

**The impacts of Environmental Supply Chain Management (ESCM)
on the environmental activities of
Small and Medium - sized Enterprises (SMEs):
Empirical Study of the Korean Electronics Industry**

By

Namkyu Kim

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Abstract

Small and medium sized enterprises' (SMEs) environmental performance and action have been often of great concern toward sustainability although they are playing a critically important role in economic and industrial development. Among lots of initiatives to engage SMEs into sustainability framework, environmental supply chain management (ESCM) of large companies has a great potential to persuade SMEs to undertake environmentally improved activities. ESCM approaches have been increasingly popular in today's large companies' businesses for their competitiveness, compliance with regulation and social responsibility. SMEs may be confronted with these environmental pressures as suppliers to large companies in the market.

This research investigated the relations and dynamics between the ESCM approaches of large companies and the environmental activities of SMEs in the Korean electronics industry. A methodological triangulation approach adopting postal questionnaire survey and interview was used to describe these phenomena and to explore to the reasons, obstacles to implement ESCM approaches, and identify key critical factors in ESCM approaches and SMEs beyond ESCM pressures.

This study found that ESCM approaches of large companies have positive impacts on SMEs' environmental activity, and the collaborative approach was more effective than the arm's-length approach. Furthermore, when ESCM approaches fitted the internal conditions of an SME, the conduct of its environmental activities improved. Appropriate compensations and the environmental awareness of a CEO could make the SMEs undertake environmental activities by going beyond the criteria suggested by customers.

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Chapter 1. Introduction

Small and medium-sized enterprises (SMEs) are thought to have a large combined effect on the environment and this area has been cited as problematic. This thesis investigates the environmental activities of SMEs in response to environmental supply chain management (ESCM) considered as a way to increase the environmental activities of the SME sector.

This chapter contains an overview of the proposed research. First, the background of the study is described to justify the research. This is followed by an overview of the environmental issues of electronics industry and, specifically the South Korean (referred to hereafter as Korea) electronics industry, which defines the scope of the study. Finally, the structure of the thesis is outlined.

1.1. Research background

Sustainable development

In recent years, there has been a noticeable growth in the adoption of the notion of sustainable development by global business, and a wide range of organizations as well as corporations have embraced it as a new paradigm of development (Sharma, 2002). This concept has been accepted as a common agenda and a philosophy in the interaction between human beings and the natural environment by both individuals and organizations (Sharma, 2002). The most often cited definition of sustainable development was proposed in the Brundtland report: “development that meets the needs of the present without compromising the ability of future generations to meet their needs” (WCED, 1987, p.43).

The triple bottom line is often considered a useful approach for integrating sustainable development into business activities. While environmental concerns are central to the concept of sustainable development, it also embraces the social and economic

dimensions of society. This approach represents concerns for economic, social and environmental values, which should be involved if sustainable development is to be achieved (Elkington, 1997, 2004). The multi-dimensions of sustainable development require an integrative approach reconciling economic performance with social and environmental performance to ensure sustainable development of individuals, groups and organizations (Crane and Matten, 2004; Elkington, 1997, 2004).

One of the important pillars of sustainable development is concern for the effect of business on the environment. Environmental issues that command considerable attention in the international community include climate change, water availability, pollution and waste generation and disposal (UNEP, 1997, 2000, 2003). Corporations rely on the natural environment not only for basic resources such as raw materials, air, and water, but also for the assimilation of waste and the emissions that they can create (Sharma, 2002). In addition to being major users of raw materials and energy, and major sources of pollutants and waste, corporations are widely recognized as a vital part of economic development and wealth creation. Therefore, as important social actors, corporations should play a prominent role in identifying and implementing more sustainable options (Crane and Matten, 2004). To successfully implement sustainable development, corporations should be concerned to develop their own action plans and set out strategies for the management of the natural environment so that it can be conserved for the future (Crane and Matten, 2004).

SMEs and sustainable development

SMEs are considered to constitute an important factor of both national economic development (Harvie and Lee, 2002; OECD, 2000) and environmental degradation (Dasgupta et al., 2000; ECOTEC, 2000; Hillary, 1995, 2000a and b, 2004). However, although SMEs have played a significant role in the areas of the economy and the environment, they have commonly been passive and reactive in undertaking environmental activities designed to improve environmental performance (Clark, 2000; Hillary, 1995, 2000a and b, 2004; Remmen, 2001; Smith et al., 2000).

They have often been ignorant of their environmental impacts, the benefits of environmental performance, and the importance of sustainable development. In addition, it has proved too difficult to integrate SMEs in the framework of sustainable development, as they have been reluctant to improve their environmental performance (Hillary, 1995, 2000a and b, 2004).

Many initiatives have been introduced to assist SMEs and a number of motivations can be employed to improve environmental performance. Environmental supply chain management (ESCM), which has often been adopted by large companies to achieve their own competitive advantage or compliance with environmental regulations, can also be considered an effective initiative and motivation for SMEs. Large companies often demand their suppliers to improve environmental performance, and have adopted diverse ESCM approaches in order to effectively and efficiently control the environmental problems of their suppliers. In business relations between large companies and SMEs in manufacturing industry, many SMEs work as suppliers to large companies. They are often dependent on large corporate customers supplying products such as parts and intermediate products or services (Baylis et al., 1998 a and b; Ghobadian and Galler, 1996). SMEs in manufacturing industry may be confronted with environmental demands in the market or participate in some kinds of assistance programmes organized by their large corporate customers.

1.2. Research objective and methodology

Accordingly, considering this background, it could be valuable to evaluate the impacts of large companies' ESCM approaches on the environmental activities of SMEs. In addition, SMEs' internal resources, which have often been cited as critical obstacles to the implementation of environmental activities, should be considered simultaneously in order to integrate SMEs into the sustainable framework more effectively. Thus, the objective of this study is,

to understand the relationships and dynamics between the ESCM approaches of large corporate customers and the environmental activities of SMEs under different internal resource conditions of SMEs.

In order to achieve the main research objective, three more detailed research questions are raised in three steps as followings;

Research question 1: Do the ESCM approaches of large corporate customers have positive impacts on SMEs' environmental activities?

Research question 2: If so, which ESCM approach of large corporate customers strongly impacts on SMEs' environmental activities?

Research question 3: How do the internal resources of SMEs impact on SMEs' environmental activities in response to the ESCM approaches of large corporate customers?

The task of the thesis is to find approaches that could lead to the development of SMEs' environmental activities in ESCM. In order to achieve research objective, and answer the three supplementary questions, this study adopted the instrument of the questionnaire survey and the interview. These methods were conducted in three stages.

In the first stage, interviews were conducted to find preliminary evidences of the impacts of ESCM approaches on environmental activities of SMEs. It was hoped that this preliminary probing of the phenomena under study through interviews with a small number of SMEs would give the researcher the confidence to implement a large-scale survey despite the uncertain impacts of ESCM on SMEs' environmental activities in the Korean electronics industry sector and the lack of previous studies in Korea.

In the second stage, a questionnaire survey was conducted to find the general patterns of SMEs' environmental activities in response to the ESCM approaches of their large corporate customers, and evaluate the impacts of each ESCM approach in conjunction

with the SMEs' internal resources. The questionnaire survey was adopted to cover a large number of SMEs in the Korean electronics industry. The relationships between the ESCM approaches and SMEs' environmental activities considering SMEs' internal resource condition were examined in the collected data set.

In the third stage, interviews were conducted with experts in the field of ESCM and SMEs. These supporting interviews were designed to investigate the intrinsic meaning of the relationships found through the questionnaire survey. In addition, the findings of the survey could be tested for reliability and strengthened through the interviews.

1.3. Selection of the study area: the Korean electronics industry

The electronics industry as an industrial sector and Korea as a research area were chosen for this empirical study. ESCM is relative well developed in the electronics industry; thus, it was expected that the impacts of the ESCM approaches of leading large companies on SMEs' environmental activities would be detected in this industry. In addition, the Korean electronics industry has made great strides globally and the researcher is familiar with Korean language and industry. Therefore, the context of Korea was considered likely to provide significant examples of ESCM phenomena.

Environmental issues in the electronics industry

The electronics industry is generally considered a clean industry in terms of environmental impacts compared with other industrial sectors (USAEP, 1999). However, the manufacturing process and products of this industry has raised a number of environmental issues (Koh, 1997).

First, the manufacturing process can be divided into two major processes: fabrication and assembly (Koh, 1997). Work in these manufacturing processes could result in skin diseases caused by certain chemicals such as solvents, soldering flux, chlorinated hydrocarbon compounds, hydrofluoric acid, epoxy resins, metals, fibreglass and others (Koh, 1997). Thus, health and safety in the manufacturing process has been an

important area for a company to control (USAEP, 1999). In addition, the use of water, hazardous materials and chemicals, energy and other resources such as plastics and metals has an impact on the environment (Wilson, 2003).

Electrical and electronic products also have environmental impacts throughout their life cycle, in the use of energy and disposal of these used products (Cooper, 1994; Wilson, 2003). Energy consumption of consumer electronic equipment has steadily increased over recent years, and the increase of electrical and electronic products results in the subsequent production of large quantities of waste electrical and electronic equipment (Wilson, 2003).

Controlling environmentally hazardous materials and recycling is an important step in reducing the considerable impacts, and has been key issues addressed by environmental regulations (USAEP, 1999). Domestic and international regulation and standards affect every step of the product life cycle in the electronics industry (USAEP, 1999). For example, the Montreal Protocol requires that manufacturing operations should be CFC-free (USAEP, 1999). In addition, European regulations control environmental problems in the life cycle of electronics products. The WEEE (The Waste Electrical and Electronic Equipment) and RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) directives directly control this industrial sector. These regulations implement the principle of producer responsibility, and require corporations to reduce the use of hazardous substances and to improve the recyclability of electrical and electronic products (CEC, 2003, a and b).

The Korean electronics industry

Korea achieved an impressive growth in the late 20th century as often described as the “Miracle”. Korean economy has increased almost 240 times from 2 billion US \$ in 1960 to 471.7 billion US \$ in 2002. Korea joined the Organization for Economic Co-operation and Development (OECD) in 1996, transforming from one of the poorest agrarian economy to the 12th largest economy and exporting country in the world (KOIS, 2004). Korean economic growth has been based on industrialization, in which the heavy

industry-oriented policies and the huge export-oriented companies have played a key role in this economic growth (Lee, 1998). The economic structure was radically transformed. The manufacturing sector increased its share of GDP from 14.4% in 1962 to 29.6% in 2002 (Kang, 2003).

The Korean electronics industry also grew rapidly, playing a key role in the industrialisation of Korea (Kim, 1997). The electronics industry in Korea is considered economically important. The proportion of electronics goods in terms of both production and export has been the greatest among the domestic industries, and the Korean electronics industry has come to be well known throughout the world (Oh, 2001 a and b). For example, in 2001, the Korean electronics industry was placed fourth in the world on the criterion of the production by country. Its annual production that year amounted to US\$ 67.3 billion, representing 5.6% of the world's total production, following the United States (26.0%), Japan (19.1%) and China (7.8%) (Yearbook of World Electronics Data, 2002). In that year, the Korean electronics-electricity¹ industry accounted for 33.7% of the total production of the manufacturing sector, and exports reached US\$ 51.5 billion, accounting for 34.3 % of Korea's total export volume (KNSO, 2001)

A number of large companies in Korean electronics industry achieved recognizable in the world electronics industry. Samsung Electronics and LG Electronics are major global players in the electronics industry in the world. Samsung is currently the world's number one of manufacturer of TV, TFT-LCD, DVD, and is producing Mobile phone, CRT monitors, PC, CRT, PDP, and DRAM memory chips and other electronic home appliances with worldwide electronic product sales of US\$27 billion, over 64,000 employees in 89 facilities, and a global network in 47 countries. LG is operating 72 subsidiaries around the world with over 55,000 employees worldwide, focuses on Digital TV, CD-RW, DVD, CD-ROM, DVD-ROM Drives, PCs, Monitors, Mobile phones, CRT and PDP (KELA, 2003).

¹. The Bank of Korea (BOK) publishes statistics on production, which do not separate the electronics industry from the electricity industry.

1.4. Structure of the thesis

The thesis consists of nine chapters, including an introduction and a conclusion. The following outline summarises the structure and content of the study chapter by chapter (excluding chapter 1).

Chapters 2 and 3 review the current literature in this area. Chapter 2 (SMEs and the environment) aims to explain the environmental activity status of SMEs. To do so, the review investigates the motivations prompting and obstacles impeding to SMEs' implementation of environmental activities. Acknowledging the economic and environmental importance of SMEs, and the obstacles they face, the chapter examines the conditions of effective assistance programmes to support the environmental activities of SMEs.

Chapter 3 (SMEs and Environmental Supply Chain Management) focuses on environmental supply chain management (ESCM). This chapter reviews the academic studies and practical guides including the characteristics of ESCM, corporate customers' perspective on ESCM, and suppliers' perspective on ESCM. The literature review suggests that ESCM practised by large companies could have the potential to influence the environmental activities of SMEs.

Chapter 4 (Research Questions and Theoretical Framework) presents research questions and theoretical framework. The research questions were raised on the limitations of previous studies. Then, the chapter explains the study's theoretical background and research framework. The study adopts stakeholder theory and the resource-based view of the firm in order to understand the external and internal factors operating on SMEs responding to ESCM pressures from their large corporate customers. Based on the contingency perspective, the conceptual framework including hypotheses is developed, encompassing the theoretical background and literature reviews presented in chapters 2 and 3.

The methodological process designed to answer the research questions and examine the theoretical framework is discussed in chapter 5 (Methodology). Data collection and analysis were conducted through quantitative (questionnaire survey) and qualitative (interview) process. The main issues in data collection and analysis such as sampling, measurement, data collection procedure, and analysis techniques are considered in this chapter.

The results of the data collection and analysis yielded by both quantitative and qualitative processes are reported in chapters 6 and 7.

In chapter 6 (Relationships between ESCM Approaches and the Environmental Activities of SMEs: Quantitative analysis results), the underlying dimensions of ESCM, the internal resources of SMEs, and the environmental activities of SMEs are identified, and then the relations between these are evaluated using regression analysis. The quantitative analysis results show the impacts of ESCM approaches on the environmental activities of SMEs in conjunction with the internal resource conditions of SMEs.

Chapter 7 (Dynamics between ESCM Approaches and Environmental Activities of SMEs: Qualitative analysis results) presents the qualitative analysis results, which were expected to validate those produced by quantitative analysis, and add deeper insights into the evidence provided by the quantitative analysis.

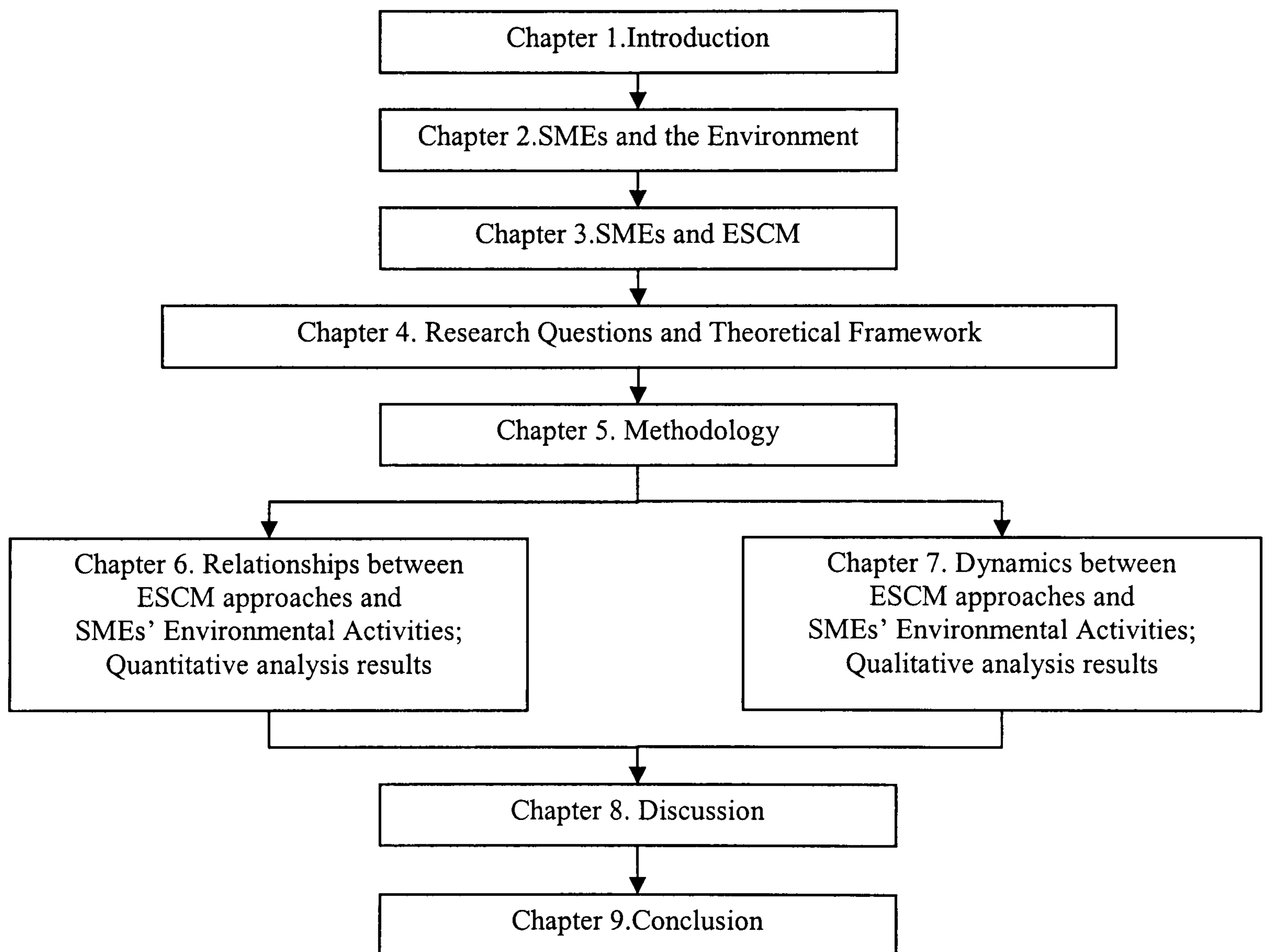
The results of both analyses are compared and integrated with those found in the literatures in chapter 8 (Discussion). The comparison and integration are conducted on the basis of research questions.

In chapter 9 (Conclusion), conclusions are drawn from the analysis results, and recommendations are presented for SMEs and ESCM managers. SMEs may choose to consider these recommendations as a guideline helping them to cope with the environmental pressures from their corporate customers. Also, ESCM managers could use these recommendations to better control their suppliers' behaviour with regard to

sustainable development. In addition, certain implications for theories and policies could be drawn.

A visual schema of the study is given in Figure 1.1.

Figure 1.1 Study framework



1.5. Conclusion

This chapter has introduced the background, objective, and scope of this study. The objective of the study is to examine the relationships and dynamics between the ESCM approaches of large corporate customers and the environmental activities of SMEs under different internal resource conditions of SMEs.

This empirical study was carried out in the context of the Korean electronics industry. The environmental issues pertaining to this industry, the industry itself, and SMEs were overviewed in this chapter.

This study begins by the examination of the relevant literatures on SME and the environment, and SMEs and ESCM. After raising research questions, theoretical framework is developed to describe the relationships between ESCM approaches and the environmental activities of SMEs in conjunction with the internal resources of SMEs. The theoretical framework is examined and research questions are answered through a questionnaire survey and interviews. Finally, the analysis results are discussed and interpreted in terms of theories, and academic and managerial interests.

Chapter 2. SMEs and the Environment

The aim of this chapter is to review the relevant literature in the field of small and medium-sized enterprises (SMEs) and their relationships to the environment. In the first section, after overviewing the economic and environmental importance of SMEs, the status of their environmental activities with respect to improving their environmental performance is addressed. In the second section, the pressures for and barriers against implementing those environmental activities are considered. Then, these pressures and barriers are addressed in the context of Korean SMEs. In the third section, the diverse conditions that might effectively assist SMEs' environmental activities are discussed, drawing on the existing literature.

2.1. SMEs and their environmental activities

This section focuses on the environmental activity status of SMEs. Previous studies have commonly pointed out that SMEs' activities in this regard have been weak and reactive. Before review environmental activity status of SMEs, the definition of SMEs, and their economic and environmental importance are considered.

2.1.1. Definition of SMEs and their economic and environmental importance

Definition: small and medium-sized enterprises (SMEs)

The criteria used to define small and medium-sized enterprises (SMEs) have traditionally been the number of employees, turnover or assets, and ownership. The first two of these emphasize that such enterprises are smaller than large companies. Ownership has also often been considered important in defining SMEs. This criterion emphasizes the independence of SMEs from a large associated company in decision-making. Hence, subsidiaries of large companies have often been excluded, because the parent company could directly influence their decision-making (Hough, 1982).

Practical definitions may differ according to sectors, country and purpose. For example, according to the EU definition, an SME is a company, which has fewer than 250 employees and either an annual turnover not exceeding 50 million euros, or an annual balance sheet total not exceeding 43 million euros (CEC, 2003c).

In Korea, the definition is slightly different from the EU definition. The criteria defining SMEs in Korea are number of employees, paid in capital or sales, and ownership according to The Framework Act on Small and Medium Enterprises (SMBA, 2005). Specifically, in the manufacturing sector, an SME is defined as a company having fewer than 300 employees and paid in capital not exceeding 8 billion won (around 6.7 million euros). In addition, it should not be a subsidiary of any of the thirty largest companies in Korea. However, regarding small enterprises, the criterion of paid in capital are not suggested, only number of employees is a criterion for small enterprises as less than 50. Definitions of SMEs in Korea according to industrial sectors including manufacturing are shown in Table 2.1.

Table 2.1. Definitions of SMEs in Korea

Industry	Small and Medium Enterprises		Small Enterprises
	Employees	Paid in capital	
Manufacturing	Fewer than 300	8 billion won or less (around 6.7 million euros)	Fewer than 50
Transportation	Fewer than 300	3 billion won or less (around 2.5 million euros)	Fewer than 50
Construction	Fewer than 300	3 billion won or less (around 2.5 million euros)	Fewer than 30

*Source: The Framework Act on Small and Medium Enterprises (2000)

This study follows the Framework Act's definition of an SME in the Korean manufacturing sector, that is, a company with fewer than 300 in number of employees, 8 billion won or less (around 6.7 million euros) in paid in capital, and which is not a subsidiary of a large company for two reasons. First, this definition refers not only to the number of employees and paid in capital indicating that the SME is too small to be considered a large company, but also to the ownership of the company, indicating its independence from a larger partner with regard to decision making. Second, since the data in this study were to be obtained from SMEs in the Korean electronics industry, it was possible to secure a wealth of statistical data using this definition.

Economic importance of SMEs

There is general agreement among previous researchers that SMEs are critically important to economic development. The economic importance of SMEs can be examined in various aspects across countries. For example, in the area of the OECD countries, which can be considered developed countries, SMEs accounted for over 95% of firms and 60-70% of employment and generated a large proportion of new jobs (OECD, 2000). Even in the developing countries, their economic importance is undeniable. SMEs accounted for over 90% of enterprises, and 50-60% of employment (Hobbs, 2000). On the basis of these figures, it seems that SMEs have contributed to the private sector's provision of employment and income for the population in the developing countries (Scott, 2000). Consequently, they are regarded as significantly contributing to creating new jobs and economic growth.

There are other reasons to emphasize the economic importance of SMEs. SMEs are considered sources of innovation and entrepreneurial spirit and creators of competition (Hillary, 1995, 2000a and b, 2004). Further, they are regarded as significantly contributing to equitable income distribution and in turn, ensuring social stability by alleviating redistribution pressure and reducing economic disparities between urban and rural areas (Luetkenhorst, 2004).

Environmental importance of SMEs

Quantitative data on the environmental impacts of SMEs have rarely been reported at either national or regional levels. However, even if these data are sparse, previous studies have commonly considered that the contribution of SMEs to environmental pollution has been substantial and undeniable (e.g. Beckerman 1995; Hillary, 1995, 2000a and b, 2004; Hobbs, 2000; Johannson, 2000; Tilley, 1999).

The small number of quantitative studies agrees in emphasizing SMEs' responsibility for pollution. For example, ECOTEC research (2000) concluded, from its analysis of the replies given by six EU member states to a European Commission's questionnaire

on SMEs and the environment in 1997, that the proportion of SMEs' contribution to environmental pollution in EU countries was around 50%. Further, in a UK study, Hillary estimated the contribution of SMEs to industrial pollution at around 70% (Hillary, 1995).

There could be several reasons for SMEs' significant contribution to environmental pollution. Among those suggested by previous studies are the number of SMEs, their industrial sector, and the intensification of pollutions due to a lack of operation techniques.

First, although individual SMEs have contributed less environmental pollution than large companies, cumulatively their contribution has been significant (Hillary, 1995, 2000a and b, 2004; Johannson, 2000).

Second, the industrial sectors containing particularly high proportions of SMEs have been more environmentally harmful than those dominated by large companies. That is, SMEs commonly operate in pollution-intensive industries such as metal finishing, leather tanning, dry-cleaning, printing and dyeing, brewing, food processing, fish farming, textile manufacturing, and so on (Beckerman 1995; Hobbs, 2000).

In addition, SMEs often cause more intensive environmental pollution than large companies in the same sector because of a lack of operation techniques (Dasgupta et al., 2000; Hobbs, 2000). For example, Dasgupta et al. (2000) compared the intensity of environmental pollution produced by SMEs and large companies in Mexican and Brazilian industry. They reported that SMEs were more pollution intensive per employee than large companies.

2.1.2. Environmental activities of SMEs

Environmental activities

Researchers trying to define environmental activity have suggested systems of categorization with respect to companies' environmental activities. For example, Peattie and Ringler (1994) suggest that the activities can be divided into "software" and "hardware" activities. Software activities refer to the organizational activities such as audits, organizational structure, policies and decision-making procedures. Hardware activities refer to the activities associated with technologies designed to reduce the environmental impact of the firm such as pollution prevention technologies. Recently, González-Benito and González-Benito (2005) have categorized environmental activities into planning and organizational activities, product-related operational activities, process-related operational activities, and communicational activities. Although previous researchers have defined environmental activities in different ways, and have suggested different categorizations, they commonly stress the pressing need to improve environmental performance. This research adopts Ramus's (2000) definition of environmental activity: "action that will improve environmental performances of company operations, products and services" (p.151).

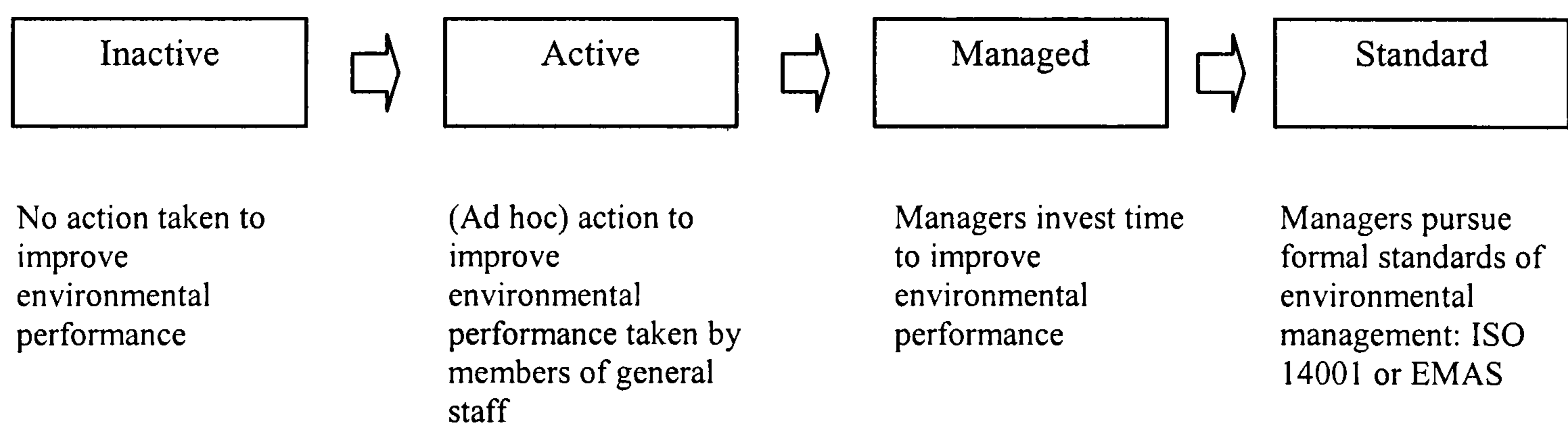
Environmental activity status of SMEs

As argued above, SMEs activities are significant both economically and environmentally. However, their activity to improve environmental performance has often lagged behind that of large companies and has generally been reactive rather than proactive. They have not seemed to be concerned about environmental issues. Many researchers have reported that it was difficult to persuade SMEs to adopt proactive environmental activities or strategies.

For example, Clark (2000) noted that the industry's responses to environmental issues had evolved from ignorance to recognizing the economic benefits of improved environmental performance. However, integrative approaches designed to include

environmental issues into business practice are tended to be adopted by large companies rather than SMEs. Furthermore, Remmen (2001), in his study of Danish companies, reported that even where the external pressures improved progressively, SMEs' environmental strategy continued to be reactive and passive. Typical SMEs were unaware of the urgency of environmental issues and took little measures to improve environmental performance. More specifically, Palmer (2000) provided a classification of the different status levels of environmental activity conducted by SMEs, as seen below in Figure 2.1. He remarked that most SMEs were at the inactive stage, and thus taking no action to improve their performance. Even if some SMEs were pursuing environmental activities, the great majority had not advanced beyond active status; in other words, their general staffs were engaged in merely ad hoc action. The managed and standard status levels, which involved some degree of commitment on the part of management, were rare, and seldom visible.

Figure 2.1. Environmental activity status (Palmer, 2000, p.326)



In a review of the literature, Hillary (2000) stated that the SME sector was “largely ignorant of its environmental impacts and the legislation that governs it; oblivious of the importance of sustainability; cynical of the benefits of self-regulation and the management tools that could assist it in tackling its environmental performance; difficult to reach, mobilise or engage in any improvements to do with the environment” (p.18).

2.2. Pressures and barriers affecting SMEs' environmental activities

As noted in the previous section, typical SMEs tend to be unaware of the urgency of environmental issues, and take few measures to improve their environmental performance. However, it does not mean that there are no pressures on SMEs. Rather, they are still experiencing a number of pressures to do so. The inactive or reactive stances might be due to strong barriers of various kinds preventing them from pursuing environmental activities. This section deals with the pressures and barriers affecting SMEs' environmental activities.

2.2.1. Pressures driving environmental activities of SMEs

Gerstenfeld and Roberts (2000) identify three main categories of the pressures inducing SMEs to undertake environmental activities: legislative pressures from government; business-to-business pressures from the market; and other stakeholder pressures such as from local residents, insurers, employees, and interest groups. This section discusses these three categories and their related characteristics.

Legislative pressures from government

One clear and powerful pressure experienced by SMEs is brought to bear by government through environmental regulations (Hillary, 1995, 2000b, 2004). Environmental regulations can briefly be categorized into command-and-control regulation and self-regulation (Petts, 2000; Tilley, 2000). Unlike command-and-control regulation, self-regulation is characterized by voluntary enforcement (Jacobs, 1991; Petts, 2000) and administered by private interests, not by government. Self-regulation includes codes of conducts, environmental certification, eco-labelling and voluntary agreement between industry and interest groups (Gouldson and Murphy, 1998).

On the other hand, command-and-control regulation has a critically important role in regulating the business practices (Crane and Matten 2004; Freeman, 1984). Environmental command-and-control regulation is the means, by which the

environmental practices of business are directly controlled by the government (Tilley, 2000). Government can develop, implement, and enforce formal legislation by establishing quantitative environmental performance standards (Gouldson and Murphy, 1998).

The perceived risks business might run by violating government standards are main motivation for engaging environmental activities. The violation of environmental regulations could result in penalties, business suspension, permit revocation, and imprisonment. The pressures of these risks could persuade companies to practice at least a minimum level of environmental activities, and the achievement of the standards entails engagement in at least some kinds of environmental activities (Moon et al., 2000)

Business-to-business pressures from the market

Previous studies have also emphasized the importance of market pressures on SMEs' environmental activities. The pressures are exerted by consumers, customers (supply chain pressures) and competitors (Hoffman, 2000).

Consumers can exert pressures on SMEs' behaviour with regard to environmental concerns. It is evident that the number of "green" consumers, who take into consideration environmental issues as well as function, cost, or design in their purchasing decisions, has increased. They often purchase environmentally friendly goods or services, and want to be given environmental information on the products and the corporations that produce them. Accordingly, although there could be differences between attitude and purchasing behaviour, their demands are creating a growing market for environmentally friendly goods, and are influencing the environmental activities of manufacturing companies including SMEs (Roberts, 1996).

In addition, competitors of SMEs in the market could be another factor motivating SMEs to engage in environmental activities. A large amount of SMEs are constantly struggling to gain competitive advantage in the market, and a superior environmental performance could be a strategic asset. Competitors might adopt green marketing strategy based on their excellent environmental performance. To deal with this situation, SMEs might benchmark their rivals' environmental activities and try to achieve better environmental performance (Perez-Sanchez et al, 2003).

The corporate customer can also exert significant pressure on the environmental activities of SMEs, especially in the manufacturing sector, where most SMEs are subcontractors to large companies, supplying them with parts or intermediate products and services. When it comes to environmental issues, large corporate customers could choose to purchase environmentally friendly products and require environmental information on both their products and processes. In addition, they might decide to initiate and manage some kinds of assistance programmes for their suppliers. As for the SMEs, their large corporate customers' environmental initiatives could be a significant motivation for introducing environmental activities (Green et al., 1996).

Other stakeholder pressures; local residents, insurers, employees, interest groups

The enforcing authorities, local residents, insurers, bankers, employees, interest groups and the general public could be other sources of pressure persuading SMEs to undertake activities that will increase their environmental performance (Gerstenfeld and Roberts, 2000). For example, the emissions of a manufacturing SME could pollute air and water, and its waste could pollute the land. In these cases, the pollution could directly affect the local community, which might initiate a legal or political campaign against the environmental problems caused by the SME's manufacturing process (Baylis et al., 1998, a and b; Johannson, 2000).

2.2.2. Barriers to implementing environmental activities of SMEs

Considering SMEs' inactive and reactive environmental activities, the pressures, though considerable, have not fully persuaded SMEs to undertake environmental activities. Many researchers have pointed out that the lack of internal resources constitutes a critical barrier preventing SMEs from pursuing environmental activities (e.g. Brio and Junquera, 2003; Hillary, 1995, 2000a and b, 2004). Among the various kinds of resources, this study focuses on financial resources, information, human resources, and the environmental attitudes of the CEO and the employees. In addition, the pressures for SMEs were not properly working to persuade SMEs to adopt environmental activities. These problems of environmental pressures were also addressed in this section.

Lack of financial resources

A lack of financial resources can weaken SMEs' ability to undertake environmental activities. For example, financial constraints can make it impossible to conduct a number of diverse environmental activities simultaneously (Azzone et al., 1997, Azzone and Noci, 1998; Brio and Junquera, 2002). In addition, Litsikas (1999) reported that the costs of attaining ISO 14001 were relatively high, compared with ISO 9000 certification, because the former environmental certification was more demanding and required extra paperwork; consequently, significant or additional financial resources were required to implement environmental activities, and their financial resources needed to be relocated. When financial resources are insufficient, environmental activities could be hindered and might not attract management attention (Gerstenfeld and Roberts, 2000).

Lack of relevant information

Obstacle impeding firms wishing to undertake environmental activities is the lack of necessary information. Relevant environmental information is necessary to translate environmental attitudes into real actions (Anglada, 2000; Clark, 2000; Petts, 2000; Tilley, 2000). In many cases, SMEs have little knowledge of how to implement

environmental activities and are unable to introduce appropriate options to improve performance (Meritt, 1998; Smith et al., 2000).

The obstacle of a lack of relevant environmental information may be faced by SMEs in the areas of information type and flow (Clark, 2000; Hunt 2000). First, SMEs operate in a wide range of areas. They need information specific to the complexities and diversity of their operation processes. It has been noted that in order to facilitate increased use of environmental information, the information should be clear and specific to their operation processes (Clark, 2000). Second, environmental information flow can cause another problem: a huge amount of environmental information is available from the government, non-government organizations, and the mass media, and is easily accessed through the Internet; however, even for large companies, managing large volumes of information is a major problem, and also many SMEs suffer from information overload. This overloading tends to occur because SMEs often seek environmental information only when they need it, and they lack the ability to distinguish between relevant and irrelevant information (Clark, 2000).

Lack of human resources

A lack of human resources such as the expertise to monitor the environmental problems that arise in the operation process and to cope with external demands for new environmental technologies is also a critical barrier preventing SMEs from undertaking environmental activities (Hillary, 1995, 2000b, 2004). Highly educated employees would easily be able to understand environmental issues and find appropriate options to deal with these problems; however, a lack of appropriate expertise prevents SMEs from adopting environmental initiatives. SMEs generally suffer from a lack of trained personnel to take charge of the management, control, and implementation of waste management programmes is unable to manage additional environmental programmes (Perez-Sanchez et al., 2003).

Financial limitation can also impact on an SME's human resources, since because of those limitations SMEs are often unable to employ skilled staff and tend to employ less

well-qualified workers (Ghobadian and Galler, 1996; Gerstenfeld and Roberts, 2000; Hillary, 1995, 2000b, 2004; Perez-Sanchez et al., 2003). Thus, in order to increase employees' skills in addressing environmental problems, additional training programmes may be necessary; however, such training programmes may be delayed for lack of financial resources (Holliday, 1995)

Employees' lack of environmental awareness

SMEs are often more people-dominated than large companies, except perhaps in the high-tech industry sector. Employees working on site can be crucial in preventing or dealing with environmental accidents (Pedersen, 2000)

SMEs' employees, however, often have a low level of environmental awareness (Azzone et al., 1997; Azzone and Noci, 1998; Brio and Junquera, 2002), which could be an obstacle to conducting environmental activities because implementation usually needs the participation of employees and the skilled use of their knowledge (Brio and Junquera, 2002; Hart, 1995; Klassen and McLaughlin, 1993). On the other hand, when employees are well educated about environmental issues, SMEs are able to pursue a higher level of environmental activity (Brio and Junquera, 2002).

CEO's lack of environmental commitment

The decision making process in SMEs is less formal and more personalized than in large companies, and managers are often in the dominant position in the decision-making structure. In addition, the relationship between top managers and employees is closer than in large companies and the enterprise's decided objectives are often implemented through a top-down process. Hence, the decision makers can directly influence the operations and behaviours of the employees by their ethos and outlook (Bridge et al., 1998).

The company's environmental activities can, however, be established and facilitated entirely by the CEO's environmental strategy and capability. If the CEO is aware of

environmental issues and has enough environmental knowledge, the activities can be effectively planned and controlled (Petts, 2000); however, if the CEO considers environmental issues irrelevant or has inadequate knowledge, the activities might not be effectively implemented or controlled (Merritt, 1998; Tilley 2000)

Problems of legislative pressures on SMEs

Environmental regulations, when appropriately designed, can provide an impetus for industrial companies' increased environmental performance (Porter and van der Linde, 1995). However, inflexible environmental regulation is not always able to control SMEs' environmental activities effectively in spite of the extensive powers of government. Overly prescriptive regulatory standards could restrict flexibility and innovation in the environmental practices of SMEs (Brio and Junquera, 2003). In addition, SMEs are often unaware of environmental regulations and lack the resources to conduct environmental activities in conformity with the regulations (Hillary, 1995, 2000b, 2004). Furthermore, SMEs are not subject to environmental regulations to the same extent as large companies are (Baylis et al., 1998, a and b).

Problems of market pressures on SMEs

Although market pressures are a potentially powerful factor to stimulating SMEs' environmental activities, many SMEs are discouraged by a lack of suitable markets. According to Bianchi and Noci (1998), most customers are unwilling to pay a premium price for an environmentally friendly product or process. Thus, the introduction of a proactive environmental strategy is problematic for SMEs, because they tend to be skeptical that economic and competitive advantage will accrue from an enhanced environmental performance.

In addition, an SME's distance from its customer can reduce the intensity of customer pressure regarding environmental performance (Hall, 2000; Williams et al., 1993). Large companies producing final products attract the attention of consumers, while

SMEs, in case that they may be operating as suppliers to large companies, do not face customer pressure to the same degree (Baylis et al., 1998, a and b; Williams et al., 1993).

Problems of other stakeholder pressures on SMEs

Pressures from other stakeholders such as local residents, interest groups and the general public can be an important factor motivating SMEs to pursue environmental activities. However, this only occurs when the local community is able to identify an SME and assess its environmental performance. If an SME' factory and number of employees are small, it is often difficult to identify the environmental problems caused by its operation (Baylis et al., 1998, a and b). Moreover, although government assistance programmes can provide benefits to SMEs such as financial assistance and environmental knowledge, the limited number of such programmes may make them difficult to access, and if the programmes are not implemented by experienced consultants and based on sector-specific tools and examples, they could work as barriers and be considered as giving poor information and guidance (Hillary, 1995, 2000b, 2004).

2.2.3. Pressures and barriers affecting SMEs' environmental activities in Korea

SMEs in Korea have many similarities to those in other countries in European region and USA regarding the barriers and motivations that they are faced in the implementation of environmental activities.

The studies have repeatedly reported that SMEs in Korea are also undertaking reactive and inactive environmental activities. However, the strengths of pressures on SMEs and intensity of the barriers faced by SMEs in Korea are slightly distinct from those in other contexts. The details are discussed in this section.

SMEs and the environment in Korea

Although quantitative data regarding SMEs' contribution to environmental pollution in Korea has been unavailable, the researchers in Korea consider that the contribution of SMEs to environmental degradation are considerable, judging by the likely effect of a large number of SMEs, their pollution-intensive industrial sectors, and their lack of internal resources to implement environmental activities (Korcham, 2001; Moon et al., 2001).

Regarding the environmental activities of SMEs in Korea, it has been repeatedly reported that they are making little efforts to improve environmental performance (KFSB, 2002, 2003, 2004; Moon et al., 2001). For example, according to KFSB's (Korea Federation of Small Business, 2002) survey, which is based on the survey data on six hundred SMEs in manufacturing sector, the attitudes of SMEs to the environment was relatively positive (e.g. 50% of respondents regards the environmental issues as an important or most important issues in their management), however, most of SMEs (80.8%) did not have a qualified employee in charge of their environmental problems. In addition, regarding the investment by SMEs in the environmental facilities, the ratio of this investment was only 4.5% in 1999, this ratio was far too small compared to those of productivity increase, old facility repair, automation, developing new products, and R&D (KMOE, 2001).

Pressures driving environmental activities of SMEs in Korea

However, the SMEs are not exposed to pressures to improve their environmental performance, and to undertake environmental activities. There are several influential factors encouraging SMEs to undertake environmental activities.

In the survey data on Korean SMEs, which already have achieved a certain level of environmental activities including ISO 14001 certified companies, the strongest force on environmental management in Korea was environmental regulation, followed by corporate image and competitive advantage (Moon et al., 2001). These results are

presented in Table 2.2.

Table 2.2. Drivers of environmental management of SMEs in Korea (Moon et al, 2001, p.128)

Driving Force	%	Driving Force	%
1. Environmental regulations	19	5. Environmental awareness of the employees	12
2. Corporate image	19	6. Requirement of customers	8
3. Competitive advantage in the market	16	7. Media and NGOs	7
4. Cost saving	13	8. Community	6

In their survey, environmental regulations were conceived as one of the most important influential factors on undertaking environmental management. As introduced in chapter 1, the economic growth of Korea has been achieved on the basis of the heavy industry-oriented policies and the huge export-oriented companies (Lee, 1998). These policies have resulted in heavy contamination of the environment, and Korean government introduced extensive environmental regulations from 1963 legislating ‘the Pollution Prevention Act’ to address environmental problems arising from industrialization (Kwon, 1999). The various areas of environmental pollution are covered by Korean regulation such as ‘the Environmental Preservation Act’, ‘The Natural Environment Preservation Act’, ‘The Air Quality Preservation Act’, ‘the Water Quality Preservation Act’, ‘the Noise and Vibration Control Act’, ‘The Act Relating to the Promotion of Resource Saving and Reutilization’, and ‘the Toxic Chemicals Control Act’ (Kwon, 1999). However, these environmental regulations in Korea often have problems to most of SMEs such as low awareness of existing regulations and low capabilities to cope these regulations (KFSB, 2002, 2003, 2004).

As shown the results of Moon et al.’s study in Table 2.2, many of influential factors were related to business-to-business pressures in the market; four different influential factors involving corporate image, competitive advantage in the market, requirement of customers, and media and NGOs were related to these pressures. Consequently, they concluded that, although there are few studies examining the impacts of business pressures on SMEs in Korea, the business pressures have great potentials to persuade SMEs to introduce environmental management.

Barriers to implementing environmental activities of SMEs

Despite experiencing various pressures from government and their corporate customers, SMEs in Korea have faced many difficulties in undertaking environmental activities, such as a lack of financial resources, a lack of information, a lack of support from the CEO, and a lack of human resources (Lee et al., 2003; Korcham, 2001; Moon et al., 2001).

According to the Korea Federation of Small Business' survey results (KFSB, 2002), the most frequently cited barrier to adopt environmental management is lack of financial resources, followed by insufficient government support, lack of information and lack of human resources. Their results are presented in Table 2.2.

Table 2.3. Barriers of environmental management of SMEs in Korea

Barrier	%	Barrier	%
1. Lack of financial resources	27.2	4. Lack of human resources.	13.5
2. Lack of government support	23.2	5. Others	19.5
3. Lack of information	16.7		

* Source: Korea Federation of Small Business (2002)

In addition, Moon et al. (2001) supported this with presenting similar results. In their survey data in Korean SMEs, lack of human resources and financial resources were the most important barriers faced by SMEs in order to environmental management.

These previous studies indicated that SMEs in Korea also faced many barriers in order to implement environmental activities in order to improve their environmental performance.

2.3. Conditions for effective programs to support environmental activity of SMEs

As shown above, many obstacles may hinder SMEs' undertaking environmental activities; however, effective approaches should allow them to overcome these obstacles. The next section discusses in some detail the conditions that may effectively support SMEs' efforts to implement environmental activities.

Most studies conclude that, in order to be more effective, the approaches should consider the obstacles to environmental activities. The following recommendations have been summarized from the literature.

Inexpensive options for SMEs

The most general constraint on the implementation of environmental options is the lack of financial resources. Most SMEs find themselves in this situation, and so reducing financial obstacles is essential to their implementing environmental options (Gerstenfeld and Roberts, 2000). Consequently, any suggested option should be inexpensive. One possibility is to integrate environmental advisory services with other management advisory services (Luken and Navratil, 2004).

Practical and easily understandable options

Training, support and implementation programmes should be practical and easily understood by SMEs, providing, for example, easy guides or practical translations of confusing technical and management terms (Gerstenfeld and Roberts, 2000). Although there are many proposed environmental programmes and tools, these tools have mostly been designed for large companies, and are often inappropriate and irrelevant to the purpose of SMEs, which are very diverse (Holmberg and Lundqvist, 2000; Starkey 2000; Whalley, 2000). SMEs require the most appropriate tools for their particular environmental management needs (Starkey, 2000). The assistance provider should be fully conversant with the environmental management options in order to help SMEs

come to the correct conclusion about which form of action is likely to have the most advantages (Starkey, 2000).

Flexible programmes specific to the characteristics of SMEs

Flexibility is an important prerequisite of an effective assistance programme that aims to assist SMEs to improve their environmental initiatives. Environmental assistance programmes should be conducted according to the SMEs' environmental attitude and the characteristics of its product and services (Pedersen, 2000).

First, regarding the SMEs' environmental attitude, even if it is probable that most SMEs have negative attitude to environmental issues, the level of negativity will vary. Environmental assistance programmes should, therefore, adopt different approaches according to the SMEs' attitude to the environment (Pedersen, 2000). The relationships between attitude to the environment and management tools are presented in Table 2.4.

Table 2.4. Supporting tools in relations to company's attitude to the environment (Pedersen, 2000, p.207)

	Company with a positive attitude to the environment	Company that merely complies with legislation	Company with a negative attitude to the environment
Development of rules and requirements	Dialogue on specific issues Framework permits	Dialogue on rules at industry level	Dictation of rules and regulations
Enforcement and Supervision	Environment management Spot check	Standard supervision Environmental management and spot checks	Intensive supervision and any necessary use of power

Second, the products and services of SMEs are often diverse and varied (Gerstenfeld and Roberts, 2000). Accordingly, individual SMEs need specific knowledge and assistance programmes tailed to their products and processes (Gerstenfeld and Roberts, 2000; Whalley, 2000).

The effectiveness of flexible programs is identified in supplier management. For example, 'Project Acorn', designed to help organizations improve environmental performance was proved successful for SMEs (Gascoigne, 2002). As shown in Table

2.5, the framework suggests six-level approach, which enables SMEs to choose the pace of their environmental programmes (Gascoigne, 2002).

Table 2.5. The six levels of Project Acorn (Gascoigne, 2002, p.64)

Level 1	Commitment, policy, establishing a baseline, developing initial environmental performance indicators, initiating culture change and continual improvement
Level 2	Identifying and compliance with legal, market and customer requirements
Level 3	Developing environmental objectives, targets and management programmes, establishing operational control
Level 4	Implementation and operation of the environmental management system
Level 5	Checking, Audit and Review
Level 6	External communication and/or Environmental Management System registration

Co-operative approach

Co-operation has a critical role in developing an effective mechanism for encouraging SMEs' activity (Gerstenfeld and Roberts, 2000). According to Hutchinson and Hutchinson (1995), SMEs rarely undertake environmental activities without any stimuli, and co-operation. Furthermore, Biondi et al. (1998) suggest that collaboration to improve SMEs' environmental improvement would be a useful and efficient method because they could learn from each other, create synergy, and develop better relationships with other stakeholders. Hence, a successful programme would be one established and implemented on the basis of co-operation (Gerstenfeld and Roberts, 2000).

Locally based approach

Gerstenfeld and Roberts (2000) point out the effectiveness of locally based assistance programmes for SMEs. For example, success stories tend to be more visible in a small society and other SMEs could benchmark and follow the successful programmes more easily. Accordingly, localized programmes could achieve synergy effects and the impacts could be greater than those of individually executed programmes (Gerstenfeld

and Roberts, 2000). In his study of Danish local authority programmes, Pedersen (2000) found various advantages in locally based programmes. The advantages of local authority included:

- The local authority had knowledge of the local business community
- The permitting department of the local authority had responsibility for all local environmental problems
- The permitting department of the local authority had knowledge of environmental regulations, cleaner production alternatives, and the experience of other companies, which could be disseminated to SMEs
- The department of economic affairs had responsibility for the local economy
- The local authority was able to benefit from the economic success of local SMEs
- The local community was familiar with the local SMEs, and was able to help promote the proposed environmental activities

Appropriate reward for environmental performance

An appropriate reward could be a critical motivation for SMEs' wishing to undertake environmental activities. The reward system could be established by corporate customers using a well-designed voluntary approach. The clear commercial benefits of their environmental activities could persuade SMEs to bear the costs of investment in order to improve their environmental management and make assistance programmes more effective. For example, Johannson (2000) reported that obvious business benefits from SMEs' environmental performances were necessary to improve their environmental management. Gerrans and Hutchinson (2000) note that "voluntary mechanisms that incur private costs have less chance of being successful in the absence of tangible benefits. A standards-based approach, coupled with direct subsidies to cover private costs of adoptions, would face better prospects of success, as would a reward-based system. The use of standards may be a necessary step towards achieving sustainable development. They are not, however, sufficient by themselves" (p.81).

2.4. Conclusion

This chapter has reviewed the literature related to SMEs and the environment. More specifically, these studies were linked to the economic and environmental importance of SMEs, the environmental activity status of SMEs, the pressures driving and barriers impeding SMEs' environmental activities including Korean context, and the conditions for effective assistance programmes for SMEs.

The literature review regarding the economic and environmental importance of SMEs, and the environmental activity status of SMEs indicated that, although SMEs are significant contributors to economic development and environmental pollution, their environmental activity to improve their environmental performance has generally been weak and reactive.

In addition, the literature indicated that there have also been diverse pressures on SMEs regarding environmental issues, exerted by diverse environmental stakeholders including government, corporate customers, consumers, local residents, insurers, employees, and interest groups.

However, it might be that these pressures cannot overcome the barriers preventing SMEs engaging in activities designed to improve their environmental performance. SMEs' inactivity and reactivity might be caused by particularly strong barriers. SMEs' lack of internal resources is important factor in this regard, and the external pressures are insufficient to persuade SMEs to adopt environmental activities.

Thus, in order to assist or persuade SMEs to improve their environmental performance, more effective approach should be found to overcome the barriers facing SMEs. The study summarized the conditions necessary to effectively support SMEs' implementation of environmental activities, drawing on previous studies. It was suggested that appropriate approaches should be inexpensive, practical, easily understandable, flexible, co-operative, and appropriate rewarding.

This chapter' literature review suggested that, among diverse pressures, one possible mechanism to include SMEs could be implemented by corporate customers, which have the potential to persuade SMEs to implement environmental activities. Chapter 3 discussed in details the role of corporate customers with respect to the environmental activities of SMEs in a review of the relevant literature.

Chapter 3. SMEs and Environmental Supply Chain Management

As discussed in chapter 2, corporate customers can play a critical role in facilitating the environmental activities of SMEs. The aim of this chapter is to review the relevant literature in the field of SMEs and environmental supply chain management (ESCM), to which SMEs could be exposed as suppliers to large companies.

This chapter is composed of four sections: ESCM, corporate customers' perspective on ESCM, suppliers' perspective on ESCM, and SMEs and ESCM. In manufacturing industry, ESCM approaches are mainly adopted by large companies, and most SMEs have relations with large companies as suppliers. In this study, corporate customers applying ESCM approaches are considered to be large companies, and suppliers are considered to be SME suppliers.

3.1. Environmental Supply Chain Management (ESCM)

3.1.1. Definition of ESCM

Various definitions of ESCM have been proposed that differ according to the research scope of studies in question. For example, Narasimhan and Carter (1998) define it as “the purchasing function’s involvement in activities that include reduction, recycling, reuse and the substitution of materials” (p.6). The National Environmental Education and Training Foundation’s Green Business Network (NEETF, 2001) defines ESCM as “a variety of approaches through which companies work with their suppliers to improve the environmental performance of the products or manufacturing processes of the supplier, customer or both” (p.5). These definitions limit ESCM to the purchasing function and to approaches involving corporate customers and suppliers with respect to the manufacturing process.

However, there is a broader conception, encompassing diverse environmental initiatives across the whole supply chain. Life cycle thinking considering the whole supply chain

has been considerably important in response to sustainable development (Cooper, 2005). Zsidisin and Siferd (2001) suggested that ESCM should be defined as “the set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services” (p.69). The scope of this definition is more comprehensive than two previous definitions, including downstream activities from manufactures to end user as well as upstream activities. Moreover, Zsidisin and Siferd’ (2001) definition is theoretically effective and powerful, as it emphasizes the role of relationships as well as action and policy in managing environmental issues in the supply chain, and the scope encompasses diverse activities throughout the chain.

In addition, a number of similar terms have been used, each emphasizing a slightly different aspect such as responsible chain management (Bakker and Nijhof, 2002), integrated chain management (Cramer, 1996; Ytterhus et al., 1999), and sustainable supply chain management (Charter et al., 2001). For example, responsible chain management (Bakker and Nijhof, 2002) focuses on the responsibility of actors across the supply chain and emphasizes the capability of managing the whole chain. Sustainable supply chain management (Charter et al., 2001) emphasizes social and ethical issues as well as environmental issues. Although there are differences of emphasis and approach, these conceptions share the broad aim of increasing environmental and ethical performance throughout the supply chain.

This study accept the term ESCM and its definition as suggested by Zsidisin and Siferd (2001) in order to take advantage of the strengths of this definition, which emphasizes the relationships formed as well as the actions taken and policies held in response to environmental concerns arising throughout the supply chain. This term and definition are considered more relevant to this study considering its research scope such as environmental issues, ESCM approaches and relationships between corporate customers and suppliers.

