FACTORS INFLUENCING ENVIRONMENTALLY RESPONSIBLE BEHAVIOR IN THE FINNISH SERVICE SECTOR

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Dissertation for the degree of Doctor in Science and Technology to be presented due permission of the Department of Industrial Engineering and Management for public examination and debate in Auditorium TU1 at Helsinki University of Technology (Espoo, Finland) on the 25th of April, 2008, at 12.00.

1 Abstract

Companies and society are increasingly interested in the environmental impacts caused by their various actions. The environmental impacts of industrial activities have been considerably reduced as a result of increased economic and normative steering. However, the majority of organizations nowadays operate in the service sector where normative steering is rare. This study concentrates on finding factors that encourage environmentally responsible behavior in service sector companies. Research on this area has until now been lacking.

The methodological choices are quantitative survey research and a qualitative case study. The survey examined the effect that employees' environmental knowledge, attitudes, social pressure, and the company's environmental management system have on environmentally responsible behavior. 756 office workers' in four different companies answered the survey. The case study investigated the efficiency of electricity saving measures in a service company.

The research results consist of three main findings. Firstly, the research shows that knowledge of causes of environmental problems does not lead to environmentally responsible behavior without appropriate environmental training being organized by the employer. Secondly, the results indicate that environmental training in companies improves employees' knowledge of both how to behave in an environmentally responsible manner and also of the environmental and economic effects of environmental behavior. Thirdly, the research results suggest that environmental training should be repeated regularly.

This study presents new empirical knowledge of employees' environmental behavior and the factors affecting it in service sector companies. Companies aiming to improve their environmental efficiency can use these results in decision-making. Further research is needed to evaluate the content and curriculum of environmental training. The duration of the impact of environmental training and the need for further training are of additional interest.

Keywords Environmental behavior, environmental management, sustainable development, environmental knowledge, organizational learning

Tiivistelmä

Yhä useammin sekä yritykset itse että yhteiskunta kiinnittävät huomiota yrityksen toiminnan aiheuttamiin ympäristömuutoksiin. Ihmisten toiminnasta aiheutuva ilmastonmuutos on ensisijainen globaali huolenaihe. Teollisuuden ympäristökuormitus on vähentynyt merkittävästi taloudellisen ja normatiivisen ohjauksen vaikutuksesta. Kuitenkin tänä päivänä suuri osa yrityksistä toimii palvelualalla, missä normatiivinen ohjaus on vähäistä. Tämä väitöskirjatutkimus keskittyy palvelualan yritysten työntekijöiden vastuulliseen ympäristökäyttäytymiseen kannustavien keinojen kartoittamiseen. Tähänastinen tutkimus kyseiseltä alalta on vähäistä.

Tutkimus koostuu kahdesta osasta, kvantitatiivisesta kyselytutkimuksesta ja kvalitatiivisesta tapaustutkimuksesta. Kyselytutkimuksella tutkittiin neljän palvelualan yrityksen yhteensä 756 toimistotyöntekijän ympäristötiedon ja asenteiden, työntekijöiden kokeman sosiaalisen paineen sekä yrityksen ympäristöjohtamis-järjestelmän vaikutusta vastuulliseen ympäristökäyttäytymiseen. Case-tutkimuksessa arvioitiin sähkönsäästöön kannustavien toimenpiteiden tehokkuutta eräässä palvelualan yrityksessä.

Tutkimus tuotti kolme päätulosta. Ensiksi, tutkimustulokset paljastavat, että tieto ympäristöongelmien syistä ei johda vastuulliseen ympäristökäyttäytymiseen ilman työnantajan järjestämää ympäristökoulutusta. Toiseksi, tutkimustulokset osoittavat, että työnantajan järjestämä koulutus lisää työntekijöiden tietoa sekä ympäristöystävällisistä toimintatavoista että toiminnan taloudellisista ja ympäristöllisistä vaikutuksista. Kolmanneksi, tutkimustulosten perusteella voidaan osoittaa, että ympäristökoulutuksen pitää olla toistuvaa.

Väitöskirja antoi uutta empiiristä tietoa palvelualan yrityksen työntekijöiden ympäristö-käyttäytymisestä ja siihen vaikuttavista tekijöistä. Väitöskirjan tuloksia voidaan käyttää yrityksissä apuna päätöksenteossa, kun pyritään parantamaan yrityksen ympäristötehokkuutta. Opetussuunnitelman laatiminen yrityksen työntekijöille suunnattua ympäristökoulutusta varten vaatii jatkotutkimusta. Tämän lisäksi tulisi tutkia koulutuksen vaikutusaikaa ja mahdollisten jatkokoulutusten tarpeellisuutta ja tiheyttä.

Asiasanat Ympäristökäyttäytyminen, kestävä kehitys, ympäristöjohtaminen, ympäristötieto, oppiva organisaatio

Preface

One of the great sides of working on a PhD is that one can deeply study a subject that really interests and is of great personal importance to the writer. My interest in factors influencing office workers' environmentally responsible behavior began little by little during the years I have taught environmental issues in Helsinki Business College. Many of the graduated students will be working as office workers. I am grateful for the possibility to do this thesis.

First of all I express my warmest thanks to my supervisor, Docent Tuula Pohjola, for her ideas and support, and her inspiring attitude throughout my work. Next, I would like to thank Professor Eero Eloranta for reading my last manuscript and for making valuable comments regarding the thesis. I want to express special thanks to the reviewers, Professor Don Huisingh from University of Tennessee and Docent Minna Halme from Helsinki School of Economics, whose expert comments improved the quality of the thesis greatly. I would like to thank Mr. Matti Rinnekangas from Nordea, Mr. Jouko Kuisma from Kesko, Ms. Liisa Rohweder from Helia, and Ms. Maria Joki-Pesola from City of Helsinki, Public Works Department for the help in collecting data for the survey study. I also give special acknowledgements to all the survey respondents. Furthermore, I want to thank Professor Roger Burritt from University of South Australia for his expert comments. My gratitude to my colleague Ms. Eila Jaranka whose help and support made it possible to carry out the case study. I would like to thank my colleagues in Helsinki Business College for the participation in the case study. I want to thank Ms. Marja Ollila, Ms. Eeva Lappalainen, Ms. Louise Standsfield, and Ms. Maria Nevala for revising the English and putting final touches to the layout of the thesis.

My family thanks for being there for me and believing in me even when I did not. My deepest gratitude and love goes to my husband Heikki, who has been supportive and patient during my PhD studies. I want to also express my sincere gratitude to my children Markku, Päivi, and Pipsa who encouraged and helped me in finishing the thesis. My sister Sirkka, her husband Juha and Heikki, thank you for the many common journeys that have made sure I have done also other things than just research. Finally, the greatest thank to our grandchildren Leo, Matias, Ella, Maisa, and Henri for your many delightful and energy giving visits to us during the process.

Kauniainen, 3th of March 2008

Marketta Koivisto

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2 Introduction

This is a story about four people named Everybody, Somebody, Anybody, and Nobody. There was an important job to be done and Everybody was asked to do it. Everybody was sure Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that, because it was Everybody's job. Everybody thought Anybody could do it but Nobody realized that Everybody wouldn't do it. It ended up that Everybody blamed Somebody when Nobody did what Anybody could have done.

-Waldemar Hopfenbeck (1993): The Green Management Revolution

2.1 Background of Sustainable Development and Environmental Management

Environmental issues are phenomena which arise when the changes in environment are experienced as problems. Increasingly they are also admitted to be caused by human beings. (Haila et al. 1992, Berninger et al. 1996, Järvelä et al. 1996a, Ahlonsou et al. 2001) Since the middle of the 18th century, the impact of human activities has begun to extend not only locally but even continentally and globally (Alhonsou et al. 2001).

The need for sustainable development results from the global ecological and social conflicts arising from the current economic system and its underlying value structures (Zabel 2005). Due to the increased environmental challenges, it is important to think about the chances for a single person to make a difference, although an individual's behavior normally has no visible environmental effects (Uusitalo 1991, Bratt 1999b, Ahlensou et al. 2001, Do Valle et al. 2004).

Sustainable development is a form of development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED 1987). Sustainable development consists of economic, ecological, and social dimensions (Linnanen et al. 1994, 1997, Welford 2000, Vanhala et al. 2002). The

ecological dimensions of sustainable development are climate change, biodiversity, use of energy and natural resources, and eco-capacity as shown in Figure 1 (Pohjola 2005). Environmental management or corporate "greening" is a process by which companies act in an environmentally responsible way in all their operations (Linnanen et al. 1994, Ketola 1991, Vanhala et al. 2002, Räsänen et al. 1993, Cramer 1998, Schaefer et al. 1998, Pohjola 2003, Halme 2004). However, every definition for environmental management has its own perspective, which depends on the interests of an organization.
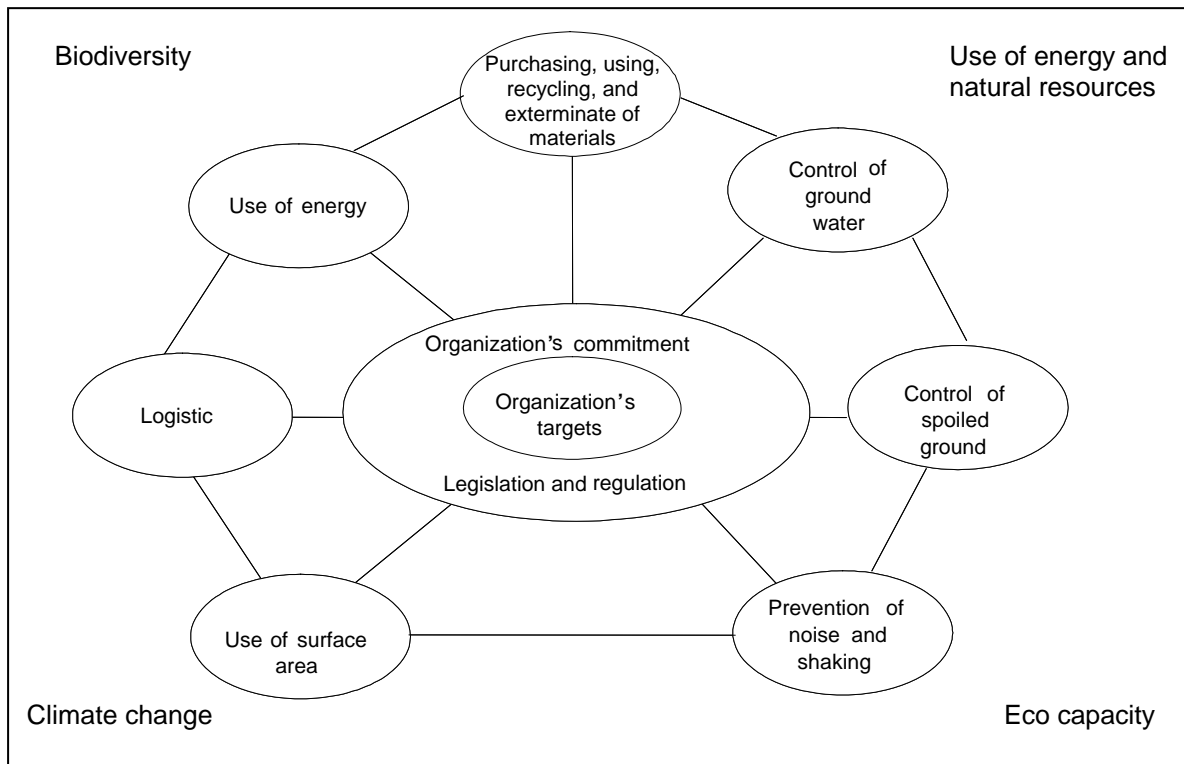
Figure 1. The environmental framework of organizations (Pohjola 2005, originally in Finnish).

In an organization, strategic environmental management entails the organization's commitment to adopt environmental issues as part of the company's strategic decision-making and the setting of the organization's environmental targets (Pohjola 2003). Operational environmental management, on the other hand, includes all the practical issues needed in order to reach the environmental targets of the organization as depicted in Figure 1. In this study, the practical issues of interests are use of energy and use of materials. Use of materials is a wide totality consisting of purchasing, using, recycling, and exterminate of materials as depicted in Figure 1. This study concentrates on

organizations' commitment to environmental issues, demonstrated by environmental training arranged by the company, and on the practical issues which influence employees' use of energy and their usage and recycling of materials.

