder onderzoek op. Drie richtingen worden aangestipt: ten eerste het beschouwen van PMZ als onderdeel van een ***proces***, waarin ondernemingen hun verantwoordelijkheden heroverwegen en het concept PMZ bezien binnen de bredere context van duurzame ontwikkeling. PMZ beschouwen als een proces benadrukt de behoefte van een onderneming om de positie ten opzichte van de milieu-effecten van de producten continu te heroverwegen, en om de stakeholderbelangen en -verwachtingen te identificeren en af te wegen. Als onderdeel van dit dynamische proces, en de veranderende eisen die aan een onderneming worden gesteld, wordt het concept ***verantwoordelijkheid*** prominenter. De toenemende aandacht die door een onderneming aan haar producten wordt gegeven, zoals door PMZ, stelt andere eisen aan het inzicht in de verantwoordelijkheden die een onderneming heeft ten opzichte van de milieu-effecten van haar producten, de wijze waarop het deze op continue wijze kan beheersen, en het beschouwen hiervan in een breder perspectief van ***duurzame ontwikkeling***. Vanuit onderzoek naar het concept PMZ kan verdere aansluiting met onderzoek richting meer duurzame ontwikkeling worden gezocht.

Appendix A
Product Stewardship

Within the chemical industry, POEM is often carried out as part of the so-called Product Stewardship (PS) code, which is one element of the Responsible Care Programme. The first two case studies discussed in chapter 6 of this thesis also address this PS code. In this appendix, brief overviews of Product Stewardship and Responsible Care are given in order to provide some further background information, and to indicate their relationship with the POEM concept as it is applied in this thesis.

The Responsible Care Programme is a voluntary code of practice that is widely applied within the chemical industry. In a study on the adoption of Responsible Care in the USA, Howard et al. (1999: 282) noted: "The US Chemical Manufacturers Association (CMA) established the Responsible Care Programme in 1988 in a climate of steadily eroding public confidence in the chemical industry (…) Responsible Care was designed to improve the environmental, health and safety performance of its members, but also demonstrate its improved performance to critics." It was expected that, through such self-regulation, both the environmental, health and safety performance of the chemical industry, and the public perception of the industry could be improved (King & Lenox, 2000).

According to the CMA website[119], Responsible Care is obligatory to membership of the American Chemistry Council, and requires member companies to: continually improve their health, safety and environmental performance; to listen and respond to public concerns; to assist each other to achieve optimum performance; and to report their goals and progress to the public. Responsible Care consists of several elements, including guiding principles, six different codes of management, performance measurement and reporting obligations. As King and Lenox (2000) summarise, these management codes focus on specific management practices, guiding dialogues with the community (the community awareness and emergency response code); addressing how a firm manages its own facilities (the pollution prevention, process safety, and employee health and safety codes), and interacts with chain partners such as suppliers and customers (the distribution and product stewardship codes). Various chemical industry associations endorse Responsible Care, including the European Chemical Industry Council (CEFIC) and the Association of Dutch Chemical Industry (VNCI). The broad support for the programme could create peer pressure among member companies of these associations, as discussed also in chapter 6. "As a greater portion of the chemical

[119] The address of the website, as accessed in March 2001, is http://www.cmahq.com. Some other relevant chemical industry websites include the site of the European Chemical Industry Council CEFIC (http://www.cefic.be), and of the Association of Dutch Chemical Industry (VNCI) (http://www.vnci.nl). In the literature, works on product stewardship include Simmons and Wynne (1993), Howard et al., (1999), and King and Lenox (2000).

industry participates in Responsible Care, there may be greater incentives for other firms to participate" (King & Lenox, 2000: 714).

However, these different management codes only set standards for inputs, not for outputs (King & Lenox, 2000). In the Responsible Care Programme, determination of performance targets is left to firms, which led Howard et al. (1999: 294-295) to conclude that "Self-reporting of compliance with a voluntary code will tend to reflect an organization's internal interests and standards, which may, or may not, conform with the desired institutional norms. Successful implementation of non-regulatory codes of practice requires the meaningful involvement of a larger community to ensure that the actions of the adopter are consistent with societal goals."