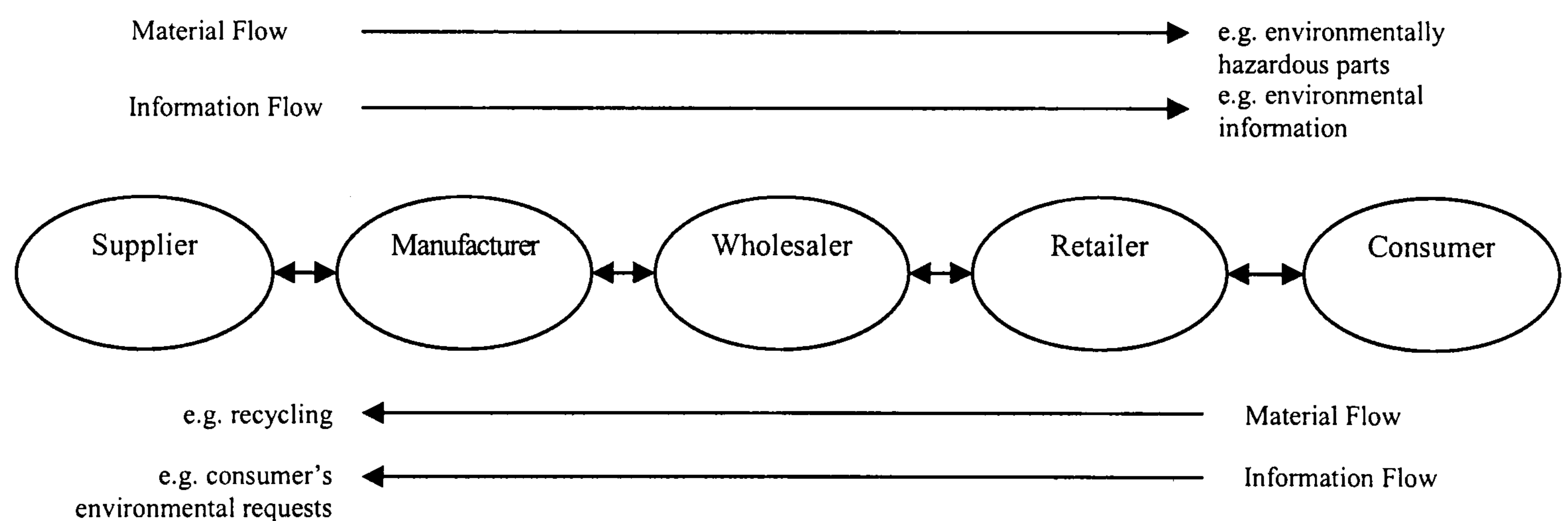
3.1.2. Characteristics of ESCM

The definition adopted by this study emphasizes the relationships between actors and broad scope from suppliers to final consumers. This section describes the characteristics of ESCM based on the basis of this definition.

Material and information flow

Information and material flows are important constituents of the supply chain (Handfield and Nichols, 1999). In the field of ESCM, similar characteristics have been identified. The environmental information and material flow through the supply chain as shown in Figure 3.1.

Figure 3.1. Material and information flow in ESCM



* Adapted from Sohal et al. (2002, p.98), and Remmen and Holgaard (2003, p.4)

Regarding information flow, environmental information is transferred both upwards and downwards through the supply chain. For example, a manufacturing company can request environmental information on the parts and products of their suppliers through environmental audit or environmental questionnaire (Lippman, 1999; NEETF, 2000). This information informs the decision-making process of the manufacturing company (Preuss, 2005). On the other hand, the retailer may demand manufacturing companies to use recycled packing for their products (Ytterhus et al., 1999). Similarly, manufacturing

companies might disseminate environmental demands from consumers to their suppliers through seminars and workshops (Lippman, 1999; Rao, 2003).

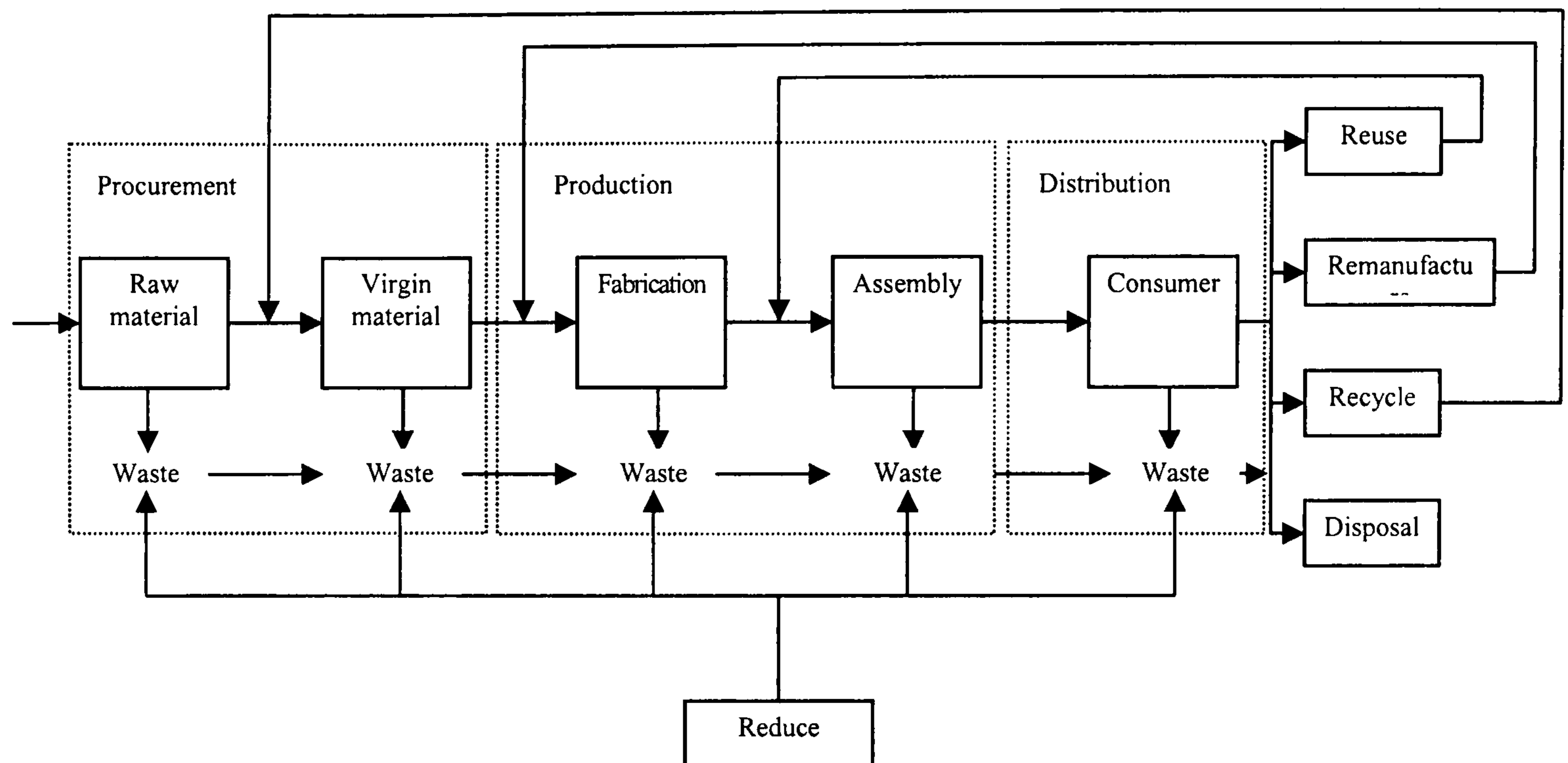
Regarding material flow, environmentally hazardous materials might be transferred from suppliers to the final consumer through manufacturing companies' purchasing (Remmen and Holgaard, 2003). In addition, the used products could be returned to upstream through reuse and recycling (Zsidisin and Siferd, 2001).

Individual function of ESCM through material flow in supply chain

As already pointed out by the definition of Zsidisin and Siferd (2001), ESCM deals with the environmental concerns with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services. In the functioning of the supply chain, the environmental impacts of a product may occur at every stage throughout the life cycle, from extracting raw materials to consumption and final disposal of the products. To manage environmental impacts throughout the supply chain, diverse environmental issues should be considered (Powell, 2000; Sarkis, 1995, 2003). Sarkis (1995) has proposed a conceptual framework identifying four functional constituents of the supply chain with a view to minimizing environmental impacts; these are purchasing, production, distribution and reverse logistics (Sarkis, 1995). Sarkis' functional model of ESCM is presented in Figure 3.2.

In the purchasing stage, the environmental impacts of the entire supply chain can be managed by supplier selection and purchasing environmentally friendly materials. For example, under the criteria governing the selection of suppliers, a criterion such as ISO 14001 certification could be included (Sarkis, 2003). In addition, manufacturers could purchase recycled and reused materials and parts or consider the possibility of these actions (Sarkis, 2003).

Figure 3.2. Functional model of supply chain with environmentally influential practices (Sarkis, 1995, p. 85)



The production phase can minimize environmental impacts in various ways such as reduction of waste and pollution through cleaner production (Rao, 2003). For example, manufacturers could reduce the amount of materials in order to minimize waste from the production process (Boons, 2002; Sarkis, 1995, 2003) and change from a fossil energy source to a more sustainable source such as solar or wind energy (Cramer, 1996). In addition, it may be possible to reduce environmental impacts through integrating reusable components into the production system (Sarkis, 2003).

The distribution stage could include decisions regarding the adoption of distribution methods, the location of distribution outlets, control systems, the adoption of a just-in-time policy (Sarkis, 2003) and packing systems (Rao, 2003). For example, the environmental burdens of packing materials and the energy efficiency of transportation methods such as cars, trains, aircraft, and ships could be considered when selecting packing materials and transportation methods (Rao, 2003).

Reverse logistics refers to the return of recyclable and reusable products and materials after final usage (Sarkis, 2003). For example, solid waste materials such as paper, glass, plastics and metals could be recycled or reused (Boons, 2002; Sarkis, 1995, 2003)

3.2. Corporate customers' perspectives on ESCM

This section discusses the motivations to introduce ESCM approaches from the perspective of corporate customers, who are managing suppliers' environmental problems. However, they often do not manage their suppliers to the same level; this being so, the relationships, with which ESCM approaches are implemented in accordance, is addressed.

3.2.1. Drivers regarding ESCM approaches

Manufacturing companies cannot attain their business objectives by themselves. They have to work with other companies in the supply chain to achieve the objectives such as better quality, lower costs, and quicker delivery (Reed, 2003). As for the environmental issues, the necessities for introducing ESCM approaches were increasingly recognized by the business managers, and many leading companies were integrating environmental issues into supply chain management (Berger et al., 2001; NEETF, 2001; Wycherley, 1999).

There could be diverse factors to introduce ESCM approaches. For example, to cope with environmental issues of regulations and consumers, companies had to consider the environmental issues in their supply chain, and manage environmental problems of their suppliers (Reed, 2003; Walton, et al., 1998). In addition, social responsibility for manufacturing companies were also emerging reasons to implementing ESCM approaches (Rao, 2005). The practical business backgrounds for implementing ESCM approaches was precisely investigated in previous studies (e.g. BSR, 2001; NEETF, 2001; USAEP, 1999). NEETF (2001) identified these motivations more specifically, and categorized the economic reasons into internal and external factors. These motivations were summarized in Table 3.1.

Table 3.1 Motivations for undertaking ESCM approaches (NEETF, 2001, p.4)

Primary Motivations	
Internal	External
Risk management •supply interruption •long-term risk to human health and the environment •competitive disadvantage	Enhanced brand image •potential to improve public image as responding to environmental concerns •corporate culture of forecasting trends and moving proactively
Regulatory stance •desire to go beyond compliance •potential for suppliers to provide materials containing problematic substances •Supplier non-compliance may pose production risk	Customer pressure •often appears in conjunction with a threat to brand image •frequently focused on high-profile brands
	International purchasing restrictions •eco-labelling and product takeback gaining momentum •may drive the creation of systems for collection, transport, and disassembly or recycling
Secondary Motivations	
•Cost reduction as suppliers apply pollution prevention •Enhanced quality	•Increased innovation-can result from supplier participation in new product development

External factors driving adoption of ESCM approaches

The key external factors are enhanced brand image, international purchasing restrictions, customer pressures and increased innovations (NEETF, 2001). Among these factors, international purchasing restrictions perhaps constitute the most powerful motivation (NEETF, 2001; USAEP, 1999).

The environmental regulations recently implemented in Europe such as WEEE and RoHS in electronics industry require manufacturing companies to recycle their products after final usage and eliminate environmentally hazardous materials from their products. These environmental requirements has increasingly been pushed manufacturing companies collaborate on product design with their suppliers and manage environmental issues concerning suppliers' parts and intermediate products (Canning and Hanmer-Lloyd, 2001; NEETF, 2001; USAEP, 1999). Although these regulations

are applied in European countries, companies in the other areas such as South-East Asia have similar concerns and influenced by these regulations (Rao, 2005).

The other external factors are enhanced brand image, customer pressure, and increased innovation. A supplier's environmental problem could be related to the overall image of the manufacturing company, and it could enhance its image by publicising its credentials as an environmentally aware enterprise (NEETF, 2001; Rao, 2005). In addition, customers could require manufacturers to manage their suppliers' activities in order to improve environmental performance, and these pressures could go beyond simple regulatory compliance. Furthermore, increased innovations could be the management of suppliers in the new product development (NEETF, 2001, Sarkis, 1995; Zsidisin and Siferd, 2001)

Internal factors driving adoption of ESCM approaches

The key internal factors are risk management, regulatory stance, cost reduction as suppliers apply pollution prevention, and enhanced quality. Among these factors, risk management and regulatory stance underlie most ESCM initiatives (NEETF, 2001).

First, regarding risk management, suppliers can be temporarily shut down for practices that do not meet the criteria of environmental regulations. These interruptions will inevitably hamper the final manufacturing production process. Because suppliers' poor practice could affect the environmental quality of the manufacturing company' products or process, the risk should be effectively managed to ensure reliable supply and production (Hill, 1997; NEETF, 2001; Zsidisin and Siferd, 2001).

Second, regarding the decision process conducted in response to pressure from environmental regulations, the degree of supplier management is highly dependent on the regulatory stance of the manufacturing company. For example, supply chain managers could decide the level, from merely complying with the regulations to establishing ESCM approaches that go well beyond compliance (NEETF, 2001; Sarkis, 1995).

Additional internal concerns bearing upon ESCM approaches are cost reduction and enhanced quality. Increased environmental performance could be related to cost reductions such as reduced handling costs due to reduced packing (NEETF, 2001) and less waste from facilities (Canning and Hanmer-Lloyd, 2001; Rao, 2005; Reed, 2003). In addition, working with suppliers on environmental issues could result in increased quality as well as increased environmental performances on the part of suppliers (BSR, 2001; NEETF, 2001).

3.2.2. Relationships with suppliers and ESCM approaches

In supply chain management, the relationships between corporate customers and suppliers have been recognized as a critically important factor to the effective management of the supply chain as well as information and material flows (Handfield and Nichols, 1999). The relationships have been also recognised in the studies of ESCM (Canning and Hanmer-Lloyd, 2001; GEMI, 2002; Kriwet et al., 1995). Corporate customers are aware that their suppliers vary in their degree of importance to the company. Hence, it is more effective to apply ESCM approaches according to the strategic importance of a supplier.

Relationships with suppliers

Companies often maintain portfolios in order to manage relationships and several researchers have proposed models of the effective management of the relationships with suppliers (e.g. Dyer et al., 1998; Hut and Speh, 2001; Parker and Hartley, 1997; Patterson et al., 1999). Various types of inter-organizational relationships can be summarized in the form of continuums as seen in Figure 3.3.

Figure 3.3. Continuums of relationships between organizations

Dyer et al. (1998)	Arm's-length relationship			Collaborative relationship	
Patterson et al. (1999)	Transactional Relationship		Transitional Relationship		Transcendental Relationship
Hutt and Speh (2001)	Pure Transaction	Repeat Transaction	Long-term Transaction	Buyer-supplier Partnership	Strategic Alliance
Hagelaar and van der Vorst (2002)	Market Transaction	Short-term Contract	Long-term Contract	Joint Venture	Vertical Integration

For example, Hagelaar and van der Vorst (2002) categorized the full range of relationships into five sub-relationships as seen in this figure: market transaction, short-term contract, long-term contract, joint venture and vertical integration. Hutt and Speh (2001) categorized the relationships into pure transactions, repeat transactions, long-term transactions, buyer-supplier partnerships and strategic alliances.

Traditional relationships with suppliers

Besides the continuums shown in Figure 3.3, the terms of arm's-length and collaborative relationships have traditionally been used to characterize customer-supplier relationships, being situated at opposite ends of the continuums. Dyer et al. (1998) characterize these relationships according to product characteristics and dependence on suppliers. According to them, arm's-length relationships often emerge with the producers of commodity and standardized products, and are characterized by a low degree of interdependence between customer and supplier. In contrast, collaborative relationships are built with the producers of customized, non-standard products and are characterized by a high interdependence between customer and supplier (Dyer et al., 1998).

Further, in arm's-length relationships, the corporate customer focuses on prices, short-term contracts, and multiple sourcing. The corporate customer's primary objective is to minimize the cost of purchasing products and services (Maloni and Benton 1997; Shapiro, 1986; Tang et al., 2001). In contrast, collaborative relationships focus on

quality rather than price (Mayhow, 1985) and are characterized by long-term contracts, joint problem solving, a high degree of information sharing and the corporate customer's investment in its suppliers (Campbell, 1997; Maloni and Benton 1997). The characteristics of arm's-length and collaborative relationships are compared in Table 3.2.

Table 3.2. Comparison between arm's-length and collaborative relationships

	Arm's-length	Collaborative
Product	Commodity/standardized products	Customized, non-standard products
Dependence	Low	High
Duration	One-time	Long-term
Communication	Very little	Complex, two-way sharing
Transferability	Completely transferable	Extremely difficult to transfer
Management support	Low	Exclusive, sincere
Attitude	Profit-focused	Open, trusting, cooperative
Visibility	Low	High
Planning and Goals	Individual, short-term	Joint, long-term
Benefits and Risks	Individual	Shared, mutual
Problem solving	Power driven	Mutual, judicious

* Adapted from Dyer et al. (1998, p.72) and Maloni and Benton (1997, p.421)

ESCM approaches in accordance with the relationships with suppliers

ESCM approaches cover a wide range of specific practices. For example, Lippman (1999) identified ESCM approaches with written policies and communication materials, questionnaires and audits, meeting with suppliers, training and technical assistance, and collaborative research and development. Leung (2002) suggests that ESCM approaches involve collaboration with suppliers, green purchasing, screening and selection of suppliers, auditing and certification of suppliers, and service supply chain strategies.

ESCM approaches can be categorized according to purpose. Beamon (1999) suggests two different types; greening the supply process, and product-based green supply. The first involves collecting environmental information on suppliers, and assessing and ranking suppliers' environmental performance. The second included involves attempts to manage the by-products of supplied inputs such as packaging, and co-operation with suppliers.

However, in reality, supply chain managers often divide their suppliers on the basis of the relationships and ESCM approaches often correspond to these relationships (GEMI, 2001). The two extreme types of relationships can be applied to characterize the corporate customer's ESCM approaches to its suppliers; like the relationships described in the supply chain literature, ESCM approaches can be categorized as arm's-length approaches or collaborative approaches (Preuss, 2005; Rao, 2003).

ESCM approaches needs some kinds of investment for suppliers. In the two different types of ESCM approaches, the arms' length approach is much less resource-and time-intensive to corporate customers than the collaborative approach (Preuss, 2005).

Companies adopting an arm's-length approach depend minimally on their suppliers, keeping them at arm's-length using their bargaining power and avoiding any commitment. In contrast, collaborative approach involves sharing information and collaborating to enhance the environmental performance of the corporate customer and the supplier. The corporate customer invests in building a close relationship to improve supplier's environmental performance (Rao, 2003).

These relationships are concerned with the environmental characteristics of the suppliers' products and services. For example, when environmentally friendly products such as recycled paper or biodegradable materials are readily available in the market, corporate customers can purchase in the markets adopting the arm's length approach (New et al., 2000). On the other hand, when the environmentally friendly products are not available, corporate customers have to adopt the collaborative approach such as supplier development programmes to meet the required environmental criteria (Preuss, 2005). In addition, if the products of a supplier have significant impact on the corporate customer, unlike in the area of maintenance, repair, and operating items, the corporate customers will prefer to the collaborative approach (Carter and Carter, 1998)

Large corporate customers often divide their suppliers into a few subgroups to ensure the practicability of their ESCM approaches. GEMI (2001) suggests four subgroups, a categorization based on the degree of intimacy and mutual dependency of the

relationship; spot purchasing, competitively based incumbent relationships, preferred supplier, and strategic partnerships. The detailed characteristics of each relationship were shown in Table 3.3.

Table 3.3. Level of suppliers (GEMI, 2001, p. 35)

Spot Purchasing	There is little or no relationship with or knowledge of the supplier. Price is the key determinant of purchase. To the extent that quality is important, it is assessed based on predictable product characteristics or supplier reputation alone. Each transaction is its own business contract. Commodity items such as coal, sand, mops, and pencils are often purchased on the spot market.
Competitively Based Incumbent Relationships	Suppliers have a long-term business relationship, typically an annual contract against which purchase orders are issued. Contracts are renewed annually. Relatively little technical cooperation is invested in these short-term relationships, because a better supplier may be located the next year.
Preferred Supplier	The intention is for a long-term relationship that requires and benefits from fairly frequent communication and collaboration to improve or adjust supplier inputs over time.
Strategic Partnerships or Alliances	Relationships involve an even deeper level of commitment. Typically, there is an explicit or implicit understanding that supplier and buyer will share the business benefits of effective collaboration.

Practical ESCM approaches can be categorized by reference into four levels. First, in the case of spot purchasing, interdependency between customers and suppliers is minimal and purchasing decisions depend mainly on price. To manage environmental issues, corporate customers may change products or product specifications. Second, competitively based incumbent relationships may be long term, but typical contracts are renewed annually, and the relationships involve relatively little co-operation. To manage environmental issues, customer companies may change specifications, and look for suppliers who are better able to meet these specifications. Third, the relationship with a preferred supplier is a long-term one, and corporate customers and suppliers often collaborate to maximize value. In this case, environmental issues could be discussed during periodic visits and meetings with regard to progress, quality, and targets. Fourth, strategic partnerships or alliances involve mutual investment and benefit sharing. Partners may draw up contracts in order to share the benefits of improved environmental and economic performance. Examples of individual ESCM approaches with respect to the four levels of suppliers are shown in Table 3.4.

Table 3.4. Typical tools by level of supplier (GEMI, 2001, p. 40)

Supplier Level				TOOL
1	2	3	4	
Stage 1: Pre-Screening Communications				
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Policy Statements (EHS and Procurement Policies)
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Code of Conduct for Suppliers
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Minimum EHS Performance Standards
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Product Specifications
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lists of Chemicals to Avoid
Stage 2: Qualifying and Negotiating				
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	List of Pre-Approved Materials
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Requests for Proposal
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Surveys and Questionnaires
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Required Standards of EHS Performance
		<input type="radio"/>	<input type="radio"/>	Supplier Selection Criteria/Ranking
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pre-Approved Supplier Lists
		<input type="radio"/>	<input type="radio"/>	Contract Negotiations
Stage 3: Monitoring and Continuous Improvement				
		<input type="radio"/>	<input type="radio"/>	Audits
		<input type="radio"/>	<input type="radio"/>	Regular Supplier Visits
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Performance Reviews
		<input type="radio"/>	<input type="radio"/>	Collaboration to Solve EHS Problems
		<input type="radio"/>	<input type="radio"/>	Supplier Training and Seminars
			<input type="radio"/>	Collaboration on R&D and New Product Development

3.3.3. ESCM approaches in the electronics industry

Electronics industry has been considered as one of leading industry sector applying comprehensive ESCM approaches (Preuss, 2005), many leading companies have already been undertaking these approaches in order to manage environmental performance of their supply chain.

As noted in chapter 1, one of critical motivations to introduce ESCM approaches in electronics industry was recent European regulations such as RoHS and WEEE. For example, RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) directive requires the substitution of various heavy metals such as lead, mercury, cadmium, hexavalent chromium, and brominated flame retardants in electronic and electric equipment from 2006 (CEC, 2003a). In response to these environmental regulations or for other reasons such as their realization that they

should fulfil their social responsibility, corporations in the electronics industry have been applying a number of ESCM approaches (USAEP, 1999).

There are a number of good examples in EU, USA, and Japan. The large companies in these regions such as Sony, Xerox, Intel, Hewlett Packard and Compaq Computers are using advanced ESCM approaches.

For example, Sony started 'Green partnership programmes' to manage their suppliers' environmental performance. In 2002, this company established its own guideline to control environmentally hazardous substances in parts and materials. Suppliers are required to eliminate and reduce these substances in their products as well as their applications. In addition, Sony conducts on-site audit designed to check suppliers' environmental management activities and qualifies approved suppliers as Green Partners. Sony purchases parts and products from these qualified suppliers, and cooperate with them in the production of environmentally sensitive products (BSR, 2001, 2003)

In addition, Hewlett Packard expects their suppliers to formally include health, safety, labour and human rights practices in their performance standards, and this company implements policies on 'Supply Chain Social and Environmental Policy' and 'Supplier Code of Conduct'. This company requires their suppliers to contract reflecting environmental and social expectations, and monitors suppliers' compliance (PPRC, 2004)

In the Korean electronics industry, the ESCM approaches were partly adopted by some leading companies from the mid of 1990s. Major companies in Korea (e.g. Samsung, LG, Hynix) exporting many of their products to EU, USA and others had to take actions in response to WEEE (Waste Electrical and Electronic Equipment) and RoHS (Restriction of Certain Hazardous Substances) and adopted the ESCM approaches extensively.

LG Electronics, which developed lead-free LCD-TV, electric washing machine, and air conditioner, began purchasing environmentally friendly parts and materials in accordance with its own criteria in 2001. This company applied stricter standards than those prescribed by the European environmental regulations such as WEEE and RoHS (LG Electronics, 2004). Samsung Electronics applies its ‘Eco-partnership Programme’, which give credits to its certified ‘Eco-partners’, and assisted these suppliers to get accreditation of ISO 14001 certification as well as to manage their environmentally hazardous materials in their products in 2004 (Samsung Electronics, 2005). Hynix, a semiconductor manufacturer, educate its suppliers with regard to environmental, health and safety (EHS) management with Internet, and conducts regular site visit programmes in order to evaluate their EHS performance and assist them with consulting (Hynix, 2002). Samsung SDI established technology transfer programmes regarding cleaner production for its suppliers and conducts walk-around inspections to address suppliers’ environmental problems from 1994. Thus company also started applying a number of initiatives in order to manage environmentally hazardous materials in suppliers’ products and develop environmentally friendly products with suppliers (Samsung SDI, 2005).

Some examples of practical ESCM approaches are summarized in Table 3.5.

Table 3.5 Practical ESCM approaches in electronics industry

Companies	ESCM approaches
Samsung Electronics	Ban environmentally hazardous materials involving ozone-destroying substances and chemicals as outlined in RoHS by 2004 (KELA 2003) Establish ‘Eco-partnership program’ designed to apply different purchasing procedures (KELA, 2003) Require suppliers submit assurance statements related to hazardous substances in the products including analysis results and a disposal plan (KELA, 2003) Conduct audit on environmentally hazardous materials with respect to new purchases (KELA, 2003) Operate eco-product web site designed to provide information to suppliers (KELA, 2003) Operate mentoring programs with regard to LCA, Eco-design, green purchasing, environmental accounting, and environment-related customer treatment (KELA, 2003) Provide LCA data (KELA, 2003)
LG Electronics	Establish guideline on the selection of twenty seven environmentally hazardous materials referring US EPA’ Cancer Risk Scores and RoHS (KELA, 2003)

	<p>Conduct on-site inspection with expert group (KELA, 2003)</p> <p>Ask information on parts components, environmental management activities, and environmental policies (KELA, 2003)</p> <p>Operate 'Green-partnership program' (FKI, 2005)</p> <p>Provide suppliers with testing equipment in order to examine the environmentally hazardous materials (FKI, 2005)</p>
Daewoo Electronics	<p>Operate 'DEC Green-partner program' (FKI, 2005)</p> <p>Provide suppliers with testing equipment in order to examine the environmentally hazardous materials (FKI, 2005)</p>
Sony	<p>Establish 'Green Partnership Programmes' (BSR, 2001, 2003)</p> <p>Designate suppliers as 'Green Partners' that cooperate in the production of environmentally sensitive products (BSR, 2001, 2003)</p> <p>On-site visit to check environmental management activities (BSR, 2001, 2003)</p> <p>Require green partners to reduce and eliminate environmentally hazardous materials (BSR, 2001, 2003)</p> <p>Require green partners to maintain and upgrade their environmental management systems (BSR, 2001, 2003)</p>
Intel Corporation	<p>Offer EHS awards programmes, EHS requirements, contractual safety guidelines, and other supplier and contractor outreach efforts and information (PPRC, 2004).</p>
Hewlett Packard	<p>Expect suppliers to formally include health, safety, labour and human rights practices in their performance standards (PPRC, 2004)</p> <p>Implement policies on 'Supply Chain Social and Environmental Policy' and 'Supplier Code of Conduct' (PPRC, 2004)</p> <p>Require supplier contract and purchasing agreements to reflect environmental and social expectations (PPRC, 2004)</p> <p>Communicates suppliers' compliance monitoring process (PPRC, 2004).</p> <p>Require supplier performance reporting and corrective actions for non-compliance (PPRC, 2004)</p> <p>Assist in developing a standard environmental questionnaire for use within the computer industry, to screen and evaluate suppliers (PPRC, 2004)</p>
Compaq Computers	<p>Notify and screen suppliers with pre-selection criteria for environmental performance (PPRC, 2004)</p>
Xerox	<p>Communicate frequently with suppliers in the design of products (PPRC, 2004)</p> <p>Require suppliers to comply with environmental regulations (Rao, 2003)</p> <p>Require suppliers to provide information of the products supplied to Xerox in order to identify ozone-depleting substances (Rao, 2003)</p> <p>Restrict toxic heavy metals including cadmium, lead, mercury or hexavalent chromium (Rao, 2003)</p> <p>Require suppliers to follow packing material guidelines and recyclability requirements (Rao, 2003)</p>

3.3. Suppliers' perspectives on ESCM

This section discusses the impacts of ESCM approaches from the viewpoint of suppliers in manufacturing industry, and the studies cited consider this subject from the perspective of those suppliers.

3.3.1. Impacts of ESCM approaches on suppliers

As discussed above, most SMEs in manufacturing have business relations with large companies as suppliers, and they can be exposed to ESCM approaches organized by these large companies. This section was concerned with the impacts of ESCM approaches from large corporate customers on environmental activities suppliers.

The impacts of ESCM approaches on suppliers

Regarding the impacts of ESCM approaches on suppliers, previous empirical researches have produced controversial or inconsistent results. Some empirical studies reported that, although it was believed by them that pressure from corporate customers have potentials to influence suppliers, these pressures was not or not yet a critical factor. For example, according to the Preuss' (2001) study of Scottish manufacturing companies, the 'green multiplier effect', which refers to the spreading of environmental impact of one company's supply management function through and beyond the supply chain, did not (yet) exist. In addition, Lamming and Hampson (1996) found that the supply chain could be an effective means of diffusing environmental management techniques backwards and forwards. However, they reported that very few suppliers whose product had a high environmental profile were proactive regarding environmental supply chain pressures.

On the other hand, some researches have presented clear evidence of the impacts of large corporate customers' ESCM approaches on suppliers. Particularly, recent empirical studies have reported that the positive impacts of large. For example, in the recent study of UK manufacturing industry, Preuss (2005) identified that the ESCM

approaches had partially influenced, contrary to his prior study in 2001, on suppliers' production processes and the finished products, because the environmental criteria were not consistently included in purchasing decision. In addition, in its presentation of interview data with US suppliers, BSR (2001) reported that some suppliers had acknowledged the positive impacts of ESCM approaches of corporate customers such as obtaining ISO 14001 certifications as a results of customer requirements, and positive environmental and economic benefits as a result.

The findings of some of these empirical studies are summarized in Table 3.6.

Table 3.6. Empirical studies on the impacts of ESCM on SME or suppliers

Authors	Study area	Findings
Green et al. (1996)	UK Manufacturing and Services	Supply chain pressures could motivate suppliers' environmental innovations. To improve supplier environmental performance more effectively, joint working initiatives were necessary.
Lamming and Hampson (1996)	UK, Manufacturing and Retail	Suppliers responded positively to the corporate customer's environmental demands. Very few suppliers whose product had a high environmental profile were proactive in response to the environmental supply chain pressures.
Hill (1997)	UK, Manufacturing	Environmental pressure from customers was potentially significant to suppliers. However, this pressure was rarely exerted because of the lack of external pressures such as environmental regulations
Ytterhus et al. (1999)	UK/Norway, Retail	Environmental pressure from large corporate customers was an effective means of improving SME suppliers' environmental performances.
BSR (2001)	USA, Manufacturing and Services	Corporate customers ESCM pressures positively affected many small suppliers' environmental practice.
Preuss (2001)	UK, Manufacturing	The 'green multiplier effect', which refers to the spreading of the environmental impact of one company's supply management function through and beyond the supply chain, not (yet) exists.
Holt (2004)	UK, Manufacturing and Services etc	Larger and higher-risk organizations were beginning to reach out to their suppliers mainly through assessment and evaluation, and to a lesser extent through education and mentoring. The multiplier effect through supply chain was identified.
Preuss (2005)	UK, Manufacturing	The multiplier effect was partially identified in suppliers' production processes and the finished products.

Trans-national impacts of ESCM approaches

Suppliers can be engaged with large companies because the supply chain's scope has become worldwide in a highly competitive global market. Corporate customers have many reasons to seek international suppliers such as currency restrictions, local content and counter-trade, lower prices, higher quality, access to technology and new markets, shorter product development and life cycles, and comparative advantage (Bozarth et al., 1998). Accordingly, the management of global suppliers is considered an important issue (Kotabe and Murray, 2004). In the perspective of SMEs, they tend to believe that it is not necessary to export their products or services, and that they can prosper by doing business in the local area (Johannson, 2000). However, some SMEs build a business strategy of seeking overseas new markets. In that case, they often engage in cross-national trade via large overseas companies and become involved indirectly in the global market as suppliers to those large companies (Johannson, 2000).

Regarding the trans-national impacts of ESCM, the environmental impacts of corporate customers on suppliers could spread across the border into the other countries through the supply chain. For example, the environmental specifications of European supermarkets have served to reduce the use of environmentally hazardous materials such as pesticide in production process in South Africa, and have thus improved worker health and environmental quality (Robins, 2000). In addition, although it was not an environmental issue, the US ban on child labour in the clothing industry has forced manufacturers in Bangladesh to take action to address this economic threat (Robins, 2000).

3.3.2. Different impacts in accordance with relationships with customers

The areas influenced by ESCM approaches

As above, suppliers can be engaged with large corporate customers and influenced from them. The impacts of the corporate customer on its suppliers can cover diverse areas. The recent Preuss' (2005) study dealt with these areas. First, the customers'

environmental requirements or development programmes can make suppliers take the environmental issues seriously. Second, regarding the products of suppliers, the corporate customers' purchasing decisions or supplier development programmes can encourage and enable its suppliers to produce products that meet the environmental criteria it has established. Third, the corporate customer's environmental requirements or assistance programmes can also influence its suppliers' manufacturing process. The corporate customers may select its suppliers on the basis of the environmental criteria of the manufacturing process. These criteria can include requiring suppliers to establish an environmental policy, or become accredited by ISO 14001 certification. The corporate customer could manage assistance programmes for its suppliers regarding cleaner production. These pressures and assistance programmes can disseminate environmental management tools, and thus make suppliers' manufacturing activities more environmentally friendly (Preuss, 2005).

The different impacts in accordance with relationships with customers

As discussed in section 3.2.2., corporate customers have mainly adopted ESCM approaches based on the relationships with suppliers. If the traditional viewpoints on relationships such as arm's-length approach and collaborative approach are accepted for the sake of convenience, each has a different influence on suppliers.

In the arm's-length approach, suppliers are often exposed to strong pressures to reduce their prices, and their rivals in the market may be able to supply large volumes at highly competitive prices. In addition, regarding environmental issues, they are only expected to meet current trends such as regulatory requirements and there is little communication or assistance (Preuss, 2005). In response to these expectations, suppliers need only demonstrate their environmental performance to the level of the suggested criteria (Preuss, 2005). However, the arm's-length approach can provide opportunities to suppliers who are able to achieve a superior environmental performance, which is more easily noticed in a new market than a repeated buying situation (Preuss, 2005)

In contrast, close relationships of the collaborative approach between corporate customers and suppliers facilitate the adoption of advanced manufacturing practices, improvements in productivity and environmental outcomes. Co-operation between corporate customers and suppliers were stronger than in the arm's-length approach (Preuss, 2005). Suppliers have the opportunity to improve their relationships with their corporate customers, and these improved relationships may result in the suppliers' increased sales (Prahinski and Benton, 2004). In addition, suppliers can know and meet the requirement of corporate customers more effectively (Gascoigne, 2002). Moreover, suppliers are usually given the opportunity to transfer the advanced technology and knowledge from their corporate customers (Prahinski and Benton, 2004; Tunnessen, 2000).

Problems associated with the arm's-length and collaborative approaches

The nature of the arm's-length approach can significantly limit suppliers' environmental performance; typical problems are conflicts over prices, delivery terms, and quality levels (Preuss, 2005). More specifically, if the environmental criteria are set low, suppliers are not motivated to more than the criteria demand. In addition, if a supplier's environmental performance is subject to diverse pressures from various stakeholders and corporate customers, the pressures are likely to be fragmented and the performance weakened. Furthermore, an examination of a supplier's environmental performance would tend to be costly, if not the examination was not conducted in an atmosphere of mutual trust (Preuss, 2005).

Traditionally, the collaborative approach has been considered to have some advantages over the arm's-length approach from the corporate customer' perspective, such as the sharing of information, the better coordination of independent tasks, and investment in dedicated assets (Dyer et al., 1998). However, the collaborative approach has some problems in regard to constructing appropriate relationships. A partnership could deepen the dependence of corporate customers on suppliers (Preuss, 2005). This high degree of dependence might prove catastrophic if the supplier has major problems of price, delivery, and quality (Preuss, 2005). In addition, building a partnership of this kind

usually requires significant use of time, financial resources, and management tools. Moreover, it is very often extremely difficult for corporate customers to manage all suppliers efficiently in a collaborative manner. Hence, the collaborative approach is much rarer than the arm's-length approach in supplier-customer relationships (Preuss, 2005).

3.4. SMEs and ESCM

Both large companies and SMEs are members of the diverse function of supply chain with regard to design, acquisition, production, distribution, and disposal of the firm's goods and services. However, in the manufacturing industry, ESCM approaches designed to manage environmental concerns in the whole supply chain, are more often adopted by large companies, while SMEs tend to follow their lead.

3.4.1. Relationships between large companies and SMEs in manufacturing industry

This section describes these roles and characteristics: large companies as customers and coordinators of the supply chain, SMEs as suppliers and followers in manufacturing industry. The large companies, who are situated as the corporate customers of SMEs in the supply chain, often adopt the ESCM approaches, which are taken actions in order to manage environmental problems in the supply chain.

Large companies as customers and SMEs as suppliers in manufacturing industry

'SME' and 'small supplier' are not identical in theoretical terms. SME refers to the overall size of a business and concerns such features as turnover, sales, and number of employees. On the other hand, small supplier denotes "simply an organization whose sales value to any one customer is relatively minor" (Powell, 2000, p.239). Thus, an SME could be both customer and supplier; it could be a customer of a large company by purchasing some of its products. However, in manufacturing industry, SMEs usually have the attributes of suppliers and large companies those of customers in the product

supply chain, and SMEs often supply raw materials and parts to large companies in the manufacturing process (Baylis et al., 1998, a and b; Ghobadian and Gallear, 1996).

Large companies as coordinators and SMEs as followers with regard to ESCM approaches

Many actors can be situated in the different phases of the supply chain, and almost every company is a member of multiple supply chains. Each supply chain is composed of various actors such as suppliers, customers, producers, service providers and ultimate end users, who are concerned with acquisition, manufacturing or assembling, or distribution of goods and services (Handfield and Nichols, 1999). However, not all actors in supply chain can manage the environmental issues that arise throughout the chains. The dominant actor, often called the 'key player', takes on the role of coordinators (Ytterhus et al., 1999).

In order to be a coordinator in the supply chain, specific power and motivation to manage environmental issues in the supply chain are necessary (Ytterhus et al., 1999). Accordingly, coordinators are often large companies rather than SMEs (Baylis et al., 1998a; Cramer, 1996; Preuss, 2005). Large companies have more potential power than SMEs because they command resources, especially financial and knowledge resources (Baylis et al., 1998a; Preuss, 2005). In addition, they are more often exposed to pressures regarding environmental concerns than SMEs are (Baylis et al., 1998a; Preuss, 2005). By contrast, SMEs in the supply chain are often situated in a position that makes it difficult to implement ESCM in order to improve environmental performance. They generally have little power and influence, and often only respond to the ESCM approaches of the coordinators in the supply chain (Cramer, 1996). Hence, it follows that ESCM approaches are mainly adopted by large companies rather than SMEs. SMEs are generally not capable of taking initiatives to manage environmental issues throughout the supply chain.

3.4.2. Benefits and barriers relevant to SMEs and ESCM

Benefits and opportunities provided by ESCM approaches to suppliers

SMEs may be exposed to the ESCM approaches of their corporate customers as suppliers, and the benefits can have significant implications for their business, providing business opportunities that SME suppliers can learn to take advantage of. For example, mentoring programmes organized by large corporate customers could provide opportunities for free access to experienced professionals' expertise (Envirowise, 2002). In addition, these programmes teach the management of environmental problems by transferring large companies' theoretical and practical knowledge of environmental technology and management techniques (Envirowise, 2002). Further, companies mentored by their customers could have the opportunity to build stronger relations with customers and ensure longer-term inclusion in the supply chain (Tunnessen, 2000). The possible opportunities and benefits for SME suppliers are summarized in Table 3.7.

Table 3.7. Benefits and opportunities provided by ESCM to SME suppliers

Cost reduction	<ul style="list-style-type: none"> •Free access to expertise and information •Cost saving from more efficient raw materials and packing use, reduced waste, and reduced water and energy consumption •Reduced environmental risks •Cost-effective compliance with environmental regulation
Operational efficiency	<ul style="list-style-type: none"> •Increased future capability through building and expanding environmental expertise within company •Improved quality •Improved efficiency
Enhanced customer values	<ul style="list-style-type: none"> •Better working relationships with corporate customers •Maintained or increased sales, i.e. competitive advantage and access to new market •Development of value added customer services
Other	<ul style="list-style-type: none"> •Improved public image and relationships with stakeholders (shareholders, employees, neighbours) •Increased stock price •Proactive preparations for future environmental regulations

* Summarized from Envirowise (2002b) and BSR (2001)

Barriers impeding the effective implementation of ESCM approach

As well as the opportunities and benefits ESCM approaches can provide to suppliers, several obstacles and barriers in corporate customers and SME suppliers have also been reported. These barriers were summarized in Table 3.8.

Table 3.8 Barriers impeding SME suppliers' environmental activities

Barriers related to corporate customers and their ESCM approaches	
Onerous or conflicting questionnaires	Numerous and frequent audits and questionnaires are requested by suppliers' diverse corporate customers. The requests for complex environmental are burdensome and ineffective
Lack of lead time for implementing initiatives	To implement the requirements from their corporate customers, considerable time is necessary for preparation such as developing new technology, documenting information and educating employees. Requirements from corporate customers are often too advanced than for suppliers to deal with.
Customers' lack of environmental awareness or values	In some cases, suppliers have much more environmental knowledge than their corporate customers, which are therefore in an inferior position in this respect. In such cases, suppliers hesitate to transfer their knowledge.
Disparity of knowledge/lack of education	A lack of understanding of each other's business and environmental issues could create a disparity. For example, when ESCM managers in the corporate customer fail to educate their purchasing staff about environmental issues, these do not interest suppliers.
Environmentally unsound design specification	If some corporate customers still require environmentally unsound products, suppliers have to produce these products.
Lack of protection for innovation	Corporate customers may co-opt environmentally innovative technology from their suppliers. Suppliers need protection or reward mechanisms with respect to their innovative environmental designs and processes.
Suppliers' internal barriers	
Increased costs	To implement environmental requirements made by corporate customers, additional cost is necessary.
Technological barriers	To meet corporate customers' environmental requirements, such as for environmentally hazardous material substitution, suppliers need new technology. When proven alternative technologies are rare, suppliers cannot make environmental improvements.
Exposure risks;	Suppliers may be worried about revealing too much information about their assets and liabilities. These concerns might discourage their disclosure of their environmental records.

*Summarized from BSR (2001)

Regarding the barriers related to corporate customers and their ESCM approaches, if customers' pressures regarding environmental concerns are not sufficiently detail, they might hinder rather than stimulate suppliers' environmental activities (Preuss, 2005). In case of corporate customers' technical requirements concerning with environmentally hazardous material substitution, when there are not proved alternative technologies, suppliers cannot make environmental improvement (BSR, 2001)

The various barriers impeding SME suppliers' activities can exist in SME suppliers as well as in customers. The suppliers' barriers involve increased costs, technology, and exposure risks. The barriers in customers involve conflicting questionnaires, a lack of lead-time for implementing initiatives in response to customers' requirements, customers' lack of environmental awareness, disparity of knowledge and lack of education of customers, environmentally unsound design specification, and a lack of protection for innovation (BSR, 2001).

Among these barriers, the most common barrier is that customers are not doing enough to integrate environmental expectations for suppliers into their purchasing decision, that is, price continues to play the major role in this decision and environmental issues is merely playing an incidental role (Lippman, 2001).

3.5. Conclusion

This chapter has reviewed literature related to SMEs and ESCM including characteristics of ESCM, corporate customers' perspective on ESCM, and suppliers' perspective on ESCM, and the relations between SMEs and ESCM.

The review of the literature on SMEs and ESCM indicated that ESCM approaches were mainly adopted by large companies and SMEs were not capable of taking initiatives to manage environmental issues throughout the whole supply chain. Large corporate customers of SMEs are often exposed to diverse pressures concerned with the implementation of ESCM approaches with regard to their suppliers. ESCM approaches have potentials to influence suppliers' environmental activities.

However, in the literature review, the results of empirical studies have been controversial or inconsistent results. Some empirical studies reported that the market forces such as supply chain pressures had, as yet, had little impacts on SMEs' behaviour (e.g. Merritt, 1998). In contrast, the positive impacts were also reported by some researchers (e.g. BSR 2001). However, although previous empirical researches have yielded different results concerning the impacts of ESCM approaches on SMEs' environmental activities, most of them including those reporting little impacts, concluded that ESCM pressures could be a potentially effective mechanism to persuade SMEs to undertake environmental activities.

Specifically, in implementing ESCM approaches, large companies often divide their suppliers into a few subgroups using criteria such as product characteristics, dependence on suppliers, and intimacy. Among the various types of strategic configurations and approaches, this study considered two extreme types of relationship approaches; the arm's-length and collaborative approach. The arm's-length approach is characterized much less resource- and time- intensive to corporate customers than the collaborative approach. Hence, although there were a number of benefits and opportunities to SMEs such as cost reduction, increased operation efficiency, and enhanced customer value, the impacts of their corporate customers may differ from the ESCM approaches.

Considering the interests of the previous researchers, ESCM studies have been often designed with regard to assist large companies' decision-making. Accordingly, the narrower area in ESCM to link SMEs such as role of corporate customers for environmental activities of SMEs has not been well explored. Only a few studies tackled this issue.

Further, the impacts of each ESCM approaches were not evaluated enough with regard to the responses of SMEs to these pressures, and a lack of internal resources, which are often regarded as critical barrier of implementation of environmental activities in SMEs, have not often been considered simultaneously in the previous studies.

In addition, the previous researchers have focused on Western countries such as UK, EU, and US. Even if there are some studies in Asian area, it was extremely small.

The next section raises the research questions considering the limitation of the previous literatures in the field of SMEs and ESCM.

Chapter 4. Research Questions and Theoretical Framework

In chapters 2 and 3, the relevant literature on SMEs and the environment, and SMEs and ESCM were reviewed; this chapter presents the study's research questions and theoretical framework.

The first section addresses the research objective and questions, whose formulation reflects the limitations of the literature reviewed in chapters 2 and 3. The second section presents the theoretical background. This study adopts stakeholder theory and the resource-based view of the firm; these two different theories are presented in detail. Then, the conceptual framework including the hypotheses is developed on the basis of the theoretical background and the relevant literature.

4.1. Research objective and questions

The environmental activities of SMEs have been extensively investigated; and especially, the barriers to and motivations for SMEs' environmental activities have been the focus of previous researchers' interest and have been thoroughly explored, as discussed in chapter 2. However, the narrower area of the links between ESCM to link and SMEs, such as the role of corporate customers in the environmental activities of SMEs, has not been well explored.

As discussed in chapter 3, a number of limitations were found in the literature on SMEs and ESCM. First, although the ESCM practised by large companies can be an important mechanism to improve SMEs' environmental performance, and large companies can be important stakeholders in SMEs because they have purchasing power in the market, the impacts of ESCM approaches on the environmental activities of SMEs have been a somewhat controversial issue, mainly due to a lack of empirical evidence. Second, SMEs' internal resources, the lack of which has often been regarded as a critical barrier to SMEs' implementation of environmental activities, have not often been considered simultaneously in previous ESCM studies, and their role in the relationship between

ESCM approaches and SMEs' environmental activities has not been investigated by previous researchers. In addition, studies of ESCM have largely been conducted in Western countries such as the UK, the USA, and those of EU; very few have been carried out in Asia.

Given the limitations of previous studies, it will be valuable to evaluate the impacts of ESCM approaches on the environmental activities of SMEs through an empirical study considering both ESCM approaches and SMEs' internal resources simultaneously. Hence, this study was conducted with the objective of

understanding the relationships and dynamics between the ESCM approaches of large corporate customers and the environmental activities of SMEs under different internal resource conditions of SMEs.

In order to achieve this research objective, detailed research questions were formulated three stages. The objective, derived from the identification of a gap in the literature, led to the first research question explored in this study. This question was designed to fill the gap by addressing the controversial role of corporate customers with regard to SMEs. This would be done by providing clear empirical evidence of these impacts, assuming that the ESCM approaches of large corporate customers have the potential to persuade SMEs to undertake environmental activities because these customers exercise power in the market, and are related to SMEs through the supply chain.

Research question 1: Do the ESCM approaches of large corporate customers have positive impacts on SMEs' environmental activities?

In addition, even if it is accepted that large corporate customers influence SMEs' environmental activities, the intensity of this influence can vary according to the ESCM approach adopted. Several studies have focused on collaborations between large companies and SMEs in the field of the environment (e.g. Gascoigne, 2002) and reported positive impacts on suppliers (e.g. BSR, 2001). However, little has been done

to evaluate the impacts of different ESCM approaches designed to improve SMEs' environmental activities.

Research question 2: If so, which ESCM approach of large corporate customers strongly impacts on SMEs' environmental activities?

In addition, the degree of SMEs' environmental activities in response to the ESCM approaches of large corporate customers can vary according to the conditions of their internal resources. While some studies have identified conditions and factors that improve environmental performances of suppliers (e.g. Canning and Hanmer-Lloyd, 2001; Geffen and Rothenberg, 2000; Wycherley, 1999), no attempts have been made to fully examine the role of SMEs' internal resources in the relationships between ESCM approaches and the environmental activities of SMEs. Identification of this gap in the literature led to the third research question.

Research question 3: How do the internal resources of SMEs impact on SMEs' environmental activities in response to the ESCM approaches of large corporate customers?

4.2. Theoretical background

This section presents the theoretical background of this study. In research, theory is used to provide “an explanation of what is going on in the situation, phenomenon or whatever that we are investigating” (Robson, 2004, p.61).

In order to explain ESCM and the environmental activities of corporations, various theories have been advanced. Among these theories, this study applies stakeholder theory and the resource-based view of the firm. The first section discusses in detail the reasons for adopting these two theories. Then, the following two sections discuss the two theories themselves.

4.2.1. Adopted theories by this study

Theories in previous studies

Several theories have been adopted in order to understand ESCM phenomena, such as exploring the factors determining ESCM approaches or environmental activities. With regard to the perspective of corporate customers, transaction cost theory (Jeppesen and Hansen, 2004; Zsidin and Siferd, 2001) and resource dependence theory (e.g. Boons, 2002) have often been applied to identify the factors influencing the decisions connected with ESCM approaches.

For example, transaction cost theory provides a theoretical basis for the explanation of the criteria regarding to the choice between the collaborative approaches and the arm's-length approach (Dyer et al., 1998; Williamson, 1975, 1985, 1991). This theory emphasizes that a particular form of governance structure, either the collaborative or arm's-length relationship, should be decided in order to minimize the sum of production costs and transaction costs (Dyer et al., 1998; Williamson, 1975, 1985, 1991).

This theory has been applied to understand the decision making for appropriate ESCM approaches. ESCM approaches of corporate customers such as collaboration, auditing, design specification and the mentoring of suppliers has been considered options to reduce transaction costs (Jeppesen and Hansen, 2004; Zsidin and Siferd, 2001).

However, these theories have been unable to fully explain the impacts of ESCM approaches on the environmental activities of SMEs due to their different scopes and emphases. The theories regarding the criteria governing corporate customers' choices such as transaction cost theory and resource dependence theory do not address the dynamics of ESCM approaches' relationships with the environmental activities of SMEs from the perspective of SME suppliers.

Theories adopted by this study

This study applies stakeholder theory and the resource-based view of the firm to examine the pressures exerted by corporate customers through their ESCM approaches and to explore the role of SMEs' internal resources.

Unlike transaction cost theory and resource dependence theory, stakeholder theory can provide a guide to the structure and operations of corporations (Donaldson and Preston, 1995). Stakeholder theory is considered suitable as a way of approaching the environmental issues of corporations (Stanwick and Stanwick, 1998). In addition, stakeholder theory focuses on the network and views the corporation as a member of a network (Rowley, 1997). In this perspective, the SME supplier can be considered an important individual stakeholder by corporate customers, and vice versa. Hence, stakeholder theory was considered as a useful guide to explain the reasons underlying the environmental activities of SMEs and the influence of large corporate customers through ESCM.

However, stakeholder theory is unable to fully describe internal resources, which have often been cited as important barriers to the implementation of environmental activities in SMEs. Hence, it was considered necessary to supplement stakeholder theory by adopting another theory in order to consider the internal aspect of a firm responding to stakeholder influence. The resource-based view of the firm suggests that internal resources are critical factors in implementing environmental activities (Azzone et al, 1997; Clark, 2000; Ghobadian and Galler, 1996; Pederson, 2000).

Accordingly, in order to cover simultaneously the internal and external factors of SMEs' environmental activities, stakeholder theory and the resource-based view of the firm were linked and applied in this study. The linkage of these two theories has the advantage of providing explanations of the differences of SMEs' environmental activities in response to the ESCM approaches of their large corporate customers.

4.2.2. Stakeholder theory

The usefulness of stakeholder theory has been widely acknowledged, and many researchers have applied it in different ways (Donaldson and Preston, 1995). This section reviews the arguments in concerning stakeholder theory relevant to this study such as stakeholder influence and the degree of response of corporations to stakeholders.

The stakeholder

According to Freeman (1984, p.46), the stakeholder is defined as “any group or individual who can affect or is affected by the achievement of the organization’s objectives”. A clearer definition was proposed by Evan and Freeman (1988): the stakeholder is an individual or a group that either “benefit from or are harmed by, or whose right are violated, or respected by corporate action” (p. 79). These definitions have been widely adopted in applications of stakeholder theory.

The stakeholders that have interests in and are affected by a corporation comprise a wide variety of individuals or groups around the corporation. Typically, the list of such stakeholders include consumers, customers, competitors, media, employees, interest groups, environmentalists, suppliers, government, local community organizations and owners (Freeman, 1984). These stakeholders can directly or indirectly affect corporations. Furthermore, the range of stakeholders can be extended to include the natural environment because of its increasing importance and intrinsic value (Hart and Sharma, 2004; Starik, 1995).

However, not all stakeholders influence corporations to the same degree: the influence of stakeholder differs according to the types of stakeholder (Buysse and Verbeke, 2003; Clarkson 1995). For example, Clarkson (1995) has classified stakeholders into primary and secondary stakeholders according to their influence. Primary stakeholders directly affect the firm’s survival, profitability and growth. Such stakeholders include shareholders, employees, suppliers and customers. Secondary stakeholders are not

essential to the firm's survival without being directly engaged in transactions with the corporation. Examples of secondary stakeholders are competitors, local communities, local government, social activist groups and business support groups (Buysse and Verbeke, 2003; Clarkson 1995).