This study investigates employees' environmentally responsible behavior concerning recycling, electricity and material usage, and the effect of sociodemographic issues on their environmentally responsible behavior. People's behavior is a complicated area to study as it is affected by both internal and external influencing factors (Ajzen 1980, Blake 2001, Hartig et al. 2001, LaRoche et al. 2002, Vining et al. 1992, Barr et al. 2005, Zabel 2005). The general environmental behavior of an individual is the result of different specific environmental behaviors like recycling behavior that he/she adopts. Even though people appear not to be strictly consistent across different types of behavior, the sum index of different behaviors can be seen as presenting environmental behavior in general. (Vining et al. 1992, Dietz et al. 1998, Kaiser, 1998, Oskamp et al. 1998, Blake 2001, LaRoche et al. 2002, Poortinga et al. 2004, Zabel 2005)

Two different measures of environmentally significant behavior can be distinguished: an intent-oriented measure and an impact-oriented measure. Intent-oriented behavior styles, such as recycling, are environmentally significant from an actor's point of view. Nevertheless, such measures are generally not as significant from the environmental point of view as impact-oriented behavior styles. Impact-oriented behavior styles, such as energy use, focus on the actual environmental impact. These behavior styles contribute significantly to the main environmental problems, which confront societies and the world. Nevertheless, there is a vast body of literature on consumers', inhabitants', and students' recycling behaviors, but relatively few studies of electricity using behavior exist. Therefore, more attention should be paid to impact-oriented behavior styles that contribute significantly to the most important global environmental problems. (Järvelä et al. 1996b, Gatersleben et al. 2002)

Employers can motivate their employees to behave in a preferred way by providing the necessary conditions. Employees should have enough environmental knowledge, the right circumstances, and the supporting social atmosphere to develop their attitudes of

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environmentally responsible behavior. Therefore, the bases for environmentally responsible behavior are effective environmental management and environmental education (Linnanen et al. 1994, Ketola 1991, Vanhala et al. 2002, Räsänen et al. 1993, Cramer 1998, Schaefer et al. 1998, Welford 2000, Courville 2004, Pohjola 2003, Halme 2004). Rasmus (2001) surveyed environmentally proactive firms and noticed that a gap exists between environmental policies and practices in these firms. A firm's environmental policy alone is not enough, but management support is essential. Employees want to hear consistent messages from the whole organization. The assumption is that both employers' and employees' positive environmental attitudes and sufficient environmental knowledge help employees to behave in a more environmentally responsible way.

2.2 Environmentally Responsible Behavior and Organizations

Increased environmental changes cannot be managed without individual people recognizing their responsibility for the environment. The problem is that people may believe their individual actions to be insignificant (Uusitalo 1991, Järvelä et al.1996a, Widegren 1998, Bratt 1999a, Ebroe et al. 1999, Nordlund et al. 2002, Do Valle et al. 2004). Which, then, are the main drivers that lead people to behave in an environmentally responsible manner in organizations? In industrial countries, the main driver has been environmental legislation. Nevertheless, a large amount of organizations nowadays operate in the service sector, and their main environmental impacts are caused by computers, mobile phones, paper consumption, and heating and lighting in the offices. The actions which have environmental impacts in such organizations are almost identical to those taken by private households. The main sources of environmental impact are the use of materials and energy, logistic operations, such as traveling and freight transport, recycling, and disposal of waste. Of these, only waste is controlled by environmental legislation, namely the laws related to the recycling and disposal of waste (The Finnish waste law 1993). Any actions to limit the other activities that have environmental impact are voluntary.

If an organization wants to motivate its employees to behave more environmentally friendly, it must know the main drivers that cause changes in people's environmental and economic behavior. However, genetic differences and different personal experiences make sure that no two individuals are alike. Attempts to understand human behavior have turned out to be as frustrating as they are challenging (Ajzen 2005, Zabel 2005). In several works, the object of study has been people's attitudes and environmental behavior, especially recycling behavior (Hines et al. 1987). Environmentally responsible behavior arises from environmental sensitivity, which is the skill to observe and sense the surrounding environment and the changes in it (Wahlström 1997). The main issue is to understand that we are only a part of the whole environmental system. This understanding constructs the basis of environmentally responsible behavior. Environmentally responsible behavior is the sum of many situational, motivational, attitudinal, knowledge, and background factors (Maloney et al. 1975, Gamba et al. 1994, 1995, De Young 1996, Cottrell et al. 1997, Bratt 1999a, Olli et al. 2001, LaRoche et al. 2002, Do Valle et al. 2004, Barr et al. 2005).

In several studies, the link between attitudes and environmental behavior has the multicomponent view of attitudes consisting of cognition, affect and conation or verbal commitment. When environmental concern, verbal commitments, and environmental knowledge increase, actual environmental behavior simultaneously takes place. (Gamba et al. 1994, Cottrell et al 1997, Bratt 1999a, Cheung et al. 1999, Corraliza 2000, Pooley et al. 2000, Moisander et al. 2001, Cottrell 2003) However, there is often a gap between environmental behavior and the cognitive, affective, and behavioral aspects of attitude (Allardt 1991, Zimmermann 1996, Cottrell et al. 1997, Kaiser 1998, Gaterleben et al. 2002, Schaper 2004, Barr et al. 2005, Kilbourne et al. 2005).

Today, a popular starting point in the study of attitudes and behavior is rationality. According to the theory of reasoned action, behavioral intentions are determined by a person's attitudes towards the behavior and by his/her subjective norms. Attitudes are personal in nature and are determined by the beliefs of the consequences of that behavior. (Verplanken et al. 1999, Ajzen 1980, 1988, 2005). Attitudes reflect the feelings of favorableness or unfavorableness towards that behavior. Thus, because an

attitude comprises of the anticipated consequences of a given action and the evaluation of these consequences, the necessary preconditions for the forming of any attitude are factual knowledge and environmental values. (Ajzen 1980, 1988, Kaiser et al. 1999, Barr et al. 2005) In addition, a person's awareness of environmental problems and his/her level of environmental knowledge may vary widely because of several reasons, such as education and experience (Smith-Sebasto 1995, Oskamp et al. 1998, Hines et al. 1987, Iozzi 1989, Ewert et al. 2001, Uusitalo 1986, Syme et al. 2002, Finger 1994, Dietz et al. 1998, Poortinga et al. 2004).

The role of employers is to make environmentally responsible behavior possible and encourage employees by integrating environmental issues into management systems. Many companies have established a voluntary environmental management system (EMS) to improve their environmental management. The EMS may help a firm to improve its environmental performance, reduce costs, enhance its image, prevent pollution, conserve resources, and attract new customers and markets (Da Silva et al. 2004). The key task of environmental management is to find out the latest knowledge related to the environment and to utilize this knowledge to support the environmental strategy of the organization (Kallio 2001). Employees' environmentally responsible behavior can be encouraged by regular training and education in environmental issues. Environmentally responsible behavior can be practised in everyday work and actions if the situational, attitudinal, know-how, and know-why factors are in order. (Iozzi 1989, Turtiainen 1991, Gamba et al. 1994, De Young 1996, Ewert et al. 2001, Meima 2002, Cottrell 2003, Rohweder 2004, Barr et al. 2005) However, small and medium-sized Finnish firms have met a challenge in organizing their employees' environmental training (Penttinen 1998, Pohjola 2003). Furthermore, behavioral intention is the necessary factor for environmental behavior, which is an action under volitional control (Ajzen et al.1980).

The European Commission finds that the power of environmental information and education are well known but these tools are often used ineffectively in the EU area, in the member states or in companies. Public campaigns on issues like alcohol consumption are frequent, but so far there has been less campaigning around energy

efficiency. Public campaigns on environmental issues, such as how to reduce energy consumption in homes by means of efficient lighting, heating and sensible purchasing decisions, can be effective in enhancing knowledge, changing attitudes, and encouraging action. It should be easy to convince consumers and employees of the fact that with relatively simple measures the average European household and firm can save a significant amount in its spending. (European Commission 2005)

Environmental education can play a major role in the strengthening of a culture of energy efficiency. The European programs in the field of education and training could spread good practices among the EU member countries as well as encourage cooperative projects on these topics across the whole spectrum of lifelong learning. (European Commission 2005) The level of education in general has had only a minor effect on environmental behavior. It has been reported, however, that those individuals who major in environmental studies and biology have higher levels of pro-environmental concerns than graduates who major in other topics (Widegren 1998, Olli et al. 2001, Ewert et al. 2001, Gatersleben et al. 2002).

Good information campaigns set up in individual EU member states could be used as examples of how to increase people's environmentally responsible behavior by increasing their environmental knowledge. Effective environmental training can build up employees' skills, creativity, and eagerness, which further promote pro-environmental behavior (Welford 2000). Environmental training in organizations should be for the whole staff and focus on both environmental knowledge and emotions towards nature (Kuusisto 1994, Juuvinmaa et al. 1994, Pooley et al. 2000). According to Blake (2001), personal empowerment, based on environmental knowledge and a belief in efficacy, is important for individual action.

Several thoughts stimulated the author in writing this study. In this study, the behavior models related to recycling and energy saving are considered for the following reasons. Firstly, although many studies have been conducted to evaluate the indicators of students' and consumers' environmental behavior, office workers' environmental behavior has rarely been studied (Dietz et al. 1998, Cheung et al 1999, Corral-Verdugo

et al. 1999, Blake 2001, Bamberg, 2002, Costarelli et al., 2004, Barr et al. 2005). In addition, there are also studies which deal with people's behavior in leisure time, or with organizations that have to consider environmental issues from a business point of view (Cottrell et al. 1997, Burger et al. 1998, Bichta 2003, Cottrell 2003). Secondly, according to Asikainen (2001) and Motiva (2006), office workers' environmental impacts are mainly caused by their use of energy and materials and therefore the factors which affect their behavior are of interest. Thirdly, the motivation for the study arose from the personal experience of the author as an employee in the public sector, and as a teacher for future employees. As an employee, the author noticed that recycling, and electricity and material saving were relatively uninteresting subjects among colleagues. As a teacher, on the other hand, the question was how the author could motivate her students to behave in an environmentally responsible way now and in the future.

2.3 Problem Formulation and Objectives

The main objective of this study is to increase the understanding of environmentally responsible behavior and its incentives. The results of the study can be used in organizations to assist in designing and developing their environmental training programs, and also in their decision-making on how to support employees' efficient environmentally responsible behavior.

In this study, employees' materials and electricity consumption and saving habits are investigated. The aim of the study is to evaluate the effect of general environmental knowledge and the firm's social atmosphere on employees' environmentally responsible behavior. Additionally, employees' feelings and thoughts about their own responsibility are considered. The value of information campaigns and training courses as an effective way to increase employees' environmentally responsible behavior is also examined.

This study focuses on the following study problem:

Which essential motivational factors and drivers will improve the environmentally responsible behavior of employees in the Finnish service sector?

A systematic approach to attitudes, social pressure, environmental knowledge, and employers' support is required in order to find out which of them encourage employees to act in an environmentally friendly way. The main objectives of this study are the following:

- Identifying the effect of one's own beliefs on general environmentally responsible behavior.
- Identifying the effect of social pressure on environmental behavior.
- Identifying the level of employees' behavior with regard to the following issues:
    o general environmental knowledge
    o general environmental behavior
    o waste sorting behavior
    o material saving behavior
    o electricity consumption manners
    o employers' interest in promoting environmentally responsible behavior in the organization
    o the effect of external variables on environmental behavior
- Analyzing the most potential alternative forms of environmental training to improve environmentally friendly behavior in the service sector.