Among these management codes, the Product Stewardship (PS) code covers the integration of health, safety, and environmental protection into designing, manufacturing, marketing, distributing, using, recycling and disposing of products. This code therefore has clear similarities with the POEM concept, which has been defined as a systematic approach to organising a firm in such a way that improving the environmental performance of its products across their life cycles becomes an integrated part of operations and strategy. In the Netherlands, the VNCI commissioned a study by the consultancy firm KPMG (1997), which emphasised the close similarities between the two concepts. Therefore, the VNCI treats the concepts as being similar, and supports research and development projects in this area, linked to practical experiments (VNCI, 1998). Although the scope of PS is broader than the POEM concept (PS also considers health and safety issues), studying the organisation of PS can deliver valuable insights into organisational aspects of product-oriented management.

To perform such a study on the organisation of POEM, the difficulties identified with Responsible Care, emphasise the relevance of considering a stakeholder orientation, taking a process view (continuous improvement), and looking at the development and maintenance of the required organisational capabilities. In this thesis, the issue of responsibility has been applied to link these three different relevant areas. This issue is gradually becoming more important within Responsible Care, where ideas are being developed on third-party verification (King & Lenox, 2000), and where finding accurate performance information appears to be difficult (Howard et al., 1999). Applying the capability cycle (de Bakker & Nijhof, 2000) could therefore also be used with this chemical industry equivalent of POEM. As Howard et al. (1999: 294) noted, "greater attention by external stakeholders to internal practices could lead to a more consistent pattern of implementation."

Appendix B
Case Study Questionnaire

This appendix presents an illustration of the case study questionnaire, which formed the basis for the questionnaires applied in the different case studies. In the case studies, firm-specific questions were added, developed from information obtained in the document studies.

Introduction

- Introduction of the interviewer; indicaton of the background to this Ph.D. research project and how the interviewee has been selected.
- Explanation of the procedure.

These interviews are part of a case study I am conducting at [*name company*] to investigate the organisation of product-oriented environmental management within the firm. The results of the interviews are used anonymously and are intended to get a better view of the organisation process of product-oriented environmental management (POEM). Open-ended questions are used. To a large extent all interviewees get the same questions, although specific attention to each interviewee's background is given. The questions can be divided into four categories:

1. Basic information about the interviewee and the company
2. Information about product-market combinations (product characteristics, marketing, manufacturing)
3. Organisation of POEM within the company, and role of the interviewee in that process
4. POEM in a larger context

Sometimes the interviews were recorded to simplify the description and to enable coding of the data. Only the interviewer has access to these recordings. Subsequently, the interviews are transcribed and returned to the interviewee for verification. Following this on, analysis of the interviews took place. The results were communicated back to the firm at an aggregated level.

Do you have any questions before we start?

1. Basic information about interviewee and company

Personal characteristics

1) Function (official title)?
2) Educational background?
3) How long employed by the firm?
4) Experience / previous functions?
5) Tasks, activities, responsibilities?
6) Motivation to work in this function at this firm?

Company characteristics

1) Strategy/mission/aims; expectations for the future?
2) Structure of the company (organigram)?
3) Number of employees, turnover, number of subsidiaries etc.?
4) Product characteristics (including environmentally relevant characteristics); number and type of product-market combinations (pmcs)?
5) Environmental management system in place / certificates and standards applied (ISO/BSI/EMAS/…)?
6) Indication of number and type of competitors, suppliers, customers and end-users / what is the position of the company relative to its competitors?
7) What are the core competencies of the firm? And its weaknesses?
8) Which trends can be discerned in company strategy (e.g., ‘back to core business’, ‘invest in new technologies’, ‘cost leadership’)?