Types of stakeholder theory

The economic success of a corporation is affected by government, employees, consumers and customers. In turn, society is in need of products and services from corporations, and corporations can contribute to the quality of social communities (Freeman, 1984). Thus, the corporation can be considered a constellation of the cooperative and competitive interests of its stakeholders (Donaldson and Preston, 1995).

Stakeholder theories can be categorized into three different strands according to scope and emphasis. Donaldson and Preston (1995) distinguish these strands into descriptive, instrumental, and normative stakeholder theories as follows:

- Descriptive stakeholder theory: this theory attempts to ascertain the actual actions of corporations taking into account stakeholder interests
- Instrumental stakeholder theory: this theory attempts to ascertain whether a corporation benefits from taking into account stakeholder interests, and to discover beneficial principles and practices
- Normative stakeholder theory: this theory attempts to provide the reason why corporations should behave in certain ways or take into account stakeholder interests

Instrumental stakeholder theory is based on descriptive stakeholder theory, which provides the broad scope, and descriptive stakeholder theory supports instrumental stakeholder theory, which presents and explains relationships with stakeholders (Donaldson and Preston, 1995). These theories attempt to describe corporate strategy, including and balancing the multiple conflicting interests of stakeholders (Donaldson and Preston, 1995). In these theories, corporations are exposed to the diverse interests and expectations of stakeholders; however, these expectations and interests can be in

conflict with each other, and corporations should identify the critical stakeholders and their expectations to ensure the survival of their business (Freeman, 1984).

However, although the stakeholder theory was designed originally to provide managers with more balanced strategies reflecting the internal and external circumstances (Freeman, 1984), the theory focused not only on the identification of important stakeholders and the mechanisms of their influences (Clarkson, 1995; Mitchell et al., 1997; Rowley, 1997), but also on the extent of the activities of corporations in response to stakeholder interests and expectations (Carroll, 1991; Donaldson and Preston, 1995). The normative perspective emphasizes that all stakeholders' claims have intrinsic justice, and corporations have a responsibility not only towards the owners of the firm, but also toward their stakeholders (Freeman, 1984). In addition, with increasing attention being paid to the power and influence of corporations and to government failure, numerous researchers in ethics have emerged, emphasizing social responsibility of corporations in the area of normative stakeholder theory (Crane and Matten, 2004).

This study combines the descriptive, instrumental, and normative stakeholder theories, adopting the stakeholder perspective that the behaviours of corporations are a function of stakeholder influences and the corporations should behave in certain ways and take into account stakeholder interests (Donaldson and Preston, 1995).

In the following section, the mechanism of stakeholder influence on corporate behaviour is reviewed by reference to the literatures on descriptive and instrumental stakeholder theories. Then, the behaviours of corporations are investigated by reference to those previous studies which can be categorized as adopting normative stakeholder theory.

Dynamics of stakeholder influence

It has been noted that according to Freeman (1984), stakeholder is defined as “any group or individual who can affect or is affected by the achievement of the organization’s objectives” (p.46). As definition suggests, one of the basic assumptions of stakeholder theory is that corporations have relationships with their stakeholders, who affect and are affected by their decisions (Freeman, 1984). The relationships with stakeholders are considered to be important constituent factors identifying stakeholders’ salience and the influence of stakeholders on corporations. Stakeholder theory emphasizes that corporations should pay attention to their relationships with stakeholders in order to maximize the values held by stakeholders (Freeman, 1999). The influence of stakeholders is based on the relationships between corporations and stakeholders through diverse constituent factors such as power, urgency, legitimacy, and the density and centrality of the stakeholder network.

For example, Mitchell et al. (1997) suggest that the attributes of stakeholder influences are power, legitimacy, and urgency. These attributes constitute the perceived importance or salience of stakeholders. Power refers to the perceived ability of stakeholders to influence corporations. Legitimacy refers to whether stakeholders’ actions toward the corporations can be seen as desirable, proper, or appropriate within the norms, values, and beliefs of the larger society. Urgency refers to the extent to which stakeholder claims call for immediate attention by corporations (Mitchell et al., 1997). In their model, legitimacy is related to stakeholders’ relationship with corporations in that legitimacy does not only refer to legally mandated relationships but also to relationships or structures that are socially expected or accepted (Werhane, 2000).

Recently, Friedman and Miles (2002) clearly showed the importance of stakeholder relationships as evidenced by the influence of stakeholders on corporations. They suggest that the constituents of stakeholder influence are comprised of the structural nature of corporation/stakeholder relations, contractual forms, and institutional supports. For example, stakeholders who are in necessary and compatible relationships such as

partners, shareholders, and top managers are more influential than other stakeholders. In such cases, both corporations and stakeholders can lose when the relationships between them do not run smoothly. By contrast, stakeholders who are in relationships having no contractual form or institutional supports exert only a weak influence on corporations.

Another group of researchers emphasize the strengths of interactions with stakeholders in stakeholder relationships. For example, Rowley (1997) hypothesizes that the ability of stakeholders' influence on corporation is a function of the density and centrality of the stakeholder network. Managers of corporations are situated at the centre, from where they can easily and directly contact the other members of the network (Brass et al., 1998). The easy access of stakeholders can facilitate their influence and, therefore, control over the decision-making process of corporations. In addition, dense networks are those in which the stakeholders are highly interconnected. This tightness yields stronger influences because it allows for a high degree of surveillance (Brass et al., 1998).

Hence, the instrumental and descriptive stakeholder theories, which propose a mechanism facilitating stakeholders' influence on corporations' decision-making as seen from the corporation's perspective, can be applied to understand the responses of SMEs, in the form of environmental activities to customers' ESCM approaches.

Degree of responses of corporations to stakeholders

The extent of corporations' responses to stakeholders has been extensively investigated by the proponents of normative stakeholder theory. As discussed in the previous section, these responses are influenced by various factors including power, urgency, legitimacy, and the density and centrality of the stakeholder network. Normative stakeholder theory attempts to interpret the functions of corporations and offer guidance on the basis of moral and philosophical principles, assuming that a corporation has obligations rather than it simply responds to the demands of its stakeholders (Donaldson and Preston, 1995).

Normative stakeholder theory emphasizes that corporations have the responsibility to behave in accord with the norms and values of the stakeholders with which corporations have association (Jones and Wicks, 1999; Reed, 1999). In this perspective, all stakeholders' interests have intrinsic values regardless of actual power or legal entitlement (Donaldson and Preston, 1995). This theory suggests that in making decisions, managers of businesses should take into account their responsibilities to not only shareholders but also the other various stakeholders. Accordingly, the scope of stakeholders in normative stakeholder theory is broad, including non-powerful stakeholders such as the poor and the isolated, who are considered as having little impacts on corporations (Hart and Sharma, 2004).

Normative stakeholder theory assumes that corporations and all their stakeholders form a shared moral community, and it appeals to moral minimums or principles of fairness when evaluating organizational decisions (Crane and Matten, 2004). Accordingly, the theory strongly supports the business ethics; however, although this normative perspective is mainly concerned with the ethical appropriateness of corporate activity, economic necessities are not completely ignored. As Jones and Wicks (1999) emphasize, this perspective does not seek "to shift the focus of firms away from marketplace success toward human decency but to come up with understandings of business in which these objectives are linked and mutually reinforcing" (p.209). This theory provides an understanding of corporations' sustainability by integrating financial issues and other considerations such as ethical and social dimensions.

Corporate social responsibility (CSR) has been one popular model of normative stakeholder theory (Carroll, 1979). The aim of CSR is not only to preserve the profitability of the corporation, but also to create a higher standard of living (Hopkins, 2003). This model requires corporations to treat their stakeholders in a socially responsible manner (Hopkins, 2003).

The definitions of CSR clearly describe the extent of corporations' decision-making and behaviour regarding stakeholders' interests. For example, World Business Council for Sustainable Development (WBCSD) defines CSR as "the ethical behaviour of a

company towards society ... management acting responsibly in its relationships with other stakeholders who have a legitimate interest in the business' and 'the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large" (WBCSD, 1999, p.3). In addition, the European Union characterizes CSR more clearly: "Being socially responsible means not only fulfilling legal expectations, but also going beyond compliance and investing more into human capital, the environment and relations with stakeholders" (European Commission, 2001, p.6). These emphasize the integration of social and environmental concerns in business operations and a company's interaction with its stakeholders beyond compliance with legal regulations (Luetkenhorst, 2004).

CSR consists of economic, legal, ethical, and philanthropic responsibilities (Carroll, 1991). The satisfaction of economic and legal responsibilities is required of all corporations by society. Legal responsibility refers to the requirement to obey the regulations governing business and corporations should perform their business function such as providing society with products and services, and making profits, while abiding by this social requirement. However, ethical and philanthropic responsibilities are not required by society; rather, ethical responsibility is expected by society and given precedence over economic and legal requirements, while, philanthropic responsibility is merely desired by society without being either expected or required (Carroll, 1991)

The degree of corporations' responses to stakeholders can be clearly understood by analyzing the degree of CSR in four dimensions, focusing on accountability, business case, level of engagement, and degree of influence (UNIDO, 2002). Table 4.1 summarizes the levels of CSR in these four dimensions ranging from "the most narrow, compliance-based, reactive mode" to "the most strategic and potentially most significant in terms of addressing major social and environmental problems" (UNIDO, 2002, p.5).

Table 4.1. The dimensions of corporate social responsibility (UNIDO, 2002, p.5)

Focus of accountability	<i>From</i>	Legal and traditional stakeholders	<i>to</i>	Direct stakeholders, short-term impacts	<i>to</i>	Broad range of stakeholders, long-term impacts
Business case	<i>From</i>	Pain alleviation	<i>to</i>	Cost-benefit rationale	<i>to</i>	Strategic alignment
Level of engagement	<i>From</i>	Compliance with legal responsibilities	<i>to</i>	Harm minimization	<i>to</i>	Social value creation
Degree of influence	<i>From</i>	Market actions	<i>to</i>	Market remoulding	<i>to</i>	Policy influence

First, regarding the scope of corporations' accountability, CSR includes a more wide range of stakeholders such as future generations and the natural environment. Issues of social and environmental performance such as biodiversity, working conditions and human rights are also important. Under CSR, although not all stakeholders have interests, affect and are affected by corporations to the same extent, corporations should still take into account the interests of all stakeholders (UNIDO, 2002). Second, CSR requires that corporations integrate social and environmental issues into their business strategies, because CSR can lead to long-term benefits. Their strategies should fundamentally shift beyond addressing these issues merely in order to avoid financial damage or protect brand image or gain immediate financial advantage (UNIDO, 2002). Third, regarding the level of engagement, corporations should act more proactively beyond legal requirements to increase their positive impacts on society and the environment in areas such as job creation and social and environmental development (UNIDO, 2002). Fourth, the degree of influence concerns the role of corporations. The effectiveness of corporations in the social and environmental fields can be limited by their role, which is often restricted to purely economic activity. However, CSR recommends that corporations work with government as well as its business partners through multi-sector partnerships (UNIDO, 2002).

4.2.3. Resource-based view of the firm

As shown above, stakeholder theory is useful for understanding the responses of corporations to stakeholders' pressure. However, it is unable to fully address the internal resources of corporations. This section addresses the matter of internal resource and their effects on the implementation of environmental activities.

Resource-based view of the firm and the environment

Theory known as the resource-based view of the firm focuses on firm-specific resources, which differentiate strategies among firms, generate competitive advantage and enhance the firm's performance (Barney, 1991; Grant, 1991; Wernerfelt, 1984). This theory assumes that specific resources are heterogeneous across corporations, and these heterogeneities result in different performances among corporations (Mauri and Michaels, 1998)

According to the resource-based view, resource are regarded as "those (tangible and intangible) assets which are tied semi-permanently to the firm" (Wernerfelt, 1984, p.172). The accumulation of resources which are valuable, rare and inimitable can give corporations competitive advantages: for example, if valuable resources are not duplicated by competitors, these resources can differentiate the company's products and services in the market (Barney, 1991)

Hart (1995) has proposed a natural resource-based view of the firm that incorporate environmental considerations and emphasized the environmental resources of corporations can be linked with their economic performance: the competitive advantages of a corporation are gained by adopting proactive environmental strategy. He identifies two key specific organizational resources related to proactive environmental strategy: continuous improvement and stakeholder management. Continuous improvement refers to the continuous transformation in production and operations of a firm in order to improve environmental performance, for example, from 'end-of-pipe control' to 'pollution prevention'. Firm can achieve a competitive

advantage through cost saving adopting advanced environmental technology, process and system. Stakeholder management refers to involvement of key stakeholders (e.g. environmentalists, regulators). Firm can gain competitive advantages through building reputation and differentiating products (Hart, 1995).

Previous researchers have extensively tested the relations between resources, environmental performance and economic performance empirically. For example, in their study of the Canadian oil and gas industry, Sharma and Vredenburg (1998) reported that a proactive environmental strategy led to the development of internal capability. Further, the study by Menguc and Ozanne (2005) reported that a natural environmental orientation comprising entrepreneurship, CSR, and commitment to the natural environment was significantly related to financial performance. Similarly, Rosso and Fout (1997) reported that environmental performance positively affected economic performance, and also that the industry growth moderated the relations between environmental performance and economic performance.

Role of resources with regard to activities

As shown above, the main concern of the resource-based view of the firm is to investigate the relationships between environmental performance and financial performance. However, resources are critical domain according to this view. In this theory, firms need resources to transform undifferentiated production factors into products or services, that is, to undertake their activities (Penrose, 1959). Resources are those things that enable the firm to do each activity to produce products and services (Rubin, 1973).

A firm's resources consist of traditional production factors such as labour, capital and land. However, some resources are highly specialized or unique assets such as knowledge and technology, reputation, and specialized capabilities in marketing (Amit and Schoemaker, 1993; Barney, 1991; Wernerfelt, 1984). Researchers adopting this theory have proposed various typologies of resources. For example, Hofer and Schendel (1978) proposed that a firm's resource profile consists of financial, physical,

managerial, human, organizational and technological resources. Wernerfelt (1989) classified a firm's resources into tangible and intangible resources. Tangible resources refer to fixed and current assets such as plant, equipment, land, and other financial resources (Wernerfelt, 1989). Intangible resources refer to invisible resources such as intellectual property, reputation, culture, expertise of employees, and employees' loyalty (Hall, 1992).

These kinds of resources are used as input factors to the firm's activities, and are owned and controlled by the firm (Amit and Schoemaker, 1993). For example, the availability of financial resources can support its innovative activities (Lee et al. 2001). On the other hand, lack of financial resources limits its innovative activities (Helfat, 1997).

In the environmental field, the availability of financial resources, information, human resources, and the environmental attitudes of the CEOs and employees can strengthen and facilitate the firms' activities (Azzone et al., 1997; Clark, 2000, Ghobadian and Galler, 1996; Pederson, 2000). Specifically, technology, opportunity and cost assessment, human resource availability, capital availability, and organizational adaptability constrain the company's ability to act; that is, these resources moderate the relationships between external influence (environmental interventions, market behaviour and social expectation) and environmental strategies. Leadership, corporate tradition, corporate ethics are the required capability necessary; that is, mediate these relationships (Ghobadian et al., 1998). Moreover, Buysse and Verbeke (2003) supported this by reporting that the firm size facilitated the relationships between stakeholder pressures and environmental strategy.

4.3. Conceptual framework based on the two theories

In the previous section, stakeholder theory and the resource based-view of the firm were discussed. This section presents the study's conceptual framework and research hypotheses based on the linkage of these theories.

This section presents the contingency perspective, which is used to integrate these two

theories. Then, the research hypotheses and framework are constructed based on this theoretical background; that is, the contingency perspective, adopted two theories, and previous studies in the field of SMEs and ESCM.

4.3.1. Contingency perspective

The contingency perspective has been widely adopted in the study of organizations. This perspective is considered to occupy a mid-range position between two extremes (Hambrick and Lei, 1985; Nicolaou, 2000). One extreme, known as the universal view, is that there is a universally sound law in all conditions. The other extreme, known as situation-specific view, is that each organization is considered to be unique, and each situation should be addressed individually. The contingency perspective is situated in the middle of the continuum between these two extremes. In this perspective, no single structure is appropriate for all tasks. Effectiveness can be achieved in more than one way and the appropriate method is dependent on circumstances. However, certain contexts share uniform characteristics, and it is possible to identify common factors considering the needs of flexibility (Hambrick and Lei, 1985; Nicolaou, 2000).

Better performance in the contingency perspective: fit and if-then relationships

An extensive contingency perspective literature has tried to define essential organizational elements and to explore their interrelation and effects on corporate behaviour (Selto et al., 1995). In this perspective, organizations are considered to be open systems, which continually adapt themselves to their external environment (Romme and Dillen, 1997). The driving forces of organizational change emerge from their surroundings, particularly the task environment with which organizations are confronted (Zhao et al., 2001).

The central theme of the contingency perspective is that, when all components of an organization 'fit' well with each other, the organization can perform optimally (Perrow, 1967). Nadler and Tushman (1980) define it as "the degree to which the needs, demands, goals, objectives, and/or structure of one component are consistent with the

needs, demands, goals, objectives, and/or structure of another component” (p.40). An appropriate, which is ‘fit’, configuration between organizational characteristics and their environment can result in superior performance (Lee and Miller, 1996).

In addition, this perspective can be understood as a form of ‘if-then’ relationships between situational factors and organizational factors. That is, if certain situational factors exist, then certain factors in the organizational structure and system of management can be considered most appropriate (Luthans, 1985)

These moderating effects suggest that there exist some appropriate configurations between situational factors (ESCM approaches in this study) and organizational factors (the internal resource conditions of SMEs in this study), and the superior performance (the environmental activity status of SMEs in this study) can be expected if these conditions are fitted well.

4.3.2. Research hypotheses and conceptual framework

In the previous section, stakeholder theory and the resource-based view of the firm were examined as a theoretical background for this study. As noted in the study’s research questions, this study aims to encompass a broad scope of determinant factors with a view to explaining the impacts of the ESCM approaches of corporate customers on the environmental activities of SMEs, considering both internal and external factors simultaneously. Each theory can be applied separately in order to understand these impacts by focusing on the specific dimensions of each phenomenon. However, this study proposed an integrated model applying these two different theories simultaneously in order to consider the internal and external dimensions of SMEs collectively through a process based on the contingency perspective. This perspective is considered capable of integrating these two different theories in a conceptual model.

In this section, the study’s research hypotheses and conceptual framework are proposed based on the theoretical background and the contingency perspective. The research hypotheses were developed for the quantitative analysis in this study. However, the

proposed hypotheses were not able to cover the broad scope of the research questions. These hypotheses were therefore used to describe a few core dimensions of the research questions.

The impacts of ESCM approaches on the environmental activities of SMEs

As discussed in chapter 2 (2.1.2.), the definition of environmental activities was adopted from the work of previous researchers emphasizing conceptualizing the environmental activity of corporations as “action that will improve environmental performances of company operations, products and services” (Ramus, 2002, p.151). Traditionally, SMEs’ environmental performance has been considered poor, their activity to improve environmental performance has been generally regarded as lagging behind that of large companies, and their stance has been viewed as merely reactive (Clark, 2000; Hillary, 1995, 2000a and b, 2004; Palmer, 2000; Remmen, 2001).

Although SMEs’ environmental performance and activities designed to improve that performance are tardy and reactive, SMEs cannot be excluded from the responsibility of engaging with social and environmental issues, given the significant amount of their accumulated environmental pollution (ECOTEC, 2000; Hillary, 1995, 2000a and b, 2004). SMEs are also required by stakeholders to improve their environmental performance through undertaking environmental activities and are expected to integrate environmental concerns into their business operations beyond compliance with regulations (UNIDO, 2002).

Among SMEs’ diverse stakeholders such as government, corporate customers, consumers, and non-governmental organizations, corporate customers have the potential to be important actors, capable of persuading SMEs to undertake environmental activities. Traditionally, corporate customers have been considered primary stakeholders, who can directly affect the survival, profitability and growth of corporations (Clarkson 1995). Especially, in business relations between large companies and SMEs in manufacturing industry, many SMEs are suppliers to these large customers, on whom they are often highly dependent, supplying them with products such as parts

or intermediate products and services (Baylis et al., 1998, a and b; Ghobadian and Gallear, 1996).

Regarding environmental issues, increasing number of large companies have been introducing ESCM, and these initiatives have the potential to encourage SMEs to undertake environmental activities. Although these large companies mainly practise ESCM for their own business reasons such as enhancing brand image, compliance with regulations, risk management and reducing costs, it is necessary for them to work with their suppliers to achieve better environmental performance, and they often require their suppliers to improve their environmental performance, and adopt diverse ESCM approaches in order to effectively and efficiently address their suppliers problems (NEETF, 2001).

SMEs, in the market as suppliers, are confronted with these environmental requirements or can participate in some kinds of assistance programmes organized by large corporate customers (BSR, 2001). These ESCM approaches can provide business opportunities to SMEs such as cost reduction, increasing operational efficiency, and enhanced customer values (BSR, 2001; Envirowise, 2002b), and SMEs can be influenced by their corporate customers' ESCM approaches in the area of products and operation processes (Preuss, 2005).

Accordingly, the following hypothesis has been developed on the basis of stakeholder theory and the relevant literature. This study assumes that ESCM approaches can have positive impacts on the environmental activities of SMEs (Hypothesis 1).

Hypothesis 1: the ESCM approaches of large companies have positive impacts on the environmental activities of SMEs

However, large companies are not capable of managing the environmental issues of all their suppliers to the same level due to the limitations of their resources. The nature and quality of their business relationships with their suppliers tend to depend on the relative importance of each supplier, and their ESCM approaches to their suppliers are often

correspondent to these relationships (GEMI, 2001). Traditionally, relationships between corporate customers and suppliers have been divided into arm's-length relations and collaborative relations (Dyer et al., 1998), and ESCM approaches have often been conceptualized as the arm's-length approach and the collaborative approach in accordance with those relationships (Preuss, 2005; Rao, 2003). Accordingly, SMEs in the supply chain can be involved in different types of relationships with large companies, and can be affected by different types of ESCM approaches, which can be usefully divided into the collaborative approach and arm's-length approach.

More detailed hypotheses were developed based on hypothesis 1: that both ESCM approaches have positive impacts on the environmental activities of SMEs (Hypothesis 1a, and 1b).

Hypothesis 1a: The collaborative ESCM approach of large corporate customers has positive impacts on the environmental activities of SMEs.

Hypothesis 1b: The arm's-length ESCM approach of large corporate customers has positive impacts on the environmental activities of SMEs.

Comparison of the impacts of ESCM approaches on the environmental activities of SMEs

Stakeholder theory emphasizes that the strength of influence of stakeholders is determined by the influence's power, legitimacy, and urgency (Mitchell et al., 1997). In this perspective, the ESCM approaches of large corporate customers can influence the environmental activities of SMEs because the customers are more powerful than their SME suppliers. In addition, the stakeholder's ability to influence is a function of density and centrality of the stakeholder network (Rowley, 1997). In this perspective, the collaborative approach has certain advantages associated with the centrality and density of the stakeholder network. SMEs in collaborative relationships can be easily and directly contacted by large corporate customers, and the stakeholder network has the characteristics of centrality; these easy and direct contacts influence SMEs more effectively. In addition, SMEs in collaborative relationships are involved in a dense

network with their corporate customers, in which the tightness of the relationships allows a high degree of surveillance. Accordingly, the collaborative approach has more impacts on SMEs than the arm's-length approach.

In addition, the collaborative approach has characteristics which a number of previous studies have suggested. As discussed in chapter 2, in order to improve the environmental performance of SMEs, assistance programmes should be inexpensive, cooperative, locally based, practical, flexible, specific to the characteristics of SMEs (Gerstenfeld and Roberts, 2000; Pedersen, 2000), and should offer appropriate rewards (Johansson, 2000). Collaborative relationships enable SMEs to freely access the practical knowledge of large companies, maintain better business relationships with customers, and develop the value of their products and services through increased capabilities (Envirowise, 2002b).

Accordingly, although both the arm's-length approach and the collaborative approach have positive impacts on the environmental activities of SMEs, these impacts differ according to the type of ESCM approaches, even if the arm's-length approach has advantages over the collaborative approach because it is much less the resource- and time-intensive to corporate customers. Hence, the following hypothesis was developed. This study assumes that the collaborative approach has stronger impacts on the environmental activities of SMEs than the arm's-length approach (Hypothesis 2).

Hypothesis 2: The collaborative approach has greater impacts on the environmental activities of SMEs than the arm's-length approach.

The relationship between ESCM and the environmental activities of SMEs under different resource conditions of SMEs

Both the resource-based view of the firm and the natural resource-based view of the firm focus on competitiveness and financial performance (Hart 1995; Wernerfelt, 1984). Although competency, which is the main issue in the resource-based view of the firm, is not directly applied to understand the environmental activities of corporations, resources

are considered a critical factor in the undertaking environmental activities to improve business and environmental performance. Resources are considered things that enable the firm to implement each activity to produce products and services and cannot be separated from the firm (Rubin, 1973). A firm's investment in product, manufacturing technology, employee skills and organizational competencies, which are related to environmental performance, is understood to enhance environmental competency by accumulating environmental resources (Buysse and Verbeke, 2003).

To improve environmental performance a firm needs internal resources, and the inferior resource conditions of SMEs often hinders their undertaking environmental activities designed to improve environmental performances. For example, lack of financial resources can restrict the possibility of conducting a number of environmental activities simultaneously (Azzone et al., 1997; Azzone and Noci, 1998; Brio and Junquera 2002). Information constraints hinder introducing appropriate options (Meritt, 1998; Smith et al., 2000). Lack of human resources such as environmental expertise leads to problems in monitoring and applying a new environmental technology (Hillary, 1995, 2000b, 2004; Perez-sanchez et al., 2003). In addition, the undertaking of environmental activities can be impeded by conceptual obstacles such as a lack of environmental awareness on the part of employees, and the CEO's lack of environmental commitment. Employees' lack of environmental awareness is necessary to the undertaking of environmental activities because these activities need the participation of employees and their knowledge (Brio and Junquera, 2002; Hart, 1995; Klassen and McLaughlin, 1993). In addition, the commitment of the CEO facilitates the conducting of environmental activities since effective planning and control depend on his or her commitment (Pett, 2000).

When seeking an appropriate ESCM approach to SMEs, elements of the contingency perspective such as the 'fit' and 'if-then' concepts provide a useful theoretical basis. In the contingency perspective, organizations are considered to be open systems, which continually adapt themselves to their external environment (Romme and Dillen, 1997). The driving forces of organizational change emerge from the surroundings with which organizations are confronted (Zhao et al., 2001). In this perspective, stakeholder

pressures, which are the large companies' environmental demands on SMEs made through ESCM, can be understood as the driving force of SMEs' environmental activities. In addition, the 'fit' and 'if-then' concepts suggest that SMEs' environmental activity in response to ESCM pressures can be changed more effectively when the internal resource conditions of SMEs fit well with the ESCM approaches of their corporate customers. In addition, the influence of ESCM approaches on the environmental activities of SMEs can differ according to the conditions of their internal resources. Accordingly, the effectiveness of an ESCM approach can be increased considering the internal resources of SMEs.

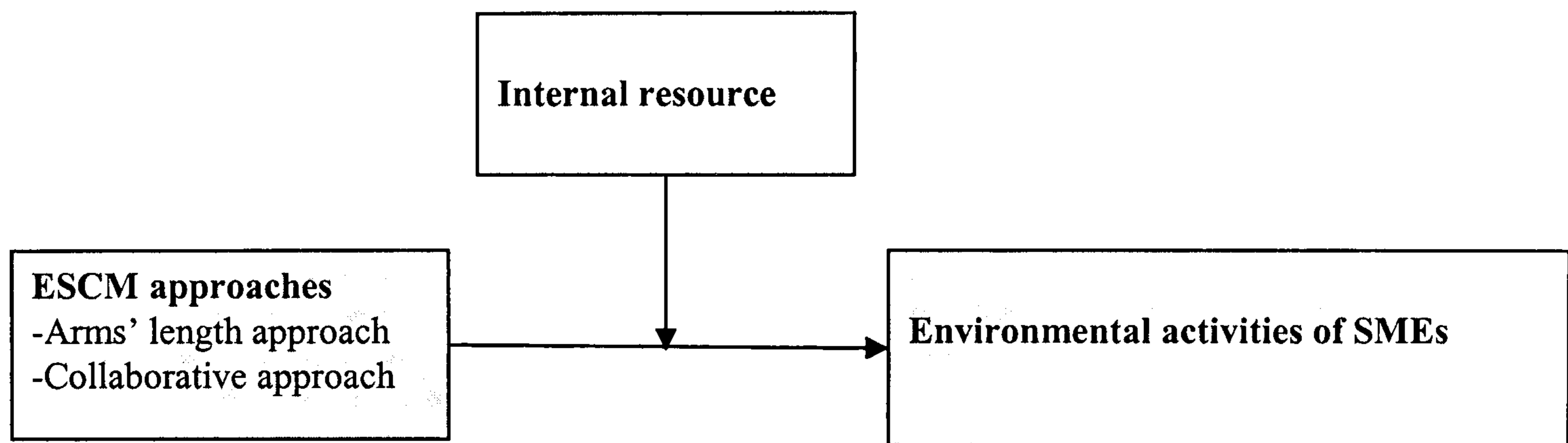
It is assumed that the internal resources of SMEs can affect the relationships between ESCM approaches and the environmental activities of SMEs. The contingency perspective suggests the following hypothesis (Hypothesis 3).

Hypothesis 3: The impacts of the ESCM approaches of large companies on the environmental activities of SMEs are dependent upon the conditions of the internal resources of SMEs.

Conceptual framework and research model of the study

Based on the theoretical background and hypotheses, it can be assumed that the individual independent variables (arm's-length approach and collaborative approaches) have causal relationships with the dependent variable (SMEs' environmental activities). In addition, the moderator variable (internal resources of SMEs) can change the strength of the relations between independent variables and dependent variables. The research framework to present these hypotheses was developed as shown in Figure 4.1.

Figure 4.1. Conceptual framework of the study



This conceptual research framework is designed to ascertain the impacts of ESCM on SMEs' environmental activities, and the role of internal resources in those activities. The framework was conceptualized on the basis of the contingency perspective to apply stakeholder theory and the resource-based view of the firm.

First, regarding the relationships between customers' ESCM approaches and the environmental activities of SMEs, stakeholder theory is applied to explain the impacts of ESCM on SMEs' environmental activities. The impacts of each ESCM approach on the environmental activities of SMEs are evaluated.

Second, the resource-based view of the firm and the contingency perspective are applied to understand the role of internal resources of SMEs in the relationships between ESCM approaches and SMEs' environmental activities. The impacts of each ESCM approach on the environmental activities of SMEs are evaluated under the different conditions of SMEs' internal resources.

However, this framework does not include normative stakeholder theory, which can offer guidance to corporate customers and SMEs. In normative stakeholder theory, SMEs have certain rights, which should be respected by corporate customers, such as the right to a contract, to a fair deal or to some level of fair treatment or loyalty (Crane

and Matten, 2004). Accordingly, when large companies contract with SME suppliers in the market, they should consider the interests of SMEs and their ESCM approaches should not make inappropriate demands. This study expects that some guides to both large companies and SMEs can be deducted from the evaluation of ESCM phenomena using normative stakeholder theory.

4.4. Conclusion

This chapter has presented the study's research objective and questions, theoretical background and conceptual framework including hypotheses. The research objective of this study is

to understand the relationships and dynamics between the ESCM approaches of large corporate customers and the environmental activities of SMEs under different internal resource conditions of SMEs.

Three research questions were proposed in stages to achieve this research objective:

Research question 1: Do the ESCM approaches of large corporate customers have positive impacts on SMEs' environmental activities?

Research question 2: If so, which ESCM approach of large corporate customers strongly impacts on SMEs' environmental activities?

Research question 3: How do the internal resources of SMEs impact on SMEs' environmental activities in response to the ESCM approaches of large corporate customers?

The conceptual framework including hypotheses in accordance with the research questions was developed from the theoretical background. The relationships between research questions and the hypotheses are summarized in Table 4.2.

Table 4.2. Relations between research questions and hypotheses in this study

Research question 1: Do the ESCM approaches of large corporate customers have positive impacts on SMEs' environmental activities?

Hypothesis 1: The ESCM approaches of large companies have positive impacts on the environmental activities of SMEs.

Hypothesis 1a: The collaborative ESCM approach of large corporate customers has positive impacts on the environmental activities of SMEs.

Hypothesis 1b: The arm's-length ESCM approach of large corporate customers has positive impacts on the environmental activities of SMEs.

Research question 2: If so, which ESCM approach of large corporate customers strongly impacts on SMEs' environmental activities?

Hypothesis 2: The collaborative approach has greater impacts on the environmental activities of SMEs than the arm's-length approach.

Research question 3: How do the internal resources of SMEs impact on SMEs' environmental activities in response to the ESCM approaches of large corporate customers?

Hypothesis 3: The impacts of the ESCM approaches of large companies on the environmental activities of SMEs are dependent upon the conditions of the internal resources of SMEs.

In order to explain the relationships and dynamics between customers' ESCM approaches and the environmental activities of SMEs, this study applied stakeholder theory and the resource-based view of the firm and made use of the contingency perspective. Stakeholder theory was used to describe SMEs' environmental activities in response to the ESCM approaches of their large corporate customers (research questions 1 and 2). In addition, the resource-based view of the firm was utilized to understand the internal resources of SMEs. These two different theories were linked in the contingency perspective (research question 3).

However, the developed conceptual framework, including the hypotheses, reflects only a few core dimensions of the research questions. This study tries to answer these research questions beyond the established hypotheses in data collection and analysis. In addition, normative stakeholder theory suggests that SMEs have certain rights, which should be respected by corporate customers, and offers guidelines for the behaviour of corporate customers seeking to formulate their ESCM approaches. This study expects to be able to offer guidance from the perspective of normative stakeholder theory.

The study's data collection and analysis were designed to answer these research questions and deduce some guidelines in the perspective of normative stakeholder theory. The details are presented in the next chapter.

Chapter 5. Methodology

This chapter presents the research procedures for achieving the objective of this study and to answer the research questions. The first section attempts to identify an appropriate methodology for the research objective. This research adopts triangulation method using both qualitative (interview) and quantitative (questionnaire) approaches. The second section describes the procedure of conducting the survey. The main aspects covered are sampling, measurement, procedure of the survey, and data analysis strategy. The last section describes the interview process. This section explains the interviewee selection, interview topics, interview procedure and analysis strategy.

5.1. Research approach

5.1.1. Research approach to knowledge

Choosing an appropriate research method is important to gaining appropriate knowledge about and effective access to the phenomena under study. According to Blaxter et al. (2001), “the choice of the best method is not simply the technical or practical question” (p.71). On the other hand, “Underpinning these research tools is more about how we understand social reality, and what are the most appropriate ways of studying it” (p.71).

Hence, the best method is dependent on general philosophical backgrounds. This study adopt a research approach on the philosophical basis of realist one.

Ontological and epistemological consideration

The extent to which knowledge can be attained is a matter raising ontological, epistemological and methodological questions. The ontological question concerns the nature of being, that is, the ‘reality’ which researchers investigate. The epistemological question concerns the relationship between the researchers and the reality. Finally, the

methodological question concerns with the techniques, that is, how the researcher goes about finding what can be known (Guba and Lincoln, 1994)

Ontological realism says that there exists a reality independent of theorizing about it. In this perspective, there is a real structure, that is a set of internally related objects, external to human minds and independently of human sense experiences, and mechanism, that is ways of acting (Sayer, 1992).

The epistemological realist holds that the world is knowable, and that reality can be described by theories. The main task of the researcher is to demonstrate the existence of an explanatory mechanism in the real domain (Outhwaite, 1987), and to theorize about real world phenomena and test the existing theories (Miles and Huberman, 1994). To realists, theory is “a description of structures and mechanisms which causally generate the observable phenomena, a description which enables us to explain them” (Keat and Urry, 1975, p.5). The realist aims to identify and illuminate the structures and mechanisms in the phenomena of experience and to explain observable phenomena by means of theories describing underlying structures and mechanisms, which it is the role of science to discover (Lawson, 1994).

The ontological position adopted by this study is the belief that the reality exists independently of the researcher, and that there are causal mechanisms and structures that generate the observed events. Thus both intrinsic factors that constitute the phenomena of ESCM, and the environmental activities of SMEs in response to these exist, and the causal mechanisms and structures inside and outside SMEs such as the characteristics of ESCM approaches and the internal resource condition of SMEs create the environmental responses of SMEs.

Epistemologically, the study holds that social phenomena can be transformed and reproduced by the researchers. The focus of this study is not only on understanding what is happening but also on how it is happening. It is also believed that the observable phenomena under investigation can be explained with theories.

Methodological implications of the adopted philosophical choice

Realist methodology starts with the proposition that although the social world is complex and open, there are structures and mechanisms that make events (Robson, 2002). The social objects can be investigated scientifically (Robson, 2002). In its context, an experiment is considered as “an attempt to trigger or unleash a single kind of mechanism or process in relative isolation, free from the interfering flux of the open world, so as to observe its detailed workings or record its characteristic mode of effect and/or to test some hypothesis about them” (Bhaskar, 1986, p.35).

The realist method in social science seeks to reconstruct structures and mechanisms by experiencing some event (Yeung, 1997). The explanation of the social world can be accompanied by direct experience and practice (Yeung, 1997) and shows how events occur in particular circumstances (Robson, 2002)

Realists emphasize that the method used should fit the method of research (Robson, 2002). In addition, this philosophical perspective offers an opportunity to seek appropriate research methods in a broader scope and encourage the researcher to obtain the scientific knowledge by extensively considering diverse potential data collection methods (Robson, 2002).

5.1.2. Choosing research approach: methodological triangulations

The researcher’s philosophical position has implications for the data collection method and analysis (Carson et al., 2001; Yeung, 1997). From the realist standpoint, quantitative methods such as the questionnaire survey are particularly useful for establishing the empirical regularities between objects. On the other hand, qualitative methods such as interviews and ethnography are necessary to abstract the causal mechanisms (Sayer, 1992). Moreover, as discussed above, the realist allows employing more extensive research methods. In this section, after examination of the usefulness of the quantitative and qualitative methods, triangulation method is introduced.

Characteristics of quantitative and qualitative approaches

Quantitative methods describe social phenomena in terms of numbers; it is applied to a large sample in a highly structured manner. This approach is appropriate to test theory, and the theory and concepts should be built prior to data collection. On the other hand, qualitative methods are appropriate to generate theory. This approach is based on words rather than numbers, and is often applied to a small sample in an unstructured manner to generate ideas emerging from the data (Bryman, 2004). The details of each approach are briefly compared in Table 5.1 below, which shows the characteristics and relative strengths of quantitative and qualitative approaches.

Table 5.1. Contrasts between quantitative and qualitative research (Bryman, 2004, p.286)

Quantitative	Qualitative
Numbers	Words
Point of view of researcher	Points of view of participants
Researcher distant	Researcher close
Theory testing	Theory emergent
Static	Process
Structured	Unstructured
Generalization	Contextual understanding
Hard, reliable data	Rich, deep data
Macro	Micro
Behaviour	Meaning
Artificial setting	Natural setting

The relative strengths of each approach are closely related to the shortcomings of the other research approach. For example, the quantitative approach has an advantage over the qualitative approach in generalization of the findings. However, numbers have the limitation that they cannot directly or fully explain the meaning of the relations or patterns detected in the quantitative approach. The researcher should deduce the intrinsic meaning and explain the relations between variables. In addition, the quantitative approach can produce a generalized knowledge based on a large amount of data. While, it is more difficult to gather a large amount of data through the qualitative approach because the qualitative method often collected data in an unstructured manner. However, it is useful to understand the meaning and explain social phenomena (Bryman, 2004). The limitations of both approaches are briefly compared in Table 5.2.

Table 5.2. Limitations of quantitative and qualitative research

Quantitative	Qualitative
Only proves what one already believes Limited range or scope of knowledge Restricted demonstration of the meaning of findings to people's lives.	Less systematic. Limited generalizations to broader groups of people. Hardly replicable findings. Minimized possibility of inferences beyond the data.

* Adapted from Francisco et al. (2001)

Research approach in this study: methodological triangulation

Traditionally, there was a significant gap between qualitative and quantitative research, which were conceived as adhering to distinct paradigms (Layder, 1988). However, these two different approaches have become increasingly interactive (Brannen, 1992). The mixed method incorporating both qualitative and quantitative research has been advocated from realist standpoints (Blaikie, 1991; Brewer and Hunter, 1989; Brannen, 1992), because these different methods complement each other in revealing different facets of the social world (Blaikie, 1991; Yeung, 1997).

Triangulation has been traditionally defined as the combinations of methodologies in the study of the same phenomenon (Denzin, 1970). Denzin (1970) extended the idea of methodological triangulation beyond its conventional conceptualization, distinguishing four types of triangulation with respect to research methods and designs as follows:

- Data triangulation, which refers to data collection from different data sets
- Investigator triangulation, which refers to the use of a research group rather than one researcher in data collection and interpretation
- Theoretical triangulation, which refers to the use of multiple theories rather than one theory in interpretation
- Methodological triangulation, which refers to the use of multiple methods rather than one method in data collection.

This study adopted methodological triangulation to take advantage of both qualitative and quantitative methods. The combination of methods to investigate the same phenomenon has advantages over the single method. For example, methodological triangulation is suitable for the description of process and can thus be used to improve the validity and reliability of the collected data (Saunders et al., 2003). Moreover, the use of multiple methods makes it possible to compensate for the weakness of one method by applying the strength of the other methods, adopting each method for a particular purpose and considering the advantages of each method (Saunders et al., 2003).

However, although the methodological triangulation approach has advantages over the single method, problems may arise in analyzing data yielded by two different methods, especially when the data conflict; in such cases, it can be difficult to decide which should be accepted (Yeung, 1997). In the realist, the methodological triangulation approach is based on the conviction that “there is no fundamental clash between the purposes and capacities of qualitative and quantitative methods or data. What clash there is concerns the primacy of emphasis on verification or generation of theory” (Glaser and Strauss, 1967, p.17). Consequently, in the case that the findings differ, the analysis results produced by each method are to be respected rather than disregarded or treated selectively, since the differences arise from the intrinsic methodological limitations of each method, and the discrepancies may be reconciled by reference to methods, theoretical backgrounds and previous empirical research (Blaikie, 1991).

In this study, the improved validity and reliability of the collected data was sought by using more than one methodological approach. In addition, the characteristics of each method such as sample size, particular purpose of each method (e.g. behaviour/meaning, macro/micro, generalization/contextual understanding) were key considerations in selecting appropriate data collection methods. The quantitative method was adopted to explore the general patterns of the environmental activities of SMEs in response to the ESCM approaches of large companies, taking into consideration the large sample size possible in studying the SMEs in the Korean electronics industry. The qualitative method was adopted as a means of explanation to explore the reasons and

meaning for these general patterns, discernible through the application of quantitative method, using a small sample.

5.1.3. Specific data collection methods in quantitative and qualitative approaches

A number of data collection methods can be used in both quantitative and qualitative research. As mentioned briefly in section 5.1.2, the advantages of each method were taken into consideration in selecting the appropriate data collection method. The self-administered postal questionnaire survey was chosen as the quantitative method, and the telephone interview was chosen as the qualitative method. The reasons for selecting these methods are presented in detail in this section.

Quantitative study: self-administered postal questionnaire survey

The questionnaire survey is considered appropriate for examining causal relationships between variables and regarded as an efficient method of collecting data from a large sample (Saunders et al., 2003). It can be defined as either self-administered or interviewer-administered depending on the procedure of administration. The self-administered survey can be conducted by post, on-line, or during the researcher's onsite visit. The interviewer-administered survey can be conducted by telephone or through face-to-face interviews (Saunders et al., 2003).

Of these various methods, the self-administered postal questionnaire survey was employed for two reasons. First, the focus of this study is on the very large population of SMEs in the Korean electronics industry; it was therefore necessary to collect data from a large sample. Second, the aim of this quantitative research was to examine the relation between the ESCM approaches of corporate customers and the environmental activities of SMEs in the Korean electronics industry. This being so, the postal questionnaire survey was considered appropriate to achieve the research purpose.

In the early stage of this study, the e-mail survey was considered a possible data collection method, its main advantage being its relatively low cost. However, in the

pilot test stage the e-mail survey produced an extremely low response rate: of one hundred potential informants contacted, only five responded. Hence, this method was considered unsuitable, being unlikely to collect a useful amount of data.

Qualitative study: semi-structured telephone interview

The three major forms of qualitative interview are the face-to-face interview, the telephone interview and the focus group interview (Saunders et al., 2003). Of these, the most popular is the face-to-face interview, which has various advantages such as a high response rate, the possible use of probing techniques and the quick correction of obvious misunderstandings. The telephone interview has similar characteristics to the face-to-face interview, over which it has certain advantages: it can reduce the tendency to produce a socially desirable response, and can overcome geographical distance. However, it has a disadvantage with regard to interpretation, since the interviewer cannot witness the non-verbal behaviour of the interviewee (Robson, 2002; Saunders et al., 2003).

The telephone interview was employed as a qualitative data collection method for two reasons. First, this study is closely related to social issues. The extent and quality of a company's environmental activities can be overestimated when interviewees feel they should extol the excellence of their company's environmental practice. The telephone interview was adopted in order to reduce these tendencies to answer in a socially desirable manner. Second, the telephone interview can overcome geographical distance, as it happened in this case because the data was collected in Korea while the research was carried out from the UK.

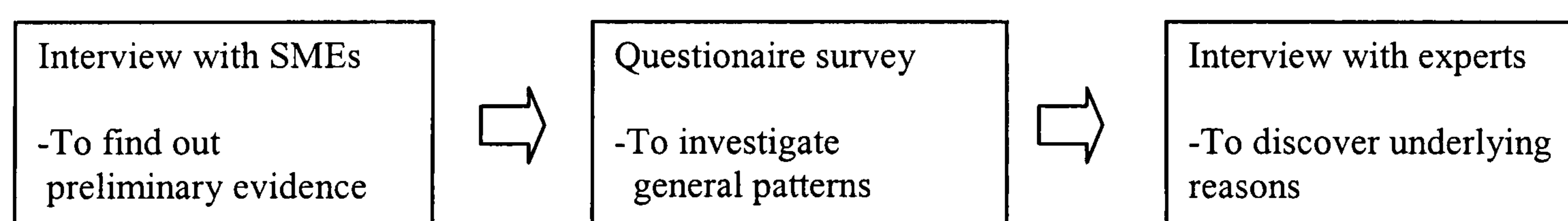
The three main types of qualitative interview are the fully structured interview, the unstructured interview and the semi-structured interview (Robson, 2002). The fully structured interview uses a questionnaire with standardized questions; it is inflexible and is similar to a survey questionnaire (Robson, 2002). In an unstructured interview, the interviewer has a general interests and concerns, and the conversation is encouraged to develop within this area. In a semi-structured interview, a list of questions on specific

topics is put to the interviewee whose answers are confined to those topics (Bryman, 2004). This study employed the semi-structured interview because this method was considered appropriate to probe specific issues such as environmental activities and motivations more deeply.

5.1.4. Designing research in accordance with triangulation approach

Regarding the research design of this study, the qualitative method before the quantitative method can be tried with the aim of giving the researcher confidence that the researcher is addressing relevant and important issues (Saunders et al., 2003). Further, the qualitative method can be again adopted after the quantitative method in order to enhance the explanation and interpretation of the quantitative analysis results through further qualitative evidences (Robson, 2002). Following these guides, the qualitative method (telephone interview) was applied two times before and after the quantitative method (questionnaire survey). The aim and methods adopted in this study are shown in Figure 5.1, and briefly described in this section.

Figure 5.1. Research approach in this study



The first step: interview with SMEs

Interview with SMEs was adopted as in the first stage of this study. As discussed in the previous chapter, the research focused on the environmental activities of SMEs in response to ESCM pressures from their large corporate customers. However, these of SMEs in Korea to ESCM approaches were not confident because of the disputed nature of SMEs' response to ESCM pressures as evidenced by studies in Europe and the USA and the lack of research in the Korean context.

Thus, preliminary work designed to probe the existing phenomena using a small sample was necessary before undertaking questionnaire survey. An interview was applied to six managers of SMEs in the Korean electronics industry, and the data was collected by telephone asking current environmental activity, pressures from large corporate customers, internal resources for implementing environmental activities of SMEs (See section 5.3.1 and 5.3.2.)

The second step: questionnaire survey with SMEs

In the second stage, the questionnaire survey was employed in order to investigate the general patterns environmental activities of SMEs in response to ESCM pressures from their large corporate customers in Korean electronics industry. The sample consisted of one thousand SMEs, representing all SMEs in Korean electronics industry (See section 5.2.1), and the data was collected by means of postal questionnaire (See section 5.2.5.).

In the survey questionnaire, a number of questions asking for the information of about environmental activities, the ESCM approaches of their corporate customers, and the status of internal resources with regard to implementing environmental activities were included, and these measurement (See section 5.2.2.). The final valid collected data set consisted of one hundred and eighty-two with the 18.2% response rate (See section 6.1.1)

The third step: qualitative method

The third and final stage also involved the use of interview, the aim being to discover the reasons underlying the findings produced by the questionnaire survey. Quantitative method (questionnaire survey) can reveal general patterns but cannot easily discover the intrinsic meaning of those patterns.

Hence, the additional qualitative data was expected to provide an explanation of SMEs' behaviour as well as improve validity and reliability of the quantitative research. The

data was collected through telephone interviews with five experts in the field of ESCM and SMEs in Korea (See section 5.3.1) asking reasons for choosing each ESCM approaches from the perspective of corporate customers, the impacts of ESCM approaches on the environmental activities of SMEs from the perspective of SMEs, obstacles and recommendations for more effective ESCM approaches, and the role of internal resources in dealing with ESCM approaches (See section 5.3.2.).

5.2. Data collection and analysis : Questionnaire survey

This research adopts questionnaire survey as a quantitative approach. The section describes the procedure of conducting the survey including sampling, measurement, procedure of the survey, and data analysis strategy.

5.2.1. Sampling

Sample frame

The population in this study consists of SMEs in the Korean electronics industry. According to the Ministry of Commerce, Industry and Energy (MOCIE), there were 7,955 firms in this industry in 1999. Since the study' sample frame could not possibly cover the whole population, it is important to find a manageable sample frame that would represent this population.

The database of the Korean electronics newspaper ('Hanguk jeonja shinmoon') provided a useful sample frame. This database provides detailed information about 7,000 SMEs in the Korean electronics industry such as the name of company, product and e-mail address. This database is updated every year and provides the most extensive profile of SMEs in the Korean electronics industry. Therefore, this dataset was considered as an appropriate sample frame for this study.

Simple random sampling

In selecting the sample, simple random sampling was adopted in order to ensure that it was representative of the population. This technique made it possible to estimate the characteristics of the entire population from the selected sample without bias (Saunders et al., 2003). In order to select randomly, the sample frame list, which was the database of the Korean electronics newspaper, was arranged alphabetically and a serial number was given to each name. Random numbers were generated using the sampling function of Microsoft Excel, and then the random numbers and the serial number were compared to select the sample. In this way, a sample of one thousand SMEs was selected. Further, to increase the quality of the sample, the addresses were compared with another data set, the database of Korea Electronic Industries Cooperative (KEIC), which is the representative organisation of SMEs in the Korean electronics industry.

Appropriate sample number

The sample size was determined by checking the response rate in previous studies and the size of the data set necessary for analysis. The response rate of postal surveys is commonly ten to twenty percent (Saunders et al., 2003). Certain techniques can be adopted to increase response rate by several percent (Saunders et al., 2003). The expected response rate in this study was around twenty percent and the final data set for the analysis was expected around to be two hundred.

The amount of data necessary for analysis was decided by considering the analysis strategy of this study. The study adopted factor analysis as the first step of the quantitative analysis (See 5.2.6). The research made use of twenty-seven items for measuring environmental activities and twenty-three items for ESCM approaches (See 5.2.2.). Hair et al. (1998) suggest that a minimum of five data per item is necessary for conducting factor analysis. As a minimum of one hundred and thirty-five data was required for the analysis, the expected data (two hundred) was considered sufficient for the analysis.

5.2.2. Measurement of research variables

Researchers have three options in designing individual questions: adopting questions used in other questionnaires, adapting questions used in other questionnaires, and developing their own questions. Among these options, adopting or adapting questions has some advantages over developing questions in regard to validity and reliability of the questions (Bourque and Clark, 1994)

This study aimed to measure ESCM approaches, internal resources, environmental activities and environmental regulation. It mainly adopted or adapted questionnaire items from previous studies to measure internal resources, environmental activities and environmental regulation; however, some questionnaire items for ESCM approaches were not readily available from the literature, and so had to be developed on the basis of the literature review. All items were measured on a five-point Likert-type scale.

ESCM approaches

Several studies have attempted to measure ESCM approaches in various perspectives (e.g. Holt and Kockelbergh, 2003; Krause, 1999; Rao, 2003). For example, Holt and Kockelbergh (2003) suggested thirty-two questionnaire items including logistics, procurement, operational practice, supplier assessment, evaluation, industry network, and mentoring regarding ethical issues as well as environmental issues. However, although some of previous measurement items are useful to measure ESCM approaches in the electronics manufacturing industry, certain important ESCM approaches, especially those adopted in this industry are often neglected.

Accordingly, this study developed or adapted twenty-three items for measuring ESCM approaches, drawing on recent studies such as those of Leung (2002), Lippman (1999), NEETF (2003) and Rao (2003): for example, holding one-to-one meeting for addressing environmental issues (Lippman, 1999), providing training or site visit programmes for environmental management techniques with the third organization (NEETF, 2003), and breaking off business relations in case of environmentally bad process and product

(Leung, 2002) were developed from these studies. In addition, providing written guidance/training materials to build environmental capability (Rao, 2003), and requiring the questionnaire to address environmental management activities and initiatives (Rao, 2003) were adapted from these studies' questionnaire items (See Appendix 1.Sources for measuring ESCM approaches). However, the words of these selected questionnaire items were slightly changed so that they would be appropriate for understanding SMEs suppliers' perspectives, because the original questionnaires were designed to be completed by managers of large corporate customers.

Internal resources

Researchers have often been concerned to measure resources. The measurement of internal resources has frequently been attempted by considering such factors as total annual sales (Melnik et al., 2003) or number of employees (King and Lenox, 2000). However, these indicators do not clearly represent the internal resource conditions for environmental activities. For example, even if the annual sales of a company are larger than those of a competitor, this does not automatically mean that its financial resource to spare environmental practices will also larger. In addition, even if the number of employees was larger, the competitor's employees may be able to devote far more time to additional environmental activities. Consequently, it is advisable to ask respondents directly about the conditions of their company's internal resources in order to implement environmental activities. Moon et al. (2000) suggested questionnaire items to measure a company's internal resources for environmental activities. They directly asked about the internal resource conditions for environmental activities, and this study has adopted these questionnaire items.

Environmental activities

Many researchers have tried to define environmental activity and investigate the dimension of company's environmental activities (e.g. Aragon-Correa 1998; Lefebvre et al., 2003; Melnik et al., 2003; Peattie and Ringler, 1994). For example, Aragon-Correa (1998) measured environmental activities using fourteen items including

marketing, production and operation management. Although these researches measured environmental activities in different ways, they did not adequately cover the diverse dimensions of environmental activities.

Recently, González-Benito and González-Benito (2005) suggested a range of questionnaire items to measure environmental activities. These items concerned extensive environmental activities such as planning and organizational activities, product-related operational activities, process-related operational activities and communicational activities and were applied to various industrial sectors including the electronics industry. Their questionnaire items covered a more extensive area of environmental activities than those covered by all comparable studies; hence, these items were considered suitable for use by this study. However, the items were slightly changed in order to improve understandability by reflecting specific issues in the electronics industry, for instance by including particular examples drawn from the industry.

Control variables: environmental regulations

The environmental activities of SMEs can be affected by many factors (e.g. environmental legislation, NGOs, consumers, employees, shareholders, ownerships and others) other than the proposed study variables (ESCM approaches, internal resources). Therefore, these factors that could have a causal effect should be controlled in order to isolate the effects of ESCM on the environmental activities of SMEs. However, controlling all these factors was not possible in the questionnaire survey, and thus this study controlled the impacts of environmental regulation, which was frequently cited as a main driver of environmental activities.