The motivational factors and drivers considered in the study were selected based on the literature on behavior models, environmental knowledge, and training (Ajzen et a. 1980, Ajzen 1988, Cottrell et al. 1997, Bratt 1999a, Welford 2000). The context of the study is presented in Figure 2.
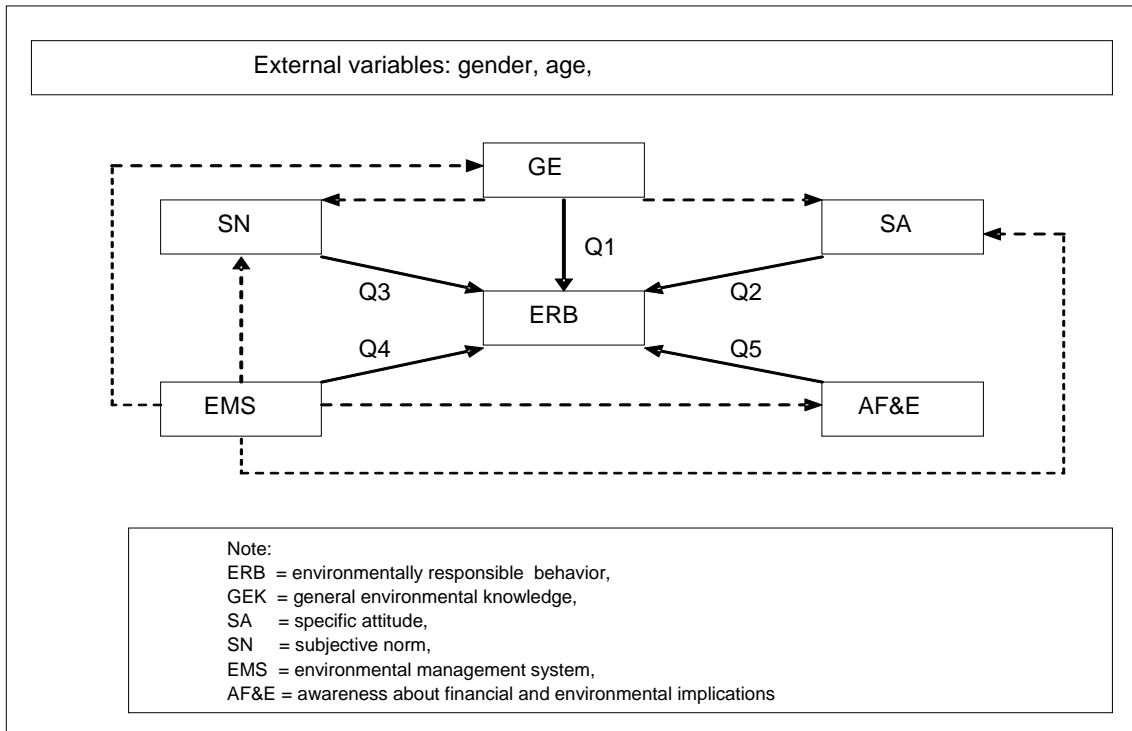
Figure 2.   The context of the study and the research questions.

The main study problem – finding out the essential motivational factors and drivers – is supported by five study questions. The questions and their implications are listed below. The questions' relationships with the study context are shown in Figure 2 above.

Q₁: Do general environmental knowledge and rational understanding of environmental changes lead to environmentally responsible behavior?

The aim of this study question is to evaluate the direct effect that the level of general environmental knowledge has on general environmentally responsible behavior. The indirect effects through specific attitudes and subjective norms on general environmentally responsible behavior are also of interest.

Q₂*: Do employees' specific attitudes influence their environmental behavior?*

This study question evaluates the assumption that the employee's personal values and beliefs related to the environment affect on his/her general environmentally responsible behavior.

Q$_3$: *Do employees' subjective norms influence their environmental behavior?*

The aim of this study question is to evaluate the assumption that the social surrounding and the atmosphere in the workplace influence general environmentally responsible behavior.

Q$_4$: *Do environmental training and good circumstances for responsible behavior as a part of the environmental management system (EMS) cause environmentally responsible behavior?*

This study question aims to evaluate the direct effect of environmental training on general and specific environmentally responsible behavior. The indirect effects through general environmental knowledge, specific attitudes and subjective norms on general environmentally responsible behavior are also of interest.

Q$_5$: *Do employees' awareness of financial and environmental consequences of their own environmental behavior correlate with environmentally responsible behavior?*

This study question evaluates the direct correlation between awareness of environmental and financial consequences and general environmentally responsible behavior. The question also relates to the correlation between the EMS and the perceived difficulty of specific environmentally responsible behavior. Additionally, the indirect effect of environmental training on general environmentally responsible behavior through the awareness of the environmental and financial consequences is also of interest.

2.4 Study Framework

The approach of this study to organizational learning and environmental behavior is based on theories of the roles of education, demographics, and requirements of society. Hence, the study aims at evaluating the effects that attitudes, social pressure,

environmental knowledge, environmental education, environmental training have on environmental behavior. The consideration of individuals' attitudes leads to an understanding of why people behave the way they do (Ajzen et al 1980, Ebreo et al.1999, Bratt 1999a).
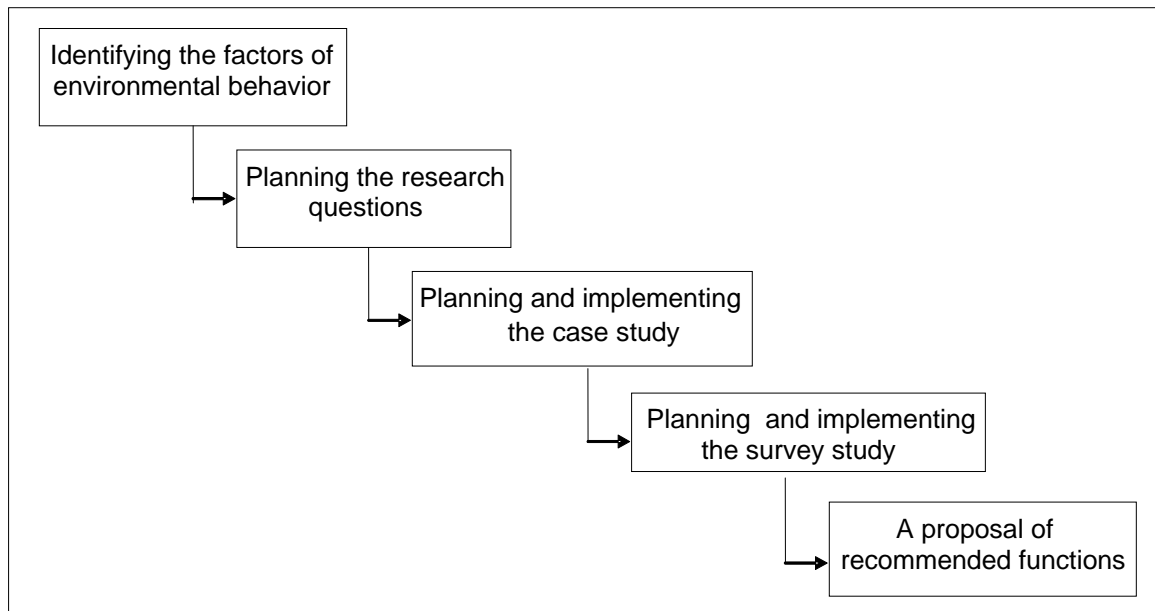
Figure 3.   The framework of the study.

The first stage of the study was to identify the key factors that are related to the environmental behavior of individuals. This information was then used as the basis for the selection of variables for the case study and the survey. The second stage was to formulate the research questions. The third stage was to conduct a case study and to analyze the effects that direct electricity saving instructions have on specific environmental behavior. The fourth stage was to design a survey questionnaire that was sent to four selected firms, and to analyze the collected data. The fifth and final stage was to create a proposal of recommended actions for companies to motivate their employees to adopt environmentally responsible behavior. The phases of the study are summarized in Figure 3 above.

2.5 Methodology of the Study

This study is a positivist research, i.e. the study is based on the technical interest of knowledge. A hypothetic-deductive logic is applied. The main research methods are case study and survey. (Creswell 2003, Kyrö 2003) The case study was selected in order to examine the effect of environmental information on specific environmental behavior. Taking into account the difficulty of observing and recording employees' environmental behavior on a large scale, self-reported behavior was used as a proxy measure of actual behavior. The survey as a research method also makes using a large sample possible, and permits respondents to answer anonymously. The survey data were collected with a questionnaire, which can be found in Appendix 1 and 2 (in Finnish).

The data from the survey study were analyzed using the statistical analysis software SPSS 13.0 for Windows (**S**tatistical **P**ackage for the **S**ocial **S**ciences). The statistical tests used were Pearson's chi-square independent test, the nonparametric correlation test, and the Kruskal-Wallis test. Research methodology and methods are discussed in detail in Chapter 3. In the case study, the data were analyzed by comparing the electricity consumption figures of the case study company, Helsinki Business College (HBC) over three years.

2.6 Scope and Limitations of the Study

The sample of the case study consisted of the staff members and students of Helsinki Business College. The case study focuses on the electricity saving aspect of environmental behavior.

The sample of the survey study consisted of employees of service sector firms. The companies that were selected for the study represented retail, public, education, and banking sectors. Data were collected in the beginning of the year 2003 from Kesko Ltd (grocery trade), the Helia University of Applied Sciences (education), the Public Works Department of the City of Helsinki (public sector), and Nordea Ltd (banking).

2.7 Structure of the Study

The structure of the study is shown in Figure 4. Chapter Two contains a literature review concerning environmental behavior in general. It looks at the context of sustainable development, environmental management systems, and organizational learning. Additionally, the effects of general environmental knowledge, education, attitudes, demographics, and social environment on environmental behavior are reviewed.

Chapter Three provides a methodological discussion. It introduces issues related to methodological choices and the research process of the study, such as the research methods, data collection, and data analysis.

Chapter Four presents the results of both the case study and survey and analyzes these. It provides answers to the study questions based on research findings and evaluates the validity and reliability of the study.

Chapter Five discusses the findings and the theoretical contribution of the study. It proposes methods to increase environmentally responsible behavior in future and gives recommendations as to what actions firms should take in order to inspire environmentally responsible behavior. The limitations of the study are also discussed in this chapter.

Chapter Six presents the conclusions of the study.

Chapter Seven provides suggestions for further research.
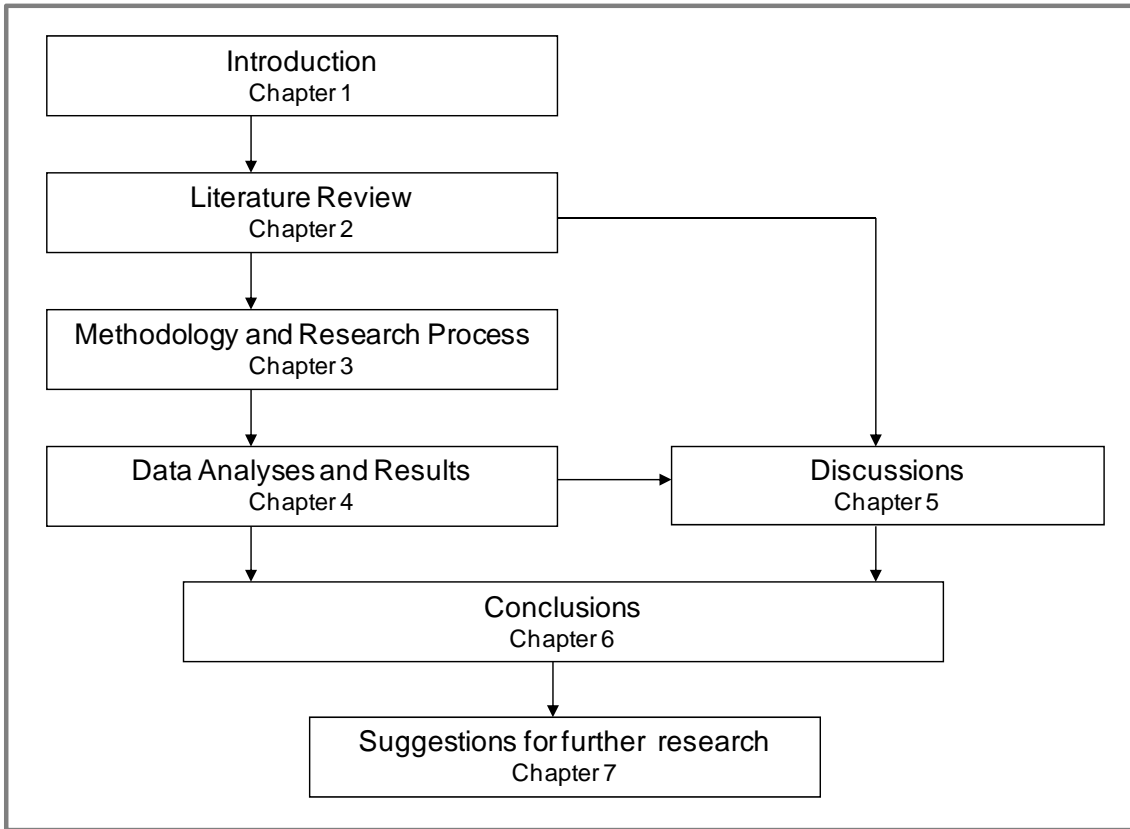
Figure 4.   The structure of the study.