2. Specific product-market combination

1) Aims and main activities?
2) Structure of pmc / departments involved?
3) Division of tasks?
4) Cross-functional co-operation (when, who, why, how)?
5) Number and type of sub-pmcs?
6) Allocation of resources?
7) Performance measurement / reward systems?
8) Communication to and from senior management?
9) Main characteristics of the firm culture (examples)?

3. Product, market and manufacturing information

1) Main product characteristics (type, materials, design characteristics, number of components, complexity)?
2) Main product demands?

3) Strong and weak points of the product?
4) Which phase of the product life cycle is the product in?
   - introduction; (just on the market)
   - growth; market share rising
   - maturity; market share stagnating
   - decline; market share decreasing
5) Type of market (consumer, industry, government) / How does that influence the product?
6) What drives innovations (market or product development)? / How much freedom does R&D have; are they stimulated in environmental directions?

4. Internal organisation of POEM

1) What has been the motivation to become involved with POEM (e.g., regulation, market demands, costs, crisis, opportunity, responsibility, competitors)?
2) What are, in your opinion, the main characteristics of POEM?
3) At which parts of the product life cycle is POEM aimed at within your firm?
   - R&D, product development and design
   - Suppliers: materials acquisition and service providers
   - Production
   - Logistics
   - Customers
   - Re-use and recycling;
   - Disposal
4) Why were these products / this pmc selected for POEM?
5) Is there any relationship with:
   - The existing (process-oriented) environmental management system?
   - The quality management system?
   - ISO 14000 and 9000 series?
6) In which implementation phase is the POEM initiative?
7) Are there any multidisciplinary teams involved with this issue?
8) How are POEM and environmental issues viewed within this PMC / the firm?
9) Are there activities to stimulate employee co-operation in environmental projects? If so, which (e.g., courses, participation in pilot projects, co-operation with trade associations, activities with suppliers, activities with regulators)
10) Is there any internal environmental education and training?
11) Is there a separate budget for environmental activities?

5. Personal role and perception of the interviewee

1) What is your own role in the POEM project (tasks and activities; responsibilities)?
2) What possibilities do you have to influence the project?

3) Which means of communication, feedback etc. are applied?
4) What role does company management play in POEM?
5) Is Product-Oriented Environmental Management supported by those not directly involved?
6) What is the expected added value of POEM?
7) Is POEM compatible with other processes within the firm / differences between POEM and other projects?
8) Is there sufficient knowledge available within the firm to organise POEM (if not, what is done to improve the situation)?
9) Your general impression of POEM?

6. POEM in larger context

1) Is there an active exchange of knowledge with supplies and customers?
2) Is your firm in a position to influence chain partners (how is that done)?
3) Does your firm communicate with other stakeholders on Product-Oriented Environmental Management and if so with which stakeholders (customers, suppliers, government, universities, consultancies, special interest groups etc.)?
4) Is there any co-operation with other companies on this topic (competitors?)?
5) What are the main external stimuli to work on POEM?
6) What are the main internal stimuli to work on POEM?
7) What are the main barriers to working with POEM?
8) Pros and cons of the chosen approach towards POEM?
9) Are environmental issues currently a competitive factor, or could they become one? Do you see possibilities in there for your firm?
10) How does the firm stay technologically and environmentally up-to-date?
11) Plans, expectations or future improvements regarding POEM?

Closure

1) Have we discussed all the main issues concerning POEM?
2) Are there any important things I have overlooked?
3) Could I contact you while transcribing the interview for clarification?
4) Are there any other people you think I should talk to about this topic inside or outside your firm?

Thank you very much for your co-operation and your time. As indicated I will send you a report of this interview for verification. The results of this research will be reported back to the company shortly.