The measurement items for environmental regulation were adapted from Lefebvre et al. (2003). Their items asked about the influences of environmental regulation in foreign countries as well as by the national government, in this case that of Canada. In this study, 'Canada' was changed to 'Korea', indicating the area of study.

5.2.3. Designing the questionnaire

Generally, the questionnaire includes a cover letter and the main questionnaire items. The cover letter provides information to the respondents such as details about the researcher, the purpose of the research and an assurance of confidentiality. This information can motivate the respondents to reply (De Vaus, 2002). The cover letter in this study included information about the researcher, the objective of the study and the questionnaire, and an assurance of confidentiality.

A well-structured questionnaire should start with factual questions, move from easy to more difficult questions (De Vaus, 2002), and be logical (Saunders et al., 2003). In accordance with these guidelines, the questionnaire was structured into five parts: the first contained general information about the surveyed SMEs; the second asked for information about environmental activities; the third asked about the influence of environmental regulation on environmental activities; the fourth concentrated on the ESCM approaches of corporate customers; the last part asked about the status of internal resources with regard to implementing environmental activities (See Appendix 2. Survey questionnaire)

Prior to the survey, the questionnaire was translated into Korean. A research fellow, Dr Whang, in the School of Earth and Environment at the University of Leeds, who was bilingual in English and Korean and had sufficient knowledge of business and environment studies, kindly agreed to check the accuracy of the translation

5.2.4. Pilot testing of the questionnaire

Prior to the main survey, a pilot test was carried out. The purpose of the pilot test is to “refine the questionnaire so that the respondents will have no problems in answering the questions and there will be no problems in recording the data’ and ‘to obtain some assessment of the questions’ validity and the likely reliability of the data that will be collected” (Saunders et al., 2003, p.308).

To evaluate the questionnaire items, the draft was sent to an academic expert, who was a specialist in the field of questionnaire survey methods and to two professional executives, who were in charge of ESCM programmes as senior managers in large Korean companies. The internal validity and reliability issues of this questionnaire were discussed via e-mail and telephone for two months. Their comments informed the revision of the questionnaire.

First, some words such as 'ESCM' and 'environmentally hazardous material' needed explanation because some managers of SMEs might not understand their exact meaning. These words were explained more clearly and in detail.

Second, a few questionnaire items, which were related to controlling environmentally hazardous materials, were added to provide examples reflecting the ESCM approaches adopted by some large Korean companies such as Samsung and LG Electronics. Further, one of the senior executives pointed out that one item, namely 'providing low interest loans to small suppliers for environmental projects', has not yet been adopted by large Korean companies. However, this item was not deleted because large foreign companies might adopt this practice.

Third, one item was added to check the respondent's appropriateness. This item asked 'please indicate how extensively you are related to environmental issues of your company' (See Appendix 2: Survey questionnaire). When the respondent had no involvement, and so answered 'not at all', the data provided by that respondent could be considered invalid.

5.2.5. Posting the questionnaires

The survey questionnaires were distributed to one thousand informants by first class mail in December 2004; a prepaid envelope was supplied for returning. The questionnaires were mailed to CEOs or senior executives because they were considered the most suitable informants regarding firm-level activities. In the case that they were not the most suitable person to complete the questionnaire, they were asked to pass it to

the appropriate person in accordance with the instruction in the cover letter. They were asked to return the fulfilled questionnaire to KETI (Korea Electronics Technology Institute) because this organization was considered to enhance the credibility of the research in the eyes of the respondents. KETI had agreed to assist the data collection; however, the costs of printing and sending the questionnaires including envelopes and postage were paid by the researcher.

There are a number of techniques designed to raise response rates such as prior notification, monetary incentives, non-monetary incentives, stamps on return envelope, ensuring anonymity, and follow-ups (Saunders et al., 2003). In this study, some of these techniques were adopted. First, respondents would receive the results of the survey after analysis had been completed. Second, ten randomly selected respondents would receive a gift set; this gift was English pottery, which is admired by Korean. Third, a prepaid envelope was included so that the completed questionnaires could be returned at no cost to the respondent. Fourth, a few follow-ups via e-mail were tried with people who had not answered. Through these procedures, the researcher finally accumulated one hundred and eighty-two valid responses with a response rate of 18.2%.

However, the ethics of repeated follow-ups and monetary incentives could be of concern in accessing relevant informants, who might not like receiving multiple follow-ups. Also, they might not want to reveal information about their company's environmental activities. Hence, the tasks of researchers such as providing adequate information about the risks and ensuring the confidentiality of information are more alleviate concerns about the capacity of incentives to distort the these risks (Singer and Bossarte, 2006).

Bearing in mind the informant's need for privacy and dignity, the study included a number of remarks in the cover letter on such matters as the academic usage of the collected data, and the expected outcomes for SME suppliers as a result of the research. There were no complaints by informants concerning the repeated follow-ups in the data collection process. In addition, no bias regarding environmental issues was detected in the collected data, as is shown in the quantitative analysis (See section 6.1.2).

5.2.6. Analyzing survey data

An appropriate analysis strategy can be derived from the research objective and questions (Saunders et al., 2003). The aims of this quantitative study were to examine the relations between the ESCM approaches of corporate customers and the environmental activities of SMEs, and the moderating effects of the internal resources of SMEs on these relations. In order to achieve these aims, factor analysis, multiple regression analysis, and moderated multiple regression analysis were adopted.

Factor analysis

The aim of factor analysis is to uncover the latent dimensions of a set of variables and to reduce a large number of variables to a small number of factors (Hair et al., 1998). This analysis technique can produce factors considering the relations of a large set of items, and these produced factors can describe the items using a much smaller number of underlying concepts than the original individual items. The inter-correlated items can be better interpreted through the extracted factors (Hair et al., 1998). In this study, factor analysis was employed in order to take advantage of these functions. First, this analysis was able to produce the underlying dimensions of ESCM approaches, internal resources, and environmental activities. Second, it was able to reduce the data to a smaller number of factors that could be used in further analysis.

Factor analysis can be used for exploratory and confirmatory purposes. Exploratory analysis can be employed when the researcher does not set any prior constraints on factors or the number of factors to be extracted. On the other hand, confirmatory analysis can be adopted when the researcher has already set prior constraints on factors or the number of factors based on theoretical supports (Hair et al., 1998). However, this does not mean that exploratory analysis can be applied without any theoretical background. Even in exploratory analysis, the extracted factor solution should have theoretical meaning (Hair et al., 1998).

In this study, exploratory factor analysis was applied to uncover theoretically meaningful dimensions of ESCM approaches, internal resources, and environmental activities. These identified factors were used for further analysis as independent and dependent variables to identify the detailed relations between ESCM approaches, internal resources and environmental activities of SMEs.

Theoretically, the range of ESCM approaches can be categorized into collaborative approaches and arm's-length approaches. However, in real business, large corporate customers did not classify their suppliers in theoretical terms and dichotomize arm's-length and collaborative relationships. They often apply a hierarchical model with four or five grades. In these cases, it is difficult to define ESCM approaches as either a collaborative approach or an arm's-length approach. Consequently, this research did not specify the measurement of two theoretical dimensions of ESCM approaches. The measurement of ESCM approaches was examined and compared with two different theoretical dimensions of ESCM approaches at a quantitative factor analysis stage through exploratory analysis.

Multiple regression analysis

The aim of multiple regression analysis is to examine the relationships between one dependent variable and two or more independent variables. Multiple regression analysis can be used when the researcher aims at assessing the strength of a causal effect relationship between variables, and predicting the value of one or more other variables (Saunders et al., 2003). In this analysis, the independent variables were ESCM approaches and the dependent variables were environmental activities of SMEs, which were produced by means of factor analysis. By entering these identified variables into the regression equation, the unique contribution of each ESCM approach to the environmental activities of SMEs could be assessed. In addition, through this analysis, the overall relations such as those between ESCM approaches and the environmental activities of SMEs could also be assessed. It was thought that this analysis could be useful for finding the more effective ESCM approaches on the environmental activities of SMEs.

Moderated multiple regression analysis

When a third variable is able to change the relations between independent variables and dependent variables, it has been regarded as as a moderate variable (Hair et al., 1998). Contrary to the mediating variables, which intervenes the relations between independent variables and dependent variables explaining how and why these relationships exists (Holmbeck, 1997; Lindley and Walker, 1993), moderate variables reduce or enhance the relationships between independent variables and dependent variables (Lindley and Walker, 1993). As described in research framework, this study focused on the moderating effects of the internal resources.

Three analysis methods can be used to assess these moderating effects. The first method is that the researcher dichotomizes the moderate variable by median, and then conducts a 2 x 2 ANOVA test. The second method is that the researcher dichotomizes the moderate variable by median, and then conducts regression analysis in each group. The third method is hierarchical multiple regression analysis. In this analysis, the multiplicative terms, which multiply the independent variable and the moderate variable, are assessed according to the hierarchical multiple regression process (Jaccard et al., 1990). Among these methods, hierarchical moderated multiple regression analysis has an advantage over the other methods because it can use data more completely, without loss of data (Jaccard et al., 1990). For this reason, this analysis is more popularly adopted to assess interaction effects (Jaccard et, al., 1990). Thus, this study employed hierarchical moderated multiple regression analysis to examine the interaction effects of internal resource conditions. In this analysis, the moderate variables were internal resources, the independent variables were ESCM approaches and the dependent variables were environmental activities of SMEs.

Interval level measurement for multivariate analysis

In order to conduct multivariate analyses such as factor analysis and regression analysis, the measurement level of independent and dependent variables should be interval level, which has order and equal intervals (De Vaus, 2002). Multivariate analysis using ordinal data, which has order but where the intervals between scale points might be uneven, can be controversial. However, according to Jaccard et al. (1990), “strictly speaking, the regression approach with continuous variables assumes interval - level data. However, ordinal data may be analyzed if such data approximate interval - level characteristics” (p.29).

The Likert-type scale, providing a measurement scale of at least five points (e.g, strongly agree, agree, neutral, disagree, strongly disagree), this measurement is an ordinal scale. However, these ordinal categories assume the intervals between scale points are even. For this reason, Likert-type measurement was commonly used in multivariate analysis. The measurement level of this study is a Likert-type scale. Hence, it was thought suitable to apply multivariate analysis as described above to the collected data.

5.3. Data collection and analysis: interview

This research adopts telephone interview as qualitative approach, and this data collection was conducted two times before and after the questionnaire survey. The section describes the procedure of conducting the interview including interviewee selection, interview topics, interview procedure and analysis strategy.

5.3.1. Interviewee selection

Purposive sampling

Sampling in a qualitative study is based on “wanting to interview people who are relevant to the research question” (Bryman, 2004, p.334). This sampling technique can

be applied to a small number of particularly informative interviewees and makes it possible to gather relevant information and achieve the research aim more effectively in a qualitative study (Saunders et al., 2003). Thus, for the interviews conducted by this study, purposive sampling method was considered appropriate to achieve the research objective most effectively.

Appropriate number of interviewees

The number of interviewees is not critical in a qualitative study. According to Patton (1990), “There are no rules for sample size in qualitative inquiry. Sample size depends on what you want to know, the purpose of the inquiry, what’s at stake, what will be useful, what will have credibility, and what can be done with available time and resources” (p.184) and “The validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capacities of the researcher than with sample size” (p.185).

In this perspective, selecting appropriate informants who can provide plentiful information is considered important rather than the number of interviewees. Following this perspective, informants with sufficient knowledge and experience in the field of ESCM and SMEs were selected as appropriate interviewees for this study.

Interviewees: first-stage interviews

The aim of the first stage interviews was to find preliminary evidence of the impacts of the ESCM approaches of large corporate customers on the environmental activities of SMEs, before undertaking questionnaire survey. To achieve this purpose, SMEs which had already adopted some kinds of environmental activities were considered an appropriate sample, because they had already been motivated to engage in environmental activities.

Twenty SMEs in the Korean electronics industry were recommended by the KNCPC (Korea National Cleaner Production Centre). This organization, established by the Korean government, had a great deal of experience of undertaking environmental assistance programmes to improve SMEs' environmental performance. These SMEs were regarded as experienced in the field of environmental practice. The evidence provided by this restricted sample could not accurately reflect the practice of all SMEs in the Korean electronics industry. However, it could provide preliminary evidence of the impacts of customers' ESCM approaches on the environmental activities of SMEs.

Only six interviewees were involved in the interview process. Table 5.3 summarizes the archival data on each company and interviewee. The products were parts made for the electronics industry particularly for computers and televisions. The interviewees were involved in the environmental practices of their company as a senior manager or chief executive, and each had more than two years' experience in that position. Hence, they were considered suitable to be interviewed on environmental issues. For confidentiality, the names of the interviewees were changed to anonymous numbers (SME manager 1 and so on).

Table 5.3. The archival data of each company and interviewee: first-stage interviews

Name	Number of employees	Sales (Million won)	Manufacturing items	Current position	Years in job	Years with company
SME manager 1	100	18,024 (2002)	Computer parts	Head of manufacturing	2	2
SME manager 2	262	4,733 (2002)	Antennas Computer parts	Head of assistance	4	5
SME manager 3	38	1,500 (2003)	Small electronic motors	Head of administration	3	3
SME manager 4	60	1,200 (2003)	Wireless, communication apparatus	Head of administration	7	7
SME manager 5	10	15 (2003)	Circuit boards	CEO	6	6
SME manager 6	200	6,000 (2003)	Magnetic parts	Head of administration	3	3

Interviewees: second-stage interviews

The second-stage interviews aimed at finding the reasons for the results of the quantitative analysis. In order to achieve this aim, a wide scope of examples was considered necessary. Thus, managers or employees of SMEs were not considered appropriate informants because their experiences were likely to be too limited to fulfill the main criteria of the interviews.

Table 5.4. The archival data of interviewees: second-stage interviews

Name	Field	Educational Background	Work Experience	Years in job	Years with company
Consultant 1	Consultant	Ph.D in Management	Participated in formulating green purchasing guidelines for POSCO Participated in ESCM project as a consultant for POSCO. etc.	6	6
Project Manager 2	Project manager	Ph.D in Engineering	Participated as project manager in cleaner production programmes for SMEs etc.	5	6
Project manager 3	Project manager	Ph.D in Engineering	Participated in ESCM education programmes of GM Participated as project manager in cleaner production programmes for SMEs etc.	3	3
Consultant 4	Consultant	MSc. In Management	Participated in ESCM project as a consultant for LG, etc.	2	2
Consultant 5	Consultant	MSc in Engineering	Participated in ESCM project as a consultant for Samsung and LG, etc.	4	4

*Interviewee's status was displayed at the time of the interview.

Initially, ESCM managers working for large companies in the Korean electronics industry were considered appropriate informants. It was expected that they would be able to provide plentiful information about the responses of SMEs to the ESCM approaches of large corporate customers. However, when approached, these managers would not agree to reveal detailed information, fearing breached of confidentiality, and so, other options had to be considered.

Accordingly, five experts were chosen as interviewees for the second-stage interviews. They were considered appropriate informants because they had extensive experience in the field under study and could provide much useful information. Table 5.4 summarizes the archival data on these experts. Three interviewees were participating in ESCM projects as a consultant for Samsung and LG Electronics, and POSCO. Two interviewees were working as project managers of environmental assistance programmes in the KNCPC (Korea National Cleaner Production Centre). All interviewees had more than two years' experience in this field. Hence, although they were not members of staff of large companies such as Samsung and LG Electronics, they had a good deal of experience of the activities of large companies in the field of ESCM, and could provide much useful information about environmental practices of SMEs. In addition, it was expected that they had more experience than an employee working for a single company. Accordingly, they were considered appropriate informants to be interviewed.

5.3.2. Designing interview schedules

Interview schedule design

Semi-structured interview often employ an interview schedules. The interview schedule contained a protocol for the interview process, in order to ensure that certain areas should be discussed during the interview (Robson, 2002). Thus, the interview schedule can be used as a checklist at the end of the interview to ensure that all topics have been discussed.

The interview schedule is applied to the interview process to maintain consistency in each interview. However, the order of questions may be subject to change during the interview process to get the interviewee to talk freely.

Interview topics: first-stage interviews

The first-stage interviews were to find preliminary evidence of the impacts of the ESCM approaches of large corporate customers on the environmental activities; thus, the questions asked should be consistent with this research aim and drawn from the research questions. The interviewees were asked about the current environmental activity status of SMEs and about motivation. Later, the researcher asked sub-questions about the impacts of corporate customers' ESCM approaches on their company's environmental activities, after the interviewees had reported that they were being exposed to ESCM pressures. Finally, questions were asked about the role of internal resources in their company's environmental activities (See Appendix 3: Interview guide and control sheet: first stage)

Interview topics: second-stage interviews

In the second-stage interviews, the questions were related to the quantitative analysis results and sought to elicit detailed explanation of these results. Accordingly, the questions were drawn from the results of quantitative analysis.

The interviews mainly focused on these topics; however, a few further questions were necessary in order to understand more clearly these relations. For example, the reasons customers had chosen each ESCM approach were investigated in order to understand more fully the characteristics of ESCM approaches from the perspective of corporate customer. In addition, questions were asked about the impacts of environmental regulation in order to compare these impacts with those of ESCM approaches. Furthermore, the roles of internal resources in dealing with ESCM approaches were asked (See Appendix 4: Interview guide and control sheet: second stage).

5.3.3. Interview procedure

Interview procedure

The two sets of interviews were conducted under the interview schedules developed for each stage. In both cases, the opening remarks included information such as details about the researcher, the purpose of the research and a guarantee of confidentiality. After asking for the general information such as relevant archival data on the interviewees and their companies, the main questions were asked.

All the interviews were conducted in Korean and recorded with the permission of the interviewees. The recordings were then transcribed, and the transcripts were translated into English. A Korean research fellow, Dr Whang, at the school of Earth and Environment in the Leeds University kindly checked the accuracy of this translation. She had also checked the translation of the English version of the interview questionnaire into Korean.

There were some problems in conducting the interviews. The interviews had to be conducted in Korean because the informants were not fluent in English. After the interviews, the interviews were fully transcribed. However, the transcripts were not fully translated into English, and some redundant remarks were omitted deliberately because translating all the interview data was too time consuming. In addition, the excerpts from interviews directly quoted in this study appear in a formal written style rather than in normal spoken English. However, the accuracy of the translation was thoroughly checked and is satisfactory.

Interview procedure: first-stage interview

In April 2004, twenty managerial level informants recommended by the KNCPC were asked to participate in a telephone interview by an e-mail which explained the aim of the study and guaranteed confidentiality. Of these twenty, fourteen did not reply; only

six answered positively. The interview questionnaire, translated into Korean, was sent a few days before the interview, and a follow-up telephone call was made one day before the interview. The telephone interviews were conducted from 2 to 19 May 2004, and lasted between twenty and thirty-five minutes. Table 5.5 summarizes the interview dates and periods.

Table 5.5. Interview dates and periods (approx.): first stage interviews

	Interview date	Interview period
SME manager1	2 May 2004	30 minutes
SME manager2	6 May 2004	20 minutes
SME manager3	6 May 2004	30 minutes
SME manager4	7 May 2004	35 minutes
SME manager5	19 May 2004	25 minutes
SME manager6	19 May 2004	30 minutes

Interview procedure: second-stage interview

To elicit further information about relations between customers' ESCM approaches and the environmental activities of SMEs, the second-stage interviews were conducted with five experts in the field of ESCM in Korea.

Some problem related to interview time, was encountered in the first-stage interviews. The first-stage interviews took around thirty minutes, and the interviewees were either chief executives or senior managers; most of them emphasized that they were very busy people before the interview began. The interviewees probably thought that the time they had set aside was enough to give the necessary information. However, the researcher began to feel pressured to finish the interview after their brief answers and could not ask the more detailed further questions.

However, in the second-stage, an attempt was made to avoid this problem by conducting e-mail interviews prior to the telephone interviews: first, the questionnaire was sent to each interviewee, who completed and returned it. After a review of the e-mail interview, further in-depth questions were put by telephone to each interviewee with a view to confirming the results of the e-mail interview. These telephone

interviews were conducted from 20 to 30 August 2005 and lasted between forty-five minutes and one hour ten minutes. This was successful and the second-stage interviews were conducted more effectively. Table 5.6 summarizes the interview dates and periods.

Table 5.6. Interview dates and periods (approx.): second-stage interviews

	Interview date	Interview period
Consultant 1	20 August 2005	45 minutes
Project manager 2	23 August 2005	55 minutes
Project manager 3	26,27 August 2005	70 minutes
Consultant 4	28 August 2005	60 minutes
Consultant 5	29,30 August 2005	70 minutes

5.3.4. Analyzing interview data

As noted above, two sets of interviews were conducted, one before and one after the questionnaire survey. The first-stage interviews provided evidence of the impacts of customer's ESCM approaches on the environmental activities of SMEs; the second-stage interview provided meaningful explanations for the results of the quantitative analysis. In the interview analysis procedure, and especially in the 'data display' and 'drawing conclusions' steps, more plentiful examples and reasons were generated when the collected data from the two stages were synthesized. Thus, the study reports the results of both interview data analyses simultaneously.

Analysis of the interview data was conducted in accordance with the framework developed by Miles and Huberman (1994), which comprises three components: data reduction, data display, and drawing conclusions.

Data reduction

The first elements of the process, data reduction, involves summarizing and simplifying the data collected by, for example, interview summary, coding and categorizing data (Miles and Huberman, 1994). In this study, the collected data set was able to be handled easily due to the relatively small number of interviews; accordingly, the collected data

did not need to be summarized for further analysis. In order to detect the patterns or logics of interview data, the interview data were redistributed to the categories based on the interview topics.

Data display

Data display is the second element of the analysis model. This stage includes organizing or arranging the collected data for the purpose of drawing conclusions. Data display allows the researcher to make comparisons between the elements of the data (Miles and Huberman, 1994). In this stage, the study intended to find underlying factors or dimensions of the relations between customers' ESCM approaches and the environmental activities of SMEs in conjunction with SMEs' internal resources. Accordingly, the analysis involved the selection of underlying factors, and broad categories were narrowed down to more focused concepts. For each issue, important remarks were highlighted to see how ESCM approaches actually impacted on the environmental activities of SMEs.

Drawing conclusions

Drawing conclusions is the final element, which involves activities designed to draw meaning from the arranged data, such as searching for key themes and relationships in the rearranged data (Miles and Huberman, 1994). Conclusions can emerge in this stage; accordingly, some intervening and intrinsic variables or factors identified. Qualitative analysis was conducted by this study to detect factors in the relations between ESCM approaches and the environmental activities of SMEs in conjunction with their internal resources. The important factors or paths within these relations were captured through this analysis.

5.4. Conclusion

Chapter 4 discussed the research objective, questions, and theoretical framework. This chapter has presented the research procedures for achieving the objective of this study and answer the research questions.

Based on epistemological and ontological considerations, two different approaches were compared. In order to take advantage of both quantitative and qualitative approaches, bearing in mind the limitations of each, this study adopted the methodological triangulation approach incorporating both quantitative and qualitative approaches. The qualitative approach was adopted as a facilitator before the quantitative approach and as a supplement in order to enhance the interpretation of the results of quantitative approach.

The self-administered postal questionnaire survey and the semi-structured telephone interview were adopted as data collections method for the quantitative and qualitative approaches respectively. The details of the data collection and analysis procedures for these methods such as sampling, measurement, questionnaire structure, distribution questionnaire, interview topics, interview procedure, and analysis strategy were presented.

The results of the collection and analysis of the quantitative data were reported in chapter 6. Chapter 7 presents the results of the collection and analysis of the qualitative data.

Chapter 6. Relationships between ESCM approaches and SMEs’ Environmental Activities: Quantitative analysis results

This chapter presents the results of the quantitative analysis. First, the response rate of the questionnaire survey and the result of the non-response bias check are discussed. Then, ways of dealing with missing data are described, and the results of the factor analysis are explained. The impacts of ESCM approaches on the environmental activities of SMEs are assessed by means of the regression analysis. Finally, the moderating impacts of SMEs’ internal resources are examined by means of hierarchical moderated multiple regression analysis.

6.1. Results of data collection

6.1.1. Examination of response rate

The questionnaires were distributed to one thousand informants. This study adopted a number of methods (e.g. follow-ups by e-mail, incentives for respondents) to increase the response rate. The researcher finally accumulated two hundred and fourteen responses with an initial response rate of 21.4%.

Among these responses, seventeen were immediately excluded, as they did not meet criteria for SMEs in Korea; three responses were returned by subsidiaries of large companies, and fourteen exceeded the criteria of SME definition with regard to the number of employees and paid in capital. In addition, seven responses were excluded due to significant missing data (See section 6.1.3). Further, eight respondents were not involved with the environmental activities of their company; these responses were excluded from the subsequent data analysis in order to increase the credibility of the data.

Therefore, the final data set for data analysis consisted of one hundred and eighty-two responses. The useable response rate was 18.2%. Table 6.1 summarizes these response rates.

Table 6.1 Response rate of survey

	Number	% of cases
Questionnaires sent out	1,000	100
Questionnaires returned	214	21.4
Questionnaires filled out by unsuitable companies*	17	1.7
Questionnaires filled out incorrectly **	7	0.7
Questionnaires filled out by unsuitable respondents***	8	0.8
Questionnaires filled out by suitable respondents	182	18.2

* These responses did not conform to the definition of SMEs

** These responses had significant missing data

*** These respondents were not concerned with their companies' environmental activities

Response rate is an important indicator of how much confidence can be placed in the results of a survey. In postal surveys, the response rates of business studies are often as low as 10-20 percent (Saunders et al., 2003). Table 6.2 shows that the response rates of some previous studies in the area of SMEs and the environment ranged from 6.9 to 33.0%(e.g. Merritt, 1998; Pimenova and van der Vorst, 2004; Worthington and Patton, 2005). As this study's response rate lied within this range and is similar to the rate presented by Saunders et al. (2003), it can be considered to be acceptable.

Table 6.2. Comparison of response rates of previous studies on the environmental issues in SME sector

Authors (year)	Country (Industry)	Main Strategy	Response Rate
Merritt (1998)	UK (agriculture, manufacturing, construction, services and etc.)	Follow – ups	6.9%
Pimenova and van der Vorst (2004)	UK (manufacturing, construction and services.)	N/A	10.3%
Worthington and Patton (2005)	UK (printing industry)	Follow – ups	33.0%

6.1.2. Checking non-response bias

Non-response cannot be avoided in a questionnaire survey. Saunders et al. (2003) advise the researcher: “Non-respondents are different from the rest of the population because they have refused to be involved in your research for whatever reason. Consequently, your respondents will not be representative of the total population, and the data you collected may be biased”(p.156). Further, when it comes to criterion variables, the results can be misleading or erroneous (Fox and Tracy, 1986). In this study, SMEs engaged in relatively superior environmental activities might answer these questionnaire items in order to draw attention to the excellence of their environmental practices. In such cases, the environmental activities of SMEs can be overestimated.

Extrapolation method can be applied to examine non-response bias. This method assumes that the responses to a questionnaire after the respondents have received a reminder (e.g. push mail) are similar to those of non-respondents (Armstrong and Overton, 1977). That is, to evaluate non-response bias, the final responses are divided into two groups according to the response time: early respondents (before reminder) and late respondents (after reminder). The profiles of the two groups are compared. If the profiles do not differ statistically, it is supposed that non-response bias is not evident in the research (Carter, 2000; Churchill, 1999).

Thus in this study, the collected data was divided into two subgroups. The early respondents group comprised those who responded to the first posted mail. The late respondents group comprised those who responded after the reminder. The numbers in each group were one hundred and seven, and seventy-five, respectively. In order to examine the differences between these two subgroups, the items measuring environmental activities were chosen as a representative variable for describing the profile of responses. A one-way analysis of variance (ANOVA) test was adopted to identify the difference of the means of these items. The ANOVA statistics produced the mean values of each item and the statistical differences (*p* value).

As shown in Table 6.3, the results of the ANOVA test were not significant (all p values were greater than 0.05). Hence, it can be concluded that there were no significant differences in environmental activities between early and late responses, and so non-response bias was not detected in this study.

Table 6.3. One way ANOVA statistics for non-response bias check

Items	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9
Early respondents	2.96	2.92	3.00	2.41	2.78	2.50	2.35	3.29	3.00
Late respondents	3.01	2.71	2.76	2.25	2.56	2.68	2.21	3.56	3.15
Sig.	.755	.193	.112	.259	.127	.266	.444	.136	.385
Items	Item10	Item11	Item12	Item13	Item14	Item15	Item16	Item17	Item18
Early respondents	3.21	2.95	2.92	2.73	2.73	2.65	3.07	3.17	2.76
Late respondents	3.28	2.88	3.00	2.81	2.67	2.55	2.97	3.13	2.76
Sig.	.604	.626	.580	.635	.706	.475	.529	.813	.985
Items	Item19	Item20	Item21	Item22	Item23	Item24	Item25	Item26	Item27
Early respondents	3.59	2.83	3.07	2.93	2.92	2.40	1.76	2.25	2.21
Late respondents	3.59	2.63	2.99	3.00	2.87	2.23	1.73	2.17	2.15
Sig.	.990	.228	.572	.654	.732	.308	.858	.601	.676

6.1.3. Handling missing data

Missing data, like non-responses, can create biased results and affect the generalizability of the results. Accordingly, it should be dealt with carefully (Hair et al., 1998). There are a number of ways to deal with missing data such as use of observations with complete data only, elimination of variables and/or cases, and using imputation methods (e.g. mean substitution). Among these methods, where no pattern can be discerned in the missing data and the missing data is concentrated in a small subset of cases, the elimination of cases is the most efficient solution (Hair et al., 1998)

In this study, twenty-six respondents did not answer the questions concerning the number of employees and paid in capital in the section seeking general information about the company. These items were included in the part of open questionnaire in order to identify whether or not the company could be categorized as an SME. The omission of the data might have been due to the respondent's ignorance of these details or reluctance to answer open-ended questions. This data was critical to the research; fortunately, it was available on the official websites of these companies and from the

other data sources in the database of the Korea Company Information Ltd. (KCI). It was thus possible to fill in the missing items and these cases were included in the final data set for further analysis.

Moreover, there were seven cases including missing values pertaining to the questionnaire items designed to measure the research constructs. Compared to the rate with respect to the number of employees and paid in capital, the rate here was relatively low, and may have been due to the closed nature of the questionnaire. However, the information about research constructs such as environmental activity status, the corporate customer's ESCM approaches, and the internal resource conditions of these seven cases could not be obtained from secondary sources. Consequently, the pattern of this missing data had to be carefully assessed. In the data set, the distribution of the missing data was spread across the questionnaire items. In addition, the missing value cases amounted to only 3.1% of the total. It was therefore considered reasonable to exclude these seven missing value cases from further analysis.

6.2. The results of the factor analysis

In this study, factor analysis was conducted for two purposes: the first was to identify the underlying dimensions of customer company's ESCM approaches, the environmental activities of SMEs, and the internal resources; the second was to reduce the data to a small number of factors that could be used in further analysis. The process and results of factor analysis are presented in the following section.

6.2.1. Data analysis procedure: factor analysis

Examining variables

Sampling adequacy for factor analysis should be examined prior to analysis. The data for factor analysis requires some interrelations between each variable, because one aim of this analysis is to detect an interrelated set of variables (Hair et al., 1998). The correlations can be examined statistically by Kaiser-Meyer-Olkin (KMO)'s sampling

adequacy value and Bartlett's test. Bartlett's test of sphericity is "a statistical test for the presence of correlations among the variables" (Hair et al., 1998, p.99). This test provides "the statistical probability that the correlation matrix has significant correlations among at least some of the variables" (Hair et al., 1998, p.99). In addition, the measure of sampling adequacy (MSA) value can be also applied to determine the sample's appropriateness for factor analysis. The MSA value can be produced on individual variables and overall variables. A guideline for this analysis has been provided by Kaiser (1974): 0.90 or above: marvellous, 0.80-0.89: meritorious, 0.70-0.79: middling, 0.60-0.69: mediocre, 0.5-0.59: miserable, and less than 0.50: unacceptable (Kaiser, 1974).

Extraction procedure

There are two widely used methods to extract factor solutions such as principal component analysis and common factor analysis (Hair et al., 1998). Hair et al. (1998) suggested the guidelines for selecting the appropriate method: principal component analysis is appropriate to reduce the data; common factor analysis is better for detecting underlying theoretically meaningful structures (Hair et al., 1998). In addition, principal axis factoring is a widely adopted method in common factor analysis (Gorsuch, 1983). Following the suggested criteria, this study adopted principal axis factoring in common factor analysis to derive theoretically meaningful factors.

In the extraction procedure, communality is produced. Communality refers to "total amount of variance an original variable shares with all other variables included in the analysis" (Hair et al., 1998, p.88). If communality is lower than 0.50, one possible option is to derive a new factor solution without these variables (Hair et al., 1998)

Number of factors

The optimal number of factors can be determined based on certain criteria, the most frequently adopted methods being eigenvalue and scree criteria. An eigenvalue greater than one is considered the cut-off point in determining the number of factors. As for the

scree test, the visual inspection of the eigenvalue plot shows the number of factors. The point at which the eigenvalue begins to level off indicates the maximum number of factors extracted. To extract the exact factor solution, multiple criteria are recommended. In addition, more importantly, a good solution should be interpretable in terms of theoretical background (Hair et al., 1998).

Rotation of factors

Factor rotation is useful because it makes factor solutions simpler and more theoretically meaningful. The two methods of factor rotation are orthogonal and oblique rotation. Orthogonal rotation rotates the axis while maintaining the axes at 90 degrees; oblique rotation rotates the axis while not maintaining the axes at 90 degrees. When uncorrelated factors are necessary and these extracted factors are to be used in subsequent analysis, orthogonal rotation is preferred (Hair et al., 1998). In the orthogonal rotation methods, varimax rotation can produce a clearer factor solution than other methods such as equimax and quartimax rotation (Hair et al., 1998). This study adopted varimax rotation to extract factor solutions.

Significance of factor loadings

Factor loading represents the relationships between variables and extracted factors. A number of criteria are used to assess the significance of factor loading; a factor loading of 0.5 is considered practically significant (Hair et al., 1998). However, most factor solutions do not show that each variable has a significantly high loading on only one factor. Some variables often have several moderate size factor loadings. In such cases, the interpretation of factor solutions is difficult and this variable is considered a candidate for deletion (Hair et al., 1998).

Data reduction

Three methods are generally adopted for data reduction: selecting a surrogate variable, using a factor score, and creating a summated scale. The surrogate variable method

involves choosing a single item that has the highest factor loading score; it is simple and easy to use. However, this approach has problems, such as possible weakness of validity and reliability in choosing the variable, and interpretation. Another method is to use factor scores produced by factor analysis. However, this method may involve difficulties of interpretation. The third method is to create summated scale, which is a composite value obtained by adding up each variable highly loaded on a factor. This average score method has some advantages over the others: it reduces measurement errors, and is relatively easy to use (Hair et al., 1998). Hence, this study adopted the summated scale method of data reduction.

Testing reliability

Reliability is assessed prior to data analysis. Reliability concerns “an assessment of the degree of consistency between multiple measurements of a variable” (Hair et al., 1998, p.117). Cronbach’s alpha coefficient is often applied in order to statistically test the reliability. It is considered acceptable if the value is more than 0.7 or 0.6 in exploratory research (Hair et al., 1998).

6.2.2. Results of factor analysis

Factor analysis was applied to the questionnaire items on ESCM approaches, environmental activities, environmental regulation and internal resources. The results are reported in this section.

Factor analysis with items on ESCM approaches

The factorability of the items on ESCM approaches was evaluated by KMO’s measure of sampling adequacy (MSA) value and Bartlett’s test. The MSA value was 0.936, which was considered acceptable for factor analysis. In addition, Bartlett's test (Chi-Square=4778.051, $p=0.000$) also confirmed the adequacy of the sample for factor analysis.

The principal axis factoring analysis with varimax rotation was conducted to extract factor solutions on ESCM approaches. Three items (E9, E11, and E16) with low communalities of less than 0.5 were dropped from the analysis. Subsequently, twenty items were entered into factor analysis.

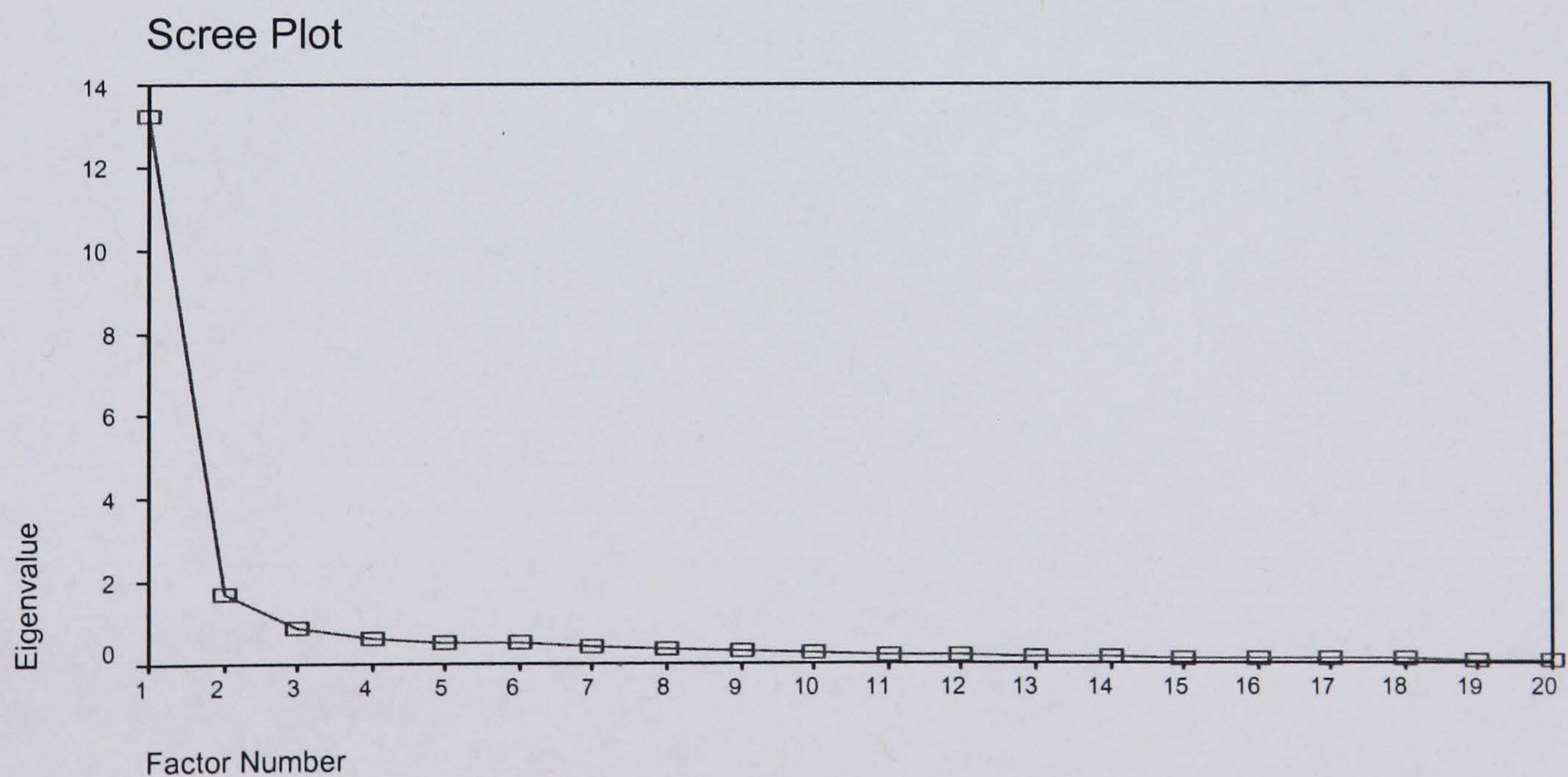
Eigenvalue criteria and the scree test were applied to determine the number of factors. As shown in Table 6.4, the principal axis factoring analysis produced two factors with eigenvalues of more than 1. These two factors accounted for 74.6% of cumulative variance. The result of the scree test supported the factor solutions in Figure 6.1.

Table 6.4. Total variance explained on ESCM approaches

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	13.204	66.021	66.021
2	1.718	8.588	74.610
3	.850	4.249	78.859
		<Omitted>	
19	6.685E-02	.334	99.724
20	5.517E-02	.276	100.000

*Extraction Method: Principal Axis Factoring

Figure 6.1. Scree test on ESCM approaches



The factor solutions indicated two different factors in ESCM approaches. Table 6.5 showed the factor loading results. The factor loading demonstrated that items E1, E12, E13, E14, E15, E17, E18, E19, E22, and E23 contributed to factor 1, and items E5, E6,

E7, E8, E20, and E21 contributed to factor 2. However, the factor loading values of items E2, E3, E4, and E10 were distributed evenly on factor 1 and factor 2. These results indicated that the items E2, E3, E4, and E10 were correlated with both factor 1 and factor 2.

The factor analysis results demonstrated that ESCM approaches were categorized into two different approaches. This was plausible in terms of theoretical background and corresponded to the previous studies (e.g. Holt, 2003; Klassen and Vachon, 2003, Preuss, 2005). The produced factor solutions were named the arm's-length approach and the collaborative approach. New constructs were created by summing questionnaire items, and the Cronbach' alpha values of the arm's- length approach and the collaborative approach were 0.9609 and 0.9386 respectively.

Table 6.5. Rotated Factor Matrix on ESCM approaches

	Two Factor Model	
	Factor 1	Factor 2
E 1	.667	.461
E 2	.513	.514
E 3	.561	.651
E 4	.651	.578
E 5	.391	.816
E 6	.339	.863
E 7	.237	.876
E 8	.233	.884
E 10	.566	.581
E 12	.774	.229
E 13	.896	.247
E 14	.880	.261
E 15	.846	.353
E 17	.565	.445
E 18	.740	.437
E 19	.752	.460
E 20	.459	.612
E 21	.417	.616
E 22	.681	.485
E 23	.746	.389

*Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 3 iterations.

The four items (E2: holding one-to-one meetings to address environmental issues; E3: holding seminars/workshops for environmental awareness; E4: providing written guidance/training materials to build environmental capability; and E10: holding site visits or audit to review environmental performance) had even distribution of factor

loading values on each factor. This result led to the interpretation that these four individual approaches were related to both arm's-length and collaborative approaches. These items were therefore not included in creating new constructs.

Factor 1: arm's-length approach

The arm's-length approach involves corporate customers' relatively weak interaction with SMEs on environmental issues. In this study, items connected with the arm's-length approach comprised: providing policy materials for environmental expectations (E1), purchasing products without environmentally hazardous materials (E12), requiring information about environmentally hazardous materials in products (E13), requiring to plan to reduce and eliminate environmentally hazardous materials (E14), requiring to control our suppliers for environmental reasons (E15), requiring to answer the questionnaire addressing environmental management activities and initiatives (E17), requiring to set up an environmental management system (E18, E19) and breaking off the business relationships in the case of the supplier's environmentally bad process and product (E22, E23)

Factor 2: collaborative approach

The collaborative approach involves corporate customers' relatively strong interaction with SMEs on environmental issues. In this study, items connected with the collaborative approach comprised: providing training or site visit programmes for environmental management techniques or environmental technology by the corporate customer alone (E5, E6), providing training or site visit programs for environmental management techniques or environmental technology with a third organization (E7, E8), involving the supplier in the design process for environmental improvement of product and manufacturing process (E20), and providing incentives for suppliers' good environmental performance (E21).

Factor analysis with items on environmental activities

Factor analysis was run on the items to extract the underlying factors of environmental activities. The results of KMO's measure of sampling adequacy (MSA value=0.922) and Bartlett's test (Chi-Square=3751.942, $p = 0.000$) were acceptable. Eight items (A7, A8, A10, A11, A18, A19, A20, A25, and A26) were not included due to low communalities. Accordingly, eighteen items were entered into factor analysis.

The principal axis factoring analysis with varimax rotation was performed to identify the underlying factors of environmental activities. As shown in Table 6.6, the analysis produced three different factors with eigenvalues of more than 1 explaining 70.3% of the variance of the eighteen items. However, the scree test result shown in Figure 6.2. was somewhat difficult to interpret due to relatively smooth curve. This result indicated two or three factors. The scree test result partly supported the factor solutions.

Table 6.6. Total variance explained on environmental activities

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	9.424	52.357	52.357
2	1.993	11.071	63.428
3	1.239	6.883	70.312
4	.869	4.829	75.141
		<Omitted>	
17	.130	.720	99.473
18	9.489E-02	.527	100.000

* *Extraction Method: Principal Axis Factoring*

Figure 6.2. Scree test on environmental activities

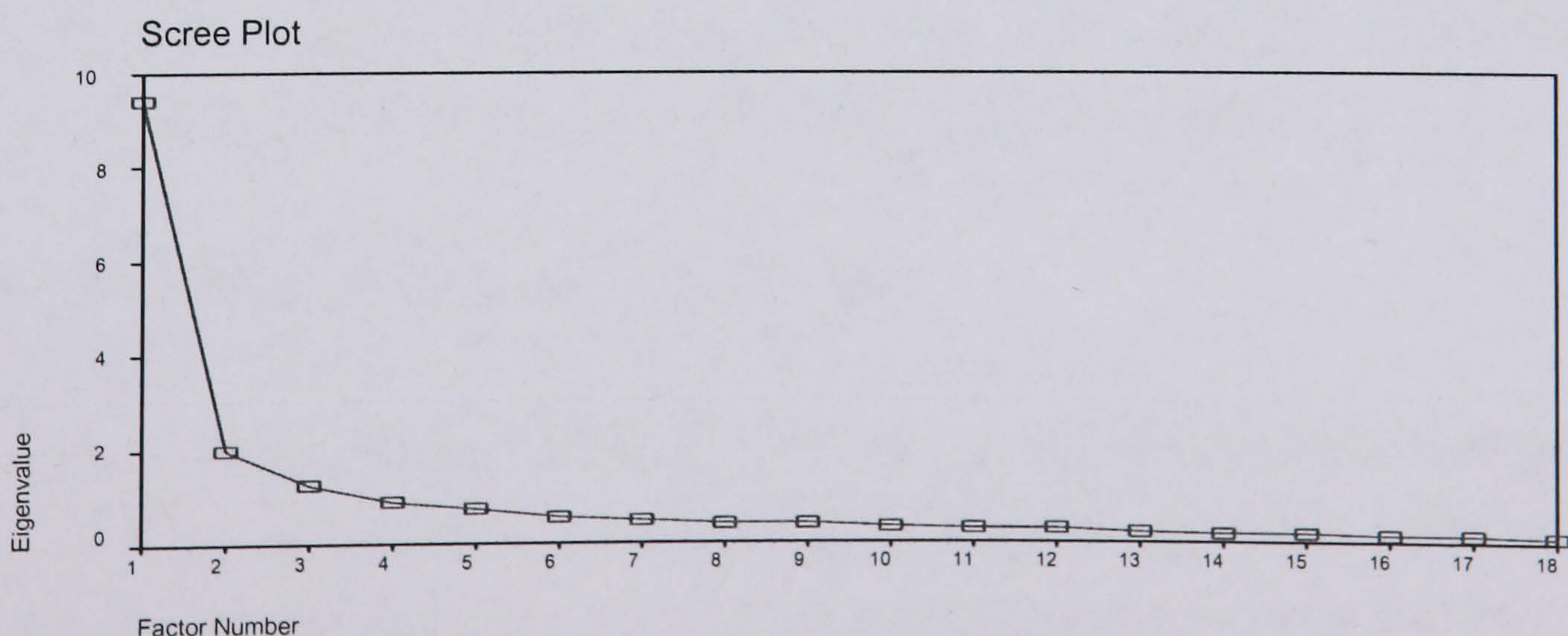


Table 6.7 shows the pattern matrix with the factor loading for each item on three extracted factors. 18 items having factor loading values greater than 0.5 were considered practically significant.

Table 6.7. Rotated Factor Matrix on environmental activities

Items	Factor 1	Factor 2	Factor 3
A 1	.795	.206	.170
A 2	.757	.269	.241
A 3	.789	.220	.209
A 4	.763	.221	.148
A 5	.618	.249	.328
A 6	.799	.208	.182
A 9	.367	.535	.340
A 12	.198	.655	.188
A 13	.403	.576	.154
A 14	.273	.743	.119
A 15	.319	.781	.135
A 16	.151	.727	.245
A 17	.104	.703	.220
A 21	.342	.276	.657
A 22	.361	.273	.830
A 23	.266	.304	.801
A 24	.700	.241	.328
A 27	.607	.368	.292

*Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization. a Rotation converged in 6 iterations.

The factor analysis with respect to environmental activities produced three dimensions of activities; the result indicated that environmental activities could be categorized into three different kinds. These results were plausible and almost correspondent to González-Benito and González-Benito's (2005) results. The produced factor solutions were named as planning and organizational activities, product and logistics activities, and internal production process activities. New constructs were created by summing the questionnaire items and the Cronbach's alpha values of these three kinds of environmental activities were 0.9357, 0.8969 and 0.9068 respectively.

Factor 1: planning and organizational activities

Planning and organizational activities consisted of six environmental management activities (A1: explicit definition of environmental policy; A2: clear objectives and long-term environmental plans; A3: well-defined environmental responsibilities; A4:

full-time employees devoted to environmental management; A5: environmental training programmes for managers and employees; and A6: systems for measuring and assessing environmental performance) and two communicational activities (A24: periodic elaboration of environmental reports; and A27: regular voluntary information about environmental management to customers and institutions).

Factor 2: product and logistics activities

Product and logistics activities comprised three product-related activities (A9: designs focused on reducing resource consumption and waste generation during production and distribution; A12: preference for green products in purchasing; and A13: environmental criteria in supplier selection) and four logistics activities (A14: shipments consolidation; A15: selection of cleaner transportation methods; A16: recyclable or reusable packaging/containers in logistics; and A17: ecological materials for primary packaging).

Factor 3: internal production process activities

Internal production process activities consisted of three items (A21: process design focused on reducing energy and natural resources consumption in operations; A22: production planning and control focused on reducing waste and optimizing materials exploitation; and A23: acquisition of clean technology/equipment).

Factor analysis with items on internal resources

Factor analysis was run on the questionnaire items to assess environmental activities. KMO's measure of sampling adequacy (MSA value=0.821) and Bartlett's test (Chi-Square=413.494, $p=0.000$) results were acceptable for factor analysis.

All five items were entered into factor analysis. The principal axis factoring analysis with varimax rotation produced one factor with an eigenvalue greater than one, as shown in Table 6.8. However, as shown in Figure 6.3, the scree test clearly indicated

two factors. Consequently, it was necessary to examine theoretically the results of the one factor model and the two factor model.

Table 6.8. Total variance explained on internal resources

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.236	64.716	64.716
2	.652	13.038	77.754
3	.473	9.464	87.218
4	.377	7.542	94.760
5	.262	5.240	100.000

**Extraction Method: Principal Axis Factoring*

Figure 6.3. Scree test on internal resources

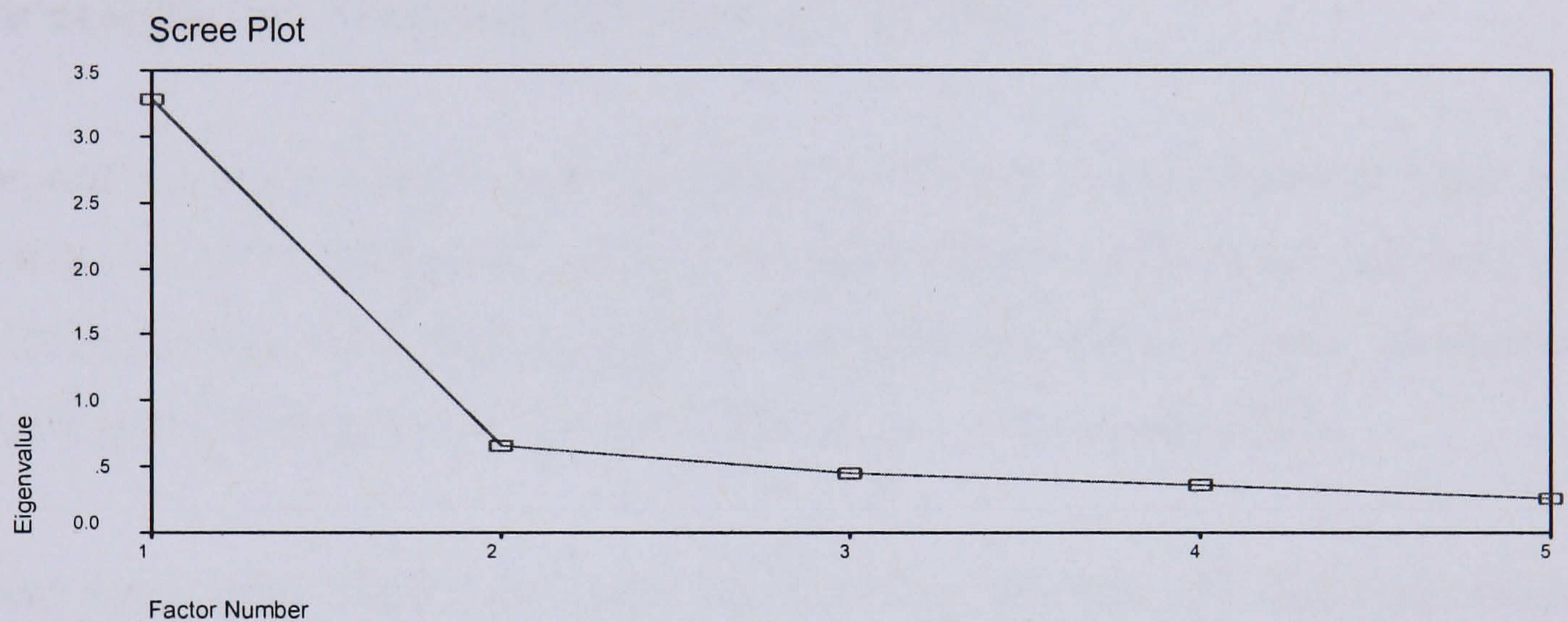


Table 6.9 shows the factor loading for each item on the extracted factors in the one factor model and the two factor model. The result of the factor analysis was examined in terms of theory: from this perspective, the two factor model was clearer than the one factor model. Theoretically, these factors could be divided into tangible resources and intangible resources. Tangible resources include I1 (financial resources) and I2 (human resources). Intangible resources include I4 (environmental awareness and support for environmental activities of CEO) and I5 (environmental awareness of employees). These results were satisfactory for further analysis. Hence, the two factor model was adopted for further analysis. However, the factor loading values of items I3 was distributed evenly on factor 1 and factor 2. These results indicated that the items I3 (Information for environmental activities) was correlated with both factor 1 and factor 2.

Two constructs were created by summing the questionnaire items. The Cronbach' alpha values for tangible resources and intangible resources were 0.8366 and 0.7659 respectively.

Table 6.9. Comparison of factor matrix on internal resources

Items	One Factor Model	Two Factor Model	
	Factor 1	Factor 1	Factor2
I 1	.753	.389	.679
I 2	.804	.349	.856
I 3	.725	.538	.501
I 4	.762	.733	.356
I 5	.694	.709	.291

*Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

Factor analysis with items on environmental regulation

Factor analysis was run on the items to assess the impacts of environmental regulation. The value of KMO's measure of sampling adequacy (MSA value=0.694) was relatively low. However, this value was regarded as acceptable for factor analysis. In addition, Bartlett's test (Chi-Square=541.936, $p=0.000$) results were also acceptable.

All four items were entered into factor analysis. The principal axis factoring analysis with varimax rotation produced only one factor meeting eigenvalue criteria, as shown in Table 6.10. However, like the results of factor analysis on internal resources, the scree test indicated two factors, as shown in Figure 6.4. The factor analysis was run again to extract one more factor. However, the SPSS program could not produce the two factor model for the communality of a variable exceeding 1.0. Hence, the one factor model was adopted for further analysis.

This factor was named as environmental regulation and consisted of four items: R1(existing environmental regulation from government in Korea), R2(anticipated environmental regulation from government in Korea), R3(existing environmental regulation from foreign governments), and R4(anticipated environmental regulation from foreign governments).