3 Literature Review

The chapter consists of five parts. Firstly, an introduction to recent literature on sustainable development is given. Secondly, the context of EMSs is determined. Thirdly, philosophical explanations of and solutions to environmental issues are studied. Fourthly, the variables influencing environmentally responsible behavior are determined. Finally, the necessity to connect EMSs with environmentally responsible behavior is discussed.

3.1 Framework for Sustainable Development

The term "sustainable development" (SD) has been around for about 30 years. It derives from the biological concept of "sustainable yield", the rate at which species may be harvested without depleting the whole population. The need for sustainable development arises from the global ecological and social conflicts emanating from the current economic system and its underlying value structures. (Zabel 2005). In the late 1980s, environmentalists and government officials began applying the terms "sustainability" and "sustainable development" when discussing environmental policy (Morris 2002). The concept was made popular by the Brundtland committee in 1987. Sustainable development has been defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. (WCED 1987). Despite its popularity as a concept, ecological and economic sustainable development is a demanding aim. Achieving the ideal situation is probably impossible. Nevertheless, sustainable development is definitely a field of growing global importance. (Markkanen 2004, da Silva et al. 2004)

Sustainable development or sustainability is basically a normative concept pursuing ecological, economic, and social goals of ensuring human survival and a good, free, and meaningful life for today's and future generations (WCED 1987, Pearce et al. 1990, Welford 2000). Socially sustainable development is the process aiming at improving the quality of life in major sectors such as health, education, employment, housing and

personal safety. It also aims at enhancing social equity, social inclusion and social protection. The process must be inclusive, with institutionalized consultations that involve government ministries and parliaments as well as other development partners and, most important, organizations of the poor and vulnerable groups at all levels in society. (United Nations 2002). The eight UN Millennium Development Goals – to halve extreme poverty and hunger, to achieve universal primary education, to empower women and to promote equality between women and men, to reduce under-five mortality by two thirds, to reduce maternal mortality by three quarters, to reverse the spread of diseases, especially HIV/AIDS and malaria, to ensure environmental sustainability, and to create a global partnership for development, with targets for aid, trade and debt relief - are an integral part of SD and all by the target date of 2015. They form a blueprint agreed to by all the world's countries and all the world's leading development institutions. (United Nations Millennium Summit 2000)

Financial, social, and environmental issues should not be treated as three separate and indistinguishable concepts which have to be managed separately. Instead, they should be seen as important and integral parts of a large whole. It is sometimes argued that growth has not always led to development, but rather to a significant decrease in the quality of human life. (Welford 2000) We live in an increasingly globalized economy where companies will only survive if they can maintain a degree of competitive advantage. Therefore, rather than see globalization and trade as a barrier to environmental improvement we ought to see sustainable development as part of a company's competitive strategy and a new business opportunity (Welford 2003). However, what is proper for the core business may not be proper for environmental management. If they are in conflict, the greening process may be doomed to failure because the core business culture will be more powerful than the new environmental beliefs. On the other hand, if all operations are supportive, the environmental program would be expected to succeed. (Dodge 1997). So in order to achieve sustainable development, the economy should be considered as a part of it and business should not concentrate only on economic growth (Welford 2000).

Changes in the environment are increasingly experienced as problems and are often acknowledged as being caused by humans (Haila et al. 1992, Berninger et al. 1996, Järvelä et al. 1996b, Ahlonsou et al. 2001). Since the middle of the 18th century, the impact of human activities has begun to extend even continentally and globally (Alhonsou et al. 2001). Green thinking provides a radical challenge for companies. Moreover, moving towards sustainable development represents such a fundamental change in the values and visions of companies that it cannot be expected to come about quickly. (Welford 2000)
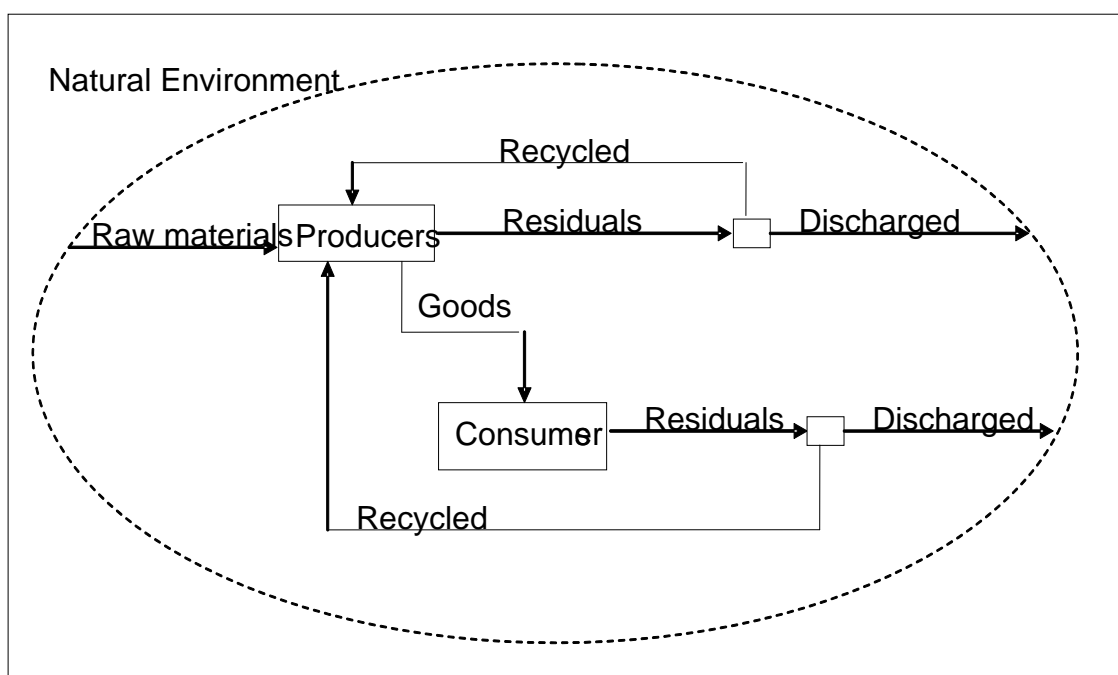
Figure 5.   The main factors, which have environmental and economic impacts, are the use of natural resources and discharging of wastes (text modified from Field 1997).

Business organizations have environmental impacts when they discharge residuals in the natural environment, as shown in Figure 5. Companies have an important part to play in the promotion of sustainable development. Sustainability involves building consensus among all the interest groups of business organizations, including the government, public interest groups, customers, employees, and consumers. All of these groups have a role to play when contributing to sustainable development. The responsibility for sustainable development is universal, encompassing all groups from consumers to communities and states world wide. (Meadows et al. 1993, ICC 1997,

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Elliot et al. 2004) For this reason, businesses need not only to recognize and acknowledge sustainable development issues but also educate others about it (Porter et al. 1995, Payne et al. 2001). As shown in Figure 1 in Chapter 1.1, the ecological dimensions of sustainable development are climate change, biodiversity, use of energy and natural resources, and eco-capacity.

3.1.1 Climate Change

One of the most important worldwide challenges is to slow down climate change. The amount of greenhouse gases in the atmosphere remained relatively constant before pre-industrial times. Since then, the composition of the atmosphere has changed, and the concentration of greenhouse gases has increased substantially. This increase leads to a significant trapping of heat. When considering the principles of physics and observational evidence, it can be predicted that this heat trapping will almost certainly lead to such changes in climate that are significant from a human point of view. (Berninger et al. 1996, Harvey 2000, Manahan 2000) According to the IPCC Special Report on Emission Scenarios over the period 1990 to 2100, a warming of 1.4 to 5.8°C is likely (IPCC 2001).

Carbon dioxide, (CO_2) is the best-known greenhouse gas. CO_2 is the least effective of greenhouse gases in trapping heat on a molecule-per-molecule basis. However, the amount of CO_2 emitted into the atmosphere is much larger than that of any other greenhouse gas. Globally, CO_2 is responsible for about from one half to two thirds of the atmospheric heat retained by trace gases. (IPCC 1995, Berninger et.al. 1996, IPCC 1996, Harvey 2000, Manahan 2000) The amount of CO_2 has increased by more than 30 % since pre-industrial time and is increasing still, at an unprecedented rate of 0.4 % per year. This increase is mainly due to the combustion of fossil fuels and deforestation. During the last 75 years, the use of energy has increased substantially. (Berninger et al. 1996, Nordström et al. 1999, IPCC 2001, Alhonsou et al. 2001) In Finland, the overall greenhouse gas emissions in 2005 were 69.32 Mt CO_2 eq., or almost 3 % below the greenhouse gas emissions level from the year 1990. Energy production accounted for

52.8 % of this, while the share of traffic was 23.7 %. In 2004, on the other hand, the greenhouse gas emissions were 14 % above the target level of the Kyoto Protocol, or 81.8 Mt $CO_{2\ eq}$. Of these greenhouse gas emissions, 85 % were CO_2 emissions mainly from the energy sector. (Statistics Finland 2007a, b)

The potential for saving energy is considerable. An average household in the European Union area can easily save an amount ranging from between €200 and €1000 a year, depending on its energy consumption and energy prices. The European Commission has proposed that measures should be taken to reduce the stand-by electricity consumption of (televisions and information technology) electrical appliances. Increasingly electric equipment is used in the stand-by mode, and stand-by consumption alone can amount to 7 % of a household's electricity consumption. Energy consumption is also the main reason for the growth in greenhouse gas emissions that contribute to climate change. It has been estimated that saving 20 % of energy consumption by the year 2020 would secure 50 % of the necessary reductions in CO_2 emissions. (European Commission 2005)

Other trace gases that contribute to global warming are nitrous oxide (N_2O) which is generated by energy production, industrial processes and farming; ozone (O_3) which is generated by traffic; chlorofluorocarbon (CFC) compounds from old refrigerators; and methane (CH_4) (Berninger et al. 1996, Harvey 2000, Manahan 2000). On a molecule-for-molecule basis, CH_4 is 20 to 30 times more effective in trapping heat than CO_2 (Manaha 2000, Harvey 2000). In Finland, the main sources of methane emissions are the incomplete burning of fuels, leakages of natural gas pipes, and fugitive emissions of methane from landfills (Berninger et al. 1996). Globally, CH_4 accounts for 20 to 30 % of the human impact on the atmosphere (Berninger et al. 1996, IPCC 1996).

The aim of the Kyoto Protocol is to reduce the level of greenhouse gases (UN 1998). However, this reduction is an extremely slow process. Therefore, adaptation to climate change is also needed. Adaptation measures, concerning mainly the developing countries, were first initiated in the World Climate Conference in Nairobi, Kenya in November 2006. The conference finalized a five-year work program, whose implementation can start immediately to support adaptation efforts and to enhance best

practices in the developing countries (Nairobi World Climate Conference 2006). If there are no efforts to restrict emissions, not only will the human-induced change in climate be unprecedented in speed and magnitude, but also much greater changes will occur during the 21st century and beyond (Harvey 2000).

3.1.2 Biodiversity

According to the Rio declaration, biodiversity is the variety of life: it includes the different plants, animals, and microorganisms, as well as their genes and the ecosystems of which they are a part. The target of the declaration is to promote the conservation of biodiversity and the sustainable use of biological resources. This should be encouraged by taking effective economic, social, and other appropriate incentive measures. To this end, the cooperation of governments with the relevant United Nations bodies at the appropriate level, as well as with all other members of the society, including local people, is needed. (UNCED 1992, Berninger et al.1996)

The main reasons to protect biodiversity are ethical, financial, and ecological. The ethical reason is that people have no right to destroy other creatures or ecosystems. On the other hand, biodiversity has a noticeable financial weight as a raw material resource. Ecological reasoning points out that biodiversity is a basic feature of nature, which should be protected. (Berninger et al. 1996)

3.1.3 Use of Energy and Natural Resources

Crude oil and other fossil fuels are limited natural resources. The ongoing depletion of the world's fossil fuel resources is not a simple physical process, but rather a complex process with economic and technical aspects. Additionally, the scarcity of oil implies an economically intolerable increase in price. At current level of consumption, the known oil resources of the world would be sufficient for the next 40 years. In Finland, the share of fossil fuels used in energy production was 47 % in 2005, and 45 % of petroleum

products were consumed in traffic. (EK 2004, Finnish oil and gas federation 2006, Statistics Finland 2006) However, the most critical question when using fossil fuels as energy resource is not their sufficiency but the environmental change they cause, the most serious of which is climate change (Berninger et al 1996).