Appendix C
List of Abbreviations

3M	Minnesota Mining and Manufacturing Company
3P	Pollution Prevention Pays
3R + V	Reliability, Relationship, Responsiveness and Value
CEFIC	European Chemical Industry Council
CEO	Chief Executive Officer
CI	Continuous Improvement
CMA	Chemical Manufacturers Association
DfA	Design for Assembly
DfE	Design for Environment
DfQ	Design for Quality
DfR	Design for Recycling
DfX	Design for X
DSM	De Staatsmijnen
EC	European Commission
EC DGXI	European Commission Directorate-General for the Environment
ECECP	Engineering Center for Environmentally Conscious Products
ECP	Environmentally Conscious Products
EHS	Environment, Health and Safety
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
EU	European Union
EUR	Euro
GIN	Greening of Industry Network
IBM	International Business Machines Corporation
ICM	Integrated Chain Management
INSERT	INtrinsic Styrene Emission Reduction Technology
IO	Industrial Organisation
IPP	Integrated Product Policy
IRC	Industrial Resins and Compounds
ISO	International Organisation for Standardisation
LCA	Life Cycle Assessment
LCD	Liquid Crystal Display

LCM	Life Cycle Management
NEPP	National Environmental Policy Plan
NGO	Non-Governmental Organisation
NLG	Nederlandse gulden (Dutch guilder)
Novem	Nederlandse onderneming voor energie en milieu (Netherlands agency for energy and the environment)
NPD	New Product Development
N-RVB	Natural Resource-Based View
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
ONE	Organisations and the Natural Environment
OT	Operational Team
OTA	Office of Technology Assessment
PC	Personal Computer
PEP	Product Environmental Profile
pmc	product-market combination
PMZ	Productgerichte Milieuzorg (Product-Oriented Environmental Management)
POEM	Product-Oriented Environmental Management
PRISMA	PRoject Industriële Successen Met Afvalpreventie (Project industrial successes with pollution prevention)
PROMISE	ProduktOntwikkeling met Milieu als InnovatieStrategiE (Product development with the environment as innovation strategy)
PS	Product Stewardship
RBV	Resource-Based View
R&D	Research & Development
RIVM	Rijks Instituut voor Volksgezondheid en Milieu (National Institute of Public Health and the Environment)
SCP	Structure-Conduct-Performance
SHEQ	Safety, Health, Environment and Quality
TGIC	Triglycidyl Isocyanurate
TQEM	Total Quality Environmental Management
TQM	Total Quality Management
TTM	Time To Market process
UNEP	United Nations Environmental Programme
VNCI	Vereniging van Nederlandse Chemische Industrie (Association of the Dutch Chemical Industry)

VNO-NCW	Vereniging van Nederlandse Ondernemers/Nederlands Christelijk Werkgeversverbond (Confederation of Netherlands Industry and Employers)
VRIO	Value, Rareness, Imitability, and Organisation
VROM	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of Housing, Physical Planning, and Environmental Management)
WBCSD	World Business Council on Sustainable Development
WCED	World Commission on Environment and Development
WEEE	Waste Electrical and Electronic Equipment
XMM	Xerox Management Model

About the Author

Frank de Bakker was born on 26 January 1971 in Hontenisse, the Netherlands. In 1989 he completed secondary school at the Jacob-Roelandslyceum in Boxtel and began studying Environmental Science at Wageningen Agricultural University. His first graduation project was in the field of public administration studying priority-setting in environmental policy at different governmental levels. This project was conducted at the request of the Dutch environmental NGO 'Stichting Natuur en Milieu'. His second graduation project, in aquatic ecology, was conducted at the Research Institute for Forestry and Nature Research (IBN-DLO) and focussed on the application of ecological research in the decision-making processes over drilling for gas in the Wadden Sea. To round off his studies, he spent four months at Monash University in Melbourne, Australia, conducting a study on the use of policy indicators in Australian greenhouse policy. In 1995, he obtained his M.Sc. degree in Environmental Science.

From February 1997 until May 2001, he has been working as a Ph.D. researcher in the Faculty of Technology and Management of the University of Twente, Enschede, studying the organisation of product-oriented environmental management within firms. The results of this research are presented in this thesis, and have also led to several publications. He has been appointed as an assistant professor in the Department of Public Administration and Communication Science at the Vrije Universiteit, Amsterdam; a post he will take up in June 2001.