Table 6.10. Total variance explained on environmental regulation

Factor	Initial Eigenvalues		Cumulative %
	Total	% of Variance	
1	3.050	76.248	76.248
2	.582	14.548	90.797
3	.266	6.643	97.440
4	.102	2.560	100.000

Figure 6.4. Scree test on environmental regulation

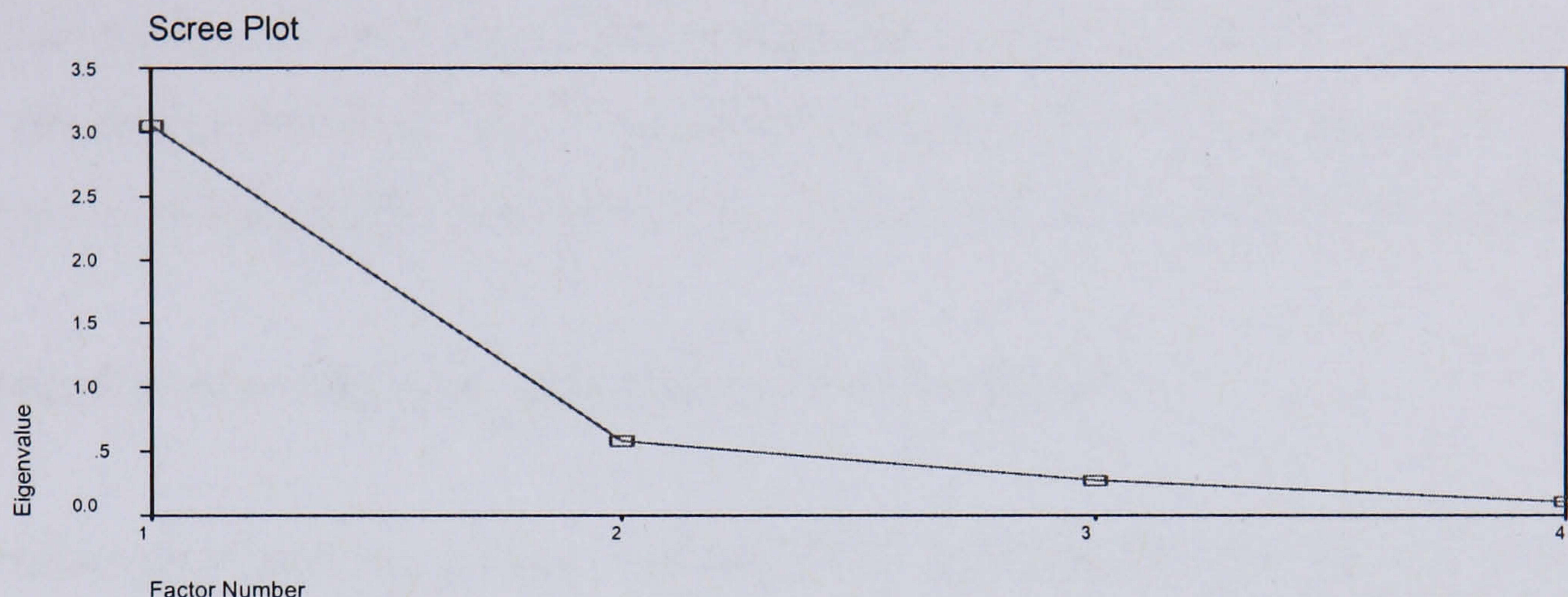


Table 6.11 shows the pattern matrix with factor loading for each item on extracted factor. All items having factor loading values greater than 0.5 were considered practically significant. The Cronbach's alpha value for this construct was 0.8950.

Table 6.11. Rotated Factor Matrix on environmental regulation

Items	Factor 1
R 1	.695
R 2	.841
R 3	.904
R 4	.865

*Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

6.3. The impacts of corporate customers' ESCM approaches on the environmental activities of SMEs

The results of the multiple regression analysis in order to investigate the relations between ESCM approaches and the environmental activities of SMEs were presented here. In addition, the results of the multiple regression analysis with regard to the reduced data set designed to identify the impacts of foreign corporate customers' ESCM approaches on the environmental activities of SMEs in Korea were reported.

6.3.1. Data analysis procedure

Defining independent and dependent variables

The main purpose of the multiple regression analysis was to examine the impacts of ESCM approaches on the environmental activities of SMEs. Hence, the regression model of this study consisted of two independent variables (ESCM approaches) and three dependent variables (environmental activities), which were produced through factor analysis. This analysis considered environmental regulation a control variable.

Examination of multiple regression analysis assumptions

In conducting regression analysis, assumptions regarding the data should be met in order to produce valid statistical results. Multiple regression analysis required a number of basic assumptions: normality, linearity, and the absence of multicollinearity and homoscedasticity (De Vaus, 2002; Hair et al., 1998). These assumptions were examined before and after the regression analysis.

Examination of the relative strengths of the impacts of ESCM approaches on the environmental activities of SMEs

Two methods can be applied to compare the relative importance of the independent variables on the dependent variables. The first is to examine standardized coefficient betas. The examination of this value makes it possible to estimate relative explanatory importance of each independent variable, controlling other variables in the regression equation by assessing the values of standardized coefficient betas in one model. The other method is to examine increased R^2 values through hierarchical regression. The increased R^2 value indicates the predictive power of the added independent variable compared with a model without the added variable when each additional independent variable is added in regression model. The magnitude of the increased R^2 value shows its additional explanatory importance. The common variance of added variable with other independent variables entered in earlier steps is already absorbed by these

variables (Cohen and Cohen, 1975). The relative strengths of ESCM approaches on environmental activities were examined using these two methods.

Examination of the impacts of foreign corporate customers' ESCM approaches on the environmental activities of SMEs in Korea

In order to identify the impacts of foreign companies' ESCM approaches, SMEs exposed to these approaches were extracted. The regression analysis was conducted on this reduced data set.

However, this technique could have raised some problems. SMEs might have been conducting business relations with one or more corporate customers, and could have been engaged in trade with both Korean companies and foreign companies. Thus, they would have been exposed to the ESCM approaches of both Korean companies and foreign companies. The problem was to clearly distinguish between ESCM approaches on the basis of nationality of the corporate customer. Although this was difficult, satisfactory estimates could be made by ascertaining the nationality of an SME supplier's 'main' corporate customers.

Another problem occurred in examining trans-national impacts. Many SMEs were suppliers to large Korean companies (e.g. Samsung, LG, Daewoo). However, these large companies had business relations with foreign companies as suppliers; in addition, they might be prompted to manage their suppliers in response to the demands of foreign companies. In these cases, the foreign corporate customers could impact on Korean SMEs indirectly. This issue was not investigated in the quantitative study because it was too difficult to clarify the details of such diverse business relations through the questionnaire items. This issue was therefore investigated through additional qualitative research.

6.3.2. Examination of multiple regression analysis assumptions

Normality

Assumption of normality comprises univariate and multivariate normality (De Vaus, 2002). Univariate normality can be statistically tested by the skewness and kurtosis statistics of each variable (De Vaus, 2002). As shown in the descriptive statistics (See Appendix 5: Descriptive statistics of questionnaire survey: Pearson's correlation between variables), all independent and dependent variables had skewness and kurtosis values that were smaller than +1.00 and greater than -1.00.

Multivariate normality can be checked by visual inspection of the patterns of standardized predicted values plotted against standardized residual values. If the distribution shows no pattern, the collected data are considered to meet multivariate normality assumption (De Vaus, 2002). The residual plot in this study presented no severe nonnormal distribution pattern (See Appendix 6: Examples of residual plots). These results indicated that all independent and dependent variables met the assumption of normality.

Linearity and homoscedasticity

Residual plots can also be used to examine linearity and homoscedasticity. Linearity refers to straight relationships between independent variables and dependent variables (De Vaus, 2002). Homoscedasticity refers to constant variance across all independent variables (De Vaus, 2002). In order to test linearity and homoscedasticity, the patterns of the actual standardized residual values against the predicted residual values of the dependent variables can be examined (De Vaus, 2002). In this study, no severe violations of linearity and homoscedasticity were detected in graphical examination (See Appendix 6: Examples of residual plots). These results indicated that the relationships between all independent and dependent variables met the assumptions of linearity and homoscedasticity.

The absence of multicollinearity

The individual variables should not be highly correlated for regression analysis. When the independent variables have multicollinearity problems, the results of regression analysis can be unreliable and unstable (De Vaus, 2002). To assess multicollinearity problems, two diagnoses (tolerance value, and variance inflation factor; VIF) are often used. The VIF value is simply the reciprocal of tolerance. As a general rule of thumb, if the VIF values of the independent variables in the regression model are less than 5, it is considered that there are no serious multicollinearity problems (De Vaus, 2002). In this study, multicollinearity was examined in each regression analysis. All VIF values were lower than 5. These results indicated that there were no serious multicollinearity problems in conducting the regression analysis.

6.3.3. The impacts of ESCM approaches on SMEs' environmental activities

Multiple regression analysis was applied to investigate the relations between ESCM approaches and the environmental activities of SMEs. The relative strength of each ESCM approach was examined with increased R^2 and standardized coefficients beta weights. The results are reported in this section

The impacts of the arm's-length approach on SMEs' environmental activities

The results of the hierarchical multiple regression analysis (HMRA) with arm's-length approach as an independent variable and environmental regulation as a control variable are reported in Table 6.12.

Regarding planning and organizational activities, the inclusion of the arm's-length approach contributed to a statistically significant increase of variance explained in these activities (R^2 change=0.142, F change=35.648, $p=0.000$). An inspection of the standardized regression coefficient in this step also showed that the arm's-length approach had a significant effect on these activities ($\beta=0.428$, $p=0.000$). These results

showed that the arm's-length approach motivated the planning and organizational activities of SMEs.

In addition, the inclusion of the arm's-length approach contributed to a statistically significant increase of variance explained in product and logistics activities (R^2 change=0.119, F change=25.848, $p=0.000$). The standardized regression coefficient of the arm's-length approach also supported the results ($\beta=0.392$, $p=0.000$). These results indicated that the arm's-length approach impacted on the product and logistics activities of SMEs.

Also, the results revealed that the arm's-length approach contributed to a statistically significant increase of variance explained in internal production process activities (R^2 change=0.059, F change=12.701, $p=0.000$). The standardized regression coefficient also showed the positive impacts of the arm's-length approach on these activities ($\beta=0.276$, $p=0.000$). These results indicated that the arm's-length approach could motivate the internal production process activities of SMEs.

The impacts of the collaborative approach on SMEs' environmental activities

As shown in Table 6.12, the inclusion of the collaborative approach contributed to a statistically significant increase of variance explained in planning and organizational activities. The value of R^2 increased by 0.229 (F change=65.681, $p=0.000$). In addition, examination of the standardized regression coefficient indicated the statistically significant positive impacts ($\beta = 0.503$, $p= 0.000$). These results indicated that the collaborative approach motivated the planning and organizational activities of SMEs.

Regarding product and logistics activities, the results revealed that the inclusion of the collaborative approach contributed to a statistically significant increase of variance explained in these activities. The value of R^2 increased by 0.169 (F change=39.035, $p=0.000$). In addition, the standardized regression coefficient also supported the statistically significant positive impacts ($\beta=0.432$, $p=0.000$). These results indicated that the collaborative approach had impacts on the product and logistics activities of SMEs.

Further, as shown in this table, the inclusion of the collaborative approach contributed to a statistically significant increase of variance explained in the internal production process activities (R^2 change=0.089, F change=19.955, $p=0.000$). The standardized regression coefficient of the collaborative approach also supported the results ($\beta=0.314$, $p=0.000$). This result showed that the collaborative approach motivated the product and logistics activities of SMEs.

Comparison of the impacts of collaborative approach and arm's-length approach on SMEs' environmental activities

Thus far, all results including both ESCM approaches (arm's-length and collaborative approaches) showed statistically significant relations with environmental activities. These results indicated that the ESCM approaches had positive impacts on SMEs' environmental activities. In this section, the strength of the impacts of each ESCM approach on SMEs' environmental activities is compared with increased R^2 and standardized coefficients beta weights.

Comparison of ESCM approach with increased R^2

The relationships between each ESCM approach and environmental activities were examined, and the increased R^2 values were calculated. The increased R^2 values showed consistent patterns. Although all ESCM approaches contributed to a statistically significant increase of variance explained in environmental activities, the increased R^2 values of the collaborative approach (0.375, 0.226, and 0.220) were larger than those of the arm's-length approach (0.228, 0.176, and 0.170). These results indicated that the collaborative approach had a stronger effect than the arm's-length approach on the environmental activities of SMEs.

Table 6.12. HMRA results with arm's-length approach/collaborative approach on environmental activities

		Step 1		Step 2	
Planning and organizational activities	Environmental regulation	0.382	***	0.179	**
	Arm's-length approach			0.428	***
	F for the step	30.788	***	35.648	***
	F for the regression	30.788	***	36.175	***
	R ²	0.146		0.288	
	Environmental regulation	0.382	***	0.228	***
	Collaborative approach			0.503	***
	F for the step	30.778	***	65.681	***
	F for the regression	30.778	***	53.759	***
	R ²	0.146		0.375	
	Environmental regulation	0.382	***	0.203	***
	Arm's-length approach			0.089	-
Collaborative approach			0.445	***	
F for the step	30.778	***	33.264	***	
F for the regression	30.778	***	36.113	***	
R ²	0.146		0.378		
Product and logistics activities	Environmental regulation	0.239	***	0.053	-
	Arm's-length approach			0.392	***
	F for the step	10.899	***	25.843	***
	F for the regression	10.899	***	19.123	***
	R ²	0.057		0.176	
	Environmental regulation	0.239	***	0.106	-
	Collaborative approach			0.432	***
	F for the step	10.899	***	39.035	***
	F for the regression	10.899	***	26.118	***
	R ²	0.057		0.226	
	Environmental regulation	0.239	***	0.072	***
	Arm's-length approach			0.125	-
Collaborative approach			0.350	***	
F for the step	10.899	***	20.275	***	
F for the regression	10.899	***	17.928	***	
R ²	0.057		0.232		
Internal production process activities	Environmental regulation	0.333	***	0.202	**
	Arm's-length approach			0.276	***
	F for the step	22.390	***	12.701	***
	F for the regression	22.390	***	18.273	***
	R ²	0.111		0.170	
	Environmental regulation	0.333	***	0.236	***
	Collaborative approach			0.314	***
	F for the step	22.390	***	19.955	***
	F for the regression	22.390	***	25.352	***
	R ²	0.111		0.200	
	Environmental regulation	0.333	***	0.216	***
	Arm's-length approach			0.073	-
Collaborative approach			0.266	***	
F for the step	22.390	***	10.181	***	
F for the regression	22.390	***	15.012	***	
R ²	0.111		0.202		

Main table contains standardized coefficient betas. (p < 0.1, ** p < 0.05, ***p < 0.01)

*VIF values range from 1.104 to 2.559

Comparison of ESCM approaches with standardized regression coefficient

To examine the standardized coefficients beta weights, all ESCM approach variables were entered simultaneously into one model. Before this step, environmental regulation was entered as a control variable. The standardized coefficients beta weights of the collaborative approach (0.445, 0.350, and 0.266) were larger than those of the arm's-length approach (0.089, 0.125, and 0.073). These results clearly indicated that the collaborative approach had stronger effect than the arm's-length approach on the environmental activities of SMEs.

6.3.4. Trans-national impact of ESCM approaches on SMEs' environmental activities

In order to assess the impacts of foreign companies' ESCM approaches on the environmental activities of SMEs, SMEs exposed to these approaches were extracted. The regression analysis was conducted in this reduced data set.

Data extraction based on the nationality of main corporate customers

All data was divided according to the nationality of main corporate customers. Table 6.13 summarizes the distribution of the nationalities of corporate customers adopting ESCM approaches to their suppliers

Table 6.13. Nationality of main corporate customers of SMEs in Korea

No answer	Group1	Group2				Subtotal	Total
	A Korean firm	A foreign firm operating in Korea	An American (USA) firm	A European firm	An Asian (e.g. Japanese) firm		
14	127	8	8	12	13	41	182
(7.7%)	(69.8%)	(4.4%)	(4.4%)	(6.6%)	(7.1%)	(22.5%)	(100.0%)

* The questionnaire question was '(Nationality) How would you describe the main customer adopting these approaches for your company? (Please check only one)'

As shown in this table, one hundred and twenty-seven SMEs had conducted their main business relations with Korean corporate customers (69.8%), while forty-one SMEs had conducted their main relations with foreign corporate customers (22.5%). Fourteen SMEs (7.7%) did not answer this question. It can be regarded as missing data. This missing data may have been due to a lack of information about the corporate customer, or a reluctance to provide possibly sensitive information.

In the data, it can be considered that the first group comprised SMEs which were exposed to the ESCM approaches of Korean companies (e.g. Samsung, LG), and the second group comprised SMEs which were exposed to the ESCM approaches of foreign companies (e.g. Nokia, Sony). To identify the impacts of the ESCM approaches of foreign corporate customers on the environmental activities of SMEs in Korea, the second group was selected.

The impacts of the ESCM approaches of foreign corporate customers on Korean SMEs' environmental activities

The extracted data set consisted of forty-one cases. This data was analysed by hierarchical multiple regression, using the arm's-length approach and the collaborative approach as independent variables, and regulation as a control variable. The results of the hierarchical multiple regression analysis (HMRA) regarding the environmental activities of SMEs are reported in Table 6.14.

Regarding planning and organizational activities, the effects of the arm's-length approach were significant (R^2 change=0.238, F change=16.298, $p=0.000$), and the collaborative approach also significantly increased the R^2 value (R^2 change=0.515, F change=70.539, $p=0.000$). However, the increased R^2 value of the collaborative approach was greater than that of the arm's-length approach ($0.515 > 0.238$). In addition, when the two ESCM approaches were added simultaneously, the standardized coefficient of the collaborative approach was greater than that of the arm's-length approach ($0.684 > 0.089$).

Table 6.14. HMRA results with arm's-length approach/collaborative approach of foreign corporate customers on environmental activities

		Step 1		Step 2	
Planning and organizational activities	Environmental regulation	0.456	***	0.245	*
	Arm's-length approach			0.531	***
	F for the step	10.262	***	16.298	***
	F for the regression	10.262	***	15.293	***
	R ²	0.208		0.446	
	Environmental regulation	0.456	***	0.297	***
	Collaborative approach			0.735	***
	F for the step	10.262	***	70.539	***
	F for the regression	10.262	***	49.549	***
	R ²	0.208		0.723	
	Environmental regulation	0.456	***	0.273	***
	Arm's-length approach			0.089	-
Collaborative approach			0.684	***	
F for the step	10.262	***	35.152	***	
F for the regression	10.262	***	32.846	***	
R ²	0.208		0.727		
Product and logistics activities	Environmental regulation	0.209	-	0.019	-
	Arm's-length approach			0.479	***
	F for the step	1.786	-	9.623	***
	F for the regression	1.786	-	5.902	***
	R ²	0.044		0.237	
	Environmental regulation	0.209	-	0.083	-
	Collaborative approach			0.561	***
	F for the step	1.786	-	19.275	***
	F for the regression	1.786	-	10.949	***
	R ²	0.044		0.366	
	Environmental regulation	0.209	-	0.038	-
	Arm's-length approach			0.164	-
Collaborative approach			0.488	***	
F for the step	1.786	-	10.023	***	
F for the regression	1.786	-	7.553	***	
R ²	0.044		0.380		
Internal production process activities	Environmental regulation	0.200	-	0.019	-
	Arm's-length approach			0.457	***
	F for the step	1.630	-	8.517	***
	F for the regression	1.630	-	5.230	**
	R ²	0.040		0.216	
	Environmental regulation	0.200	-	0.084	-
	Collaborative approach			0.535	***
	F for the step	1.630	-	15.063	***
	F for the regression	1.630	-	8.640	***
	R ²	0.040		0.313	
	Environmental regulation	0.200	-	0.036	-
	Arm's-length approach			0.176	-
Collaborative approach			0.434	***	
F for the step	1.630	-	7.967	***	
F for the regression	1.630	-	6.049	***	
R ²	0.040		0.329		

Main table contains standardized coefficient betas. (p < 0.1, ** p < 0.05, ***p < 0.01)

*VIF values range from 1.049 to 1.884

Regarding product and logistics activities, the addition of the arm's-length approach significantly increased the R^2 value (R^2 change=0.193, F change=9.623, $p=0.004$), and the collaborative approach also significantly increased the R^2 value (R^2 change=0.322, F change=19.275, $p=0.000$). The increased R^2 value of the collaborative approach was greater than that of the arm's length approach ($19.275 > 0.561$), and the standardized coefficient of the collaborative approach was also greater than that of the arm's-length approach ($0.488 > 0.164$).

The results of the hierarchical multiple regression analysis on internal production process activities were similar to those with respect to the other activities. The arm's-length approach significantly increased the R^2 value of internal production process activities (R^2 change=0.170, F change=8.517, $p=0.006$). Further, the collaborative approach also showed significant effects (R^2 change=0.272, F change=15.063, $p=0.000$). The increased R^2 value ($0.313 > 0.216$) and the standardized coefficient ($0.434 > 0.176$) of the collaborative approach were greater than those of the arm's-length approach.

6.4. The impacts of ESCM approaches, in conjunction with internal resources, on SMEs' environmental activities

Thus far, the results showed that both types of ESCM approaches had direct impacts on all kinds of environmental activities of SMEs, although the collaborative approach had stronger impacts than the arm's-length approach. Further analysis was conducted to examine whether internal resources moderated the impacts of ESCM approaches on the environmental activities of SMEs.

6.4.1. Data analysis procedure

Hierarchical moderated multiple regression analysis was adopted to examine the moderating effects of internal resources on the relations between ESCM approaches and environmental activities. The details of the procedure are described here.

Hierarchical moderated multiple regression analysis (HMMRA) procedure

The general purpose of standard multiple regression analysis is to examine the relationship between several independent variables and a dependent variable. In hierarchical multiple regression analysis (HMRA), unlike the standard regression model, in which independent variables are entered simultaneously, the independent variables are entered step by step according to the purpose and logic of the research (Aiken and West, 1991; Cohen and Cohen, 1975). This hierarchical multiple regression analysis is often conducted to examine the interaction effects between independent variables and moderator variables (Cohen and Cohen, 1975; Jaccard et al., 1990; Jaccard and Turrisi, 2003). In order to test the existence of interaction effects, the interaction terms, which are computed by multiplying the independent variables and the moderator variables, are entered at the last step (Cohen and Cohen, 1975; Jaccard et al., 1990; Jaccard and Turrisi, 2003).

Following this procedure, the analysis in this study was conducted in steps. First, the environmental regulation variable was entered into the regression as a control variable. Second, each ESCM approach variable (arm's-length approach or collaborative approach) was entered into the regression. Third, the internal resources variables (tangible resources and intangible resources) were entered into the regression as a block. Finally, the interaction terms of the internal resources and ESCM approaches (arm's-length approach \times tangible resources and arm's-length approach \times intangible resources, collaborative approach \times tangible resources and collaborative approach \times intangible resources) were entered as a block.

In order to assess the significance of interaction effects, a significance test of the increased R^2 value in the step entering interaction terms and coefficient of individual interaction term can be conducted (Jaccard et al., 1990; Jaccard and Turrisi, 2003). The statistical significance of the increased R^2 value indicates the presence of the impacts of added independent variables including the interaction terms on dependent variables, based on the difference between the equation including and excluding independent

variables (Jaccard et al., 1990; Jaccard and Turrisi, 2003). In addition, the significant coefficient of the individual interaction term shows that the moderator variable alters the relationship between independent variable and dependent variable (Jaccard et al., 1990; Jaccard and Turrisi, 2003).

Elimination of multicollinearity problems

The multiplied interaction terms are highly correlated with the corresponding independent variables. Multicollinearity creates problems assessing the relative importance of main effects and interaction effects. To eliminate multicollinearity of multiplied variables, the independent variables are often 'centred' by subtracting the mean score from each case (Jaccard et al., 1990; Jaccard and Turrisi, 2003). This procedure, although it has no impact on the slope of the interaction terms, minimizes problems associated with independent variables' multicollinearity and eases interpretation of the non-product terms in the final regression model (Jaccard et al., 1990; Jaccard and Turrisi, 2003).

6.4.2. Interaction effects between arm's-length approach and internal resource

This section presents the hierarchical moderated multiple regression analysis (HMMRA) results with the interaction terms between the arm's-length approach and internal resources (tangible and intangible). Table 6.15 summarizes the results.

Regarding planning and organizational activities, the arm's-length approach's main effects were significant (R^2 change=0.142, F change=35.648, $p=0.000$). The addition of both tangible resources and intangible resources significantly increased the R^2 value (R^2 change=0.164, F change=26.544, $p=0.000$). However, the interaction terms did not increase the significant amount of variance explained in planning and organizational activities (R^2 change=0.013, F change=2.131, $p=0.122$). An inspection of the standardized coefficient revealed that the interaction between the arm's-length approach and intangible resources was not significant ($\beta=-0.014$, $p=0.853$). On the other hand, the interaction coefficient between the arm's-length approach and tangible resources had a

significant effect on planning and organizational activities ($\beta = 0.126, p = 0.099$). These results indicated that the direct effects of the arm's-length approach on planning and organizational activities were dependent on the condition of the tangible resources.

Regarding the interaction effects of arm's-length approach and internal resources on product and logistics activities, the arm's-length approach's main effect was significant (R^2 change=0.119, F change=25.843, $p=0.000$). In addition, the tangible resources and intangible resources significantly increased the R^2 value (R^2 change=0.106, F change=13.046, $p=0.000$). However, the two interaction terms showed no significant incremental explanation of variance (R^2 change=0.008, F change=0.383, $p=0.682$). As for the standardized coefficients, the interaction between the arm's-length approach and tangible resources was not significant ($\beta = 0.077, p = 0.383$), and the interaction between the arm's-length approach and intangible resource had no significant effect ($\beta=-0.051, p=0.553$). The results showed no significant interaction effects between the arm's-length approach and internal resource on product and logistics activities.

The arm's-length approach's main effect on internal production process activities was highly significant (R^2 change=0.059, F change=12.701, $p=0.000$). Further, the tangible resources and intangible resources significantly increased the R^2 value (R^2 change=0.151, F change=19.701, $p=0.000$). However, the two interaction terms also showed no significant incremental explanation of variance (R^2 change=0.010, F change=1.292, $p=0.277$). The standardized coefficients showed similar results. The interaction between the arm's-length approach and tangible resources was not significant ($\beta=0.137, p=0.110$). Further, the arm's-length approach and intangible resources had no significant effect on internal production process activities ($\beta = -0.094, p = 0.264$). The results showed no significant interaction effects between the arm's-length approach and internal resources with respect to internal production process activities.

Table 6.15. HMMRA results with arm's-length approach/internal resource interaction on environmental activities

		Step 1		Step 2		Step 3		Step 4	
Planning and organizational activities	Environmental regulation	0.382	***	0.179	*	0.163	*	0.172	**
	Arm's-length approach			0.428	**	0.221	**	0.246	**
	Tangible resources					0.187	*	0.170	*
	Intangible resources					0.319	**	0.325	**
	Arm's-length approach × Tangible resources							0.126	*
	Arm's-length approach × Intangible resources							-0.014	-
	F for the step	30.778	***	35.648	**	26.544	**	2.131	-
	F for the regression	30.778	***	36.175	**	36.522	**	25.370	**
R ²	0.146		0.288		0.452		0.465		
Product and logistics activities	Environmental regulation	0.239	***	0.053	-	0.041	-	0.044	-
	Arm's-length approach			0.392	**	0.235	**	0.250	**
	Tangible resources					0.072	-	0.062	-
	Intangible resources					0.315	**	0.314	**
	Arm's-length approach × Tangible resources							0.077	-
	Arm's-length approach × Intangible resources							-0.051	-
	F for the step	10.899	***	25.843	**	13.046	**	0.383	-
	F for the regression	10.899	***	19.123	**	17.371	**	11.628	**
R ²	0.057		0.176		0.282		0.285		
Internal production process activities	Environmental regulation	0.333	***	0.202	*	0.186	**	0.193	**
	Arm's-length approach			0.276	**	0.082	-	0.109	-
	Tangible resources					0.133	-	0.115	-
	Intangible resources					0.343	**	0.340	**
	Arm's-length approach × Tangible resources							0.137	-
	Arm's-length approach × Intangible resources							-0.094	-
	F for the step	22.390	***	12.701	**	19.701	**	1.292	-
	F for the regression	22.390	***	18.273	**	20.896	**	14.407	**
R ²	0.111		0.170		0.320		0.331		

Main table contains standardized coefficient betas. (p < 0.1, ** p < 0.05, ***p < 0.01)

*VIF values range from 1.298 to 1.896

6.4.3. Interaction effects between collaborative approach and internal resources

The interaction effects on environmental activities between the collaborative approach and internal resources (tangible and intangible) were also examined by means of hierarchical moderated multiple regression analysis (HMMRA). Table 6.16 showed the interaction effects between the collaborative approach and internal resources on three kinds of environmental activities

As shown in this table, the collaborative approach's main effect on planning and organizational activities was significant (R^2 change=0.229, F change=65.681, $p=0.000$). In addition, tangible and intangible resources significantly increased the R^2 value (R^2 change=0.138, F change=24.976, $p=0.000$). However, the two interaction terms also showed no significant incremental explanation of variance (R^2 change=0.001, F change=0.214, $p=0.808$). The standardized coefficients supported the results of increased R^2 values. The interaction between the collaborative approach and tangible resources was not significant ($\beta=0.028$, $p=0.689$). In addition, the interaction between the collaborative approach and intangible resources had no significant effect ($\beta=0.011$, $p=0.877$). The results showed no significant interaction effects between the collaborative approach and internal resources on planning and organizational activities.

In addition, the collaborative approach's main effect on product and logistics activities was significant (R^2 change=0.169, F change=39.035, $p=0.000$). Tangible and intangible resources had a significant impact (R^2 change=0.095, F change=12.421, $p=0.000$). The two interaction terms significantly increased the R^2 value (R^2 change=0.020, F change=2.664, $p=0.072$). The standardized coefficients also showed similar results. The interaction between the collaborative approach and intangible resources had no significant effect ($\beta=-0.092$, $p=0.249$). However, the interaction between the collaborative approach and tangible resources was significant ($\beta=0.183$, $p=0.024$). These results indicated that the impact of collaborative approach on product and logistics activities was dependent on the condition of tangible resource.

Table 6.16. HMMRA results with collaborative approach/internal resource interaction on environmental activities

		Step 1		Step 2		Step 3		Step 4	
Planning and organizational activities	Environmental regulation	0.382	***	0.228	***	0.174	***	0.179	***
	Collaborative approach			0.503	***	0.346	***	0.346	***
	Tangible resources					0.147	**	0.143	*
	Intangible resources					0.305	***	0.309	***
	Collaborative approach × Tangible resources							0.028	-
	Collaborative approach × Intangible resources							0.011	-
	F for the step	30.778	***	65.681	***	24.976	***	0.214	-
	F for the regression	30.778	***	53.759	***	46.569	***	30.842	***
R ²	0.146		0.375		0.513		0.514		
Product and logistics activities	Environmental regulation	0.239	***	0.106	-	0.064	-	0.083	-
	Collaborative approach			0.432	***	0.312	***	0.335	***
	Tangible resources					0.044	-	0.010	*
	Intangible resources					0.309	***	0.322	***
	Collaborative approach × Tangible resources							0.183	*
	Collaborative approach × Intangible resources							-0.092	-
	F for the step	10.899	***	39.035	***	12.421	***	2.664	*
	F for the regression	10.899	***	26.118	***	20.936	***	15.108	***
R ²	0.057		0.226		0.321		0.341		
Internal production process activities	Environmental regulation	0.333	***	0.236	***	0.183	***	0.193	***
	Collaborative approach			0.314	***	0.161	*	0.186	*
	Tangible resources					0.110	-	0.081	-
	Intangible resources					0.332	***	0.339	***
	Collaborative approach × Tangible resources							0.143	*
	Collaborative approach × Intangible resources							-0.119	-
	F for the step	22.390	***	19.955	***	18.230	***	1.746	-
	F for the regression	22.390	***	22.352	***	22.442	***	15.669	***
R ²	0.111		0.200		0.337		0.349		

Main table contains standardized coefficient betas. (p < 0.1, ** p < 0.05, ***p < 0.01)

*VIF values range from 1.152 to 1.794

The collaborative approach's main effect on internal production process activities was significant (R^2 change=0.089, F change=19.955, $p=0.000$). In addition, tangible and intangible resources had also a significant impact (R^2 change=0.137, F change=18.230, $p=0.000$). The two interaction terms did not significantly increase the R^2 value (R^2 change=0.013, F change=1.746, $p=0.178$). The interaction between the collaborative approach and intangible resources had no significant effect ($\beta=-0.119$, $p=0.134$). However, the interaction between the collaborative approach and tangible resources was significant ($\beta=0.143$, $p=0.073$). These results indicated that the impact of the collaborative approach on internal production process activities was dependent on the condition of tangible resources.

6.5. Conclusion

This chapter has presented the procedure and results of the quantitative analysis for achieving the objective of this study and answer the research questions

The data set of questionnaire survey was two hundred and eight-two responses with the response rate of 18.2%. Before conducting quantitative analysis, the response rate of the questionnaire survey and the results of non-response bias check were discussed. These results indicated that no severe bias was identified in the collected data.

Factor analysis was conducted to identify the underlying structure of the data set and reduce the number of variables. This analysis was applied to the questionnaire items of ESCM approaches, environmental activities, environmental regulation and internal resources. The factor analysis produced two different factors of ESCM approaches (arm's-length approach and collaborative approach), three different factors of environmental activities (planning and organizational activities, product and logistics activities, and internal production process activities), and two factors of internal resources (tangible resources and intangible resources).

The impacts of ESCM approaches on the environmental activities of SMEs are assessed by means of the regression analysis. Before conducting this analysis, several assumptions were examined and no severe violations were detected. The results of regression analysis indicated that generally ESCM approaches had positive impacts on SMEs' environmental activities. In addition, both the arm's-length approach and the collaborative approach had significant positive impacts on SMEs' environmental activities. However, the strengths of the impacts of each ESCM approach on environmental activities of SMEs were different. Two (adjusted R^2 values and standardized coefficients beta weights) showed similarly that the collaborative approach was more effective than the arm's-length approach.

Furthermore, in order to examine the trans-national impacts of ESCM approaches on the environmental activities of SMEs in Korea, SMEs exposed to the ESCM approaches of foreign companies were extracted from data set, and regression analysis was conducted on this reduced data set. The results indicated that both ESCM approaches had positive impacts on the environmental activities of SMEs. These results showed that the ESCM approaches of foreign corporate customers as well as of Korean corporate customers had positive impacts on SMEs' environmental activities in the Korean electronics industry and the collaborative approach had stronger impacts than the arm's-length approach. This analysis in the reduced data set validated the analysis results in full data set as well as showed the trans-national impacts of ESCM approaches

The interaction effects between ESCM approaches and internal resources were examined by hierarchical moderated multiple regression analysis (HMMRA). Regarding tangible resources, the significant interaction effect between the arm's-length approach and tangible resources was detected on planning and organizational activities. Moreover, the interaction effects between the collaborative approach and tangible resources on product and logistics activities, and internal production process activities were significant. However, the other moderating effects between ESCM approaches and internal resources on the environmental activities of SMEs were not significant. For example, the moderating effect between the collaborative approach and tangible resources on planning and organizational activities was not significant.

In contrast, regarding the role of intangible resources in SMEs' environmental activities, these resources significantly impacts on each environmental activity. However, significant moderating effect with the arm's-length approach and the collaborative approach were not identified.

The quantitative analysis showed the relationships between large corporate customers' ESCM approaches and environmental activities of SMEs in conjunction with internal resources of SMEs, and presented the relative strength of the impacts of each ESCM approaches. However, this quantitative analysis did not show the reasons and factors in these relationships. The reasons and factors are investigated by means of qualitative analysis in chapter 7.

Chapter 7. Dynamics between ESCM approaches and SMEs'

Environmental Activities: Qualitative analysis results

The aims of the qualitative study were to validate the quantitative results and to illustrate and explore 'how' and 'why' questions related to the quantitative evidence provided in chapter 6. Thus, the evidence provided by the qualitative study yielded deeper insights into the quantitative evidence and revealed embedded intrinsic factors that helped to explain the quantitative results.

First, the impacts of corporate customers on the environmental activities of SMEs are compared with those of governments' environmental regulations. Second, the influential factors for the decision of customers' ESCM approaches (collaborative approach and arm's-length approach) are investigated from the perspective of corporate customers, and these impacts on the environmental activities of SMEs were compared from the perspective of suppliers. Third, the roles of SMEs' internal resources (tangible and intangible) with regard to SMEs' environmental activities are investigated.

7.1. Impacts of corporate customers and government on SMEs' environmental activities

Before analyzing the interview data, all interviewees confirmed that ESCM approaches, regarding the environmental pressures from customers, were mainly adopted by large companies not by SMEs, which did not have the capability to manage environmental performance in their supply chain. For example, a project manager commented:

I have never seen SMEs manage suppliers' environmental performance. ESCM is not an easy tool. Only a few large companies in the Korean electronics industry are currently applying it. SMEs are just following the instructions of their large corporate customers. (Project manager 2, 23 August 05)

In addition, among lots of influential factors to introduce environmental activities of SMEs, the other influential factors excluding government and large customer companies were given small considerations by the interviewees. For examples,

Regional communities and NGOs have had no impact on our company's adopting environmental programmes because our company has not produced any air or water pollution. (SME manager 1, 2 May 04)

Most SMEs operate small factories. When the factories are not large, they tend not easily be scrutinized by regional communities and NGOs. Regional communities and NGOs do not monitor the environmental activities of small factories, and their primary targets are usually large factories. (Consultant 4, 28 August 05)

As shown above, among the cited stakeholders, the interviewees regarded government and corporate customers as primary, and local communities and non-governmental organizations as secondary. One SME manager and a consultant said that local communities and NGOs showed little concerns with the environmental activities of SMEs because they were rarely exposed to these stakeholders. Hence, this section focuses on the roles of government and large companies, which were often cited by the interviewees as important motivators of SMEs' environmental activities.

In order to understand the impacts of ESCM approaches of large companies on the environmental activities of SMEs, it is helpful to compare the impacts of corporate customers with those of other influential factors. This section, therefore, compares the impacts of large companies with those of government. SMEs in the Korean electronics industry were often exposed to both the ESCM approaches of large companies and the environmental regulations established by governments. ESCM approaches and environmental regulations are the main mechanisms distributing and focusing the influence of large companies and government.

However, the reasons they gave for undertaking environmental activities in response to environmental regulations and in response to ESCM approaches were different. In addition, the levels of implementation of environmental activities were slightly different. These results are reported in what follows.

7.1.1. The interactive roles of corporate customers and governments

Governments and corporate customers influenced independently environmental activities of SMEs in Korea. In addition, large companies which subject to environmental regulations manage their suppliers' environmental performance in accordance with those regulations. Thus, the environmental regulations and corporate customers interactively influenced the environmental activities of SMEs. The interactive roles of corporate customers and governments were also examined in this section.

The impacts of governments on the environmental activities of SMEs

One interviewee commented that his company managed its toxic waste to meet the criteria suggested by the government:

We separate environmentally hazardous materials from the general waste. These materials are handled with care. We consign these materials to other special outsourcing companies. In addition, to reduce our waste emission, we are gathering information on recycling (SME manager 1, 2 May 04)

Most of the interviewees had similar views on the role of government regarding the environmental activities of SMEs. The Korean government had set specific standards through environmental regulations, and thereby had imposed a minimum level of environmental performance on SMEs.

SMEs in the electronics industry were subject to a number of regulations, which covered areas such as water pollution, air pollution, waste disposal, and the use of

environmentally hazardous materials in the product. These regulations directly controlled the environmental activities of SMEs such as the production process and the disposal of industrial waste products. SMEs had to undertake various environmental activities to ensure that their performance would meet the criteria prescribed by the government.

The impacts of corporate customers on the environmental activities of SMEs

One SME manager evaluated the pressure of corporate customers as the most powerful factors: another said that the environmental demands of corporate customers could prompt SMEs to undertake environmental activities in order to improve environmental performance. For examples,

Our corporate customer's environmental requirement has been the most influential motive for our environmental activities. (SME manager 3, 6 May 04)

Definitely, the customers' requirement is very influential on SMEs. Everyone knows that environmental issues are important in the long term, but addressing environmental issues consumes resources including manpower and money, and this usually hinders SMEs from starting environmental activities. The corporate customers' demands are critical for the decision to implement environmental activities. (SME manager 4, 7 May 04)

Other SME managers shared this view:

We have had to take action on environmentally hazardous materials. Controlling environmentally hazardous materials such as lead and chromium was the most urgent issue in the view of our corporate customers. (SME manager 2, 6 May 04)

We are preparing to get ISO14001 certification this year to meet the corporate customer's demands. To this end, we set up a task force team in April of this year. (SME manager 1, 2 May 04)

According to these interviewees, pressures from their corporate customers were growing stronger and more extensive, inducing SMEs to undertake environmental activities.

Direct and indirect trans-national impacts of corporate customers on SMEs' environmental activities

One SME manager confirmed the importance of foreign corporate customers' expectations, which had had a direct impact on his company's activities:

Regarding ISO14001 certification, we got the certification in 1999 at the demand of a European corporate customer. Later, other customers in the USA and Korea also demand this certification. (SME manager 2, 6 May 04)

In addition, an interviewee commented regarding the indirect impacts:

We have business relations with Samsung and LG Electronics. As you know, these two companies are very large, and they export many of their products to Europe. I have heard that the retail companies in this region require products that do not pose any environmental problems. Maybe Samsung and LG Electronics are taking this requirement into serious consideration. (SME manager 1, 2 May 04)

As shown above, some SMEs wanting to supply their products to foreign corporate customers were required to meet certain environmental criteria such as obtaining ISO 14001 certification, which can be considered as direct transnational impacts. In addition, companies in foreign countries indirectly influenced SMEs in Korea through large Korean companies. Samsung and LG in Korea export many of their products to foreign countries. When presented with environmental requirements by their customers in EU, they had to comply, and therefore they had to manage environmental issues of their suppliers. In this way, foreign companies influenced SMEs in Korea. SMEs in Korea

were confronted with the environmental demands from their foreign corporate customers, and these demands directly influenced SMEs' environmental activities.

The interactive roles of governments and corporate customers with respect to environmental activities of SMEs

Another interviewee provided a typical example of how corporate customers and government can interactively influence the environmental activities of SMEs.

LG had originally planned to eliminate the environmentally hazardous materials by 2005. But the schedule was flexible. When their foreign corporate customers wanted parts containing no environmentally hazardous materials before that date, they were able to comply with this. (Consultant 4, 28 August 05)

Corporate customers require their suppliers to provide materials and parts which did contain no environmentally hazardous components. These kinds of environmental requirements stem from the environmental regulations in Europe. (SME manager 1, 2 May 04)

Large companies in Korea required their suppliers to provide materials and parts containing no environmentally hazardous components in order to comply with environmental regulations in Europe. As shown above, LG Electronics planned to eliminate environmentally hazardous materials from their products so as to comply with environmental regulations such as RoHS and WEEE. Moreover, when LG's corporate customers in foreign countries required that the company's products should conform to these regulations earlier than the date fixed by the regulations, LG was able to comply to comply with this demand.

7.1.2. Comparison of reasons for undertaking environmental activities

The interview data shows that SMEs' reasons for undertaking environmental activities in response to environmental regulations were different from those connected with ESCM approaches. SMEs undertook environmental activities in response to environmental regulations in order to avoid the risks associated with violation of the regulations. By contrast, they undertook environmental activities in response to ESCM approaches because of the financial advantages involved.

The reason SMEs undertake environmental activities in response to environmental regulations: avoidance of risks

A consultant cited an example showing that SMEs recognized the importance of environmental activities because of their past experience of penalties that could be imposed due to violation of environmental regulations:

An SME in the electronics sector experienced a serious environmental accident in 1994. The accident was caused by an unexpected change in the operation process, and the effluent concentration increased to ten times higher than the normal level. Because of that accident, the company had to pay a considerable fine, and was placed under close scrutiny by the government. This pressure forced the company to implement various environmental programmes. This company made it a practice to check effluent concentration five or six times a day, and began to operate an emergency system to handle any accident in its operation processes. (Consultant 4, 28 August 05)

In addition, one SME manager said that his company had had to install equipment to comply with environmental regulations because the treatment of industrial toxic waste was tightly controlled by the government. This interviewee worried that the improper handling or disposal of hazardous waste could cause his company serious problems:

We have installed facilities to manage environmentally hazardous waste; some toxic waste is disposed of by a special outsourcing company. The treatment of this industrial toxic waste is controlled by the Korean government. We have to abide by the rules to maintain our business. (SME manager 5, 19 May 04)

The potential risks associated with violation of environmental regulations can also be a factor motivating SMEs to undertake environmental activities. SMEs naturally want to avoid the possibility of being punished by the regulatory authorities for noncompliance.

There can be a number of reasons for undertaking environmental activities in response to environmental regulations. The risks associated with violation were cited as an important factor motivating SMEs to undertake environmental activities. In addition, SMEs violating environmental regulations could be punished by business suspension, permit revocation, a fine or imprisonment. SMEs could be motivated by their past experience or by fear of the potential risks.

The reasons SMEs undertake environmental activities in response to corporate customers' demands: gaining financial advantages

One interviewee said a typical case for the reason of SMEs' undertaking environmental activities in response to corporate customers' demands comparing those in response from environmental regulations:

Most SMEs take their corporate customer's environmental requirements very seriously. If they violate environmental regulations in their manufacturing processes, they only have to pay a fine. In some extreme cases, the business can be suspended, but that is very rare. But the corporate customer's environmental requirements are different. If SMEs cannot meet the corporate customer's environmental standards, they cannot sell their products. This is crucial to their profits and sales. (Consultant 1, 20 August 05)

Most of the SME managers said that their company had undertaken some kinds of environmental activities to comply with the demands of their large corporate customers. Their reasons in these cases were different from those given with respect to environmental regulations: the reasons for adopting environmental activities in response to regulations were closely related to the risks associated with the violation of the regulations; by contrast, compliance with their corporate customers' environmental requirements were related to their company's opportunity to make a profit. From the SMEs' perspective, the customer-supplier relationship was dominated by the corporate customer's purchasing decisions in the market. These decisions were closely related to SMEs' profit.

Unlike the universal applicability of environmental regulations, the large companies did not have business relations with all SMEs in the market. SMEs exposed to the environmental demands of a few large companies could theoretically change their customers, moving to those that did not require them to undertake environmental activities. However, they maintained their relationships with their existing customers in order to obtain economic advantages, and so continued to comply with those customers' environmental requirements. These economic advantages tended to be more important to SMEs than the advantages of complying with environmental regulations.

7.1.3. Comparison of the levels of implementation of SMEs' environmental activities

SMEs' large corporate customers were more influential than environmental regulations in a number of respects. As shown above, the main reason SMEs undertook environmental activities in response to their customers' requirements was to gain financial advantages. The level of SMEs' environmental activities in response to the ESCM approaches of their corporate customers was higher than that prompted by environmental regulations. The intensity of pressures from corporate customers, and the specific assistance programmes produced higher level.

Level of SMEs' environmental activities in response to environmental regulations: minimum standard

In most cases, SMEs have only to install certain kinds of equipment to comply with environmental regulations. They often do not try to achieve further environmental performance that prescribed by environmental regulations because such a proactive environmental performance needs greater knowledge and unceasing endeavour. (Project manager 3, 26 August 05)

SMEs often did not try to raise their environmental performance above the criteria prescribed by environmental regulations, which set minimum standards in specific areas such as water pollution, air pollution, waste disposal, and environmentally hazardous materials and did not impose a higher level of environmental activities on SMEs. For example, a interviewee commented:

The intensity of the corporate customer's environmental pressures compared with environmental regulations

A consultant commented:

Corporate customers used to ask only about environmental management systems. But now, most corporate customers asking their suppliers to improve environmental performance in their manufacturing processes and eliminate environmentally hazardous materials from their products, as well as implement environmental management systems. (Consultant 1, 20 August 05)

Corporate customers' environmental requirements often included the supply of environmentally friendly products made without using certain restricted substances as well as the implementation of environmental management systems in accordance with ISO 14001. Recent environmental regulations such as RoHS and WEEE in Europe have forced large Korean corporate customers to become concerned with the environmental aspects of their products. Large companies such as Samsung and LG in the Korean

electronics industry have imposed a variety of environmental requirements on their suppliers. Thus, SMEs have recently faced their corporate customers' increasing requirements that they should demonstrate sound environmental performance and supply environmentally friendly products.

More specifically, as for the intensity of the corporate customer's environmental pressures, an interviewee said:

Corporate customers' requirements have imposed stricter criteria than the current environmental regulations. According to Rosh, the cadmium content should not exceed 100 ppm in the finished products or components of products. But Samsung and LG require their suppliers not to exceed 50 ppm. (Project manager 2, 23 August 05)

The criteria by corporate customers could be higher than those prescribed by environmental regulations. For example, environmental regulations in Europe regulate the amount of environmentally hazardous materials in electronics products. To deal effectively with these regulations, Samsung and LG have been applying stricter standards than those set by the regulations. Thus, SMEs could be asked to conform to more demanding criteria by their corporate customers, who may also insist on strengthening the implementation of the regulations:

In addition, a project manager cited an example from his experience showing the superior effects of corporate customer assistance programmes:

I met a manager in an SME who often participated in environmental mentoring programmes organized by government and NGOs. He told me about his experiences... He was given lots of reasons to apply an environmental management system and various action programmes were recommended. But he said that these reasons and programmes were not concrete and were very superficial. But the action programmes suggested by Samsung, his corporate customer, was different. What they said was easy to understand. Sometimes they

visited his company to check or to discuss environmental issues, and their advice was very clear. (Project manager 3, 27 August 05)

Corporate customers often provided assistance programmes for their suppliers as well as making demands. These programmes have been more effective than other assistance programmes because they often include information relevant and specific to SMEs. For example, although SMEs could participate in environmental mentoring programmes organized by the government and by environmental institutes, the mentoring programmes organized by their corporate customers included more practical issues, and their corporate customers' recommendation were often more relevant and credible and easily understood by SMEs. Consequently, the mentoring programmes organized by corporate customers were considered more effective than the programmes offered by other organizations.

7.2. The factors affecting the relationships between ESCM approaches and the environmental activities of SMEs

Thus far, the interview data has shown that large corporate customers were important influential factor on the environmental activities of SMEs. ESCM approaches were considered to be ways whereby the customers could induce their suppliers to undertake certain actions. However, SMEs could be exposed to different types of ESCM approaches. Two contrasting ESCM approaches (collaborative approach and arm's-length approach) were identified through the analysis of the quantitative data.

In this section, the corporate customers' reasons for deciding between these two approaches are discussed from the perspective of corporate customers. Next, the relative importance of each ESCM approach with respect to environmental activities of SMEs is examined from the perspective of suppliers. Then, after an examination of the problems associated with each ESCM approach, the conditions of each ESCM approach that might promote SMEs' environmental activities, going beyond those explicitly required by the customers, are investigated.

7.2.1. Corporate customers' perspective on ESCM approaches

A few large companies in the Korean electronics industry such as Samsung and LG are served by several thousand SME suppliers. They may have to manage their suppliers' environmental performance to deal with the environmental regulations and to gain competitive advantages in the market. However, the importance of these suppliers to their customers can differ widely, and customers tend to apply different ESCM approaches to their suppliers based on the relative importance of each supplier. In the interview data, the corporate customer's dependence on the supplier and the supplier's capability to improve its environmental performance were detected as critical factors in a customer's choice of the ESCM approach that would best manage the supplier's environmental performance.

The reasons large companies manage the environmental performance of suppliers

One project manager stated that customer pressures on this issue had begun only ten years before. Another consultant noted that the corporate customers' requests for suppliers' environmental information were increasing rapidly:

Recently, the major large companies have been adopting the ESCM tools extensively. This has been happening for less than a decade. (Project manager 2, 23 August 05)

There are statistics about the extent to which corporate customers are requesting their suppliers to disclose information on environmental performance and activities. The statistics show that corporate customers' requests have increased in frequency eight to ten times over recent years. (Consultant 1, 20 August 05)

As shown above, managing suppliers' environmental performance is a relatively new phenomenon compared to environmental regulation. Recently, large companies have

started addressing the issue of their suppliers' environmental performance, and the trend of adopting ESCM approaches to manage these activities is growing.

There could be some reasons for these phenomena. A project manager in regard to ESCM mentioned a typical example of the reasons of the reasons of large companies' managing the environmental performance of suppliers:

In the electronics industry, the recent environmental regulations [WEEE and RoHS] are very urgent issues. Samsung and LG are well aware of these regulations, but SMEs hardly have sufficient information about them. The environmental problems of suppliers can seriously harm the environmental aspect of the final product. So, Both Samsung and LG have organized programmes to disseminate information about these regulations. (Project manager 2, 23 August 05)

The environmental regulations recently established in Europe such as RoHS and WEEE have been key factors prompting large companies in the electronics industry to introduce particular management approaches in order to deal with their suppliers' environmental problems. These regulations require electrical and electronic products to be produced without using environmentally hazardous materials. Large companies in the Korean electronics industry such as Samsung and LG has been exporting their products to this region, and they have thus been subject to these regulations.

In addition, competitors of large Korean companies, was also cited as an important motivators. One of consultants showed the case:

In 2001, Sony's Play Station was not admitted to the Netherlands, because around one million Play Stations contained environmentally hazardous materials in their parts. Now, Sony is conducting a 'green partnership programme'. Sony is managing all its suppliers according to this programme. Every supplier has to report its environmental performance. Sony has categorised their suppliers into five groups and has introduced incentives and penalties. This case had a

significant impact on managers of Korean companies. Samsung, LG, Hyundai and other exporting companies took this case into serious consideration. Since then, many large companies in Korea have become convinced that they have to adopt ESCM. (Consultant 5, 30 August 05)

As shown above, competitors of large Korean companies, such as Sony, indirectly encouraged large Korean companies to introduce ESCM approaches. For example, Sony had been seriously penalized for violating European environmental regulations. This experience forced Sony to adopt more extensive ESCM approaches to control its suppliers' environmental performance. This case made large companies in Korea consider the issue of their suppliers more seriously.

Strategic choice of ESCM approaches as affected by resource constraints

However, when the large companies had to manage their suppliers, they did not regard their suppliers to the same level. Two interviewees commented:

It is impossible to collaborate with all suppliers. In the electronics industry, manufacturing companies purchase a great many of parts for their final products. (Project manager 3, 26 August 05)

Corporate customers very rarely apply the collaborative approach to their suppliers because this approach needs more resources. So corporate customers choose not to apply this approach to unimportant suppliers, and tend to work collaboratively with only strategically important suppliers. (Consultant 5, 30 August 05)

A large corporate customer's options regarding its ESCM approaches were dependent on its resource constraints. In order to collaborate with its suppliers on environmental issues, the corporate customers had to invest some kinds of resources in its suppliers such as time and expertise. Even if the customer had large resources, it may not be possible to distribute these resources among its all suppliers. Consequently, the corporate customer could not manage all its suppliers to the same level through the collaborative approach.

The corporate customer's dependence on the supplier as a factor in choosing an ESCM approach

In the previous chapter, the ESCM approaches were categorized as the arm's-length approach and the collaborative approach. The corporate customer's dependence on the supplier was cited as an important factor in choosing an ESCM approach. For examples:

MRO [maintenance, repair and operating material] is often considered not critical to the manufacturing process, and many SMEs can produce these parts. Customers tend to just suggest some environmental criteria in purchasing MRO. (Project manager 3, 26 August 05)

Samsung plans to reduce hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride in the process of manufacturing semiconductors. Samsung may not be using much of these chemicals in the manufacturing process, but these chemicals play an important role in etching films and cleaning chemical vapour deposition tool chambers. The World Semiconductor Council [WSC] made a decision to reduce the use of these chemicals in semiconductor industry because they cause the climate change. Samsung, as a leading company, has to follow this decision. Reducing emissions of these chemicals in semiconductor manufacture requires process optimization and alternative chemicals. Only two companies in Korea can produce this equipment, and both are SMEs. Samsung has been purchasing this equipment from these two SMEs. Now, Samsung is doing research with these two SMEs to develop a new process and equipment not using these chemicals. (Project manager 2, 23 August 05)

Corporate customers preferred to adopt the arm's-length approach in cases where suppliers' products, such as maintenance, repair and operating material, were not critical to the customers. These items did not seriously impact on the manufacturing process, and it was not necessary to invest resources in their suppliers. Consequently, corporate customers often applied the arm's-length approach to these suppliers with relatively low costs and investments.

Regarding the collaborative approach, collaboration with suppliers was unavoidable. One interviewee cited a typical example to illustrate the reasons a customer might adopt the collaborative approach. Samsung was forced to collaborate with some SMEs, because these suppliers' products were highly significant to the manufacturing process. Circumstances dictated that Samsung had to develop a new environmental process with these suppliers. In this case, the number of suppliers, and the importance of the

components supplied were critical factors on the dependence of the corporate customer on its suppliers.