Different metals and wood as natural resources are important for the Finnish industry. Some metals, especially iron and aluminum, are abundant and widely used in structural applications. Platinum metals, in turn, are precious, and their use is confined to applications for which only small quantities are required. Some metals are also considered to be essential for some applications, without any available substitutes. One such metal is chromium in the alloy of stainless steel. The majority of metals are recyclable: aluminum, for instance, has one of the highest recycling rates among metals. (Manahan 2000) In Finland, the recycling rate of aluminium beverage cans is 88 %. The European average is 52 % (IAI 2006).

Finland is the most forested of all European countries. Over three quarters of Finland's surface area is forest. Even now, the annual growth in forests is bigger than logging volume and natural loss together. (Metsäteollisuus 2005) If the consumption of raw materials exceeds their annual growth and the amount of waste exceeds the nature's bearing capacity, there is a clear threat to the global economy (Hoffren 1998).

Discussion on the use of resources often focuses on industry's massive use of raw materials. However, as there are many employees working in the service sector, they have a considerable effect on the environment as material and energy users. In Finland, one office-worker takes about 7,000 photocopies and consumes nearly 60 kg of recyclable paper each year (Asikainen 2001). Of the total electricity consumption in Finnish offices, lighting accounts for one third and computers for another third (Motiva 2006). The EU's Green Paper on Energy lists a number of alternative actions for reducing energy consumption by 20 % by the year 2020. This can be done in a cost-effective way by influencing consumer behavior and using energy efficient technologies. These actions concern both the public authorities and each one of us as an individual. (European Commission 2005) Noticeably, given the very strong interest in

increasing consumers' awareness about energy efficiency, analysis of public consultation has delivered a clear message that there is a lack of information. Citizens, industry and stakeholders in general are often not aware of the technology and practices they can use to improve energy efficiency. Contributors call for focus on education in schools and universities. Public authorities have a major role to play in improving energy efficiency while further developing the market for energy-efficient products and services. Energy Services Companies (ESCOs) could improve energy efficiency dramatically in public buildings and office buildings. (European Commission 2006)

3.1.4 Eco-capacity

Whenever a firm discharges residuals into the nature it has an impact on the environment, as shown in Figure 5 in Chapter 2.1. Waste production is a growing problem in both developed and developing countries. The growth in population and economic wealth has increased the number of products that are disposed of after use. (Barr et al. 2005) World leaders have long recognized landfill waste as an international challenge. Chapter 21 of Agenda 21 characterizes landfill waste worldwide as one of the key obstacles in the quest for sustainable development. Accordingly, the framework for actions should focus on minimizing waste, maximizing environmentally sound waste reuse and recycling, promoting environmentally sound waste disposal and treatment, and extending waste service coverage. Agenda 21 sets clear expectations to strengthen the role of workers and trade unions and to promote education, public awareness, and training. (UNCED 1992) In addition, the European 6th Environmental Action Programme cites waste as a key arena for action and calls for a decoupling of waste creation from economic growth (CEC 2002).

In Finland, the amount of waste produced in offices is 21 % of the total amount of waste produced by all firms (YTV 2001, 2005a). Employees in the Helsinki area have a considerable impact on the environment as each of them generates waste from 26 kg (colleges) to 4554 kg (retail) in a year (YTV 2005b). A significant proportion of waste – as much as 80–90 % – is paper (Asikainen 2001). Municipal waste contains large

amounts of unsorted exploitable material. The composition of landfill waste in the service sector in the Helsinki region is the following: plastics 11 %, organic waste 27 %, recyclable paper 30 %, other paper 1 %, soft tissue 12 %, and other waste 19 % (Jokinen 2005). On average, 40 % of paper and textiles is carbon, of plastics 50 % and of organic waste 16 %. The emissions from landfill waste are estimated to have caused more than half of the anthropogenic CH_4 emissions in Finland. (Pipatti et al.1996, Pipatti 1998)

3.2 Framework for Environmental Management Systems

The Earth Summit in Rio de Janeiro in 1992 and the challenge to put sustainable development in practice have inspired the establishment of environmental management systems (EMSs). Environmental management can be generally defined in the following way: Environmental management or corporate "greening" is a process by which companies integrate environmental issues with all their operations (Ketola 1991, Räsänen et al. 1993, Linnanen et al. 1994, Linnanen et al. 1997, Cramer 1998, Schaefer et al. 1998, Vanhala et al. 2002, Pohjola 2003, Halme 2004). The greening of corporate image influences employees' job satisfaction and subsequent attitudes and behavior (Bichta 2003). In addition, the greening itself depends on the values and beliefs of the companies' employees (Juuvinmaa et al. 1994). However, every definition of environmental management has its own perspective, which depends on the various interests and aims of organizations, sectors, and countries. Environmental management includes both the natural and the business environment as in the scope of management. The objects and the extent of these targets may vary, but the aim remains the same: to gain competitive benefits and social legitimacy, as well as to minimize the environmental impacts. (Porter et al. 1995, Klassen et al. 1996, Russo et al. 1997, Welford 1997a, Kallio 2001, 2004, Ketola 2004)

The EMS can be either a comprehensive system covering all the organization's technological, strategic, organizational, ethical, and philosophical perspectives, or a system covering only the actions related to environmental legislation and regulations (Ketola 1991, Räsänen et al. 1993). The EMS can include all the practical things that

people carry out in the course of their daily work, including educating colleagues on environmental issues (Meima 2002). The EMS approach has become common because a number of institutions have legitimized it. On the other hand, through its common use, the legitimization has deepened (Welford 2003). However, protecting their future remains the primary target of companies. Therefore, environmental management in firms is not the aim but only an instrument to help companies achieve their own business and environmental targets (Markkanen 2004).

3.2.1 Strategic and Operative Environmental Management

In the middle of the 19th century, any governmental regulations were regarded as an unnecessary burden and to go beyond compliance was anathema. In the latter part of the last century, governments increased environmental requirements and the regulatory control over the potential impacts of corporations. In the first wave of companies' ecological sustainability, the environment was regarded as a "free good" to be exploited and companies were hostile to environmental activists and to pressures from government and other stakeholders and ecological sustainability was rejected. Little by little companies generally shifted their position on regulation and compliance although financial and technological factors dominated business strategies. In the dominant current second wave of companies' ecological sustainability, poor environmental practices are seen as an important source of avoidable costs. Companies' sustainable efficiency is increased by eliminating waste and by reviewing the purchase, production, and distribution process. However, environmental issues are ignored if they are not seen as generating avoidable costs or increasing efficiency. To achieve efficiency and competitive advantage, companies see proactive environmental strategies as a source of strategic business opportunities. In the third wave of companies' ecological sustainability in the future, organizations will become active promoters of ecological sustainability values and seek to influence key participants. They are prepared to use their influence to promote positive sustainability policies on the part of governments, the restructuring of markets, and the development of community values to facilitate the emergence of a sustainable society. (Dunphy et al. 2003)

Environmental program and system

Significant environmental aspects

Environmental goals

Metrics and indicators

Targets

Follow up and reporting

Management system
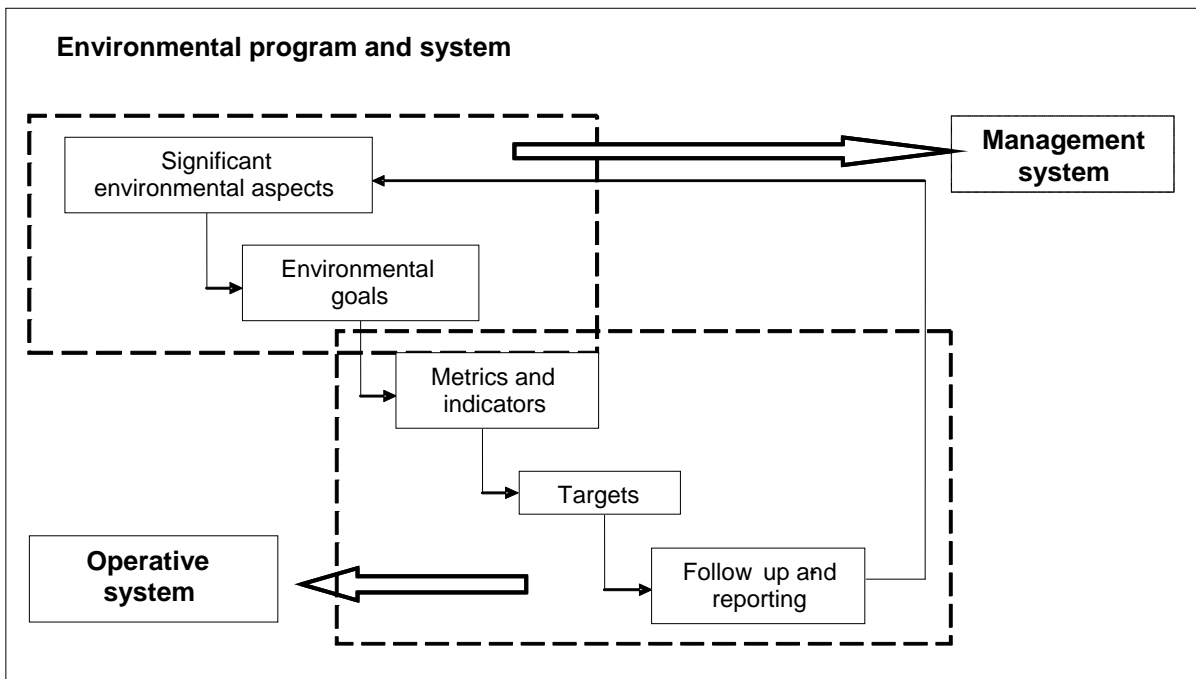
Operative system

Figure 6.   The framework of strategic and operative environmental management, which includes the links between environmental aspects and both strategic management and the operative system in an organization (Pohjola 2005).

The integration of environmental issues with the firm's operations is based on the vision of the significance of environmental issues, and on the core values of the firm. After the key values of environmental responsibility have been established and the long-term objectives have been set, a general operational framework – an operative system – for implementing them is needed (Figure 6). The environmental policies of the firm define the environmental aspects and cooperation with the most important interest groups, whereas its environmental program determines the environmental targets and action plans. (Courville 2004, Ketola 2004, Pohjola 2005)

After the company has identified its environmental issues and goals, indicators help to evaluate how well they are performing with respect to the goals. Indicators form the underlying mechanism for assessing the firm's performance. This assessment process may be undertaken by the firm's staff, or by an independent auditor to ensure greater transparency. The final steps are the reporting process and the evaluation and comparison of the auditing results with the firm's environmental viewpoints (Figure 6). The most common form of reporting is annual (environmental) reports. Because the information in these reports is critical for the firm's transparency and credibility,

harmonizing frameworks such as the Global Reporting Initiative (GRI) have been developed to allow comparison between companies. GRI comprises the reporting guidelines of companies' economic, social and ecological dimensions of sustainable development (Pohjola 2003, Courville 2004, Pohjola 2005). Economic performance indicators include economic performance, market presence, and indirect economic impacts. The GRI social performance indicators identify key performance aspects of labor practices, human rights, society, and product responsibility.The office worker's environmental performance indicators in GRI measure handling of materials (materials used by weight or volume), energy (direct and indirect energy consumption by primary energy source), water (total water withdrawal by source), waste (total weight of waste by type and disposal method), and transport (significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce.). (GRI 2006).

A systematic and comprehensive approach to environmental management leads to a more effective organization and a smoother information flow, as well as to the discovery and utilization of new "win-win" potential with ecological and economic benefits (Steger 2000). The benefits of adopting a strong environmental policy are thus likely to outweigh the costs (Steger 2000, Guenster et al. 2006). The level of ambition of a firm with respect to its environmental performance is seen as the result of the following driving forces: increased market opportunities, increased opportunities for eco-efficiency, the internal structure and culture of the firm, and pressure from the immediate and wider social environment to adopt environmental measures. Improvements in eco-efficiency and the resulting market opportunities are crucial when striving for higher eco-efficiency. These driving forces should be observed in the decision-making process in companies. (Cramer 1998) Corporate responsibility can lead to a more efficient use of resources, better reputation, improvements in investors' trust, and new market opportunities (Porter et al. 1995).

Environmental decision-making has a significant role in promoting environmental sustainability in societies and firms (Bichta 2003). The most important factor when making environmental decisions is the balance between decisions concerning the

company's environmental impacts and the resulting economic benefits. These benefits are; increasing profitability, cost saving drivers, improved public image, increased competitiveness, and the long-term survival of the firm. Other important issues in environmental decision-making are legal requirements, working conditions, and avoiding conflicts with the local community. (Kahelin 1991, Ketola 1991, Järvelä et al. 1996b, Bichta 2003) In organizations where decisions must be made in order for action to be effective, it is natural that the art of decision-making has evolved into processes that are formal, systematic, and transparent (Meima 2002).

At the operational level, the responsibility for environmental issues should remain with the individual employees in line organizations, and the responsibility should not be delegated to internal specialists, managers or external consultants (Porter et al. 1995, Bichta 2003). Organizations should therefore aim to empower workers and increase their decision-making power as well as democracy in the workplace, especially with regard to environmental issues. This should be done alongside the regular improvement of the organization's environmental performance. (Jones et al. 1997a, Welford 1997b, Welford 2000) Therefore, when developing decision-making strategies it is important to recognize, understand, and be able to forecast the ongoing processes related to environmental management (Gluch et al. 2005). Despite this, most firms make decisions mainly based on the world around them and on how they perceive their competitive situation (Porter et al. 1995). On the national level, each individual should have appropriate access to environmental information held by public authorities, as well as the opportunity to participate in decision-making processes (UNCED 1992: Principle 10).

Environmental indicators support the organization's decision-making by giving accurate environmental information on which to base environmental decisions (Heiskanen et al. 1995, Pohjola 2003). Environmental indicators can, for instance, measure the change per produced product or service in the organization's environmental performance during a given period, usually one year (Pohjola 2003). However, decision-making is often based on purely economic factors, such as monetary revenues expressed in catchwords

like cost minimization, competitiveness, positive climate for investment, stock exchange rates, and globalization (Zabel 2005).

If companies are serious about sustainable development, they will have to do things differently. However, it is not only those in managerial positions who need to change. An EMS as a purely technical solution is inadequate in a situation where qualitative changes are needed. Implementing an EMS can often require changes in the basic values of society, in the corporate culture, and in the minds and actions of every single individual (Rikhardsson et al. 1997, Welford 1997b, Kallio 2000). The corporate culture change is such that the strategic approach can only be adopted successfully if staff at all levels - not only managers - are involved. However, a culture change process is not a once and for all process. Most people need time to think through the implication of a more sustainable future. Change in corporate culture comes about through involvement and experiencing what it is like to work in accordance with the culture that is desired for the future health of any business. (Jones et al. 1997b) However, a profound change towards sustainability requires strong leadership from empowered people, including the environmental managers. Environmentally responsible behavior should be incorporated in policies, regulations, contractual obligations, and decision-making within the organization. This way, environmentally responsible behavior becomes a fundamental value for the institution and a habit for people, rather than being imposed or added on. (Welford 2000, McMakin et al. 2002, Lovio 2004b, Barr et al. 2005, Gluch et al. 2005)

A firm can be motivated to encourage its personnel to behave in an environmentally responsible way. The resulting competitive advantage, social legitimacy, minimization of the environmental impacts, and closer follow-up of the governmental regulation can all be emphasized as incentives (Kolk et al 2004). Support from managers and their own actions are essential in order to prevent a gap between environmental policies and practices. In addition, the awareness and communication of the firm's environmental policies, clear target setting, regular environmental audits, feedback, rewards, and environmental training for all employees, especially for the superiors, would encourage employees' responsible environmental action. The pressure from chief executive officers or managing directors is an important first step in attracting the line manager's

attention. (Rasmus 2001, Barr et al. 2005) Managing directors or other employees, the so-called "change agents", can organize the change from top to down or vice versa (Bichta 2003, Halme 2004). A top-down environmental management is often blamed for leaving workers' participation outside the framework. Therefore, there is a need for a systematic framework for involving employees in top-level dialogue and decision-making. It is crucial that lower levels of employees are involved in planning the environmental program from an early stage so that they will develop the necessary commitment, and so that the best possible expertise can be gathered with respect to all operations of the organization. (Halme 1997) There is also a need for a strong leadership with a solid sense of fellowship. (Rikhardsson et al. 1997) Although decisions are usually precursors for action, it can also be thought otherwise. An environmentally active person can influence decision-making, which is needed in order to reach the environmental targets of an organization. A "decisive" person is often thought of as a "person of action". (Meima 2002) This bottom-up corporate cultural change can begin with behavior and an organization ´becomes what it acts` through recognizing the benefits of a new type of behavior (Halme 1997).

Stakeholders' needs expand environmental management towards the stakeholder aspects. The long-term nature of investments and the remote location of most operations mean that companies can only make money if they behave in a responsible way in relation to the communities and the environment. (Vickerman 2006) In the past, the greatest pressure towards companies has been the financial performance pressure from the shareholders. Today, companies also face increasing pressure to improve their environmental performance significantly from some public and non-governmental organizations. (Bardouille 2004) Businesses have to understand stakeholders' values, perceptions, and interests. Nevertheless, they are not obliged to accommodate all the inputs that come from stakeholders. At any rate, it is impossible to achieve social sustainability without satisfying the needs of both businesses and stakeholders. (Foot et al. 2004) Sustainability must become an individual's own vision as well as a shared vision (Jones et al. 1997b).

Consumers are a strong market force. Green consumption can therefore, be a signal to companies and environmental management to strive for corporate "greening" (Moisander 2004). The needs of consumers and the appearance of new environmentally friendly products expand environmental management towards consumer aspects (Jalas 2004). The firm's responsibility for the product's environmental impacts during its whole life cycle broadens the operational range of environmental management (Heiskanen 1993). The action field of environmental management has thus widened and is still widening. The field now comprises not only the core business activities but all interest groups of the firm. The anticipation of environmental issues in all business networks is a key challenge for environmental management. (Pohjola 2003, Welford 2003)

3.2.2 Tools for Building Environmental Management Systems

The problem of sustainability lies not in the question "why" but rather in the question "how". Different environmental management tools help the companies to achieve sustainable development. Environmental management techniques and tools are varied by company. Tools are generally the products of cultures and systems within and outside the companies, and therefore lead to different agendas as regards behavior. Values, attitudes, and actions of senior management tend to influence culture in all companies. (Porter et al. 1995, Pohjola 1999, Welford 2000, Huhtinen 2001, Pohjola 2003, Heiskanen 2004, Halme 2004, Lovio 2004a, Vickerman 2006)

Several environmental management systems have been developed to reduce the environmental impacts of companies and to promote employees' environmentally responsible behavior. The most commonly used are the Eco-Management and Audit Scheme (EMAS) of the European Union and the ISO 14000 series of standards from the International Organization for Standardization (ISO). An organization can also create its own EMS. (Courville 2004) For instance, the WWF (World Wildlife Fund) has built an EMS for offices called the Green Office. The system is a simple and light EMS that is

suitable for both small and large offices in the private as well as in the public sector (WWF 2004).

Motives behind voluntary actions of companies might include avoiding stricter regulation and sanctions, cost savings, the pressure of different interest groups, and/or employees' concern about their own health or the health of the local community (Harrison et al. 2003, Lenox et al. 2003). Darnall et al. (2005) have studied 61 different voluntary environmental programs. Their study suggests that while voluntary environmental programs play a role in building capacity for environmental management, only a small portion of them take steps to ensure that the participants actually reduce their environmental impacts. They noticed, for instance, that about one third of the programs (30 %) expected participants to establish waste reduction or recycling targets. Even fewer programs required their participants to reduce the non-regulated environmental impacts such as of energy consumption (21 %) and water consumption (16 %). However, according to Steger (2000), there is no visible measurable difference in environmental performance between firms using EMAS, ISO 14001, or their own EMS.

Legislation is an administrative way to coerce individuals and organizations to pay attention to the principles and targets of sustainable development (The Finnish Cabinet 1992). Finnish authorities try to restrict the harm caused to nature by waste with the Finnish waste law (1072/1992). According to this law, all waste produced has to be utilized primarily as material and secondarily as energy (Finnish waste law: Chapter 3, 6§). The industrial plants and corresponding real estates have to sort and recycle their waste (Finnish waste law: Chapter3, 7§). Municipal rules give more precise directions (Finnish waste law: Chapter 3, 17§, Helsinki area municipal rules). The goal of environmental administration is thus to reduce the amount of waste by advising and producing guidance material for communities, companies, schools, organizations, and consumers (Blinnikka 2002).

Government regulations are the minimum level firms have to cope with and they have the most significant effect on environmentally responsible actions (Harrison et al. 2003,

Kolk et al 2004). Firms can actually benefit from stringent environmental regulations. Regulations reduce uncertainty and create pressures that generally motivate both innovation and progress. Regulations should thus be met in flexible ways encouraging innovation-based solutions that promote both environmentalism and industrial competitiveness. (Porter et al. 1995) Businesses need to assert their commitment to sustainability over and above environmental legalities (Payne et al. 2001). Firms that move ahead of regulation and minimize the environmental impacts of their products or operations are also better positioned to meet tighter environmental regulation in the future (Klassen et al. 1996, Russo et al. 1997, Welford 1997b).

Environmental Management Accounting (EMA) serves as a linkage between environmental management and the organization's performance. It includes valuable information that the companies' environmental managers can use to reduce the firm's overall environmental costs (Pohjola 1999). Evidence for the financial benefits of environmental management is found for example in the positive stock returns that are documented after positive environmental events (Klassen et al.1996).

Benchmarking other companies and firm networks is an effective tool and especially helpful for small firms to find out the best available practices related to promoting sustainable development. For instance, networks may provide a chance for companies to have some bearing on individual behavior through cultural and situational influences. Benchmarking can thus be valuable but it can also reinforce inappropriate general techniques. (Rikhardsson et al. 1997, Kaiser et al. 1999, Tilley 1999, Zabel 2005)

The European Commission (2006) proposes that long-lasting information campaigns should be organized in order to reduce energy use. The Finnish government, in turn, has decided to promote sustainable development, especially through efficient production and use of energy, as well as through energy saving. For the Finnish government, studying, informing, and educating are preconditions for efficient energy use. (The Finnish Cabinet 1998) The role of regional environmental centers is often understated. Environmental authorities are generally speaking considerably less about energy saving than about the possible environmental impacts of different energy production processes.

(Järvelä et al. 1996a, McMakin et al.. 2002) Companies' employees should have instructional and practical opportunities to promote sustainable development. Therefore environmental training in companies should comprise both general and specific environmental knowledge, as well as programs that are aimed to increase staff awareness of energy conservation and restrictions on business travel. (Haapala 1994, Kuusisto, 1994, Juuvinmaa et al. 1994, Halme 2004, Kolk et al 2004)

3.3 Philosophic and Scientific Explanations and Solutions to Environmental Issues

Environmental issues and their solutions can be explained from the point of view of four different frameworks of scientific thinking. The framework for humanistic thinking explains that environmental problems are due to a lack of knowledge. This view is favoured by the natural scientists. According to this view, the solution to environmental problems is to increase the amount of information available. On the contrary, another humanistic explanation for environmental problems is that in the beginning of the new age (the 16th century) there was a scientific revolution which partly was the basis for the industrial revolution. The scientific revolution was marked by many changes in science. During that period, famous scientists included Nicolaus Copernicus and Isaac Newton. Knowledge based on natural sciences forced aside the truth of religion that had previously guided people's lives. This has resulted in a "value vacuum". Scientific-technical culture concentrates only on the means to reach the goals without questioning the goals themselves. The solution according to von Wright (1987) is the "victory of the logical reasoning"; that is, the questioning of the aims of people's environmental actions. (von Wright 1987, Berninger et al.1996)

According to the sociobiological explanation, human beings are equal to all living creatures. The pessimistic sociobiological explanation views mankind in competition for the final resources on Earth. The result of this can be, for example, an enormous decrease in the population because of a shortage of food. The optimistic sociobiological explanation, on the other hand, predicts that people will adjust to nature and its limited

resources over time, like any other living creature. Ultimately, the technosystem and ecosystem will begin to live in symbiosis. Another, more humanistic explanation, is that human beings have to evolve and make conscious decisions over the directions of their own evolution (Berninger et al. 1996).