Accordingly, the corporate customer's dependence on suppliers was critically related to its choice of an ESCM approach. When the customer was highly dependent on its supplier, it had to adopt the collaborative approach with them in order to effectively manage their environmental performance. On the other hand, when the customer was not dependent on its suppliers, and could change suppliers in the market, it could adopt the arm's-length approach.

Suppliers' capability as a factor to choose ESCM approaches

Another factor influencing customers to choose the collaborative approach or the arm's-length approach was the suppliers' capability to improve their environmental performance. One interviewee explained:

In the electronics industry, lead-free soldering and eliminating environmentally hazardous materials from the core parts of final products need relatively high technology, and also the corporate customer had to collaborate with their suppliers. In this case, the collaboration was necessary to both corporate customers and suppliers. The corporate customers did not have detailed knowledge about the manufacturing processes of SME suppliers, while the SME suppliers often did not have enough knowledge of environmental technology. So collaboration between large companies and small suppliers was inevitable. (Consultant 4, 28 August 05)

Two other interviewees shared this view:

I have not seen many SMEs which have the capability to develop environmentally friendly products by themselves. Most SMEs are greatly inferior to large companies in the area of environmental technology; they do not know enough

about that technology. In such cases, the corporate customers have to assist their suppliers. (Project manager 2, 23 August 05)

When the corporate customer's environmental demand is beyond the capability of the SME such as in case of eco-design, the corporate customer has to adopt the collaborative approach. (Consultant 5, 29 August 05)

In some cases, advanced technology was necessary to develop and produce environmentally friendly products and SMEs often lacked the necessary capability to introduce this technology. Thus, the corporate customer had to provide their suppliers with specific assistance programmes.

7.2.2. Suppliers' perspective on ESCM approaches

As shown in the previous analysis, large corporate customers were important stakeholders influencing the environmental activities of SMEs in the Korean electronics industry and they adopt different ESCM approaches according to the strategic importance of SME suppliers.

Several thousands SMEs in Korean electronics industry were likely could be confronted with the arm's-length approach or the collaborative approach of their large corporate customers. This section reports different impacts of ESCM approaches on the environmental activities of SMEs from the suppliers' perspective.

Arms'-length approach's impacts on environmental activities of SMEs

A few managers in SMEs reported that they had received some kinds of environmental demands, which were categorized as exemplifying the arm's-length approach in the quantitative analysis, from their corporate customers. Not all types of the arm's-length approach were detected in the interview data, however, the few examples that were identified in interview data showed the typical characteristics of the approach.

One interviewee said:

A few years ago, I tried to talk with some overseas companies with a view to entering into business relations with them. But the negotiation did not go further because our company did not have ISO 14001 certification. They required their suppliers to have ISO 14001 certification. ISO 14001 certification is a prerequisite to make new business relationships. When doing business with corporate customers in Korea, even if we do not meet the criteria like this, I can show the excellent quality and low cost of our products, and promise to meet the criteria in the near future. That may be enough to persuade the corporate customer to buy our company's product. But in the case of business with foreign customers, it was very difficult. For that reason, our company decided to get ISO 14001 certification.
(SME manager 3, 6 May 04)

A manager in SMEs described a typical example of how the arm's-length approach affected SMEs' environmental activities. The corporate customer required that its suppliers obtain ISO14001 certification as a prerequisite for the contract. In such cases, SMEs tended to respond positively because by doing so they expect to gain financially. This SME wanted to enter a new market to sell its products and seek new corporate customers. Since the potential corporate customer required its suppliers to implement environmental management systems in accordance with ISO 14001, the SMEs complied with this requirement.

Another example was related to the product of SMEs. For examples:

To meet the corporate customers' requirements such as the restriction of environmentally hazardous materials, we are investing in R&D to develop environmentally friendly products. (SME manager 1, 2 May 04)

We have installed new equipment to exclude lead and chromium, because we need to continue business with Samsung. (SME manager 5, 19 May 04)

As discussed above, environmentally hazardous materials in products were the main concern of large corporate customers who were faced with European environmental regulations such as RoHS and WEEE. The large corporate customers asked their suppliers to make sure their products were free of such materials. A few interviewees explained that their corporate customers required information regarding any environmentally hazardous materials included in their parts, and that they made a plan to reduce and eventually eliminate such materials. In response to these corporate customers' pressures, the interviewees' companies installed new equipment and invested in R&D. These SMEs already had business relations with their large corporate customers, and were certain that the customers' environmental requirements were related to their purchasing decisions. If the SMEs could not meet the requirements of their corporate customers, they could lose the business relationships.

Collaborative approach's impacts on environmental activities of SMEs

The collaborative approach included the intensive involvement of the corporate customers such as providing training or site visit programmes, and involving suppliers in design processes. In the interview data, the collaborative approach adopted by large corporate customers was considered effective and helpful in encouraging SMEs to undertake environmental activities. Some reasons for the effectiveness of the collaborative approach were identified in the interview data.

Two interviewees cited the commitment of large companies to the environmental issues:

Sometimes the managers of SMEs were surprised with the assistance given by their corporate customers. They never expected to receive collaborative assistance from their corporate customers about environmental issues, and they very deeply appreciate this assistance from their corporate customer. (Project manager 2, 23 August 05)

I have seen many cases of the positive impacts of the collaborative approach. Generally, the environmental issue was considered trivial, and the managers

tended not to take this issue seriously. But, when the corporate customer provided some assistance programmes for them, they realized how serious this issue is. From that time, the managers showed a commitment to environmental issues and the environmental staff was encouraged by the commitment from their manager. (Consultant 1, 20 August 05)

The effectiveness of the collaborative approach in this regard was related to the customer's commitment to environmental issues, which was conveyed through the collaborative approach to the SME. These interviewees agreed this viewpoint.

In addition, the interview data showed two other reasons for the effectiveness of the collaborative approach including the knowledge accumulated by large corporate customers and the intensive interaction between corporate customers and suppliers.

Samsung's suggested programme for suppliers is very specific and reasonable, and it is easy to adopt immediately. I think Samsung has a lot of experience. They can correctly point out environmental problems which my company currently has by drawing on their accumulated knowledge. (SME manager 6, 19 May 04)

The kinds of assistance large corporate customers provide are more practical and credible. The environmental management system and cleaner production technology are already verified in large companies. Large companies have already experienced the implementation of environmental management systems and cleaner production technologies, and they can give suppliers practical advice and know-how. This can help suppliers to avoid wasting time and money testing various cleaner production technologies and implementing environmental management systems. (Consultant 4, 28 August 05)

When I visited a factory owned by one of Samsung's suppliers, I introduced new equipment in line with the instruction of their corporate customer, Samsung. It was a relatively easy step and they had only to install this suggested new equipment. But the cost was a problem. The manager of this SME complained that they had

not enough funds to install this expensive equipment. So I arranged a low-interest loan from the Korean government. This loan was for environmental investment, especially for SMEs, and the rate of interest was one or two percent lower than the average bank rate. (Consultant 5, 30 August 05)

Daeduck Co., one of LG's small suppliers, was assisted by its corporate customer through the collaborative approach. When Daeduck had serious difficulties in installing some environmental equipment, they asked LG for assistance with information, technology, and management technique. (Consultant 4, 28 August 05)

Regarding the accumulated knowledge, large corporate customers were engaged in business relations with many SMEs, and their accumulated experience from other SMEs made the environmental training programmes more practical and more suited to SMEs.

Additionally, the collaborative approach could transfer information and knowledge more intensely from large corporate customers to suppliers. SMEs could consult their customers about their problems more intensively in collaborative relationships, and these intensive interactions could make it possible to search options to solve the problems. Two consultants gave typical examples of the intensive interactions between corporate customers and SMEs. In these cases, intense on-site discussions made it possible to share information more effectively in order to solve the problems.

7.2.3. Problems of ESCM approaches

Both types of ESCM approaches adopted by large corporate customers influenced the environmental activities of SMEs. Under the arm's-length approach, SMEs reacted to the demands from their large corporate customers in order to make good business relations and secure economic advantages. Under the collaborative approach, SMEs were able to access the accumulated environmental knowledge of large companies more extensively. However, some disadvantages in both arm's-length approach and collaborative approach were also found in the interview data.

Problems of the arm's-length approach

There were some complains on the arm's-length approach.

Many SME suppliers said that the environmental requirements from their corporate customers incurred additional work and costs. (Project manager 3, 26 August 05)

Our corporate customers have required our company to install some environmental facilities. If we follow this instruction, manufacturing costs will certainly increase. If these customers will not accept the increased prices, it could cause the great damage to my company. (SME manager 3, 6 May 04)

Our corporate customers' environmental demands increased work and expenses. So far, a few large companies have required that our parts should not contain environmentally hazardous materials. To meet these requirements, we had to change some of our equipment, and this increased the costs. But there were no financial assistance programmes from the corporate customers. This was a big problem for my company. (SME manager 6, 19 May 04)

With regard to arm's-length approach, the suppliers often complain about problems of cost, and lack of information and human resources. When they invest money in environmental facilities to meet the corporate customer's requirement, this inevitably increases the price of the manufactured product. But in the arm's-length approach, price is the most important criterion to corporate customers. Corporate customers tend not to accept the increased cost, and so the suppliers have to supply the product at the same price in order to compete with other suppliers. It is a great burden to SMEs. (Project manager 2, 23 August 05)

As shown above, the increased costs and additional works without the assistance of corporate customers could be burden to SMEs. SMEs often compete with other SMEs, and the environmental demands made by their customers had to be taken seriously if SMEs were to survive competition in the market. To cope with the customer's demands, they undertook activities such as installing new equipment to ensure better environmental performance or getting ISO 14001 certification. Most of interviewees agreed that these activities were often a burden on SMEs.

Another problem was related to the level of SMEs' environmental activities. For examples:

Under the arm's-length approach, suppliers often just meet the criteria laid down by the corporate customers, because the customers do not require further environmental performance. (Consultant 4, 28 August 05)

Once suppliers have put in place some kinds of cleaner production technologies and an environmental management system to meet the corporate customer's criteria, they make no further effort. And they often prefer end-of-pipe environmental technology only to meet the spec of the product supplied to the corporate customer. (Consultant 5, 29 August 05)

SMEs would undertake environmental activities only to meet the corporate customer's purchasing criteria. The customer often did not require further environmental performance beyond these criteria.

Problems of the collaborative approach

Most of the interviewees stated that the collaborative approach was helpful in facilitating the environmental activities of SMEs. However, there were also some identified problems of the collaborative approach. For instances:

Recently, the intensity of Samsung's environmental expectations has been increasing. I have heard that Samsung is assisting only a small number of suppliers. These suppliers are larger than other suppliers. I have no idea why Samsung is assisting these large suppliers. They are in a better situation than my company. I think they have enough money to invest in environmental equipment. Samsung has not shown any special concern for my company. I think our corporate customer is demanding we enhance environmental performance without considering our costs. (SME manager 4, 7 May 04)

Sometimes the corporate customer makes the suppliers subordinate to it by assisting them to implement environmental activities. The customer worries about the technology transfer to the other competitive large companies. (Consultant 5, 29 August 05)

The scope of the collaborative approach was limited by the resource constraint of the large corporate customers. Most of the large companies applied this kind of approach only to the small number of their suppliers which they were highly dependent on. Accordingly, those suppliers which were not included in the collaborative approach tended to feel that they were excluded from the benefits of this approach. One SME manager said that his company was being forced to comply with the customer's environmental requirements without any assistance, and complained about the small number of suppliers included in the collaborative approach.

In addition, in some cases under the collaborative approach, the large corporate customers required SMEs to be subordinate to the large company. The corporate customer might think that the SME under the collaborative approach could take the customer's core knowledge, which might then be transferred to competitors. Hence, the large companies might insist that the SMEs are subject to itself alone.

7.2.4. Conditions of ESCM approaches beyond the environmental requests

In many cases, SMEs just follow the instructions of their corporate customers. Although from the perspective of corporate customers the proactive environmental activities undertaken by SMEs could enhance the implementation of their ESCM approaches, the interviewees considered that SMEs very rarely adopt proactive environmental activities that went beyond the environmental pressures exerted by their corporate customers:

I have never seen a case of proactive environmental activities beyond ESCM pressures; most SMEs just follow their corporate customers' instructions.
(Consultant 1, 20 August 05)

However, a few interviewees cited certain conditions where ESCM approaches could promote the environmental activities beyond the environmental pressures: an appropriate reward for arm's-length and collaborative approaches.

Conditions for proactive environmental activities of SME include the appropriate profit for superior environmental performance through the purchasing decision of the corporate customer. In such cases, the SME manager can understand that the environmental performance is closely linked to the business competitiveness. But this is extremely rare in Korea. (Project manager 3, 26 August 05)

In the arm's-length relationships, SMEs were situated in a relatively highly competitive market. The environmental demands from corporate customers were regarded as a motivation for the environmental activities of SMEs. As previously mentioned, the most

important barriers of the arm's-length approach to promoting the environmental activities of SMEs were increased work and costs. However, relevant direct assistance for the suppliers' environmental activities could not be expected in an arm's-length relationship. Thus, the most appropriate and effective way to resolve the problem of the arm's-length approach was considered to be monetary compensation. When suppliers could expect appropriate monetary compensation for their environmental performance, they were likely to take an active interest in their environmental activities.

They regard participating in collaboration with corporate customers on environmental issues as opportunities for their business. They think it is a good chance to build good relationships with corporate customers through collaborations, and they can relieve the costs to find appropriate options to meet the corporate customer's requirements. (Project manager 2, 23 August 05)

Regarding the collaborative approaches, as mentioned earlier, the influential dynamics of this approach was implemented through intensive interactions between corporate customers and suppliers, and the costs of the approach to the corporate customers were higher than those of the arm's-length approach. As for the suppliers, they could have been compensated for the increased costs of environmental activities. In addition, they expected that trust with corporate customers could be built and strengthened through intensive collaborative interactions, and that this established trust could underpin their long-term business contracts.

7.3. The role of SMEs' internal resources in response to ESCM approaches

Thus far, the interview analysis has focused on ESCM approaches as external factors increasing the environmental activities of SMEs. This section focuses on SMEs' internal resources as internal factors influencing the implementation of environmental activities in response to ESCM approaches.

SMEs undertook environmental activities in response to ESCM approaches of their corporate customers. However, not all SMEs were able to react to these ESCM approaches to the same degree; the internal resources used to implement environmental activities affected the level of environmental activities of SMEs. Two different internal resources (tangible resources and intangible resources) were identified through the quantitative analysis.

In this section, the roles of internal resources in the implementation of environmental activities were investigated extensively. First, the roles of tangible resources such as financial resource and human resources are examined. Second, the roles of intangible resources such as the attitudes of employees and CEOs on environmental activities are investigated. Then, the conditions of internal resources that might promote SMEs' environmental activities, going beyond those explicitly required by the customers, are investigated.

7.3.1. Role of tangible resources (financial and human resources)

The lack of financial resources and human resources, conceptualized as tangible resources in this study, was regarded as a common barrier to the implementation of SMEs' environmental activities. However, SMEs had to overcome this barrier to meet the environmental requirements of their corporate customers.

Human resources were regarded as important factor in order to implement environmental activities in SMEs. For examples:

I think we are doing best in the small and medium-sized enterprises sector. We got ISO14001 certification in 2000. We designated a member of staff to be in charge of environmental issues in each team and established targets for each team in order to implement this environmental management system more effectively. The designated environmental staff member in the management department is addressing overall environmental issues, and he is in charge of reporting environmental management activities with newsletters and doing an internal audit regularly. (SME manager 2, 6 May 04)

Additional human resources were necessary to implement environmental activities in response to the demands of corporate customers. For example, one SME manager reported that his company was undertaking various environmental activities such as installing an environmental management system and producing environmental reports. In order to implement these activities, this SME designated staff members to be in charge of environmental issues. This above case clearly showed that additional human resources were necessary in order to implement the required environmental activities.

In addition, financial resources were also closely related with environmental activities of SMEs. For instances:

Many SMEs said that they had problems meeting the corporate customers' requirements such as the restriction of environmentally hazardous materials. I participated in a workshop for the suppliers of Samsung as a speaker. After that workshop, Samsung surveyed the participants by asking 'What was the most serious problem for your company regarding the restriction of environmentally hazardous materials?'. The suppliers answered that the most serious problems were the increased cost, and the lack of expertise and information. (Project manager 2, 23 August 05)

We invested a budget to install new equipment to remove the environmentally hazardous material from our products. The cost of the equipment was more than twice that of the environmental management system. (SME manager 4, 7 May 04)

As commented by these interviewees, financial resources as well as human resources were necessary for environmental activities; additional financial resources had to be allocated for the salaries of the environmental staff. In addition, as mentioned above, some SMEs had to change their equipment to eliminate environmentally hazardous materials from their products and this replacement needed additional financial resources. Particularly when the environmental activities required new technologies, financial resource and human resource became a more critical factor. One interviewee reported that the main problems for SMEs trying to address their corporate customers' environmental demands such as the restriction of environmentally hazardous materials were increased cost, and the lack of expertise and relevant information. Furthermore, another interviewee noted that the cost of installations of environmental facilities to eliminate environmentally hazardous materials was twice as high as that of establishing environmental management systems.

In order to implement environmental activities, SMEs had to find a way to supply these financial and human resources. Some interviewees showed the ways for these resources:

We are receiving assistance from the government. The government is offering a financial assistance programmes to SMEs to promote environmental investment.
(SME manager 4, 7 May 04)

The government provides a low-interest loan to promote environmental activities. The interest rate was lower than those available in the market. But this loan also needs a mortgage, and we would have to pay the interest. I think it was better to use our own money. (SME manager 2, 6 May 04)

As shown above, one option was to reallocate their existing resources; managers could decide to give a priority to environmental issues and redistribute the company's financial and human resources to address environmental issues. An alternative option could be to seek resources outside the company; they could obtain a low interest loan from the government to supply the funds for environmental activities. Since, however,

this government loan needs a mortgage, it was not always attractive to all SMEs; it was more suited to relatively large companies, which could offer a mortgage.

Moderating factors between ESCM approaches and environmental activities

As for the roles of tangible resources (financial and human resources) in the relationships between ESCM approaches and environmental activities, the role of these intangible resources were identified as moderation the relationships between these two factors. For instances:

When I visited one SME, I found that it had already established environmental management systems according to ISO 14001. But it had not yet decided to eliminate environmentally hazardous materials from their products, because very expensive new equipment was necessary for this. (Project manager 2, 23 August 05)

In the manufacture process of PCBs [printed circuit boards], water, ink, hydrogen peroxide, and sulphuric acid are used, and these materials are strongly related to aspects of environmental pollution such as water quality, solid waste, and hazardous waste. Kyongju Co. was planning to introduce a water recycling system. For this SME, the financial issue was not a severe problem. This company was in a better situation than other small companies in this industry. After taking a managerial decision, the company quickly installed a new facility, and financial resources were not main obstacle to this decision. (Project manager 2, 23 August 05)

The additional financial and human resources necessary to implement environmental activities were not always available to SMEs. In some cases, they could not access the government assistance programmes, or did not have enough resources to reallocate a sufficient portion to the environmental activities. These problems hindered their environmental activities. For example, the lack of financial resources did not allow the investment of capital in environmental actions. As a result, it was difficult to introduce

appropriate options, and so the environmental initiatives did not proceed successfully. One interviewee mentioned that the problems of lack of financial resources delayed the decision of investment on a new facility to eliminate the environmental hazardous materials in their products. This interviewee reported another example. Another SME was in a better situation with respect to financial resources. Its relatively large financial resources facilitated its decision to invest in environmental improvement. In the decision making process, the increased cost was not considered as a serious factor. In addition, after the purchasing decision, the process progressed relatively quickly.

7.3.2. Role of intangible resources (environmental attitudes of CEOs and employees)

Another dimension of an SME' internal resource was its intangible resources such as the environmental attitudes of CEO and employees. Analyzing the interview data, the direct impacts of intangible resources on environmental activities of SMEs were identified. In addition, both mediating and moderating effects of SMEs' intangible resources of SMEs between ESCM approaches of corporate customers and the environmental activities in SMEs were identified in the interview data.

The relations of intangible resources with environmental activities

There were some examples regarding the direct impacts of intangible resources on environmental activities of SMEs:

In our company, the main motive for undertaking environmental activities was the CEO's attitude to the environment. My CEO believed that the environmentally excellent company could also increase productivity. We have been managing environmental issues with special care from the start of our business. (SME manager 3, 6 May 04)

One SME manager commented that the environmental attitude of the CEO was closely related to an SME' environmental activities. This interviewee said that his company was implementing environmental activities voluntarily, and the main motivation was the

policy of the CEO on the environmental issues. This CEO believed that enhanced environmental performance could lead to high productivity. This commitment of the CEO was sufficient to initiate environmental activities in his SME without recourse to other motivations.

Mediating factors between ESCM approaches and environmental activities

In addition, there were some examples regarding the mediating effects of intangible resources in the relationships between the ESCM approaches and the environmental activities of SMEs. One SME manager reported these mediating effects:

Assistance from the corporate customer is helpful. The most important role of the corporate customer was to encourage the environmental awareness of CEO and employees. After the corporate customer's training, they recognized the importance of environmental issues and are doing well now. (SME manager 1, 2 May 04)

This SME manager reported these mediating effects. The collaborative approach of corporate customers improved the environmental attitudes of the CEO and employees of SMEs. In addition, the enhanced environmental attitudes lead to the initiation of environmental activities. Accordingly, the environmental attitudes of the CEO and employees also worked as a mediating factor in the relations between the environmental activities of SMEs and the ESCM approaches of corporate customers. If the enhanced environmental attitude was the result of pressures from the corporate customer, the role of the environmental attitude between the ESCM approaches and the environmental activities was considered as mediating factors.

Moderating factors between ESCM approaches and environmental activities

On the other hand, some interviewees considered the attitudes of the CEO and employees to be a moderating variable between ESCM approaches and the environmental activities of SMEs. That is, when the environmental attitudes of the CEO and employees were already positive before the ESCM approaches, the change of environmental activities status of the SME in response to ESCM approaches was more marked.

One interviewee claimed that positive environmental attitudes were already widespread in his company before the SME was exposed to the pressures from its corporate customers. The employees of this cited SME were well educated and had a positive and responsible attitude to the environment. Consequently, they could easily understand their customers' environmental demands:

I have looked at a number of cases in the Korean electronics industry. The environmental attitudes of employees were very important in reducing environmentally harmful emissions in the manufacturing process. They had to manage the process carefully all the time to reduce harmful emissions and avoid environmental accidents. To say a good example for this, a company set up a task force team to cope with the corporate customer's environmental expectations. The members of the task force were selected on the basis of their involvement in the manufacturing process, and they were relatively well educated in environmental issues and took them seriously. When an LG staff member visited our company, he was astonished with this system. LG had disseminated environmental information and transferred environmental technology through this task force. (Project manager 2, 23 August 05)

On the other hand, when the attitudes of the CEO and employees towards the environment were negative, there were problems with implementing environmental programmes and decision-making regarding investment to improve environmental performance. One SME manager said that the employees of his company regarded the

company as being concerned with the environmental issues due to the industry's low emission of environmental pollutants. It was difficult for this SME to initiate environmental activities across the company:

Like other factories in the electronics industry, we do not produce much environmental pollution. For this reason, the employees think that the environmental issues are not relevant to our firm. Their perception has hindered our firm's environmental activities. (SME manager 2, 6 May 04)

One project manager shared this view:

I have seen many cases where the lack of environmental awareness was a critical barrier to the implementation of environmental activities. The decision whether to invest in environmental activities was deferred, because they were not convinced that profit could be made from environmental activities. (Project manager 2, 23 August 05)

These results indicated that the environmental attitudes of the CEO or employees of SMEs were to be considered moderating variables in the relations between ESCM approaches and the environmental activities of SMEs. That is, CEOs' and employees' attitudes towards the environment affected the degree of SMEs' environmental activities in response to customers' ESCM approaches.

7.3.3. Conditions of SMEs' internal resources beyond the environmental requests

The interview data showed that both types of the internal resources (tangible and intangible) of SMEs could facilitate the effectiveness of the influences of ESCM approaches on SMEs' environmental activities. In the previous section, the conditions of ESCM approaches that might promote SMEs' proactive environmental activities beyond ESCM pressures were discussed. This section considers the conditions of SMEs' internal resources that might facilitate the undertaking of environmental activities beyond those required by ESCM pressures. For instances:

I met a CEO at an environmental conference. His company had recently developed environmentally superior facilities on its own initiative. This facility is used in steel manufacturing. He asked me to introduce this facility to POSCO [company in steel industry] and other large steel companies. He believed that good environmental performance can lead to increased profits. (Project manager 2, 23 August 05)

I met the CEO of one particular SME around seven years ago. He said that he had been working in his factory for around thirty years. And for these thirty years, his company had been using chromium [Cr] in the coating process. Recently, he realized the risk of chromium [Cr] posed on health and was seeking to establish an alternative manufacturing process without using chromium [Cr] for the sake of the employees' health. At that time, environmentally hazardous materials were not seen as a serious issue, and many people were not aware of the negative effects of these materials. (Project manager 2, 23 August 05)

Interviewees considered the environmental attitude of the CEO was the most important factor influencing SMEs to undertake environmental activities beyond ESCM pressures. When the CEO's attitude to the environment was positive, although these cases were extremely rare in the SME sector, the company was more proactive in undertaking environmental activities. One project manager referred to the case of an SME that developed new facilities to increase its environmental performance, although the facilities were not required by either its corporate customers or environmental regulations. The CEO of this SME believed that the environmental performance could be linked with profitability.

Another example showed that the CEO's environmental perception motivated proactive activities. This CEO's perception of the dangers of environmentally hazardous materials had initiated proactive environmental activities before it was required by either the corporate customers or environmental regulations.

7.4. Conclusion

Analysis of the interview data revealed the dynamics of the impacts of the ESCM approaches of SMEs' large corporate customers, in conjunction with SMEs' internal resources, on the environmental activities of SMEs.

Corporate customers as well as government were considered important stakeholders influencing the environmental activities of SMEs in the Korean electronics industry. Moreover, customers and government influenced SMEs' environmental activities interactively as well as independently. For example, the large companies which were subject to environmental regulations in Europe extensively applied ESCM approaches in order to manage their suppliers' environmental performance. Consequently, SMEs were indirectly influenced by foreign regulations through the effect of those regulations on large Korean companies as well as directly influenced by Korean regulations.

However, the reasons SMEs undertook environmental activities in response to environmental regulations were different from those related to ESCM approaches. SMEs complied with environmental activities in order to avoid the risks connected with the violation of the regulations; they complied with ESCM approaches to gain financial advantages. In addition, it was found that the level of SMEs' environmental activities in response to their corporate customers was higher than the level with respect to environmental regulations. The criteria required by customers were higher than the criteria of environmental regulations, and specific assistance programmes offered to SMEs through ESCM approaches led SMEs to adopt a higher level of environmental activity.

A few large Korean companies such as Samsung and LG had several thousand SME suppliers. They were applying ESCM approaches to their suppliers in order to comply with environmental regulations in Europe such as RoHS and WEEE and to gain competitive advantages in the market. Because of their resource constraints, however, these corporate customers could not manage all their suppliers to the same level. They applied different ESCM approaches to their suppliers on the basis of the relative

importance of each supplier. In the interview data, corporate customers' dependence on suppliers and suppliers' capability to improve their environmental performance were detected as critical factors influencing the customers' choice of an appropriate approach between the arm's-length approach and the collaborative approach to manage the environmental performance of the supplier.

An SME could be affected by both the arm's-length approach and the collaborative approach; both were found to have positive impacts on SMEs' environmental activities. However, the collaborative approach was more effective than the arm's-length approach. The arm's-length approach influenced SMEs' environmental activities through the supplier's expectation of financial advantages given to SMEs. On the other hand, the collaborative approach was based on the accumulated knowledge of large corporate customers and the intensive interaction between customers and suppliers as well as financial advantages. These characteristics made the collaborative approach more effective than the arm's-length approach.

A few disadvantages of both approaches were also identified in the interview data. Under the arm's-length approach, the increased costs and additional work carried out without the assistance of the customer were burdensome to SMEs. In addition, regarding the level of environmental activity, SMEs undertook environmental activities only to meet the corporate customer's purchasing criteria. Under the collaborative approach, the scope of assistance programmes was limited by customer's resource constraints. In addition, large customers would sometimes subordinate strategically important SMEs under the collaborative approach.

The internal resources needed to implement environmental activities also affected the level of SMEs' environmental activities in response to ESCM approaches. The lack of financial and human resources, conceptualized as tangible resources in this study, was regarded as a common barrier to the implementation of environmental activities. Additional financial and human resources were necessary to implement the environmental activities required by the customers' ESCM approaches. When SMEs had substantial financial and human resources, they could implement environmental

activities more actively; when they had few resources, they found it difficult to implement environmental activities. The role of tangible resources such as financial and human resources was identified as moderating the relations between ESCM approaches and environmental activities of SMEs.

In addition, regarding the role of intangible resources, that is, the environmental attitudes of the CEO and employees, both mediating and moderating effects were identified in the interview data. When the ESCM approaches improved the environmental attitudes of CEOs and employees, and these improved attitudes led to the undertaking of environmental, the role of intangible resources was regarded as mediating between customers' ESCM approaches and SMEs' environmental activities. On the other hand, when environmental attitudes of CEOs and employees were already positive before the pressures of ESCM approaches, the change of environmental activities status of SMEs in response to ESCM approaches was more marked than in situations characterized by the poor environmental attitudes of CEOs and employees. The role of intangible resources was regarded as moderating between customers' ESCM approaches and SMEs' environmental activities.

The conditions for SMEs' environmental activities beyond ESCM pressures were identified with regard to both ESCM approaches and SMEs' internal resources. Appropriate reward was pointed out as the necessary condition under both the arm's-length and collaborative approaches. In addition, the environmental perception of the CEO motivated activities exceeding the existing criteria.

The qualitative analysis showed the reasons and factors with regard to the impacts of ESCM approaches on SMEs' environmental activities. This qualitative analysis result combined with the result of quantitative analysis and integrated with the previous literatures in next chapter.

Chapter 8. Discussion and Conclusion

This chapter discusses empirical results of this thesis and presents a revised conceptual model of the impacts of ESCM approaches on SMEs' environmental activities, which was initially developed in Chapter 4. In particular, the two sets of results, presented in Chapters 6 and 7 which provided in-depth explorations of the data and analysis results produced by the quantitative and qualitative approaches are combined and integrated with those of previous studies. Additionally, conclusions including implications and limitations of this study are considered.

8.1 Results of quantitative and qualitative data analyses

The following sections discuss empirical results in detail, and are structured in accordance with the study's research questions. The first section covers the first research question regarding the impacts of ESCM on the environmental activities of SMEs. The second section compares the impacts of each ESCM approach (arm's-length and collaborative approach) on SMEs' environmental activities. The third section covers the roles of SMEs' internal resources in their implementation of environmental activities in response to ESCM approaches. Then, the revised conceptual model of the impacts of ESCM approaches on SMEs' environmental activities is presented based on these discussions.

In this section, the research hypotheses for the quantitative analysis describing a few core dimensions of the research questions were discussed based in the results of both quantitative and qualitative analyses

8.1.1 The impacts of ESCM approaches on the environmental activities of SMEs

This section discusses the roles of large companies in SMEs' environmental activities. Specifically, the section addresses the study's first research question:

Research question 1: Do the ESCM approaches of large corporate customers have positive impacts on SMEs' environmental activities?

The impacts of ESCM approaches on the environmental activities of SMEs

As shown in chapter 7, the large companies in the Korean electronics industry such as Samsung and LG Electronics were managing the environmental performance of their SME suppliers through ESCM approaches. These large companies were mainly motivated by the recent European environmental regulations such as WEEE and RoHS, which were classified by the NEETF study (2001) as primary drivers of large companies' adoption of ESCM approaches. The companies were driven to comply because they were exporting many of their products to this region (See section 7.2.1). SMEs in the Korean electronics industry, as suppliers in the market, were exposed to these ESCM approaches of their corporate customers and were confronted with those customers' increasing demands for improved environmental performance (See sections 6.3.3, 6.3.4, 7.1.1 and 7.2.2).

Regarding the overall impacts of customers' ESCM approaches on the environmental activities of SMEs, both the quantitative and the qualitative analysis produced clear evidence of positive relationships between these approaches and activities. In the quantitative analysis, the relationships were found to be significant (See Tables 6.12 and 6.14). Moreover, most interviewees participating in the qualitative research reported that the corporate customers' demands were the main motivation for their company's undertaking of activities designed to improve its environmental performance (See sections 7.1.1 and 7.2.2). These results clearly indicated that ESCM approaches had positive impacts on SMEs' environmental activities, and were consistent with a number of previous studies in the field of ESCM studies such as those of Carter and Jennings (2002) and BSR (2001), and contradicted the studies reporting that the impacts of ESCM were uncertain, such as that of Merritt (1998).

Regarding the areas of environmental activities influenced by ESCM approaches, as investigated in the study of Preuss (2005); this study identified a variety of these areas.

The quantitative analysis confirmed that all kinds of environmental activities conducted by SMEs, conceptualized in this study as planning and organizational activities, product and logistics activities, and internal production process activities were positively influenced by ESCM approaches (See Tables 6.12 and 6.14). In addition, although the qualitative analysis could not cover every type of environmental activity, a number of activities such as obtaining accreditation of ISO 14001 certification and installation of equipment for producing products that did not contain environmentally hazardous materials were undertaken in response to the environmental demands of or assistance from the SMEs' corporate customers (See section 7.2.2).

Hence, it can be concluded that ESCM approaches of large companies had positive impacts on SMEs' environmental activities, and hypothesis 1 was supported by both quantitative and qualitative analyses.

Hypothesis 1: the ESCM approaches of large companies have positive impacts on the environmental activities of SMEs

The trans-national impacts of ESCM approaches on the environmental activities of SMEs

In order to identify the impacts of the ESCM approaches of foreign corporate customers by using the quantitative approach, regression analysis was conducted for the reduced data set. This data set comprised a smaller number of SMEs, which were exposed to the ESCM approaches of foreign corporate customers and were selected according to the nationality of the main corporate customer.

The analysis results with respect to the reduced data set were similar to the results for the full data set. That is, the relationships between the ESCM approaches of large companies and the environmental activities of SMEs were significant with regard to three kinds of environmental activities (See Table 6.14). These results indicated that the ESCM approaches of foreign corporate customers as well as those of Korean corporate

customers had positive impacts on the environmental activities of SMEs in the Korean electronics industry.

In addition, the analysis results confirmed the results of regression analysis for the full data set as well as indicating the trans-national impacts of ESCM approaches. According to Hair et al. (1998), one of methods of validating regression analysis results is to divide the sample into sub-samples and test the regression model for each sub-sample. Hence, the analysis results for the full data set were validated through additional regression analysis of the reduced data set presenting the same results.

However, the quantitative analysis did not show the indirect impacts of foreign customers because the SMEs in the reduced data set were those who were directly engaged with foreign corporate customers. However, SMEs in Korea might be indirectly influenced by foreign companies via large Korean companies. The qualitative analysis showed that the ESCM approaches of foreign companies had indirect as well as direct impacts (See section 7.1.1). For example, an interviewee noted that his company have obtained accreditation of ISO 14001 certification, which was required by the company's foreign corporate customers (See section 7.1.1); this was considered an example of direct influence. By contrast, Samsung and LG Electronics were often confronted with demands from their overseas corporate customers, and they had to manage the environmental performance of their suppliers in response to those pressures (See section 7.1.1). In such cases, SMEs in the Korean electronics industry were indirectly influenced by foreign companies.

These results were consistent with those of previous studies (e.g. Robins, 2000; Dobilas and MacPherson, 1997), although these studies did not investigate the indirect impacts of corporate customers in foreign countries. This study provided a clear evidence of the direct and indirect trans-national impacts of ESCM on SMEs through the global supply chain.

Comparison of corporate customers and government

In order to understand the impacts of ESCM approaches on the environmental activities of SMEs, it was helpful to compare the impacts of the environmental regulations of governments with those of the ESCM approaches of corporate customers.

Other potential factors such as pressures from NGOs and local communities were not considered by the interviewees because they were rarely exposed to these stakeholders. These were agreed with the opinions reported in the study of Baylis et al. (1998, a and b) by that, if an SME' factory and number of employees are small, it is often difficult to identify the environmental problems caused by its operation.

Regarding the impacts of government regulations: as was expected from the findings of previous studies, environmental regulations were also considered an important factor motivating SMEs to undertake environmental activities (Gerstenfeld and Roberts, 2000; Hillary, 2000; Moon et al., 2000). Government regulations in Korea directly regulated the environmental activities of SMEs such as the production process and the disposal of industrial wastes. The SMEs under study were undertaking a number of environmental activities, mainly because of their desire to avoid the perceived risks associated with the violation of the regulations. They either feared the penalties that would be incurred by violation or had had experience of those penalties (See section 7.1.2). In addition, it was found that SMEs often adopted the minimum level of activity necessary to comply with the criteria imposed by the environmental regulations (See section 7.1.3).

By contrast, SMEs' environmental activities undertaken in response to ESCM approaches were mainly driven by business reasons. SMEs were often engaged with large companies as suppliers, and their relationship was dependent upon the customer's purchasing decision. The integration of environmental concerns into the purchasing decision was critical to the profits and sales of SMEs (See section 7.1.2). In addition, the intensity of the environmental pressures from corporate customers was greater than those of the environmental regulations. Samsung and LG Electronics set higher standards regarding the incorporation of environmentally hazardous materials in the

products of their suppliers than those imposed by the current environmental regulations (See section 7.1.3).

Moreover, compared with the mentoring programmes organized by the Korean government, those organized by corporate customers were often more practical and the recommendations for SMEs were more credible and more easily understood (See section 7.1.3). These characteristics of corporate customers' ESCM approaches were similar to those of the effective assistance programmes discussed in previous studies (e.g. Gerstenfeld and Roberts, 2000; Pederson, 2000; Starkey, 2000; Walley, 2000). Consequently, the environmental assistance programmes organized by large corporate customers were considered to have a greater effect on the environmental activities of SMEs than those organized by the government.

8.1.2 Comparison between the arm's-length approach and the collaborative approach

As discussed above section, the analysis results clearly showed that SMEs were influenced by the ESCM approaches of large companies; however, those companies commonly applied different ESCM approaches to their suppliers in accordance with the relative importance of each supplier to the customer. This section compares the impacts of the two main types of ESCM approach on the environmental activities of SMEs.

More specifically, this section addresses the study's second research question:

Research question 2: If so, which ESCM approach of large corporate customers strongly impacts on SMEs' environmental activities?

In order to understand the different impacts of individual ESCM approaches, the characteristics of these approaches and the criteria used by customers in choosing a particular approach are discussed before comparing the impacts of individual ESCM approaches.

The two different types of ESCM approaches

The factor analysis produced two different types of ESCM approaches, namely the arm's-length approach and the collaborative approach (See section 6.2.2 and Table 6.5). This typology was the same as that traditionally characterizing relationships between corporate customers and suppliers (e.g. Dyer et al., 1998; Maloni and Benton, 1997), and confirmed the conceptualization of two different dimensions of ESCM approaches (e.g. Preuss, 2005; Rao, 2003). According to Preuss (2005), ESCM approaches are theoretically categorized into the arm's-length approach and the collaborative approach according to nature of the relationship between the corporate customer and the supplier. The collaborative approach is marked by the strong interaction between customer and supplier (Preuss, 2005).

The items categorized together by the factor analysis showed similar characteristics. The items connoting relatively weak interaction such as purchasing products made without environmentally hazardous materials and requiring information about any environmentally hazardous materials included in the product were correlated with the arm's-length approach. On the other hand, the items connoting strong interaction with corporate customers such as providing training or site visit programmes for environmental management techniques or environmental technology and involving the supplier in the design process for the environmental improvement of product and manufacturing process were correlated with the collaborative approach. However, a few communication approaches such as one-to-one meetings and seminars/workshops for environmental awareness were correlated with both the arm's-length approach and the collaborative approaches (See section 6.2.2 and Table 6.5). These results indicated that these kinds of communication approaches were often adopted in both arm's-length and collaborative relationships

Criteria for choosing an ESCM approach; corporate customers' perspective

In previous studies, the arm's-length approach was characterized as less resource- and time- intensive to corporate customers, while the collaborative approach was

characterized as more resource- and time- intensive (Preuss 2005). Large companies in Korea had business relations with thousands of SMEs in the market and thus could not manage all their suppliers to the same degree due to resource constraints. Although these large companies commanded large resources, it was not possible to apply the collaborative approach to all their suppliers. Consequently, they differentiated their suppliers and were managing them in accordance with the strategic importance of each supplier (See section 7.2.1).

The factors influencing decision-making on choosing between the collaborative approach and the arm's-length approach were investigated through the qualitative approach. This result reported that the decision making of large companies in Korea were dependent on the dependence of corporate customers on suppliers and suppliers' capability. When corporate customers were highly dependent on their suppliers, for example, in case that the number of suppliers was rare and the products of suppliers were critical to manufacturing process, they had to collaborate with these suppliers. In addition, when the suppliers did not have enough capability to develop or produce environmentally friendly products, assistance programmes were necessary. By contrast, the arm's-length approach was preferred, when the products provided by suppliers could be obtained in the market, and these items did not seriously impact on manufacturing process of corporate customers (See section, 7.2.1.). Accordingly, the arm's-length approach was more often adopted by large companies than the collaborative approach, and the collaborative approach was applied to a small number of their important suppliers.

Comparison of the impacts of the arm's-length approach and the collaborative approach

In the quantitative analysis, the relations between each ESCM approach and the environmental activities of SMEs were compared using two methods (adjusted R^2 values and standardized coefficients beta weights). The quantitative evidences for the impacts of ESCM approaches on the environmental activities of SMEs are summarized in Table 8.1 (See sections 6.3.3, 6.3.4 and Tables 6.12, 6.14 for details).

Table 8.1. Comparison of ESCM approaches with increased R² values and standardized coefficients

Environmental activities	ESCM Approaches	Increased R ² values	Standardized coefficients
Planning and organizational activities	Arm's-length approach	0.288 ***	0.089 -
	Collaborative approach	0.375 ***	0.445 ***
Product and logistics activities	Arm's-length approach	0.176 ***	0.125 -
	Collaborative approach	0.226 ***	0.350 ***
Internal production process activities	Arm's-length approach	0.170 ***	0.073 -
	Collaborative approach	0.200 ***	0.266 ***

(* p < 0.1, ** p < 0.05, ***p < 0.01)

As shown in this Table, both analysis methods yielded similar results, indicating that both the arm's-length approach and the collaborative approach had significant positive impacts on SMEs' environmental activities.

However, it was interesting that the standardized coefficients of the arm's-length approach in the standard regression analysis were not statistically significant. According to Cohen and Cohen (1975), 'when some or all of the independent variables are substantially correlated with each other, the coefficients obtained by the simultaneous model for the entire set may be highly misleading' (p.100). In this study, the Pearson's correlation coefficient between the arm's-length approach and the collaborative approach was 0.735 (See Appendix 5: Descriptive statistics of questionnaire survey; Pearson's correlations between variables). This value was relatively high; however, conducting regression analysis was not severely problematic since the VIF values, which indicate the multicollinearity between the independent variables, ranged from 1.104 to 2.559 (See Table 6.12). This was similar to the results of Klassen and Vachon's (2003) study. In their analysis, the ESCM approaches were highly correlated; however, the discriminant validity was maintained. Hence, the insignificant coefficient of the arm's-length approach might be caused by its modest correlations with the collaborative approach. However, the individual partition was detected by hierarchical regression analysis because a major advantage of the hierarchical regression analysis is that it can partition the variance of correlated independent variables (Cohen and Cohen, 1975). Accordingly, although the standardized coefficients of the arm's-length approach were not statistically significant, it was concluded that both the arm's-length approach and

the collaborative approach had positive impacts on the environmental activities of SMEs, and the following hypotheses, 1a and 1b, were supported by the quantitative analysis.

Hypothesis 1a: The collaborative approach of large corporate customers has positive impacts on environmental activities of SMEs

Hypothesis 1b: The arm's-length approach of large corporate customers has positive impacts on environmental activities of SMEs

Comparing the relative strengths of the two ESCM approaches, the collaborative approach was found to have stronger correlations with the environmental activities of SMEs. Examination of the increased R^2 values and the standardized coefficients showed consistent patterns. As shown in Table 8.1, the increased R^2 values of the collaborative approach (0.375, 0.226, and 0.220) were larger than those of the arm's-length approach (0.228, 0.176, and 0.170). In addition, the magnitude of the standardized coefficients of the collaborative approach (0.445, 0.350, and 0.266) was larger than those of the arm's-length approach (0.089, 0.125, and 0.073). These results indicated that the collaborative approach variable had relatively larger explanatory importance to the environmental activity variables than the arm's-length approach, and the collaborative approach was more effective than the arm's-length approach. Consequently, hypothesis 2 was supported by the quantitative analysis.

Hypothesis 2: The collaborative approach has greater impacts on the environmental activities of SMEs than the arm's-length approach

Reasons of the superior impacts of the collaborative approach to the arm's-length approach

As shown above, while both ESCM approaches had positive impacts on the environmental activities of SMEs, the collaborative approach was more effective than the arm's-length approach. The identified examples in the interview data showed the typical characteristics regarding the dynamics of the impacts of each ESCM approach,

and revealed the reasons of the superior impacts of collaborative approach over the arm's-length approach.

As for the arm's-length approach, the SMEs under study were being challenged by the environmental requirements of their corporate customers in the market. Most interviewees in SMEs reported that their companies were undertaking some kinds of environmental activities in response to the customer's arm's-length approach such as obtaining accreditation of ISO 14001 certification, and restricting the environmentally hazardous materials in their products. These activities were introduced with a view to gaining monetary compensation (See section 7.2.2.).

On the other hand, it was also reported that the collaborative approach was considered an effective and helpful mechanism to assist SMEs' environmental activities. The effectiveness of the collaborative approach was related to corporate customers' commitment to environmental issues, and to the intensity of the interactions between the customers and the SME. When SMEs were under the collaborative approach, they felt that their customers were taking environmental issues seriously and that this was likely to affect the purchasing decision. In addition, large companies often had accumulated knowledge with regard to environmental management tools and technologies. SMEs could access this accumulated knowledge more easily, and the information and knowledge of large companies could be transferred more intensively to suppliers through the collaborative approach (See section 7.2.2.).

These results were consistent with the indications of previous studies. Although some previous studies did not directly deal with ESCM, they emphasized the superiority of the collaborative approach to the arm's-length approach (e.g. Canning and Hanmer-Lloyd, 2001; Prahinski and Benton, 2004; Tunnessen, 2000). In addition, in the field of ESCM, one recent study (Preuss, 2005) reported the superiority of the collaborative approach.

8.1.3 Comparison of tangible and intangible resources

So far, the impacts of each ESCM approach have been compared with each other in this study and with those reported in previous studies. However, the response of SMEs to ESCM approaches can differ in accordance with their internal resources. This section discusses the roles of SMEs' internal resources in their responses to the ESCM approaches of their corporate customers. More specifically, this section addresses the study's final research question.

Research question 3: How do the internal resources of SMEs impact on SMEs' environmental activities in response to the ESCM approaches of large corporate customers?

Initially, this study focused on the moderating effects of SMEs' internal resources on their implementation of environmental activities in response to ESCM approaches. However, the analysis results yielded broader results regarding the roles of internal resources, including mediating as well as moderating effects. The details are discussed here.

Two different types of SMEs' internal resources

The factor analysis of the quantitative data extracted two different types of internal resources: tangible resources and intangible resources. This typology has often been adopted from the perspective of the resource-based view of the firm (e.g. Hall, 1992; Wernerfelt, 1989). In this perspective, tangible resources refer to the fixed and current assets of a corporation such as plant, equipment, land, other financial resources (Wernerfelt 1989), while intangible resources refer to invisible resources such as intellectual property, reputation, culture, expertise of employees and employee loyalty (Hall, 1992).

The tangible resources in this study consisted of financial resources and human resources (environmental expertise), and the intangible resources comprised the

attitudes of the CEO and the employees to the environment (See section 6.2.2. and Table 6.9). Especially, the intangible resources in this study, where negative, were understood as conceptual obstacles to the implementation of SMEs' environmental activities.

In the perspective of the resource-based view of the firm, human resources (environmental expertise) are usually classified as intangible resources owing to their invisibility (Hall, 1992). In this study, however, human resources (environmental expertise) were closely correlated with financial resources and hence were classified as tangible resources. In studies of SMEs and the environment, the close relationship between financial resources and human resources (environmental expertise) has often been reported because a lack of financial resources often constrains the employment of skilled employees and the establishment of additional training programmes (e.g. Ghobadian and Galler, 1996; Gerstenfeld and Roberts, 2000; Hillary, 1995, 2000b, 2004; Holliday, 1995; Perez-sanchez et al., 2003). Hence, it was reasonable for this study to classify human resources as tangible resource for further analysis.

Examination of role internal resources (tangible and intangible resources) through quantitative analysis

The contingency perspective suggests that 'if then' and 'fit' relationships may exist between ESCM approaches and the internal resources of SMEs in order to implement ESCM approaches more effectively. In this perspective, it was expected that the influence of ESCM approaches on the environmental activities of SMEs would differ according to the conditions of the SMEs' internal resources. Thus, an ESCM approach may be more effective when it fits well with the internal resources of an SME.

Table 8.2. Summary of interaction impacts between ESCM approaches and internal resources on environmental activities of SMEs

	Planning and organizational activities	Product and logistics activities	Internal production process activities
Arm's-length approach × Tangible resources	0.126 *	0.077 -	0.137 -
Arm's-length approach × Intangible resources	-0.014 -	-0.051 -	-0.094 -
F for the step	2.131 -	0.383 -	1.292 -
Collaborative approach × Tangible resources	0.028 -	0.183 **	0.143 *
Collaborative approach × Intangible resources	0.011 -	-0.092 -	-0.119 -
F for the step	0.214 -	2.664 *	1.746 -

Main table contains standardized coefficient betas. (p < 0.1, ** p < 0.05, ***p < 0.01)

The moderating effects of internal resources (tangible and intangible resources) on the relationships between ESCM approaches and environmental activities were examined by hierarchical moderated multiple regression analysis (HMMRA) (See sections 6.4.2, 6.4.3 and Tables 6.15, 6.16). Table 8.2 summarizes these moderating effects. The analysis revealed that, generally, the impact of the arm's-length approach on planning and organizational activities was dependent on tangible resources. In addition, the impact of the collaborative approach on product and logistics activities, and internal production process activities was also dependent on tangible resources. However, the impacts of ESCM approaches on these three kinds of environmental activities were not dependent on intangible resources.

The interpretation of results indicated that of these two types of internal resources (tangible and intangible resource), only tangible resources significantly affected the relationships between ESCM approaches and the environmental activities of SMEs. This indicated that tangible resources generally had a moderating role in determining the environmental activities of SMEs in response to ESCM approaches. Accordingly, hypothesis 3 was partly supported by the quantitative analysis.

Hypothesis 3: The impacts of the ESCM approaches of large companies on the environmental activities of SMEs are dependent upon the conditions of internal resources of SMEs

However, it was also found that the role of intangible resources was not negligible. Although this kind of resource did not moderate the relations between ESCM approaches and the environmental activities of SMEs significantly, it had significant direct impacts on the three kinds of environmental activities (See Tables 6.15 and 6.16). This result indicated that environmental activities were highly dependent on the environmental attitudes of CEOs and employees.

The role of both tangible resources (financial and human resources) and intangible resources (environmental attitudes of CEOs and employees) in internal resources are presented in next section respectively on the basis of qualitative analysis.

Roles of tangible resources (financial and human resources): moderating effects

In the quantitative analysis, the moderating effects of tangible resources (financial and human resources) between ESCM approaches and the environmental activities were significant. The qualitative analysis also supported these roles of tangible resources.

Regarding the role of tangible resources in the qualitative analysis, this analysis revealed that additional financial and human resources were found to be necessary to the conduct of environmental activities. Some SMEs designated additional staff to be responsible for the company's environmental performance, and installed new facilities to produce environmentally friendly products. Especially, where environmental activities were related to new technology, these resources were regarded as even more critical and more resources were considered necessary (See section 7.3.1).

However, these financial and human resources were not always available to SMEs. The different situations of SMEs regarding these resources influenced their environmental activities. For example, they had to redistribute their existing resources or seek other resources outside the company to comply with the corporate customers' environmental demands. When an SME had relatively large financial resources, the increased cost was not considered an important factor in the decision-making process, and the decision was

implemented relatively quickly. By contrast, when an SME had relatively limited financial resources, and was often confronted with problems, the decision to invest was often delayed (See section 7.3.1).

The study's qualitative results supported the findings of role of tangible resources on the relationships between ESCM approaches and the environmental activities of SMEs. Especially, these moderating effects were strongly identified in the area of decision making with regard to high-cost facilities.

These results are similar with the findings of the previous studies. For example, Ghobadian et al. (1998) reported that organizational and environmental resources (technology, human resource availability, capital, and organizational adaptability) moderate the relationships between external influences (environmental interventions, market behaviour and social expectation) and environmental strategies. Buysse and Verbeke (2003) supported this by reporting that the firm size, which was understood as tangible resource, is a moderating factor in the relationships between environmental strategy and stakeholder pressures.

The moderating effects are 'those elements in a decision making process that constrain the company's ability to act' (Ghobadian et al., 1998, p.18). Consequently, the lack of financial and human resources can be regarded as barriers to SMEs' conduct environmental activities in response to ESCM approaches. However, when the ESCM approaches fit well with the financial and human resources, it was possible to expect better environmental activities in response to these ESCM approaches.

Role of intangible resources (environmental attitudes of CEOs and employees): moderating and mediating effects

In the quantitative analysis, the moderating effects of intangible resources (environmental attitudes of CEOs and employees) between ESCM approaches and the environmental activities of SMEs were not significant. However, in the qualitative analysis, moderating effects were identified.

In the qualitative analysis, when the attitudes of CEOs and employees were already positive before exposure to ESCM approaches, their positive attitudes facilitated the undertaking of environmental activities in response to those approaches. By contrast, when their attitudes were negative, problems arose in the implementation of environmental activities and in decision-making with respect to investment for the improvement of environmental performance. In these cases, the role of intangible resources was considered to be that of moderating between ESCM approaches and SMEs' environmental activities, and the degree of an SME's environmental activities in response to ESCM approaches were dependent on the environmental attitudes of CEOs and employees (See section 7.3.2.).

Regarding the moderating effects of intangible resources, especially in the contingency perspective, it was expected that these effects would be identified in the quantitative analysis. In addition, *Pederson (2000) noted that the supporting programmes provided by local authority were more effective when their use accorded with SME's attitude to the environment.* However, although these effects were identified in the qualitative analysis, it was not clear in the quantitative analysis.

One possible explanation for the insignificance of the moderating effects of intangible resources in the quantitative analysis is that these results reflected the natures of the two types of analysis. Contrary to the qualitative research (interview), the quantitative research (questionnaire survey) has shortcoming in detecting contextual understanding in micro situations (Bryman, 2004). Thus, it is possible to conclude that, even if there were some moderating effects of intangible resources, as identified in the qualitative analysis, these effects were very rare.

Regarding mediating effects of intangible resources between ESCM approaches and environmental activities, these effects were identified in both quantitative and qualitative analyses.

In the qualitative analysis, the environmental attitudes of CEOs and employees could be situated in the middle of the relationships between ESCM approaches and the

environmental activities of SMEs, as mediating these relationships. Analysis of the interview data revealed that their positive environmental attitude was increased in response to the demands or mentoring programmes of large corporate customers, and that this positively led to the undertaking of environmental activities. In these cases, the role of intangible resources was considered to be mediating between ESCM approaches and SMEs' environmental activities (See section 7.3.2.).

Moreover, in the quantitative analysis, the relationships between ESCM approaches and intangible resources were significant (See Appendix 5: Descriptive statistics of questionnaire survey; Relationships between ESCM approaches and intangible resources), and as were relationships between intangible resources and environmental activities were also significant (See Tables 6.15 and 6.16).

The mediating effects of intangible resources are similar with the findings of the previous studies (e.g. de Bruijn and Lulofs, 2000; Ghobadian et al., 1998). Ghobadian et al. (1998) reported that leaderships, the degree of social responsibility, existing company culture, and formal and informal company tradition, which were related to conceptual obstacle in the study of SMEs, mediate the relationships between external influences and environmental strategies. Consequently, the environmental attitudes of CEOs and employees are improved SMEs to conduct environmental activities in response to ESCM approaches.