The social explanation for environmental problems is that problems are caused and maintained by some structures of society. For instance, environmental problems could be caused by insufficient high-level direction. The solution to the problems is to activate society's own control (Berninger et al. 1996).

The fourth explanation for environmental problems is a technical-economic one. According to this explanation, environmental problems are evidence that technological development has not advanced far enough. The solution is to develop new technologies, for instance new, less polluting production methods. The economic explanation to problems, on the other hand, is that nature has no price. Because polluting nature is free of charge, nobody wants to protect it. The solutions consist mainly of different economic steering methods (Berninger et al. 1996).

As environmental issues are also social issues, their solutions demand human solidarity. Not only is solidarity between generations needed, but also solidarity between contemporaries. This way of thinking does not accept free riders. Individuals can become free riders by taking the benefits a clean environment provides while refusing to do their part to support the clean environment. In reality, all individual members of a group can benefit from the efforts of each member and all can benefit substantially from collective action. (Manahan 2000) The social concept of environmental issues views modern society as a web of social interaction and community operations. The environment is a public good and from the social point of view, the problems related to it are different from the problems of a private good. In order to promote environmental protection, people should consider the values and costs related to the environment. This has to do with the hijacker concept. A hijacker needs public goods and is ready to enjoy them but does not pay the costs of protecting the environment and the public goods. (Järvelä 1996a)

From the point of view of environmental policy, environmental issues are like social problems in general; i.e. either local, regional, or global problems that depend on traditional social resources. The biggest problem with such issues is that they are not often perceived to exist locally; usually not until the problems have escalated. Therefore, the global influence of a human being on nature is difficult to grasp. Environmental problems are a reality, but we have difficulties in understanding our own functions and their influence on nature. (Järvelä et al. 1996a)

3.4 Framework for Environmentally Responsible Behavior

According to Zabel (2005), it can hardly be denied that sustainable development requires substantial changes at the level of individual human behavior. In an organization, sustainable development requires a culture change programme that develops values and sketches the actions needed at the level of individual human behavior. This applies especially to people in industrialized countries. (Welford 1997a, Welford 2000, Zabel 2005) Sustainability will not be achieved until people accept more responsibility for the environmental consequences of their behavior. The responsibility for sustainable development is universal, encompassing everybody from consumers to communities and states all over the world. (Meadows et al. 1993)

Any study of the behavioral aspects of sustainability has to include those aspects of human behavior that are relevant to ecological sustainable development, i.e. the following:

- individual and social learning on a cognitive and emotional level that relates to the understanding and increasing the awareness of environmental problems,
- trust in, communication with, and cooperation with colleagues to solve environmental problems,
- altruism, especially with regard to future generations.

These aspects can be achieved through training and providing relevant information, through participation in the decision-making processes that are relevant to employees'

own work, and through increasing employees' control over and responsibility for the results of their work (Zabel 2005).
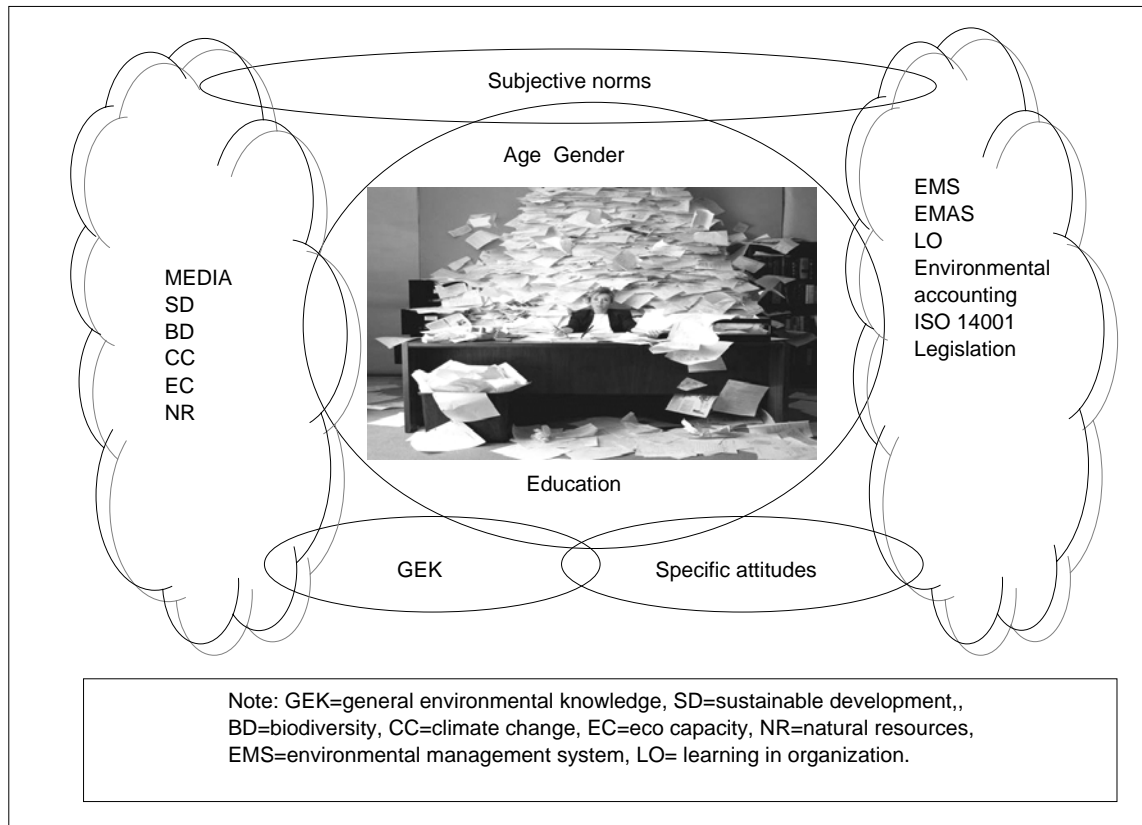
Figure 7.   An office worker and her/his environmentally responsible behavior influencing organization.

Environmental behavior generally depends on an individual's measurable internal variables (subjective norms, specific attitudes, general environmental knowledge), the explaining external variables (sustainable development, media), the helping tools in his/her surrounding organization (the EMS, EMAS, ISO 14001, environmental accounting, learning in organization, legislation), and the background variables (age, gender, education) (Figure 7). In organizations, employees' environmentally responsible behavior is related to the environmental knowledge that they have received through education and media. In addition, companies have instruments that help them to behave in a more environmentally responsible way. These instruments, such as environmental laws, standards, and environmental training are generally integrated into the organization through the EMSs. (Porter et al. 1995, Rikhardsson et al. 1997, Payne et al. 2001, Harrison et al. 2003, Halme 2004, Kolk et al. 2004) In addition, people's personal

traits influence their environmental behavior. Such personal traits include values, experience of social pressure, attitudes, and background variables. Changing environmental behavior is very difficult without also changing the motivation behind the behavior. (Newhouse 1990) The effect of external variables can only lead to stable behavioral changes when they are integrated into internal variables (Zabel 2005). The literature on environmental behavior can be divided into two major streams: studies focusing on sociodemographics (Stern et al. 1993, Cheung et al. 1999, Ewert et al. 2001, Cottrell 2003) and studies of attitudes (Gamba et al. 1994, Chawla 1999, Corraliza 2000, Rauwald et al. 2002, Ajzen 2005).

3.4.1 General Behavior Models

Researchers have usually assumed that there are different causes for different behavior styles. Often, there is little agreement over the crucial determinants of behavior. Therefore researchers will face a multitude of concepts and theories that have been proposed to explain people's behavior. (Ajzen et al. 1980)

The traditional multiple component view of attitude and behavior
The traditional multiple component view considers attitude as a complex system comprised of a person's beliefs, feelings, and verbal statements. This view sees behavior as first-order factors of cognition, affect, and conation, and attitude as a single second-order factor. (Rosenberg et al 1960) According to Ajzen et al. (1980) and Pooley et al. (2000), it is not clear whether the prediction of behavior requires assessment of all three components or if it would be sufficient to measure attitude based on one or two response classes only.

In addition to attitudes, personality traits seem to have been assured a central, lasting role in the prediction of human behavior. However, empirical research has failed to offer strong support for behavioral consistency of attitudes and traits. (Cottrell et al. 1997, Ajzen 2005) Inconsistency of behavior from one occasion to another can be explained by personal factors other than attitudes and personality traits. Such factors

relate to personal characteristics, and to the situation in which a given behavior is adopted. These factors can moderate the effect of attitudes and traits depending naturally on the strength of the attitudes and traits in question. (Ajzen 2005)

The theory of reasoned action and the theory of planned behavior
In contrast to the traditional attitude theory, the theory of reasoned action and the theory of planned behavior emphasize that specific behavior styles can be reliably predicted only from context-specific attitudes towards those behavior styles. The theories are based on the assumption that human beings are usually quite rational and make systematic use of the available information. (Ajzen et al. 1980, Ajzen 1988, 2005, Moisander et al.1995) The theory of reasoned action has been developed explicitly to comprise purely volitional behavior styles. Expressions of behavioral intention should permit a highly accurate prediction of corresponding volitional action. (Ajzen 1988)
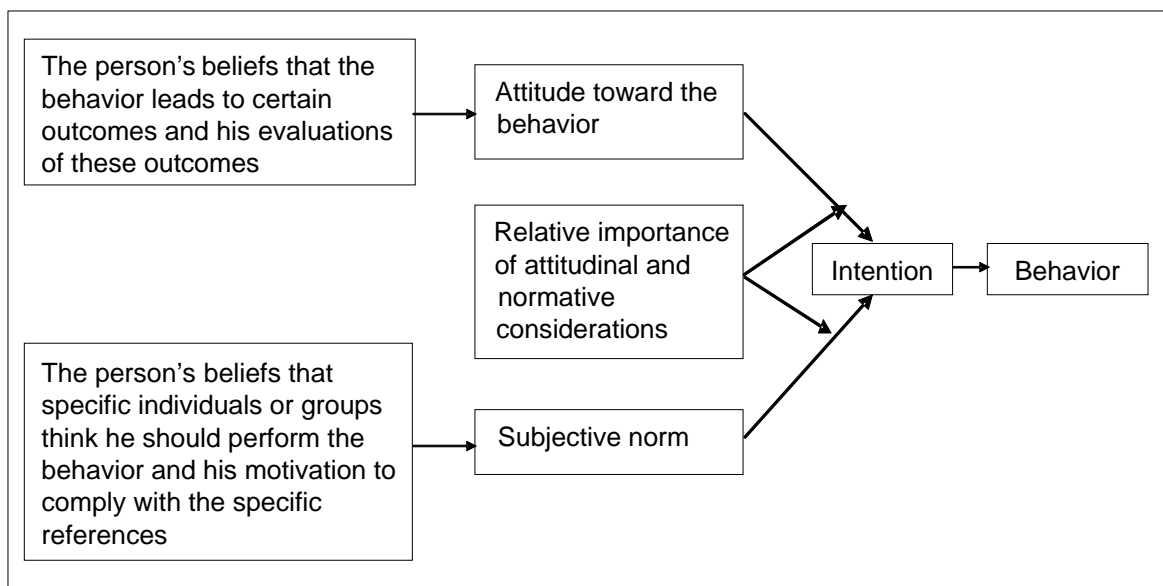
Figure 8.   Theory of reasoned actions (Ajzen 1980).