8.1.4 Summary of empirical results

In sum, this study was conducted in the context of Korean electronics industry using a questionnaire survey and interviews as data collection methods. The analysis of this data yielded a number of findings.

It was found that ESCM approaches had positive impacts on the environmental activities of the SMEs under study. More specifically, both the arm's-length approach and the collaborative approach of large companies positively influenced SMEs' environmental activities. These impacts were identified across national borders as direct

and indirect depending on the type of business relationship existing between the SME and the large foreign company.

Comparing the impacts of the collaborative and the arm's-length approaches, it was found that the collaborative approach had stronger impacts on the environmental activities of SMEs than the arm's-length approach. The motivational effect of the arm's-length approach depended mainly on the suppliers' expectation of monetary compensation. The collaborative approach was characterized by intensive interaction between parties and by easy access to accumulated knowledge of large companies' commitment through this, which were lacking in the arm's-length approach. These factors made the collaborative approach more effective than the arm's-length approach; however, the arm's-length approach had the advantage of being applied on a much broader scale.

This study found that when ESCM approaches fitted the internal conditions of an SME, the conduct of its environmental activities improved. Hence, this study suggested that the implementation of ESCM approaches could be more effective if customers took account the conditions of SMEs' internal resources. Regarding the internal resources of SMEs, the lack of which were often considered a barrier to the implementation of the environmental activities, tangible resources (financial and human resources) had a significant effect on the relationships between ESCM approaches and the environmental activities of SMEs. However, intangible resources (the environmental attitudes of CEOs and employees) had no significant effect on those relationships, although analysis of the qualitative data identified moderating effects. However, it was found that intangible resources had mediating effects: the positive attitudes of CEOs and employees toward the environment were increased by exposure to ESCM approaches and this increased positivity caused an increase in environmental activities.

The analysis identified some conditions that encouraged SMEs to undertake environmental activities that went beyond what was expected of them. Although it was rare, appropriate compensation for superior environmental performance made the SMEs undertake environmental activities by going beyond the criteria suggested by those

customers. In addition, the environmental awareness of a CEO could cause the SME to undertake environmental activities proactively regardless of the pressures from its corporate customers.

8.2 Theoretical framework revisited and theoretical contribution

This study constructed an initial conceptual framework (p.88) designed to ascertain the impacts of ESCM on SMEs' environmental activities, and the role of internal resources in those activities. The framework was conceptualized on the basis of the contingency perspective to apply stakeholder theory and the resource-based view of the firm.

However, the analysis of empirical research data, the framework should be revised to clarify relationships between elements influencing SMEs' environmental activities, including internal resources, external environments and impacts, and ESCM approaches. Thus, this section revises the theoretical framework of this study and discusses theoretical contribution of this study in the context of the wider ESCM literature/knowledge and SME literature/knowledge based on the revised framework.

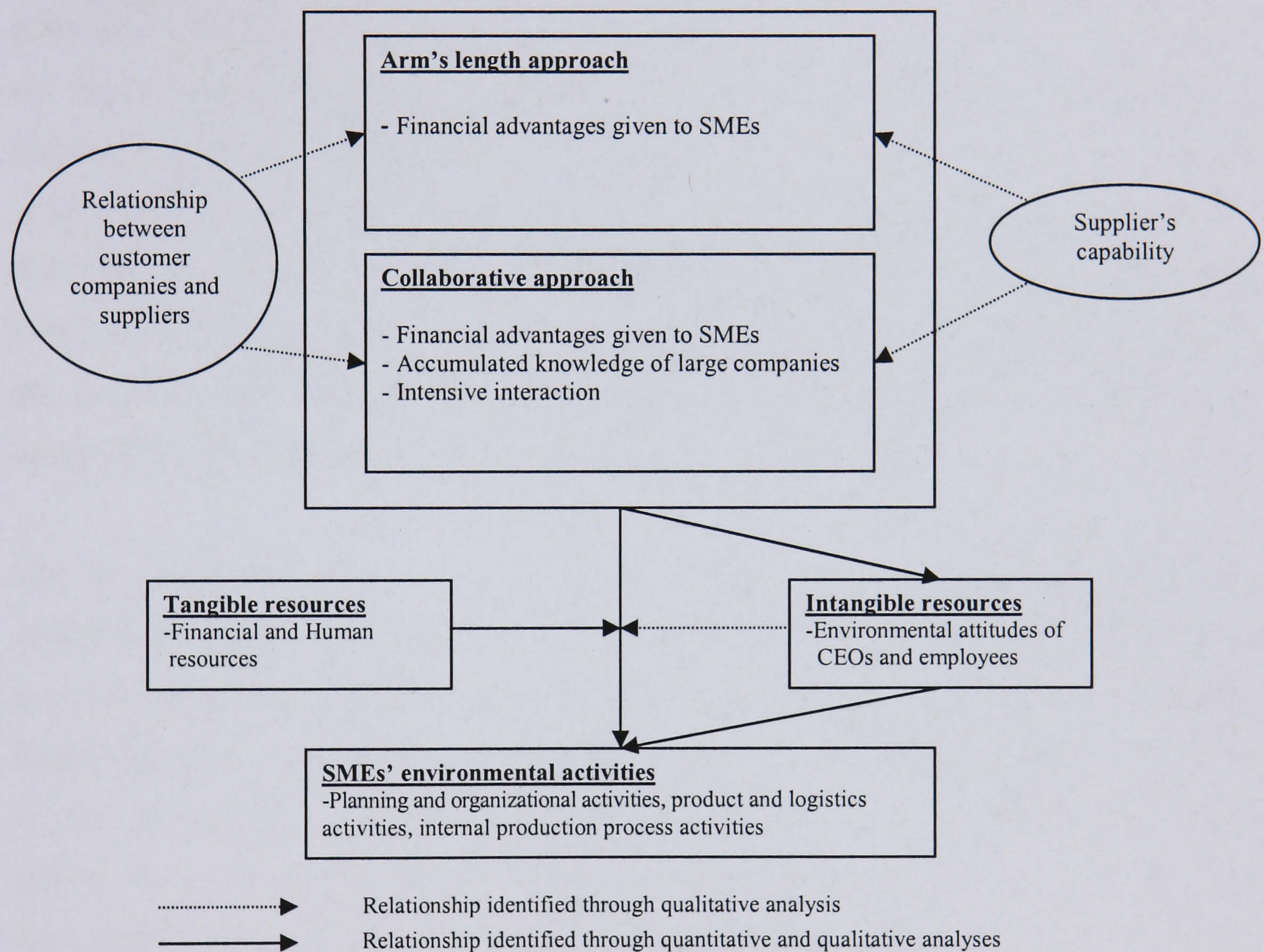
8.2.1 Re-conceptualization of the research framework

Under the realist methodological approach, an empirical study often starts with a literature review and conceptualization through theoretical viewpoints (Yeung, 1997). After analyzing the data, further re-conceptualization might be necessary in order to fill the gap between the empirical elements and the theories (Yeung, 1997).

Initially, the research framework was established in order to understand the relationships between the ESCM approaches of large corporate customers and the environmental activities of SMEs under different internal resource conditions of SMEs through integrating the stakeholder theory and the resource-based view of the firm in the contingency perspective. In the analysis of the data collected in this study, more detailed constructs and relationships between these constructs were identified.

In response to these identified structures and factors, the initial conceptual framework was revised. This revised framework is presented in Figure 8.1 reflecting the results of the analysis of the impacts of the two ESCM approaches on the environmental activities of SMEs.

Figure 8.1. The revised framework of relationships between ESCM approaches and the environmental activities of SMEs



The revised framework highlights the positive impacts of ESCM approaches on SMEs' environmental activities. Qualitative and quantitative analyses support the effectiveness of corporate customers to SMEs overcoming the problems in SMEs. It is important to recognise that these two research methods enabled the identification of suppliers' capabilities. This is a significant factor which influenced the choice of ESCM approach, especially when the two types of internal resources act differently in improving SMEs' environmental activities. The previous framework could not detect this important mechanism of influencing factors and internal resources.

It might be very possible that if quantitative data had been only used for this study, suppliers' capability and intangible resources could have easily been devaluated. In addition, the different effects and roles of tangible and intangible resources could have been missed. Vice versa, when the qualitative analysis is only used, it could have been difficult to isolate the scope and mechanism of individual internal resource types mediating and moderating the effects of ESCM approaches on SMEs environmental activities. This can raise an issue for the realism approach used in a study. Results of this study imply that realism may indicate that truth is derived from the quantitative data and the qualitative data is used to refine and enhance understanding but by implication is of secondary importance, or the qualitative data can reconstruct and complement the deficiency of the quantitative data. This study takes the latter view of the relationship between the quantitative and qualitative data in the context of realism approach, so that the revised framework can include the role of intangible resources in directly and indirectly improving SMEs' environmental.

The revised framework includes important elements (i.e. the relationship between customer companies and suppliers, and suppliers' capability) determining the choice of two different ESCM approaches, namely the collaborative approach and the arm's length approach. The relationship between customer companies and suppliers in terms of strategic business alliance or the significant role of suppliers related to environmental aspects (e.g. suppliers' products, for example hazardous material contained, are particularly concerned by environmental regulations, or the product policy of customer companies, for example green products with particular environmentally friendly components provided by specific suppliers) become a primary influencing factor for the application of ESCM approaches.

Another factor influencing the choice of ESCM approach is the supplier's capability for improving environmental performance. The capability is mostly centred on possessing technology for environmental performance, according to the qualitative analysis. The capability may be overlapping with intangible resources in terms of technical experts for environmental performance and financial resources for installing technical

equipment. However, the capability more emphasised the supplier's current capability for improving environmental performance rather than intangible resources which both include the current and potential capability. In addition, capability implies specific environmental performance which customer companies take as a choice criterion of applying two different ESCM approaches, while internal resources play a role as a moderator or mediator which act on effects of ESCM performance on SMEs' environmental activities. The findings of this study suggest that the superiority of collaborative approaches in promoting SMEs' environmental activities to arm's length approaches but the influencing factors of customer companies' choice of ESCM approaches can be counted as a significant element of ESCM.

In addition, the previous ESCM and SMEs literature has not examined the relative intensity of each ESCM approach clearly and cannot suggest the specific mechanisms in these relationships. This study evaluated the impacts of different ESCM approaches, and the findings showed the stronger relationships between the collaborative approach and the environmental activities of SMEs. Moreover, the findings in this study showed the moderating role of the internal resources in the relationships between the constructs of ESCM approaches and the environmental activities of SMEs. These moderating effects suggest that there exist an appropriate configuration between ESCM approaches and the internal resource conditions of SMEs, and the superior performance can be expected if these conditions are fitted well.

Thus, the revised framework clearly demonstrates the structure of ESCM and vital elements of ESCM. It advances the ESCM theory by illuminating relationships between elements of ESCM and their impacts on ESCM performance and environmental activities of SMEs rather than mechanically and simply evaluating individual ESCM approach. Additionally, this framework can explain more clearly the environmental activity status of SMEs in response to ESCM pressures and can be applied more practically and strategically to managing SME suppliers.

These identified relationships and revised framework suggesting possible paths to persuade SMEs to implement environmental activities can be applied in other situations when the conditions and constructs are exist in the perspective of realism.

8.2.2 Comparison of results with theories

In this study, stakeholder theory was applied to understand the role of large corporate customers, as one of powerful stakeholders for SMEs, on environmental activities of SMEs through ESCM approaches. The resource-based view of the firm with the contingency perspective were applied in order to understand the role of the internal resources of SMEs on the relationships between ESCM approaches and environmental activities.

In addition, this study expected that some recommendations to managers of large corporate customers and SME suppliers could be deduced from the empirical results in accordance with the normative stakeholder perspective. This section discusses the results in accordance with these applied theories for these purposes.

Stakeholder theory with contingency perspective

This study supported empirically a number of issues in stakeholder theory. The large corporate customers were considered critical primary stakeholders in SMEs because they were able to affect the survival, profitability, and growth of SMEs (Clarkson, 1995) and possessed relative power (Mitchell et al., 1997).

These large companies applied the collaborative approach to their important suppliers, which they considered critical stakeholders. By contrast, the arm's-length approach was applied to less important suppliers. As for the SMEs, whether or not they were considered critical stakeholders by their large customers, they tend to regard those large companies as important stakeholders because they had both real and potential power gained through purchasing the SMEs' products and services.

In addition, the results indicated that the impacts of large companies on SMES differed according to the type of ESCM approach adopted, which mainly depended on the type of relationships existing between the large customers and the SME supplier. These results supported Rowley's (1997) view concerning the mechanisms of stakeholders' influence, which is that stakeholders' influence is a function of the density and centrality of the stakeholder network (Rowley, 1997), because the study found that the collaborative approach was dependent upon and utilised the density and centrality of the stakeholder networks – more than the arm's-length approach did - through intensive interactions, accumulating knowledge through the network with various SMEs, and the commitment of the large corporate customers to the environmental activities. In addition, these results were consistent with the view of Friedman and Miles (2002), which is that the constituents of stakeholder influence are the structure of the corporation-stakeholder relationships, the contractual forms, and the institutional supports.

However, this study was limited in exploring power relationships or the relationship between centrality and periphery in the stakeholder network. It initially discovered that the ESCM approaches show the unilateral relationships with the customer companies' perspective, from the customer companies with their strategic alliance with suppliers in the market mechanisms to the supplier (the SME in this case). In this sense, ESCM approaches in the perspective of stakeholder theory with macro social approaches might be inappropriate for digging into theoretical and practical frameworks for the ESCM study as well as the SME research.

This ESCM study highlighted that the stakeholder theory may make more of a contribution to understanding individual stakeholders' influence in terms of degrees and scope of SMEs' environmental activities. This is sharply exposed in the comparison of impacts of ESCM and those of environmental regulations. In this comparison, the data analysis shows that corporate customers and government influence dissimilar areas of SMEs environmental activities with various degrees. From the data, ESCM approaches had advanced effects above the minimum compliance of the government regulations, and on more broad scope of SMEs environmental activities with business reasons than

environmental regulations. Understanding individual stakeholders' influence in the stakeholder network can be useful to set up effective strategy and policy to improve SMEs' environmental performance.

As descriptive and instrumental stakeholder approaches have a clear limitation, as discussed above, this study suggests that the use of normative stakeholder theory in order to promote and improve SMEs' environmental activities through ESCM approaches. The normative stakeholder theory, which was closely related with corporate social responsibility, emphasizes that all stakeholders have interests with intrinsic values regardless of their actual power or legal entitlement (Donaldson and Preston, 1995; Hart and Sharma, 2004), and that corporations should take into account their responsibility for those stakeholders who can be affected by their decision making (Donaldson and Preston, 1995). In addition, corporations should build strategic alignments with a broad range of stakeholders in order to address environmental and social problems (UNIDO, 2002).

This normative stakeholder theory implies that large companies should contribute to sustainable development by implementing more effective ESCM approaches, encouraging SMEs to undertake more active environmental activities, and acknowledging their responsibility to take account of the intrinsic values of SMEs.

The better approaches based on the normative stakeholder theory could be sought through qualitative analysis results considering the complaints of SME suppliers and SME's activity stances in response to ESCM approaches of their customers.

A few disadvantages of the arm's-length approach were identified in the interview data. Under this approach, the increased costs and additional work carried out without the assistance of the customer were burdensome to SMEs. In addition, regarding the level of environmental activity, SMEs undertook environmental activities only to meet the corporate customer's purchasing criteria (See section 7.2.3). By contrast, under the collaborative approach, the scope of assistance programmes was limited by customer's

resource constraints. In addition, large customers would sometimes subordinate strategically important SMEs under the collaborative approach (See section 7.2.3).

However, when the criteria required by customers were higher than the criteria of environmental regulations, and specific assistance programmes offered to SMEs through ESCM approaches led SMEs to adopt a higher level of environmental activity (See section 7.2.1). In addition, a few conditions for SMEs' environmental activities beyond ESCM pressures were identified with regard to both ESCM approaches and SMEs' internal resources. Appropriate reward was regarded by the interviewees as the necessary condition under both the arm's-length and collaborative approaches (See section 7.2.3). In addition, the environmental perception of the CEO motivated activities exceeding the existing criteria. (See section 7.3.3).

The resource-based view of the firm with contingency perspective

In the perspective of the resource-based view of the firm, the internal resources of SMEs were an important factor, necessary for the conduct of environmental activities in response to the ESCM approaches of corporate customers. These findings were consistent with those of the previous researchers in this theory (Penrose, 1959; Rubin, 1973). They noted that firms needed resources to transform undifferentiated production factors into products or services, that is, to undertake their activities (Penrose, 1959), and that resources were those things that enabled the firm to do each activity to produce products and services and could not be separated from the firm (Rubin, 1973).

However, this study recognized that corporate customers' internal resources play as a pivotal factor of decision-making to choose ESCM approaches not just the internal resources of SMEs as significant determinants which can activate the ESCM approaches' impacts and SMEs' improve environmental performance through ESCM. The data analysis indicates that collaborative approaches have limited applicability because of internal resources of the corporate customers, in spite of collaborative approaches' superior influence on promoting environmental activities of SMEs. The

resource-based theory, therefore, explained well how internal resources of both parties of ESCM act on its mechanisms.

In terms of two different types of internal resources, this study found that both tangible (financial and human resources) and intangible resources (environmental attitudes of CEOs and employees) had important role. The moderating effect has been agreed by the researchers adopting contingency perspective (e.g. Lee and Miller, 1966; Luthans, 1985; Selto et al., 1995). In this perspective, there are 'if-then' relationships between situational factors and organizational factors (Luthans, 1985), and an appropriate configuration between a company's organizational characteristics and its environment can result in superior performance (Lee and Miller, 1996; Luthans, 1985).

Regarding the role of intangible resources, mediating as well as moderating effects on the environmental activities of SMEs was identified in the study's quantitative and qualitative analyses. These mixed results can be explained by stakeholder theory, which regards corporations as organizations engaged in relationships with other stakeholders (Freeman, 1984) and as members of network (Rowley, 1997). When their corporate customers influenced the environmental attitudes of CEOs and employees, the roles of those attitudes were formed to be mediating between the ESCM approaches of their customers and their own environmental activities. On the other hand, when their environmental attitudes had already been formulated in response to another stakeholder, the moderating effects of those attitudes were identified.

8.2.3 Theoretical contribution of the study

This study has contributed to advancing the theoretical knowledge of ESCM and SMEs in several ways. Moreover, the integration of stakeholder theory and resource based view of the firm with contingency perspective in the study of ESCM and SMEs can be used to consider the internal and external factors simultaneously.

First, although large customer companies are considered critical stakeholders to whose influence is able to improve SMEs' environmental activities, the impacts of ESCM

approaches on the environmental activities of SMEs were little understood due to lack of empirical evidence and the subject was somewhat controversial (e.g. Green et al., 1996; Meritt, 1998). This study has presented clear evidence of the impacts of the ESCM approaches of large companies on the environmental activities of SMEs through both quantitative and qualitative empirical data, supporting a few studies reporting positive impacts (e.g. BSR, 2001). The study's findings highlight the importance of large companies in the general social movement toward sustainable development. However, it critically reviewed the limitation of descriptive and instrumental stakeholder theories to apply to the SME research, and suggests the normative stakeholder theory should be more appropriate for identifying the role of large companies in promoting SMEs' environmental activities.

Second, although previous studies have categorized ESCM approaches in some detail (e.g. Preuss, 2005), the impacts of those approaches on SMEs have not been distinguished and evaluated clearly. This study clearly has analyzed and evaluated these different impacts; moreover, the study's analysis of the relationships between ESCM approaches and the environmental activities of SMEs has extended the stakeholder theory by illuminating the characteristics of the two main ESCM approaches, and explaining the reasons for the different impacts of each approach. In particular, the revised framework demonstrates the mechanisms of ESCM by understanding influencing factors for two different ESCM approaches, internal resources roles, and degrees and scopes of the impacts of ESCM approaches on SMEs' environmental activities. Moreover, the revised framework implies that the resource-based theory with contingency perspective becomes a useful theoretical approach for ESCM. The resource-based theory with contingency perspective helps to understand how elements including external and internal factors of both parties (customers and suppliers) of ESCM and their relationships influence SMEs environmental activities. This can be an important theoretical contribution to the ESCM knowledge.

Third, although the conditions of internal resources of SMEs have been discussed by several previous studies in the field of ESCM (e.g. BSR, 2001; Geffen and Rothenberg, 2000; Lippman, 2001; Wycherley, 1999), the role of those internal resources in the

relationships between ESCM approaches and SMEs' environmental activities was not fully investigated. This study is the first to offer a conceptual model linking ESCM and SMEs that elucidates the relationships between ESCM approaches and the environmental activities of SMEs including the internal resource conditions obtaining in SMEs, in order to discover more effective ESCM approaches. Thus, identifying the important role of internal resources of SMEs in the successful application of specific management methods can contribute to the SME knowledge.

Fourth, this study pinpoints that intangible resources (the environmental attitudes of CEOs and employees) had no significant effect on the relationships between ESCM approaches and the environmental activities of SMEs. This implies that the overemphasis of environmental attitudes of CEOs and employees and organizational culture in the field of environmental management may have a critical limitation of understanding SMEs' environmental activities. The tangible resources in the case of SMEs may work as the threshold of environmental activities rather than environmental attitudes. This study, therefore, could decouple internal resources from general organizational environmental attitudes, and recognizes the capability of environmental activities may become a vital condition for SMEs' environmental management, though the capability of environmental activities, of course, has great variations across SMEs. However, it might be clear that the over-emphasis of environmental attitudes is derived from the study of conditions or prerequisite for the large companies' environmental management, and it cannot be simply apply to SMEs. Moreover, this implies that the resource-based theory with contingency perspective is a useful theoretical approach to understand the distinctive characteristics of SMEs from those of large companies.

Fifth, taking into account the characteristics of ESCM approaches and the constraints of SMEs, and making use of normative stakeholder theory, this study have been able to offer some suggestions regarding what they should consider when implementing ESCM approaches with a view to persuading their SME suppliers to undertake environmental activities more effectively. In addition, this study identified an important factor influencing SMEs' environmental activities, and another that encouraged SMEs to exceed the criteria suggested by their corporate customers.

Finally, most ESCM studies have been conducted in a Western business context. Even though the importance of SMEs in the East is undeniable, few studies have linked ESCM and SMEs in this context. This empirical study has expanded the field to include the Korean electronics industry. In addition, the data analysis shows trans-national impacts on the Korean electronics SMEs, which emphasizes the globalization of the business. The data analysis found that ESCM approaches of transnational customers to Korean electronics SMEs did not differ from the framework proposed in this study, which implies the possibility of wider application of the framework and research findings in the context of trans-national boundaries.

It also discovered the multi-layered ESCM structure in which trans-national customers applied ESCM approaches to Korean large companies as their suppliers that, in turn, conduct ESCM approaches to their SME suppliers. In this multi-layered ESCM structure the trans-national customers play as an indirect influence on SMEs' environmental activities. The basic mechanisms of ESCM presented in the revised framework may be similarly applied to the ESCM from the trans-national customer to large Korean company. However, the capability of suppliers in the framework will not be an influencing factor to choose two different types of ESCM approaches, because large companies can be assumed to have the capability of environmental activities. Furthermore, tangible resources may not be a barrier to environmental performance for large companies, and environmental attitudes can be more significant factor for improving large companies' environmental activities. In this case, trans-national companies might play as a role of motivating and enhancing environmental attitudes in large corporate suppliers. In this sense, the proposed framework in this study cannot be an appropriate conceptual model for large companies, so the framework might have a limitation of wider application in the context of company size.

8.3. Managerial and policy implications of this study

As noted at the beginning of this thesis, SMEs generally are considered to undertake environmental activities reactively, and thus their large customer companies have the potential to include their SME suppliers in the movement toward sustainable development. This study found that these large companies were considered critically important stakeholders. In addition, it was also found that different ESCM approaches were applied to SMEs by their customers, and the impacts of these approaches differ according to these approaches and specific internal resource conditions of the SME supplier. A number of implications can be deduced from the study's findings for the managers of both large companies and SMEs who hope to contribute to sustainable development.

8.3.1. Implications for the ESCM manager of large companies

This study expected that some recommendations for managers of large companies, who hold the power to manage the environmental performance of their suppliers, could be deduced from the empirical results. A conceptual model of the relationships between a customer company's ESCM approaches and the environmental activities of its SME suppliers can be a useful tool for understanding and considering those factors that influence SMEs' environmental activities. This research has explored the relative strengths of the main ESCM approaches, and has identified various factors explaining the impacts of these approaches. The proposed model could enable large companies to manage their suppliers more efficiently and effectively. A number of recommendations to ESCM managers are suggested by the above findings of this empirical study based on the normative stakeholder perspective and resource-based theory with contingency perspective as follows:

First, the collaborative approach was found to be more effective than the arm's-length approach. Consequently, even if this approach needs more resources to implement, large companies should try to apply the approach to as many SMEs as possible. (find appropriate methods of collaborative approaches to SMEs, and mix of collaborative and arm's length approaches, especially communication methods and educations)

Second, when engaged in arm's-length relationships, large companies should consider the increased costs and work incurred by SMEs undertaking environmental activities in response to their demands. These are a burden to SMEs, and these problems should be considered when making decisions of applying this ESCM approach.

Third, the criteria developed by some large companies, which were stricter than those prescribed by government environmental regulations, made SMEs achieve superior environmental performance. Thus, large companies could adopt more proactive ESCM approaches and make a substantial contribution toward sustainable development.

Fourth, appropriate compensation for a supplier's superior performance might persuade SMEs to undertake environmental activities beyond the demands imposed by large companies. Large companies should therefore design ESCM approaches that include appropriate compensation for superior environmental performance.

8.3.2. Implications for managers of SMEs

A number of recommendations can be made on the basis of the study's findings that might enable SMEs to adopt more active environmental activities beyond the limits suggested by their customers and that might help them prepare more effectively to meet the environmental demands of their corporate customers.

First, SMEs should be aware that they are not excluded from environmental issues. SMEs are inevitably exposed to environmental pressures from their corporate customers and requirements can be environmental demands could be important criteria in the

customer's decision-making process. Environmental issues can be critical to the survival of SMEs.

Second, SMEs would gain substantial benefits by grasping the opportunities provided by their customer's ESCM approaches. They could gain business opportunities, which could lead to economic competencies in the market, through demonstrating the superior environmental performances of their products. They could also freely access accumulated the environmental knowledge of large companies and build better relationships through collaboration.

Third, the attitudes of CEOs and employees to the environment were changed in response to the demands of ESCM pressures, and these positively led to the undertaking of environmental activities. Thus, these environmental attitudes are required to undertake environmental activities. Consequently, it may be valuable to accumulate these kinds of resources in order to better respond to those pressures, which are likely to increase.

8.3.3. Implications for policy makers

This study was conducted in the context of the market and focused on the interaction between large customer companies and their SME suppliers, designed to improve the environmental activities of SMEs. However, based on the study's findings, a number of recommendations might be offered for the attention of government policy makers.

First, government should seek to provide specific assistance to SMEs. As shown in the interview data, many programmes have been organized by government for the purpose of assisting SMEs; however, ESCM approaches were considered superior to government assistance programmes – in their provision of specific and relevant information. To be more effective, government programmes should consider the diversity of SMEs and the obstacles they face, and contain specific and relevant information to SMEs.

Second, there could be a role for government in improving the environmental attitudes of SMEs toward the environment. The attitudes of CEOs and employees can be made more positive by factors other than ESCM approaches, and its increased positivity could enable SMEs to undertake environmental activities more actively. Accordingly, the government should institute programmes designed to improve the environmental attitudes of SMEs.

Lastly, it was found that government policy designed to persuade SMEs to undertake environmental activities was essentially implemented through regulations which had effects both within and beyond the borders of the country concerned. Thus European regulation influenced Korean SMEs through the ESCM approaches of large companies doing business in Europe. This shows that governments can affect SMEs in other countries. Thus, the global impacts of environmental regulations should be considered when drafting such regulations.

8.4. Limitations of the study and suggestions for future research

8.4.1 Limitations of this study

This study investigated the impacts of the ESCM approaches of large companies on the environmental activities of SMEs in the Korean electronics industry using both quantitative and qualitative approaches. Thus, the scope of this study and the interpretation of the results were subject to a number of limitations.

First, ESCM approaches of large companies (the arm's-length approach and the collaborative approach) were only one element of the measures used by such companies to influence the environmental activities of SMEs, and the tangible (financial and human) and intangible (environmental attitudes of CEOs and employees) resources form only part of the internal resource conditions of SMEs. The measurement of the environmental activities could not include all the environmental practices applied in real business fields. In addition, the identification of the factors governing the relationships between customer's ESCM approaches and SMEs' environmental activities, in

conjunction with SMEs' internal resources, showed only parts of these influential mechanisms. The practicalities of the research project made it impossible to consider all aspects of the phenomena under study. However, these elements and identified mechanisms had significant roles in the impacts of ESCM on the environmental activities of SMEs.

Second, this study adopted two different methodological approaches: the quantitative approach and the qualitative approach. Regarding the qualitative approach, the factors identified are subject to methodological limitations such as difficulty of generalization. However, the selected interviewee had much more experiences than a number of SMEs. Hence, the problems of generalization for the results of qualitative analysis can be diminished.

Third, the scope was necessarily constrained. The data collected from SMEs in the Korean electronics industry obviously could not describe all situations in every sector and all other countries. It is to be expected that similar results would be obtained with respect to other countries and industrial sectors, in which ESCM is widely adopted and large companies are able to exert a powerful influence on SMEs. Thus, the findings of this study can be generalized to contexts similar to the Korean electronics industry.

However, even if this study has such limitations, these were considered in the research design and were not serious problems in the end. The value of this study lies in providing clear evidence with regard to the impacts of ESCM approaches of large companies on the environmental activities of SMEs toward sustainable development.

8.4.2 Suggestions for future research

The empirical evidence gathered by this study might provide a stimulus for the study of relationships between the ESCM approaches of large companies and the environmental activities of SMEs in other similar contexts. Considering the rapid development of ESCM and the importance of SMEs to the environment, several research opportunities were found through this research.

First, the identified factors and relationships could be tested and explored in more depth, and in other industries and countries. Other factors and relationships in ESCM to persuade SMEs to undertake environmental activities could exist. Such research could be valuable in the achievement of sustainable development.

Second, this study focused on the environmental dimension of supply chain management. Ethical and social issues could be examined in connection with the supply chain management practised by large companies. These issues could also be valuable research subjects in the area of SMEs' contribution to sustainable development.

Third, SMEs' environmental performance, in other words the outcomes of their environmental activities, could be improved in response to the ESCM approaches of large companies. These performances could be evaluated later by means of a longitudinal study with quantitative data.

Fourth, the research framework in this study could be used and tested in another field such as in the studies of relationships between corporate customers and suppliers. Further, it could be taken and applied in other contexts.

Last, the overall economic as well as environmental performances of the supply chain as affected by ESCM could be examined. These issues may particularly interest large companies.

8.4.3 Concluding remark

This study began with the recognition of the importance of market mechanisms and particularly the ESCM approaches of large companies, in the integration of SMEs into the movement for sustainable development. This study has provided evidence regarding the environmental activities of SMEs in response to the ESCM approaches of their large customer companies, and has also provided a number of recommendations to ESCM managers, SMEs, and policy makers.

The study showed that there were a number of paths toward sustainable development incorporating SMEs by investigating ESCM phenomena. Although the ESCM practised by large companies, which was the study's main research area, was an effective mechanism in the drive toward sustainable development, the environmental regulations instituted by governments also prompted those companies to develop ESCM approaches and controlled directly SMEs' environmental activities. Accordingly, the configurations of both government and market should be harmonized for the rapid achievement of sustainable development.

In addition, although the emphasis on environmental issues was not a new phenomenon in society, and many leading companies often integrated environmental issues into their business, the stance of the great majority of SMEs was passive rather than proactive. This is unfortunate, considering the economic and environmental importance of the SME sector. More research should be conducted to assist SMEs and improve their performance, and these objectives should also be the concern of policy makers.

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Appendices

Appendix 1. Sources for measuring ESCM approaches

Questionnaire items	Sources
1. Our corporate customer provides policy materials regarding its environmental expectations	Lippman (1999)
2. Our corporate customer holds one-to-one meeting for addressing environmental issues	Lippman (1999)
3. Our corporate customer holds seminar/workshop for environmental awareness	Lippman (1999), Rao (2003)
4. Our corporate customer provides written guidance/training materials to build environmental capability	Rao (2003)
5. Our corporate customer provides training or site visit programmes to develop environmental management techniques	Lippman (1999)
6. Our corporate customer provides training or site visit programmes to develop environmental technology	Lippman (1999)
7. Our corporate customer provides training or site visit programmes to develop environmental management techniques with a third organization	NEETF (2000)
8. Our corporate customer provides training or site visit programmes to develop environmental technology with a third organization	NEETF (2000)
9. Our corporate customer provides low-interest loans for environmental projects	Rao (2003)
10. Our corporate customer holds site visit or audit to review our company's environmental performance	Lippman (1999), NEETF (2000)
11. Our corporate customer purchases environmentally friendly products such as recycled items or those made from recycled materials	Rao (2003)
12. Our corporate customer purchases products that do not contain environmentally hazardous materials such as lead and cadmium	Rao (2003)
13. Our corporate customer requires information in product about any environmentally hazardous materials such as lead and cadmium incorporated in the product	Rao (2003)
14. Our corporate customer requires our company to plan for reducing and eliminating environmentally hazardous materials such as lead and cadmium	Rao (2003)
15. Our corporate customer requires our company to control our suppliers for environmental reasons	Rao (2003)
16. Our corporate customer provides equipment for analysing the environmentally hazardous materials in our product	Rao (2003)
17. Our corporate customer requires our company to answer the questionnaire addressing environmental management activities and initiatives	Rao (2003)
18. Our corporate customer requires our company to set up an environmental management system according to EMS standards such as EMAS or the ISO 14001 system	Rao (2003)
19. Our corporate customer requires our company to set up an environmental management system according to a customised environmental system set up for the customers company's own operation	Rao (2003)
20. Our corporate customer involves our company in the design process for the environmental improvement of product and manufacturing process	Lippman (1999)
21. Our corporate customer provides incentives for our company's good environmental performance	Lippman (1999), NEETF (2000)
22. Our corporate customer has broken the business relationships because of our company's environmentally bad process	Leung (2002)
23. Our corporate customer has broken the business relationships because of our company's environmentally bad product	Leung (2002)

Appendix 2. Survey questionnaire

PART A. GENERAL INFORMATION

1. COMPANY BACKGROUND

A1. Name of Company: _____

A2. Year of Establishment: _____ (YYYY)

A3. Type of Company: Independent Subsidiary

Others (specify) _____

A4. Annual sales for each of the last three years (Million Won)

2001 2002 2003

A5. Number of full-time employees: _____ (persons)

A6. Paid in capital: _____ (Million won)

2. RESPONDENT DETAILS

A7. Name: _____

A8. Your position in your company

CEO Senior Executive Executive

Director Other (specify) _____

A9. Please indicate how extensively you are related to environmental issues of your company.

Not at all	A little extent	To some extent	To a great extent	To a very great extent
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

A10. Contact information Phone No.: +82 - () - () - () _____

Fax No.: +82 - () - () - () _____

E-mail: _____ @ _____

PART B. ENVIRONMENTAL ACTIVITIES

This part deals specifically with environmental actions, which will improve environmental performances of company operations, products and services. Please indicate the extent of your company's activities in the following areas.

	Not at all :No action	A little extent	To some extent	To a great extent	To a very great extent: it has been a priority for our company
(1) Explicit definition of environmental policy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) Clear objectives and long-term environmental plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) Well-defined environmental responsibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) Full-time employees devoted to environmental management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(5) Natural environment training programs for managers and employees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(6) Systems for measuring and assessing environmental performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(7) Environmental emergency plans (e.g. Pollution damage insurance)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(8) Substitution of polluting and hazardous materials/parts (e.g. Pb, Cd, Cr+6and Hg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(9) Designs focused on reducing resource consumption and waste generation during production and distribution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(10) Designs focused on reducing resource consumption and waste generation in product usage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(11) Design for disassembly, reusability and recyclability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(12) Preference for green products in purchasing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(13) Environmental criteria in supplier selection (e.g. doing business ISO 14001 certified companies)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(14) Shipments consolidation (e.g. consider environmental accident in transportation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(15) Selection of cleaner transportation methods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(16) Recyclable or reusable packaging/containers in logistics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(17) Ecological materials for primary packaging (e.g. using paper bag)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(18) Recuperation and recycling systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(19) Responsible disposal of waste and residues (separation and preparation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(20) Emission filters and end-of-pipe controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(21) Process design focused on reducing energy and natural resources consumption in operations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(22) Production planning and control focused on reducing waste and optimizing materials exploitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(23) Acquisition of clean technology/equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(24) Periodic elaboration of environmental reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(25) Sponsoring of environmental events/collaboration with ecological organizations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(26) Environmental arguments in marketing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(27) Regular voluntary information about environmental management to customers and institutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

PART C. ENVIRONMENTAL REGULATION

This part deals specifically with the influence of environmental regulations on your company's environmental activities. Please indicate the extent of the impacts of the regulations on your firm's environmental activities in the past three years (2002, 2003 and 2004).

	Not at all	A little extent	To some extent	To a great extent	To a very great extent
(1) Existing environmental regulation from government in Korea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) Anticipated environmental regulation from government in Korea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) Existing environmental regulation from foreign governments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) Anticipated environmental regulation from foreign governments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

PART D. ENVIRONMENTAL SUPPLY CHAIN MANAGEMENT APPROACHES

This part deals specifically with the environmental supply chain management approaches of your corporate customers. Environmental supply chain management refers to a variety of approaches through which companies work with their suppliers to improve the environmental performance of the products or manufacturing processes of the supplier, customer or both. Please indicate the extent to which you agree with the following statements about the environmental supply chain approaches adopted by your corporate customers in the past three years (2002, 2003 and 2004)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
(1) Our corporate customer provides policy materials regarding its environmental expectations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) Our corporate customer holds one-to-one meeting for addressing environmental issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) Our corporate customer holds seminar/workshop for environmental awareness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) Our corporate customer provides written guidance/training materials to build environmental capability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(5) Our corporate customer provides training or site visit programmes to develop environmental management techniques	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(6) Our corporate customer provides training or site visit programmes to develop environmental technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(7) Our corporate customer provides training or site visit programmes to develop environmental management techniques with a third organisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(8) Our corporate customer provides training or site visit programmes to develop environmental technology with a third organisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(9) Our corporate customer provides low-interest loans for environmental projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(10) Our corporate customer holds site visit or audit to review our company's environmental performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(11) Our corporate customer purchases environmentally friendly products such as recycled items or those made from recycled materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(12) Our corporate customer purchases products that do not contain environmentally hazardous materials such as lead and cadmium	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(13) Our corporate customer requires information in product about any	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

environmentally hazardous materials such as lead and cadmium incorporated in the product

— — — — —

(14) Our corporate customer requires our company to plan for reducing and eliminating environmentally hazardous materials such as lead and cadmium

(15) Our corporate customer requires our company to control our suppliers for environmental reasons

(16) Our corporate customer provides equipment for analysing the environmentally hazardous materials in our product

(17) Our corporate customer requires our company to answer the questionnaire addressing environmental management activities and initiatives

(18) Our corporate customer requires our company to set up an environmental management system according to EMS standards such as EMAS or the ISO 14001 system

(19) Our corporate customer requires our company to set up an environmental management system according to a customised environmental system set up for the customers company's own operation

(20) Our corporate customer involves our company in the design process for the environmental improvement of product and manufacturing process

(21) Our corporate customer provides incentives for our companies' good environmental performance (e.g. extension of contract, prize)

(22) Our corporate customer has broken the business relationships because of our company's environmentally bad process (e.g. violation environmental regulation)

(23) Our corporate customer has broken the business relationships because of our company's environmentally bad product (e.g. using environmentally hazardous materials in a product)

(24) (Nationality) How would you describe the main customer adopting these approaches for your company? (Please check only one)

A Korean firm

A foreign firm operating in Korea

An American (USA) firm

A European firm

An Asian (e.g. Japanese) firm

Appendix 3. Interview guide and control sheet: first stage

Control Sheet

Interview Date

Tape No

Time

Details of the firm

Firm name

Location

Number of employees

Paid in capital (Million won)

Sales (Million won)

Manufacturing items

Details of the interviewee

Current position

Years in job

Years with company

Interview Guide

After filling out Control sheet and confidentiality discussion

Current environmental status and motivation

1. What specific activities is your company conducting to improve environmental performance? (Prompts: From when?)

(e.g. energy efficiency, waste minimisation)

2. What is the primary motivation for your company to improve environmental performance?

(e.g. regulations, corporate customers)

Supply Chain pressure

3. Have you experienced any pressure/assistance from your corporate customer to examine/improve your firm's environmental performance?

4. If yes,

4a) Where is the head office of this corporate customer?

4b) What kinds of pressure/assistance do you experience from your corporate customer regarding our company's environmental performance? (From when?)

(e.g. questionnaire, audit, ISO 14001 certification)

4c) Is this pressure/assistance from your corporate customer helpful/unhelpful for your company's environmental activities? If so, why?

Resources of SMEs

5. What are the most important barriers to your company's environmental activities?

6. What resources do you need for your firm's environmental activities?

(e.g. financial resource, knowledge, time)

Appendix 4. Interview guide and control sheet: second stage

Control Sheet

Name:

Age:

Current position:

Years in job:

Work experience of ESCM issues (in detail):

Educational background:

Years with company:

Interview Guide

After describing the objective of the research and confidentiality discussion

1. Do you think the collaborative approach is different from the arm's length approach? If so, what are the differences?
2. Why do you think corporate customers adopt the collaborative approach?
3. Why do you think corporate customers adopt the arm's-length approach?
4. How do you think the collaborative approach influences the environmental activities of SMEs?
5. How do you think the arm's length approach influences the environmental activities of SMEs?
6. Which approach was more effective? If so, why?

7. Could you provide examples of SMEs exceeding the corporate customer's environmental requirements? If so, what were the reasons for undertaking these initiatives?
8. What kind of internal resources make SMEs react effectively to the corporate customer's arm's-length and collaborative approaches?
9. What kind of internal resources are necessary for SMEs to exceed the corporate customer's environmental requirements?
10. Could you compare the impacts of ESCM approaches with those of regulations?

Appendix 5. Descriptive statistics of questionnaire survey

Response on environmental activities

Items	Mean	Std. deviation
1. Explicit definition of environmental policy	2.98	1.074
2. Clear objectives and long-term environmental plans	2.83	1.066
3. Well-defined environmental responsibilities	2.90	1.003
4. Full-time employees devoted to environmental management	2.35	.926
5. Environment training programs for managers and employees	2.69	.938
6. Systems for measuring and assessing environmental performance	2.57	1.099
7. Environmental emergency plans	2.29	1.146
8. Substitution of polluting and hazardous materials/parts	3.40	1.202
9. Designs focused on reducing resource consumption and waste generation during production and distribution	3.06	1.118
10. Designs focused on reducing resource consumption and waste generation in product usage	3.24	.949
11. Design for disassembly, reusability and recyclability	2.92	.994
12. Preference for green products in purchasing	2.95	1.004
13. Environmental criteria in supplier selection	2.76	1.177
14. Shipments consolidation	2.70	1.092
15. Selection of cleaner transportation methods	2.61	.995
16. Recyclable or reusable packaging/containers in logistics	3.03	1.066
17. Ecological materials for primary packaging	3.15	.974
18. Recuperation and recycling systems	2.76	1.070
19. Responsible disposal of waste and residues (separation and preparation)	3.59	1.067
20. Emission filters and end-of-pipe controls	2.75	1.128
21. Process design focused on reducing energy and natural resources consumption in operations	3.03	.922
22. Production planning and control focused on reducing waste and optimizing materials exploitation	2.96	.966
23. Acquisition of clean technology/equipment	2.90	.949
24. Periodic elaboration of environmental reports	2.33	1.138
25. Sponsoring of environmental events/collaboration with ecological organizations	1.75	.874
26. Environmental arguments in marketing	2.22	1.001
27. Regular voluntary information about environmental management to customers and institutions	2.19	1.081

Responses on ESCM approaches of corporate customers

Items	Mean	Std. Deviation
1. Our corporate customer provides policy materials regarding its environmental expectations	3.15	1.136
2. Our corporate customer holds one-to-one meeting for addressing environmental issues	2.59	1.025
3. Our corporate customer holds seminar/workshop for environmental awareness	2.70	1.113
4. Our corporate customer provides written guidance/training materials to build environmental capability	2.88	1.145
5. Our corporate customer provides training or site visit programmes to develop environmental management techniques	2.54	1.080
6. Our corporate customer provides training or site visit programmes to develop environmental technology	2.50	1.071
7. Our corporate customer provides training or site visit programmes to develop environmental management techniques with a third organization	2.36	1.008
8. Our corporate customer provides training or site visit programmes to develop environmental technology with a third organization	2.30	.969
9. Our corporate customer provides low-interest loans for environmental projects	1.81	.868
10. Our corporate customer holds site visit or audit to review our company's environmental performance	2.70	1.198
11. Our corporate customer purchases environmentally friendly products such as recycled items or those made from recycled materials	2.41	1.057
12. Our corporate customer purchases products that do not contain environmentally hazardous materials such as lead and cadmium	3.31	1.293
13. Our corporate customer requires information in product about any environmentally hazardous materials such as lead and cadmium incorporated in the product	3.36	1.308
14. Our corporate customer requires our company to plan for reducing and eliminating environmentally hazardous materials such as lead and cadmium	3.27	1.321
15. Our corporate customer requires our company to control our suppliers for environmental reasons	3.04	1.250
16. Our corporate customer provides equipment for analysing the environmentally hazardous materials in our product	2.07	.955
17. Our corporate customer requires our company to answer the questionnaire addressing environmental management activities and initiatives	2.64	1.107
18. Our corporate customer requires our company to set up an environmental management system according to EMS standards such as EMAS or the ISO 14001 system	3.12	1.289
19. Our corporate customer requires our company to set up an environmental management system according to a customised environmental system set up for the customers company's own operation	3.12	1.251
20. Our corporate customer involves our company in the design process for the environmental improvement of product and manufacturing process	2.61	1.155
21. Our corporate customer provides incentives for our company's good environmental performance	2.32	1.051
22. Our corporate customer has broken the business relationships because of our company's environmentally bad process	2.73	1.170
23. Our corporate customer has broken the business relationships because of our company's environmentally bad product	2.84	1.210

Influences of environmental regulation on environmental activities

Items	Mean	Std. Deviation
1. Existing environmental regulation from government in Korea	3.24	1.055
2. Anticipated environmental regulation from governments in Korea	3.74	1.016
3. Existing environmental regulation from foreign governments	3.70	1.072
4. Anticipated environmental regulation from foreign governments	3.82	1.069

Internal resources for environmental activities

Items	Mean	Std. deviation
1. Financial resources	2.68	.963
2. Human Resources (Environmental expertises)	2.49	.956
3. Information for environmental activities	2.87	.824
4. Environmental awareness and support for environmental activities of CEO	3.20	.915
5. Environmental awareness of employee	2.93	.889

Descriptive statistics of the summated scale

	Mean	Std. Deviation	Skewness	Kurtosis
Planning and organizational activities	2.6044	.86628	.234	-.272
Product and logistics activities	2.8964	.83585	-.217	-.393
Internal production activities	2.9634	.86817	-.288	-.057
Arm's-length approach	3.0571	1.06285	-.268	-.639
Collaborative approach	2.4377	.92478	.328	-.163
Environmental regulations	3.6264	.91856	-.692	-.003
Tangible resources	2.5824	.88967	.141	-.271
Intangible resources	3.0687	.81217	-.123	.266

Pearson's correlations between variables

	AT1	AT2	AT3	EM1	EM2	REG	RES1	RES2
Planning and organizational activities (AT1)	1							
Product and logistics activities (AT2)	** .620	1						
Internal production activities (AT3)	** .637	** .595	1					
Arm's-length approach (EM1)	** .513	** .417	** .372	1				
Collaborative approach (EM2)	** .573	** .464	** .386	** .735	1			
Environmental regulations (REG)	** .382	** .239	** .333	** .475	** .307	1		
Tangible resources (RES1)	** .517	** .378	** .424	** .434	** .410	** .231	1	
Intangible resources (RES2)	** .563	** .467	** .501	** .418	** .317	** .223	** .617	1

** Correlation is significant at the 0.01 level (2-tailed)

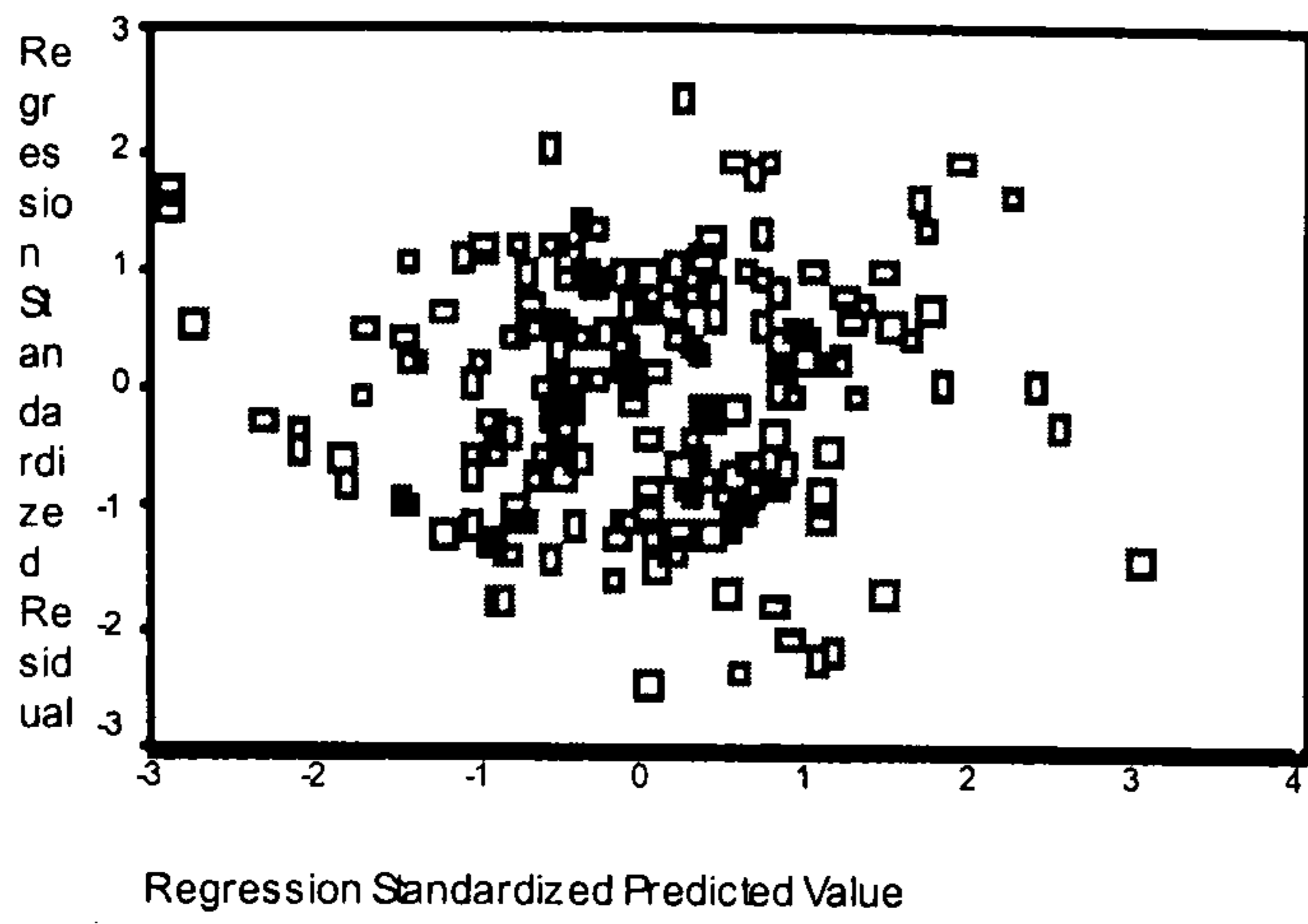
Relationships between ESCM approaches and intangible resources

ESCM Approaches	Increased R ² values	Standardized coefficients
Arm's-length approach	0.126 ***	0.403 ***
Collaborative approach	0.101 ***	0.335 ***

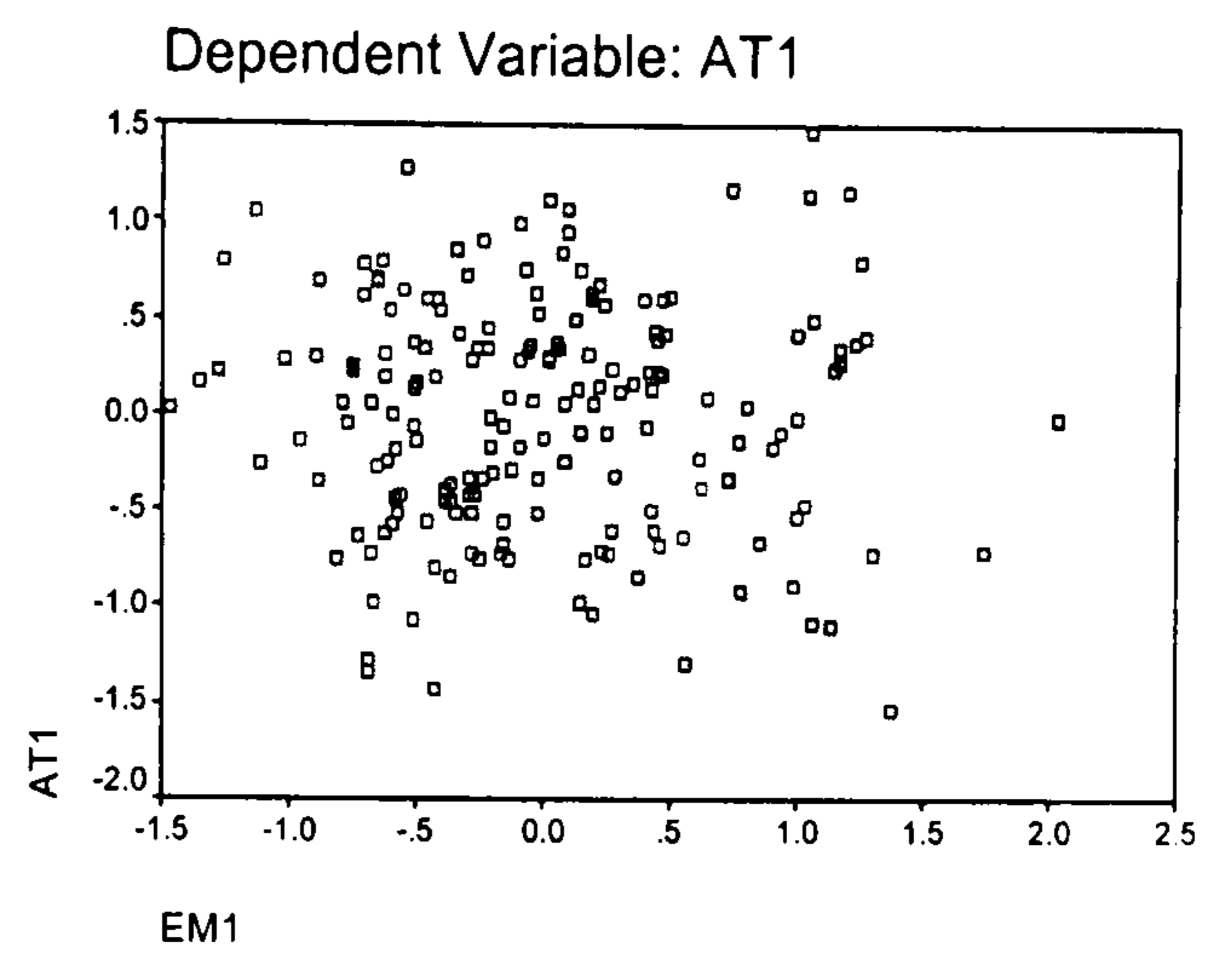
(* p < 0.1, ** p < 0.05, ***p < 0.01)

Appendix 6. Examples of residual plots

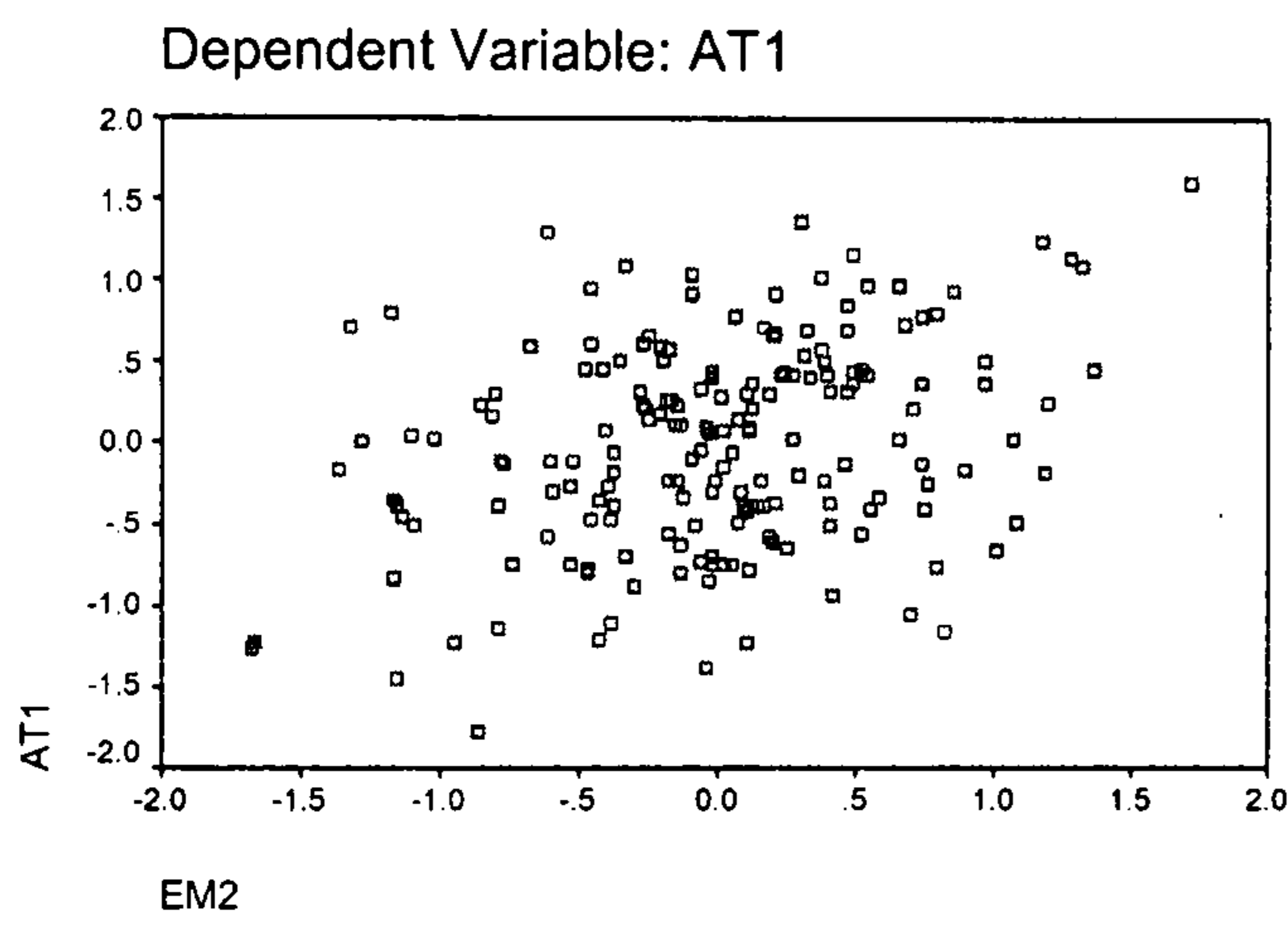
Scatterplot



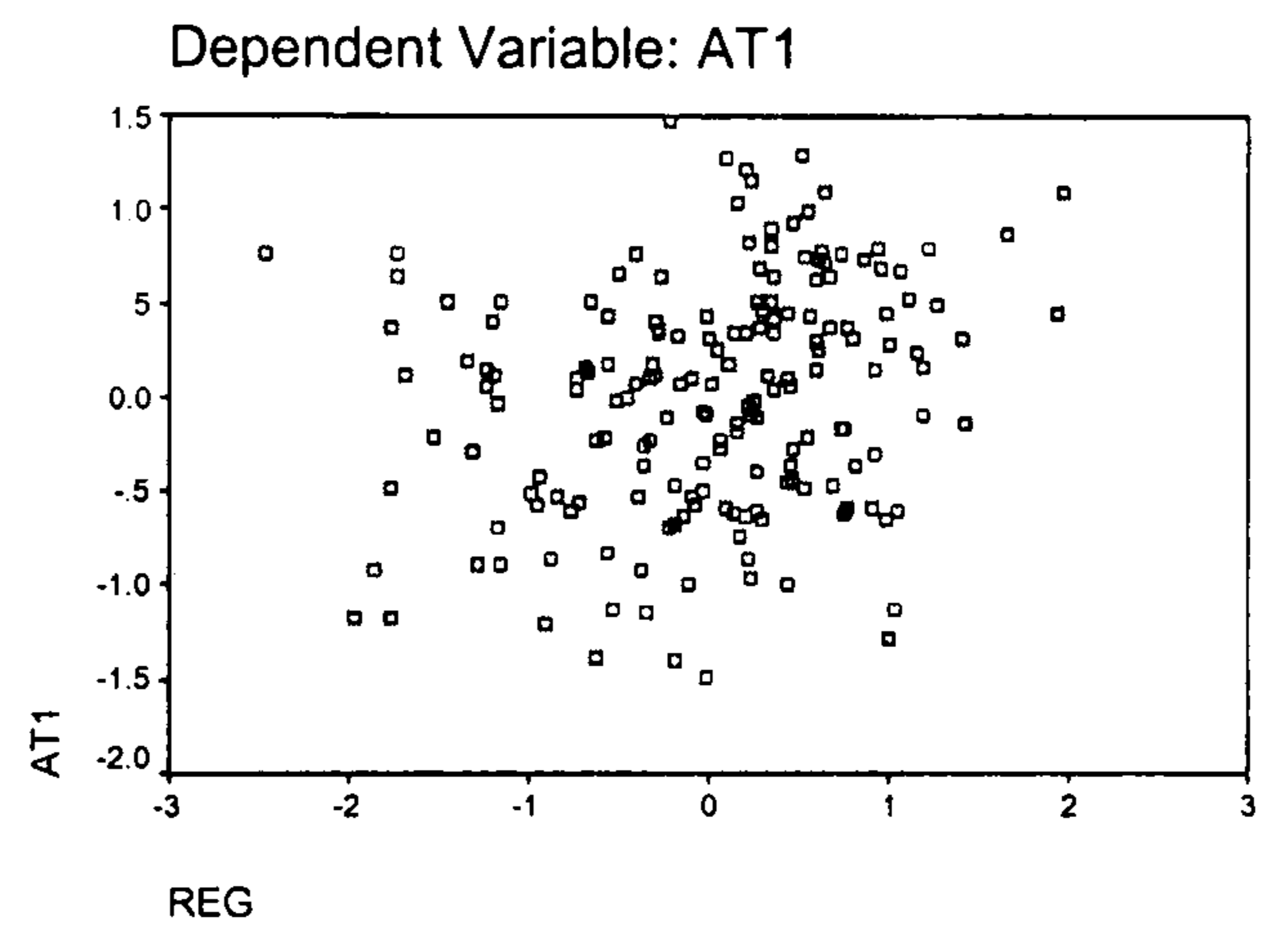
Partial Regression Plot



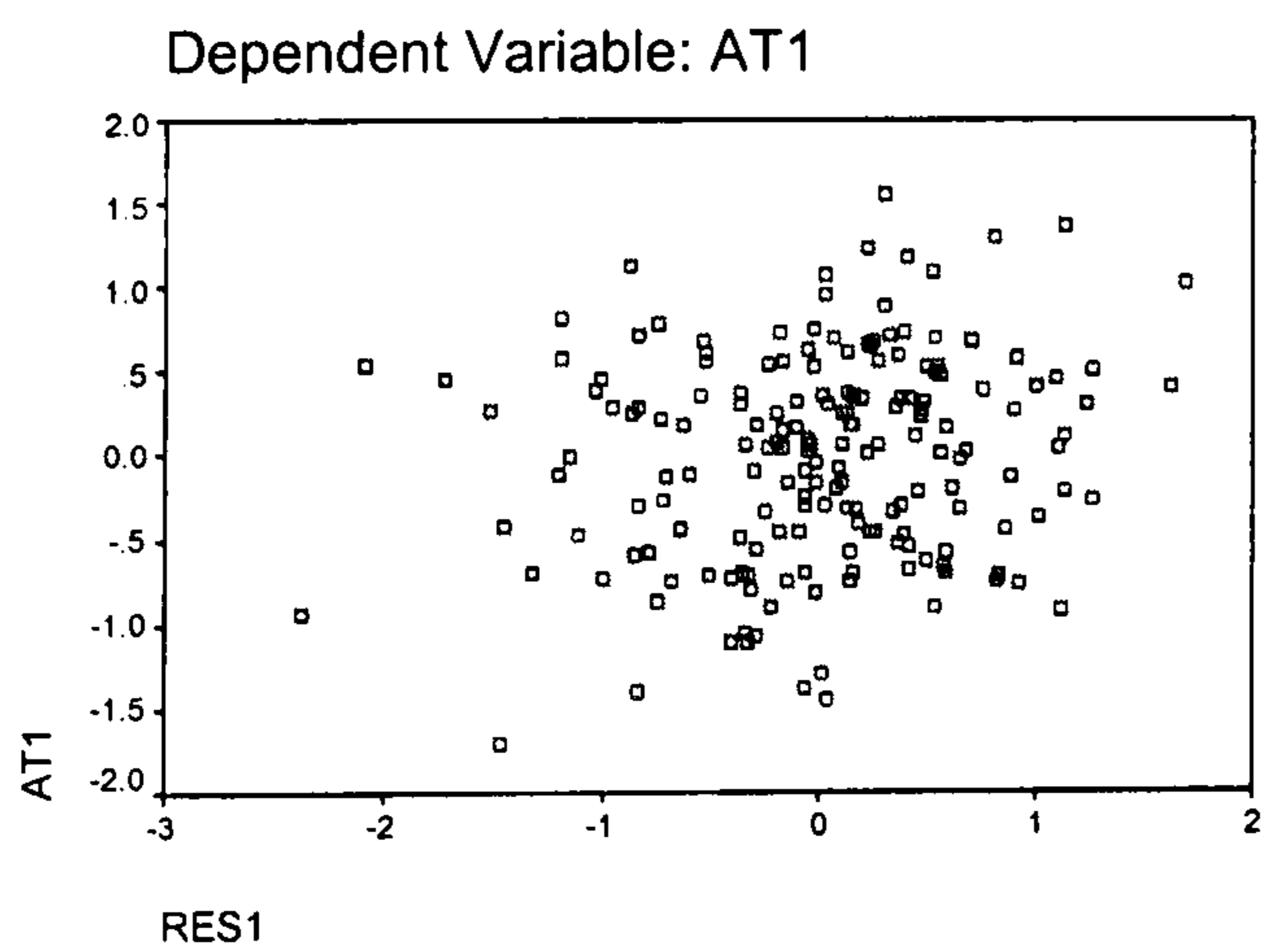
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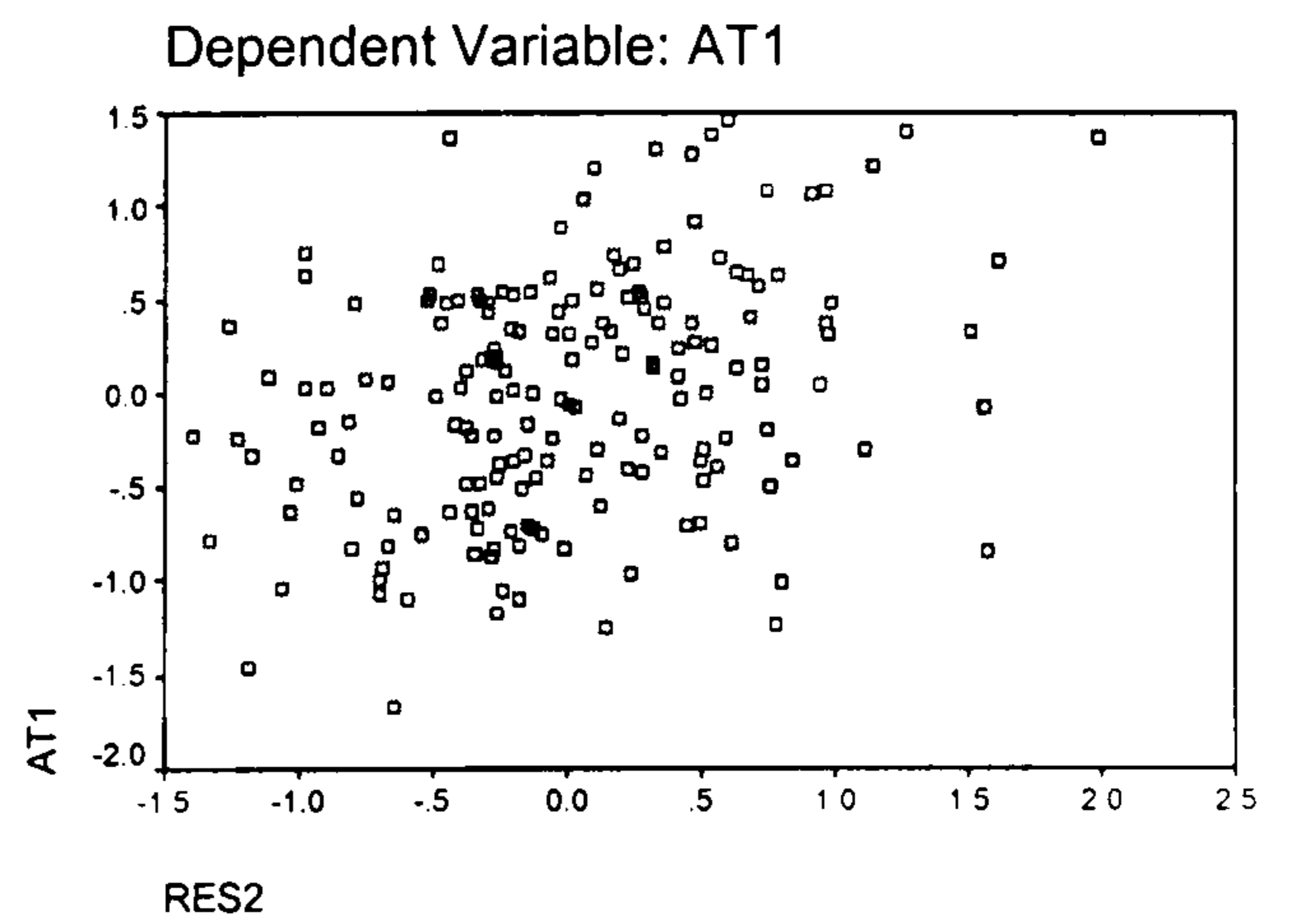
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Partial Regression Plot

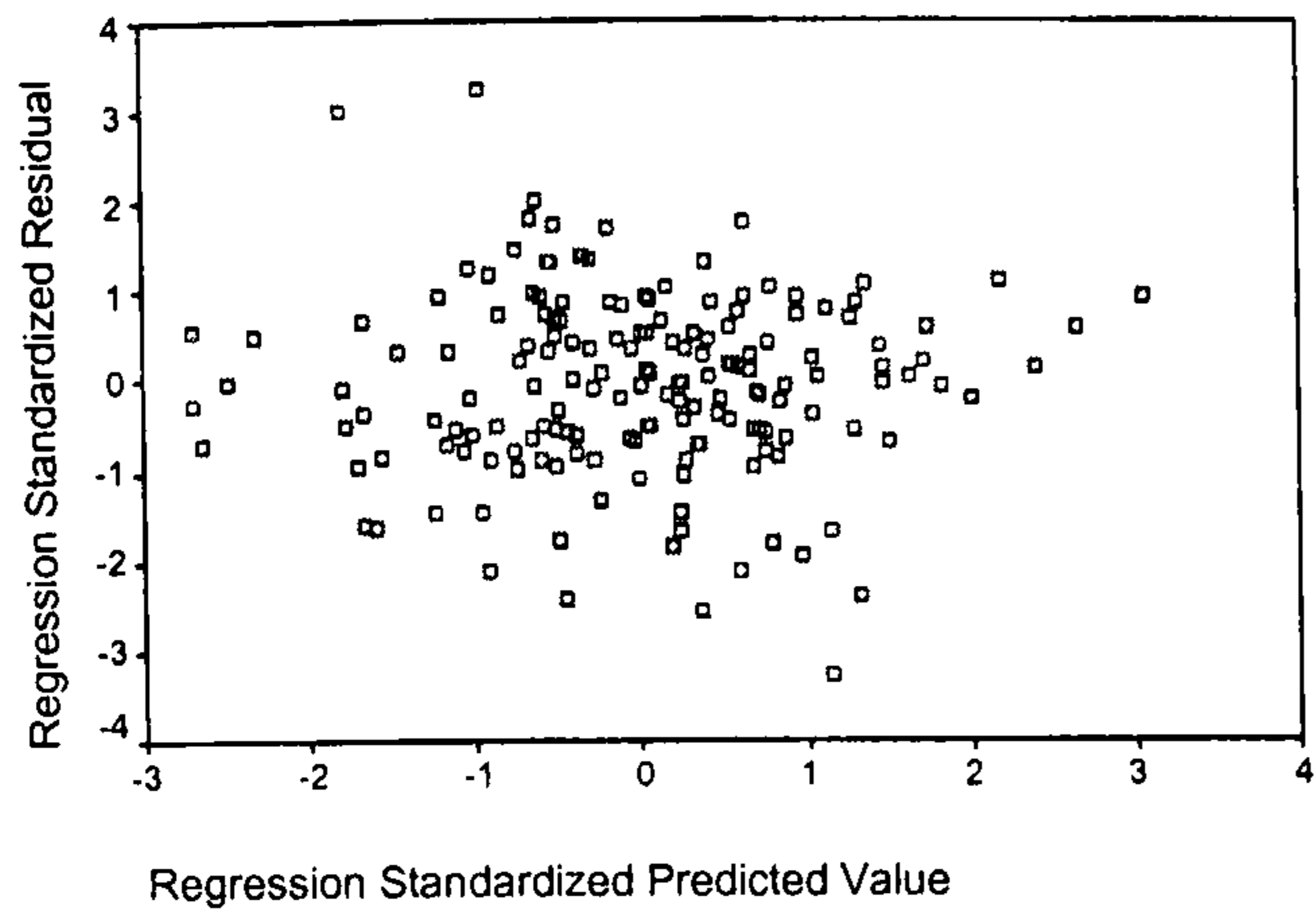


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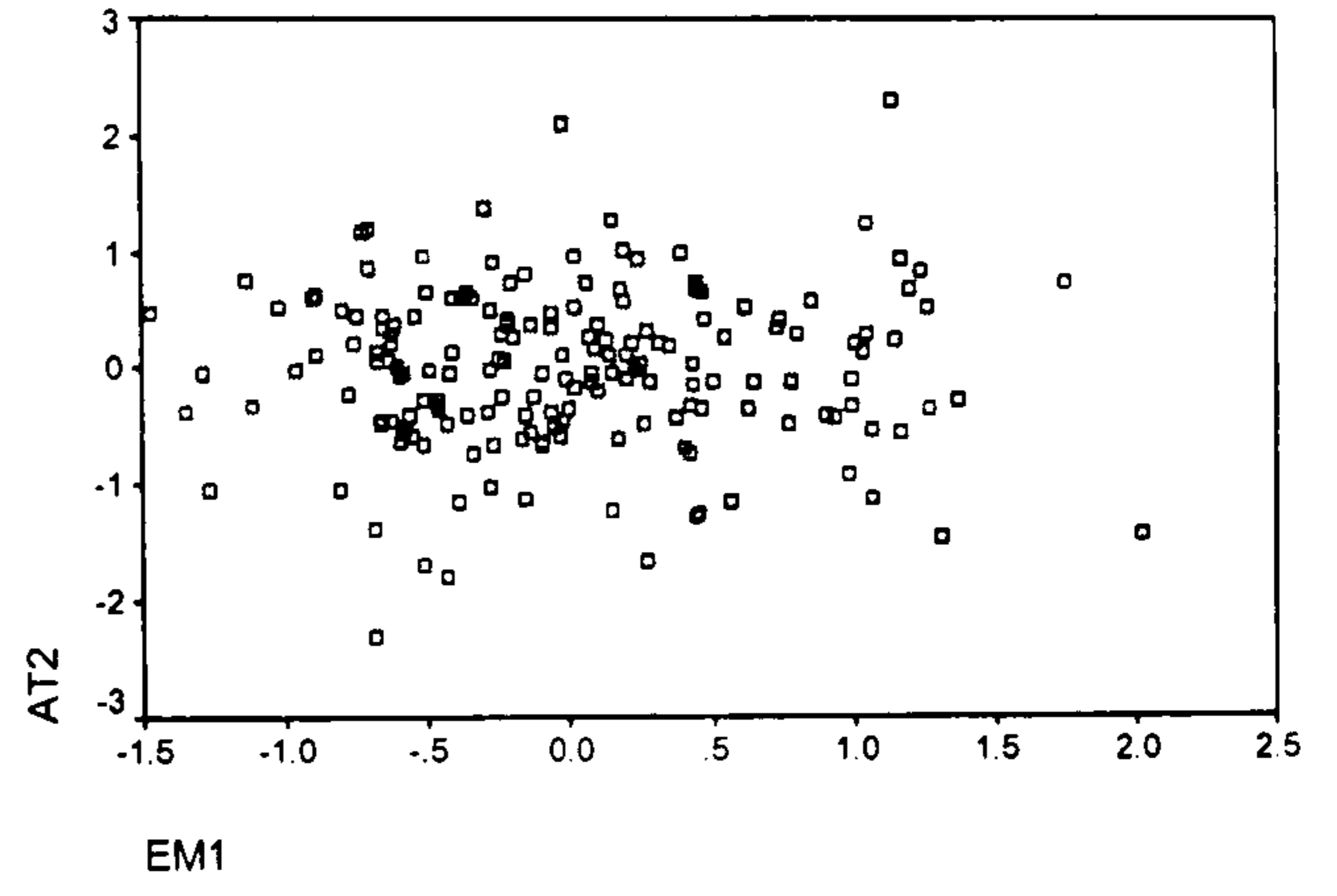
Scatterplot

Dependent Variable: AT2



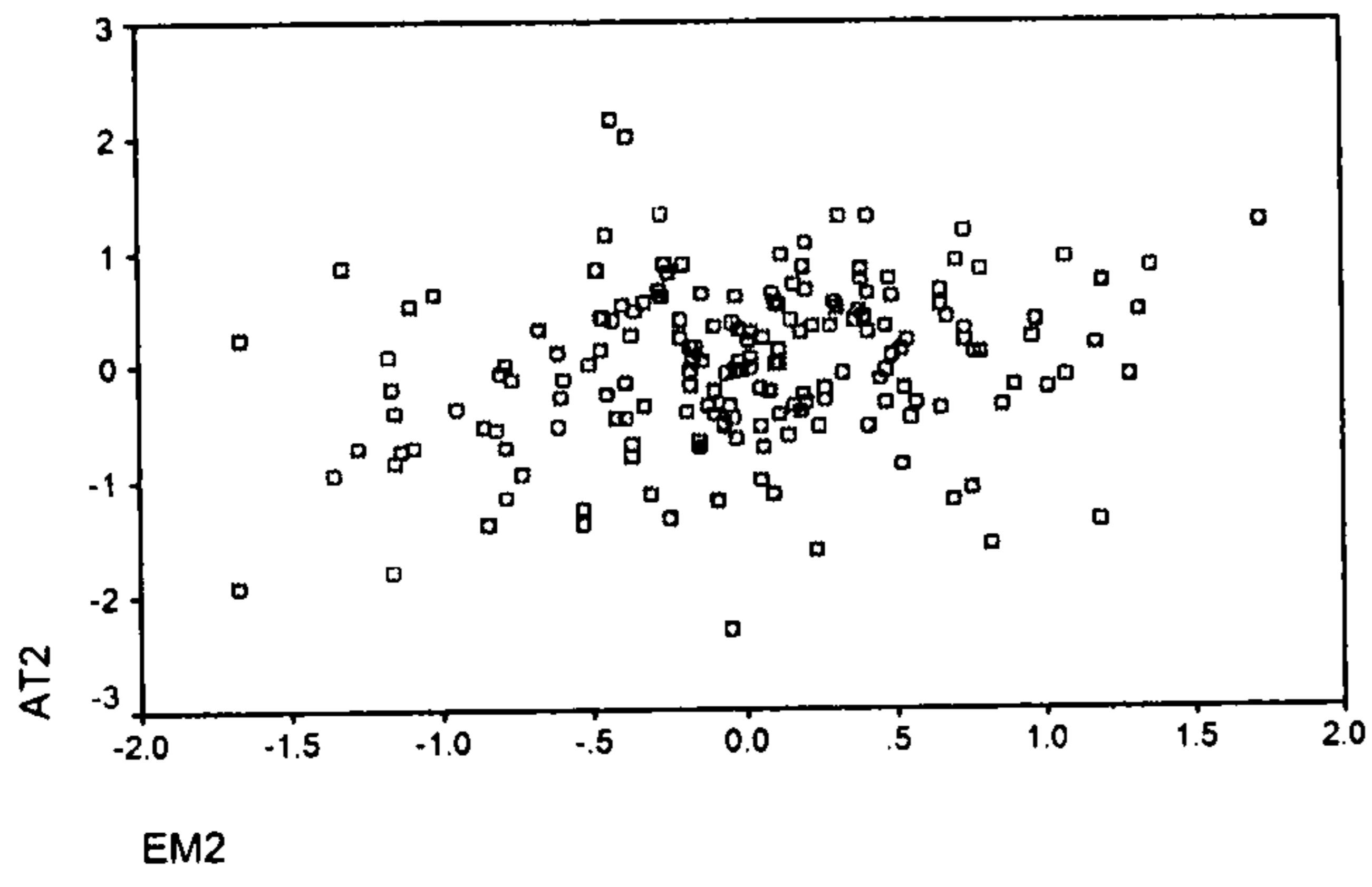
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Dependent Variable: AT2



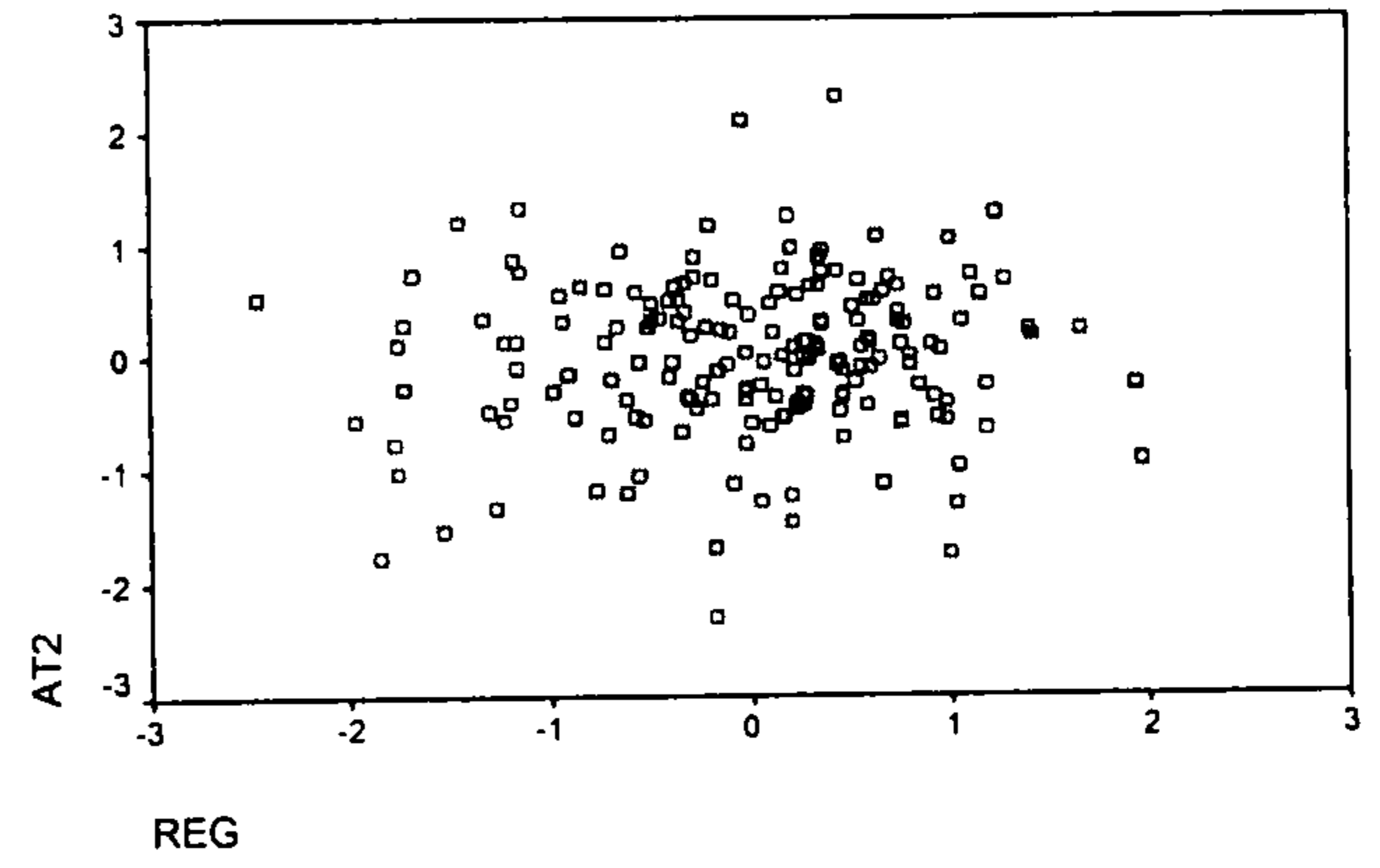
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Dependent Variable: AT2



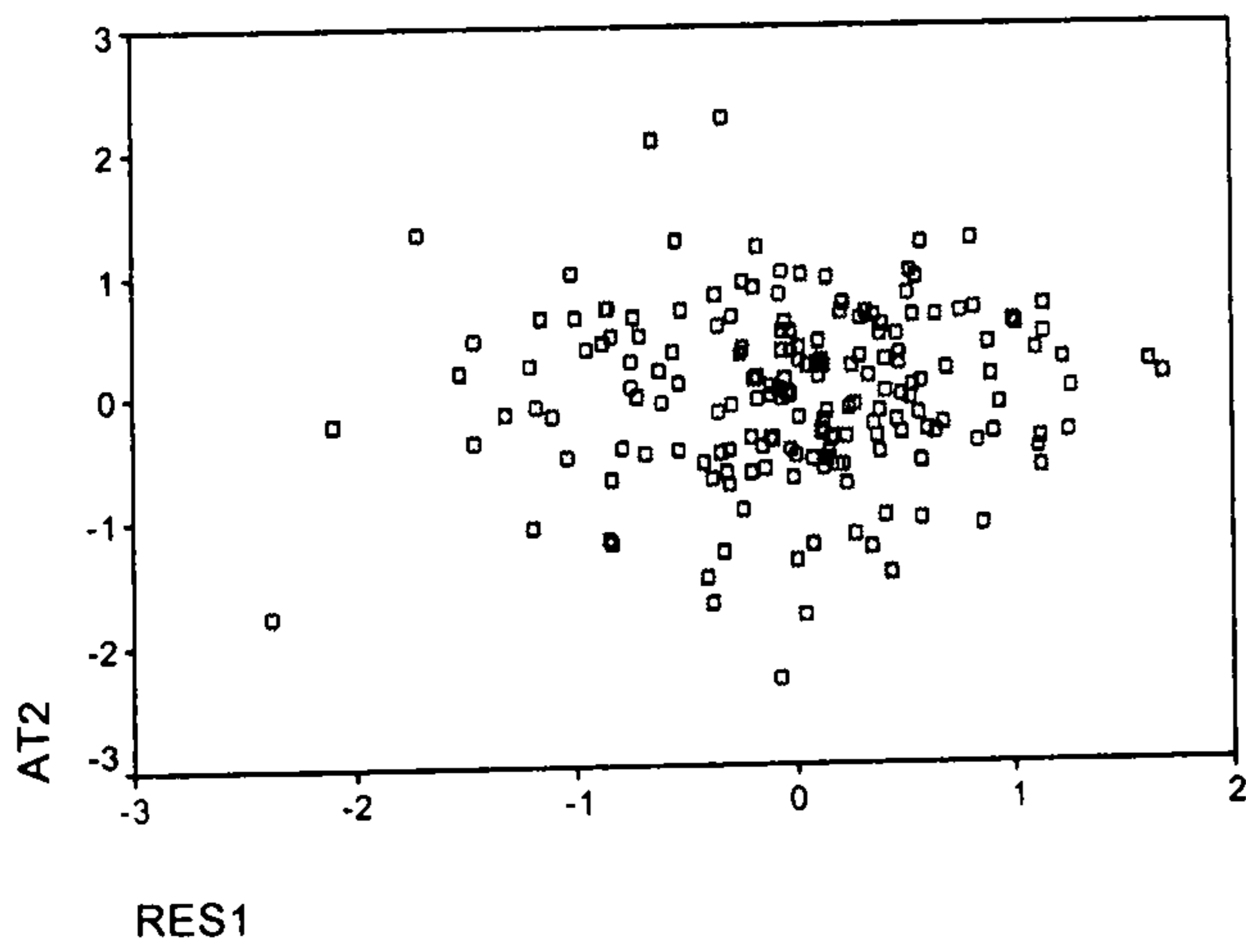
Partial Regression Plot

Dependent Variable: AT2



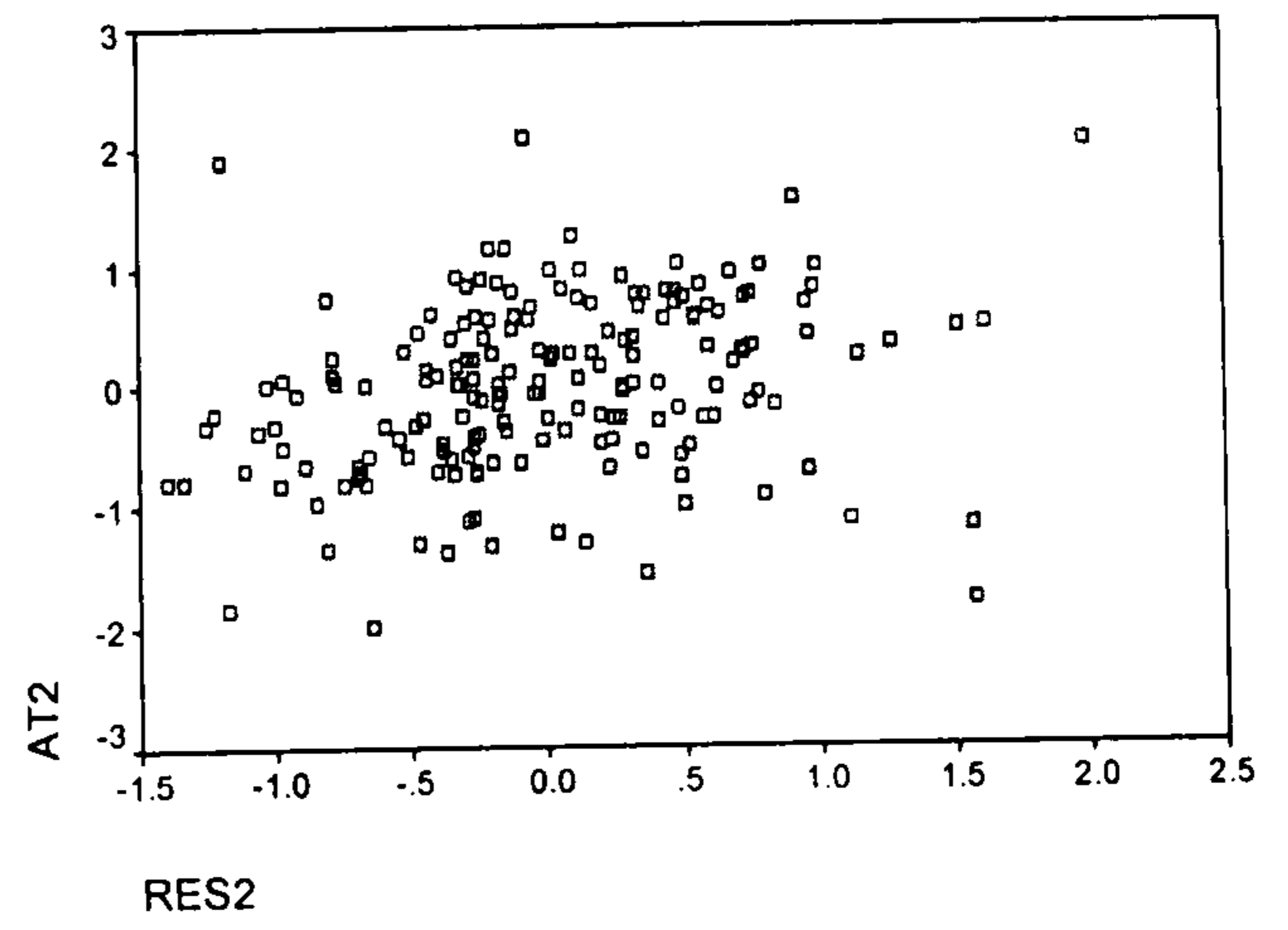
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Dependent Variable: AT2



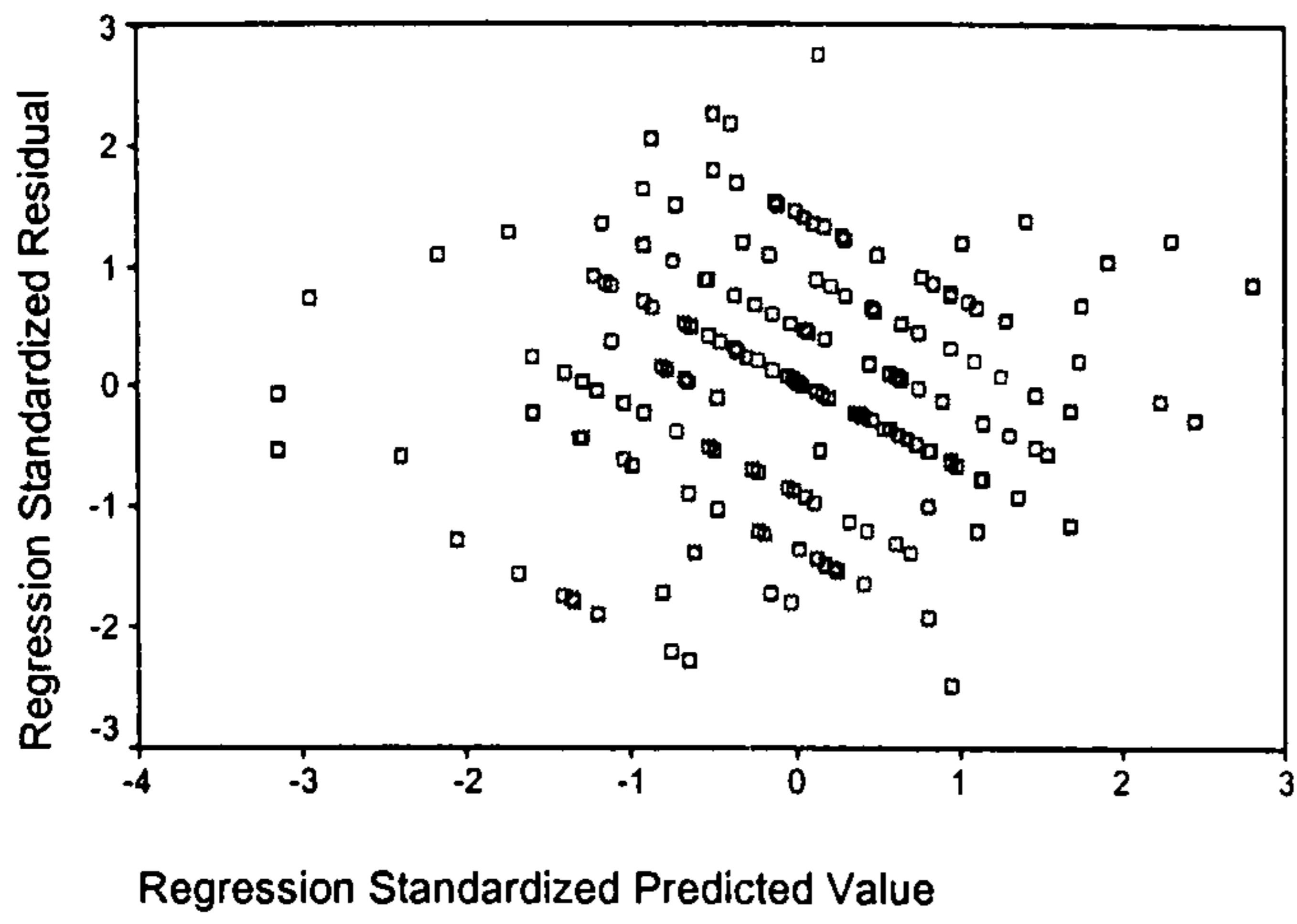
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Dependent Variable: AT2



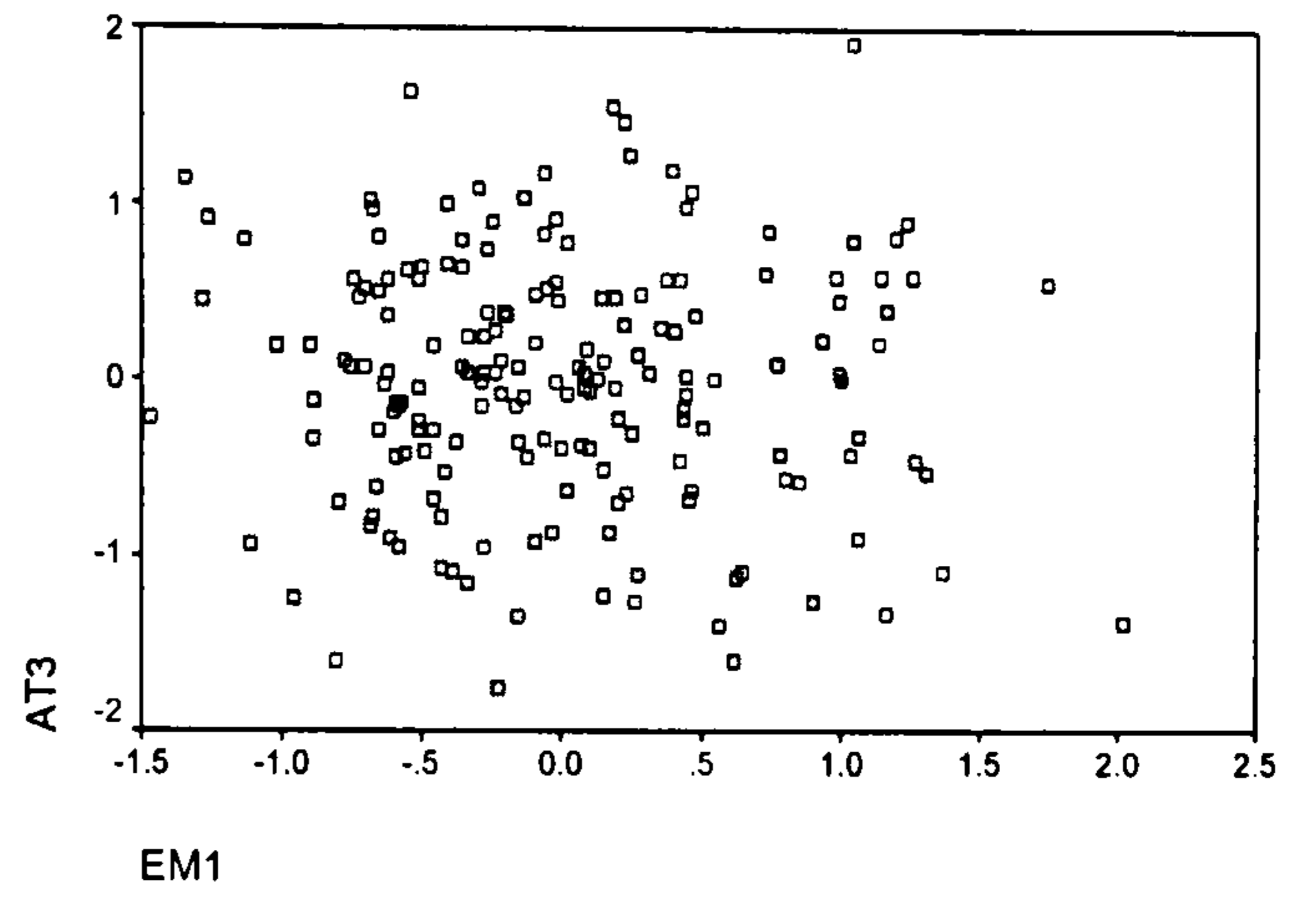
Scatterplot

Dependent Variable: AT3



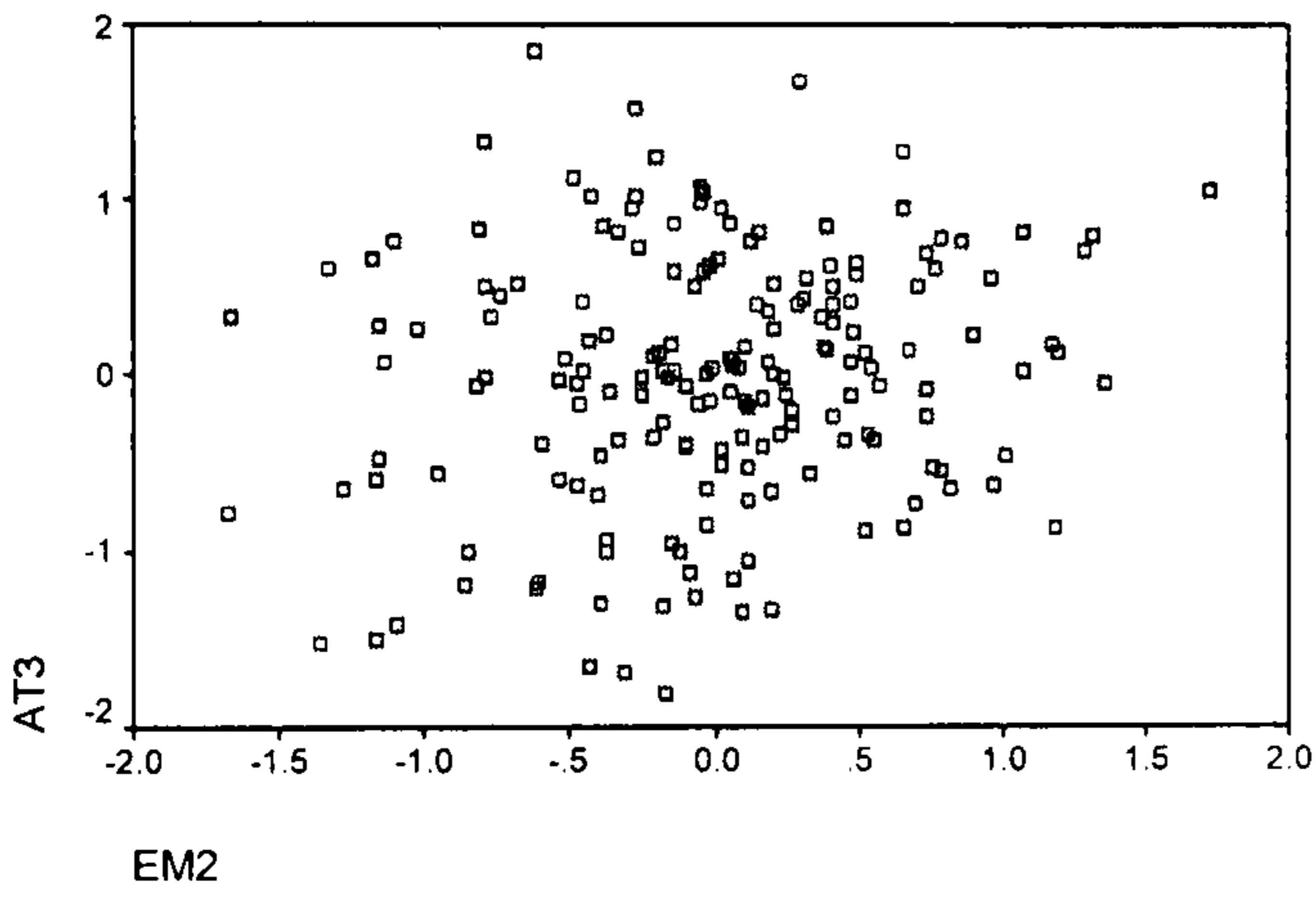
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Dependent Variable: AT3



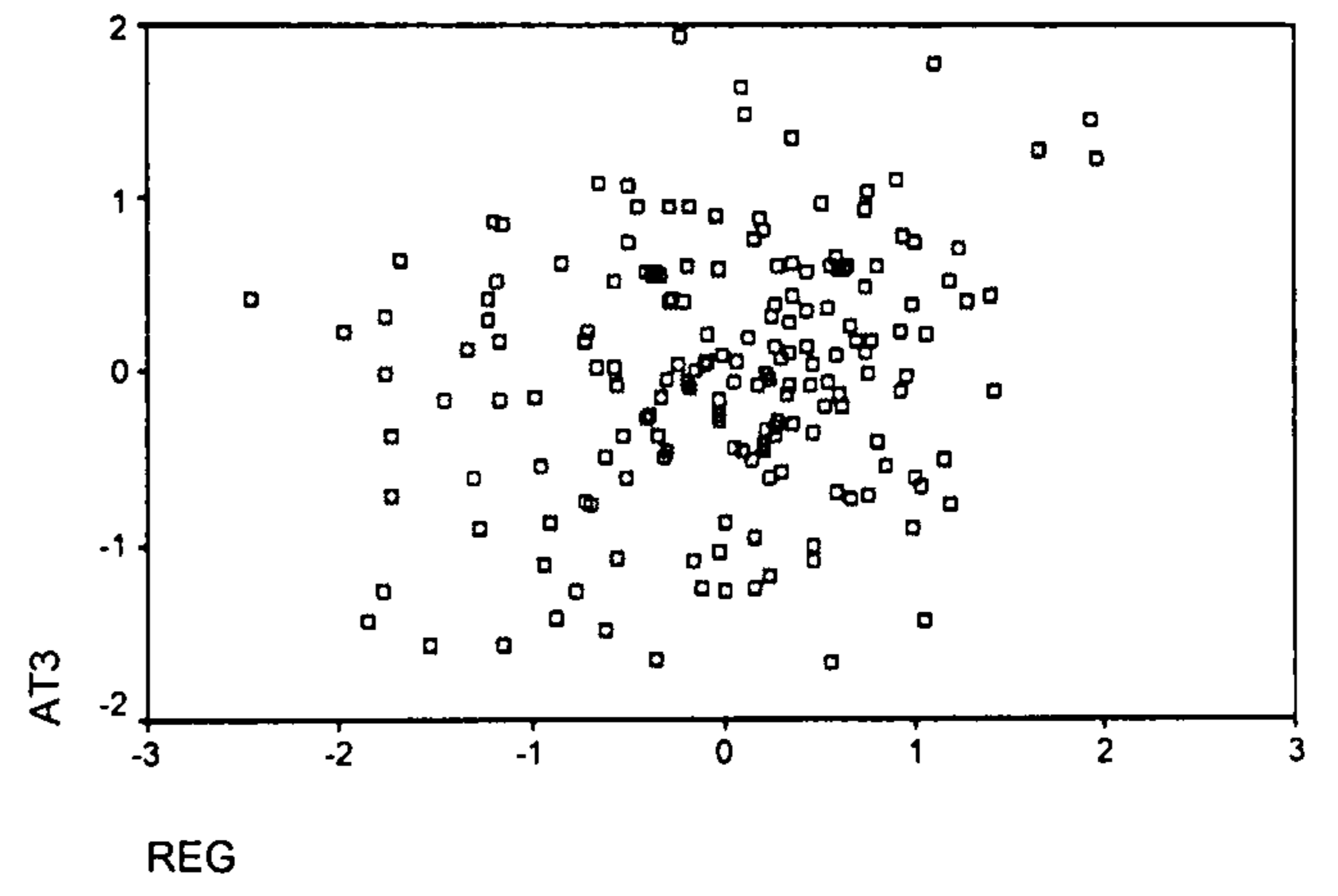
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Dependent Variable: AT3



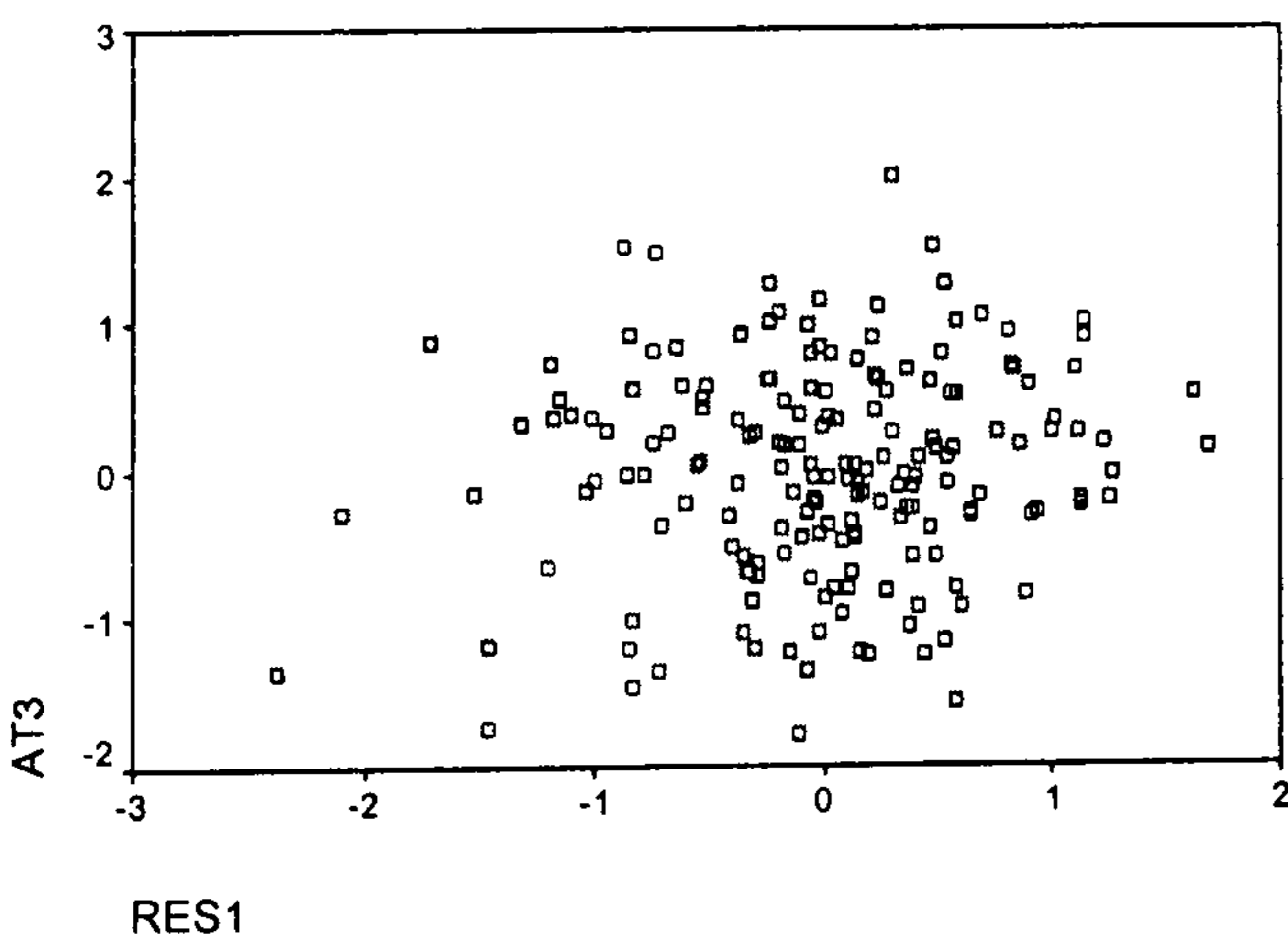
Partial Regression Plot

Dependent Variable: AT3



Partial Regression Plot

Dependent Variable: AT3



Partial Regression Plot

Dependent Variable: AT3