Behavioral intentions are determined by a person's attitudes towards the behavior and by his/her subjective norms (Figure 8). Attitudes can vary depending on the target of the behavior, the particular action involved, the context in which the action occurs, and the time of its occurrence. They are personal in nature and are determined by prominent beliefs of the consequences of that behavior. In addition, they reflect feelings of favorableness or unfavorableness towards that behavior. Because an attitude consists of

the anticipated consequences of a given action and the evaluation of those consequences, factual knowledge and environmental values are necessary preconditions for any attitude. (Ajzen 1980, 1988, Kaiser et al. 1999, Barr et al. 2005) Thus, the more similar the target, action, context, and time elements of two indicators, the stronger the statistical relation between the indicators is. Therefore, the relation between two variables is the strongest when their levels of specificity are similar. (Ajzen 2005)

Attitudes are relatively stable dispositions to evaluate a certain object, person, or action (Verplanken et al. 1999, Ajzen 1980, Ajzen 1988). However, cooperative and altruistic values are likely to be established within a process of fair and just interaction with other people. The individual values and attitudes are integrated in a long-term process of learning and education. (Zabel 2005)

Subjective norms reflect the person's perceptions and beliefs of social pressure with regard to the choice between performing and not performing a certain action (Ajzen 1988). Therefore, subjective norms are comprised of the awareness of a norm, of the normative expectation for an action, and of the acceptance of that expectation and action. Thus, social and moral values, i.e. social expectations and moral principles, can be considered as a proxy of one's subjective norms. (Barr et al. 2005) Family members or friends influence these subjective norms (Vining et al. 1992, Moisander et al. 1995, Taylor et al. 1995, Cheung et al. 1999). There is also a link between attitudes and subjective norms. Moreover, subjective norms do not induce behavior independently of one's own attitudes. The attitudinal and the normative component are both considered to be functions of the weighted sum of the appropriate beliefs. (Ajzen 1988)

Behavioral intentions express the willingness to undertake an action, for instance to vote in a forthcoming election. These intentions can change over time. The longer the time interval between the measure of the intention and the observation of the behavior, the less accurate the prediction of behavior from intention is. (Hines et al. 1987, Ajzen 1980, Ajzen 1988, Cottrell et al. 1997, Chawla 1999, Kaiser et al. 1999, Olli et al. 2001, Staats et al. 2004)

The relative importance of attitudes and subjective norms in determining intentions may vary from one behavior to another and from one individual to another (Ajzen et al. 1980, Barr et al. 2005). If an individual has strong habits, his/her intentions to act are unrelated to the behavior. Moreover, the intention to behave responsibly is often not enough. (Järvelä et al.1996a, Verplanken et al.1999, Bamberg 2002, Barr et al. 2005) Even a strong intention to change one's habits does not guarantee that this intention is actually enacted. Additionally, people's habits seem to be accompanied by an enduring cognitive orientation, which makes an individual less attentive to new information. In order to connect new knowledge to change attitudes and behavior, an information campaign alone is ineffective. The information should instead be combined with incentives that ease the performance or behavioral commitment and so connect newly learned information and behavior styles to habitual behavior styles. (Gillilan et al.1996, Järvelä et al. 1996a, Verplanken et al. 1999, Bamberg 1999, 2002, Barr et al. 2005)

Behavioral commitment to changing habits entails an additional intention of implementation: a precise plan about when, where and how to start performing the intended behavior. The forming of this intention of implementation can even override the interfering negative effects of habits on the enactment of the intended new behavior. (Verplanken et al.1999, Bamberg 2002) Thus, once a person has become accustomed to behaving in a certain way, he does not stop every time to decide how to proceed. Routine behavior styles may be controlled by spontaneously activated behavioral intentions. (Ajzen 1988, 2005) People who fear social disapproval might use the strategy of an intention of implementation in order to ensure that they actually do what they have publicly promised to do. However, repeated behavior seems to strengthen positive attitudes towards the action: past behavior often predicts the future behavior. (Ajzen et al. 1980, Vining et al.1992, Bamberg 2002)

When the theory of reasoned action is applied to behavior styles that are not fully under volitional control (e.g. to quit smoking), difficulties arise: even a strong intention to behave in a certain way does not guarantee the intended behavior (Ajzen 1988). This is explained by the theory of planned behavior, a modified version of the theory of reasoned action, which was developed to deal with behavior styles that are not fully

under volitional control. The theory emphasizes the individual's intention to perform a certain behavior. Thus, in addition to the two determinants of intention, attitudes and subjective norms, the theory of planned behavior additionally takes into consideration a factor called perceived behavioral control. Perceived behavioral control reflects beliefs regarding control over factors that may facilitate or impede performance of a behavior. (Ajzen 1988, Ajzen 2005)

Perceived behavioral control refers to the perceived ease or difficulty of performing the behavior. It also includes the reflection on experience about the results of certain behavior styles, as well as the anticipation of future obstacles and opportunities. In other words, perceived behavioral control is a person's own perception of the extent to which the behavior is within his/her control or is easy or difficult. (Ajzen 1988, Ajzen 2005, Chang 1998)

Behavior is not a linear process but an interactive process that has impacts on the individual and on the situation in which he acts (Barr et al. 2005, Zabel 2005). Although the major factors of intention and behavior are normative and relate to specific beliefs, many background variables are not necessarily related to or do not influence the beliefs people hold. These variables include personal factors such as general attitudes, personality traits, values, emotions, and intelligence, as well as social factors such as age, gender, race, ethnicity, education, income, and religion. Additionally, information factors such as experience, knowledge, and media exposure may influence people's beliefs (Hines et al. 1987, Kaiser et al. 1999, Olli et al. 2001, Bamberg, 2002, Ajzen 2005, Barr et al.2005, Zabel, 2005).

3.4.2 Environmental Behavior Models

Both the traditional multiple component view of attitudes and behavior and Ajzen's theories have been widely used in environmental behavior research (Moisander et al. 1995, Cottrell et al. 1997, Ebreo et al. 1999, Verplanken et al. 1999, Pooley et al. 2000,

Barr et al. 2005). However, there are still some particular features in studying environmental behavior.

Research on environmental attitudes has typically relied on univalent attitudinal ratings (Olli et al. 2001). Costarelli et al. (2004) claim that this provides an incomplete picture. The studies have focused only on attitudinal ambivalence and its effects on environmentally friendly behavioral intentions. The attitudes are actually defined as a compound of all performance related positive and negative evaluations multiplied with their respective likelihood of occurrence. A neutral attitude compound score may indicate either a truly neutral attitude or an extremely ambivalent attitude towards responsible environmental action. Ambivalent attitudes are different from neutral attitudes. Neutral attitudes are in the middle between evaluations of opposite attitudes, but in attitudinal ambivalence a positive and negative evaluation of the same attitude object is not equally strong. The more ambivalent the attitudes towards the environment are, the lower the strength of environmentally friendly behavioral intention. (Costarelli et al.2004)

A number of researchers have found that assessing general environmental values can also be useful in predicting general environmental behavior (Stern et al. 1993, Oskamp et al.1998, Widegren 1998, Ebreo et al. 1999, Kaiser et al. 1999, Corraliza 2000, Dunlap et al. 2000, Ewert et al. 2001, Olli et al. 2001, Barr et al. 2005). Basic values, such as a clean environment, are more permanent than attitudes, which are often very superficial (Allart 1983, Suhonen 1994, Rauwald et al. 2002). Stern et al. (1993) view the values as a dimension of moral scope. In their study, they presumed that action supporting environmental quality might derive from any of three different value orientations: egoistic, social-altruistic, or biospheric.

The new environmental paradigm (NEP) is a component of environmental attitude research and consists of several value dimensions, such as the fragility of the equilibrium of nature, the reality of the limits of growth, and anti-anthropocentrism, i.e. objection to human domination of nature. An improved version of NEP, the "New Ecological Paradigm Scale", has been extended to also contain the rejection of exemptionalism, i.e.

the exemption of people from the constraints of nature, and the possibility of catastrophic environmental changes besetting humankind (Dunlap et al. 2000).

Some studies describe norms as predictive factors of environmental behavior. Norms are means of carrying out the choices that are based on values (Allardt 1983). Personal norms describe positive and negative feelings towards environmental actions. They are influenced by feelings of conscience, guilt, and embarrassment, and by the knowledge or awareness of the consequences of one's own behavior and responsibility. Social norms describe the influence of other people, e.g. family members, on one's own environmental behavior. (Newhouse 1990, Vining et al.1992, Kaiser 1998, Widegren 1998, Ebreo et al.1999, Bratt 1999b)

Attitudes towards taking environmental actions and towards interest, utility, and importance of science have a strong relationship with and influence on each other. If information about people's attitudes towards environmental actions is not available, environmental behavior can be predicted from attitudes towards science (Ma et al. 1999).

In some studies an "environmental type or person" has been described. He is young, female, well-educated, reasonably wealthy, car-driving, politically liberal, and lives in a single family dwelling (Uusitalo 1986, Ebreo et al. 1999, Barr et al. 2005). However, according to Bratt (1999a) there is no such general environmentally friendly consumer.

Environmental behavior seems to be inconsistent and sector-based. It is unlikely that the antecedent of one form of behavior should be related to another form of behavior or represents one's environmental behavior in general. (Dietz et al.1998, Kaiser 1998, Blake 2001, LaRoche et al. 2002) The more distant two behavioral fields are from each other, the lower their correlation appears to be. These differences in behavioral performance indicate individual preferences concerning the means by which environmental concern is displayed. (Bratt 1999a, Ebreo et al. 1999, Corral-Verdugo et al. 1999, Gatersleben et al. 2002)

Research on behavioral aspects of sustainability has to include those aspects of human behavior that are relevant to sustainable development. Such aspects are individual and social learning on a cognitive and emotional level. These aspects enable the understanding of and increase in the awareness of environmental and social issues, as well as the trust in, communication with, and cooperation with other people in a collective action to solve the environmental and social problems. (Moisander et al. 2001, Zabel 2005). It is difficult to predict people's behavior because some ecological behavior styles are more difficult to carry out than others. Ecological behavior is susceptible to many influences, and single constructs cannot accurately forecast behavior. Social and cultural conditions may make one ecological behavior easy but some other behavior difficult. Factors on a personal level also influence judgment of the difficulty of specific environmental behavior or are susceptible to a wide range of influences. Therefore, people seem to be inconsistent in their ecological behavior. (Vining et al.1992, Cottrell et al. 1997, Kaiser 1998)

According to Hines et al. (1987), a change has occurred in the research of predictive variables of environmental behavior in the last decade. Earlier, predictive variables were related to changes in attitudes. During the last decade, researchers started to be also interested in the costs and benefits of behavior and in the influence of the external variables, e.g. of the inconvenience of performing the behavior (Vining et al. 1992, Gambro et al. 1996, Bratt 1999b, Chueng et al 1999, Corraliza 2000, LaRoche et al. 2002, Bichta 2003, Di Vita 2004, Barr et al. 2005). In addition, information about people's behavior can be collected in the verbal form of self-reports, from acquaintances, or it can be based on direct observations of overt behavior styles or non-verbal cues (Ajzen 2005).

The literature reviews two types of environmental behavior measures: general environmental behavior measures and measures of different, more or less independent types of ecological behavior (Kaiser 1998, Bratt 1999a, Olli et al. 2001, Cottrell 2003).The general environmental behavior indicator is a sum index of different behavior styles, and is less susceptible to a wide range of influences than the specific behavior indicators are (Vining et al. 1992, Kaiser 1998, Oskamp et al. 1998, Poortinga et al.

2004, Zabel 2005). General behavior measures can be seen as representing one underlying general dimension even though people appear not to be strictly consistent across the different types of behavior (Kaiser 1998). The most popular subject in studying people's environmental behavior with specific behavior measurements is recycling behavior. This is mainly due to the importance recycling has in solid waste management. (Gatersleben et al. 2002, Nordlund et al. 2002)

3.4.3 Environmental Knowledge and Environmental Behavior

Many studies on environmental behavior have focused on the assumption that there is a direct link between environmental knowledge and behavior, and an indirect link through attitudes and social pressure (Hines et al. 1987, Vining et al.1992, Cottrell et al. 1997, Oskamp et al. 1998, Kaiser et al. 1999, Blake 2001, Kasapoglu et al. 2002, Cottrell 2003).

Environmental education and general environmental knowledge are significantly related to intention and general environmentally responsible behavior (Hines et al. 1986/87, Iozzi 1989, Smith-Sebasto 1995, Cottrell et al. 1997, Cheung et al. 1999, Zelezny 1999, Cottrell 2003). Professed knowledge of action strategies and awareness of consequences predict self-reported environmentally responsible behavior in specific situations, such as in waste paper recycling. (Hines et al. 1987, Gamba et al. 1994, Smith-Sebasto 1995, Cheung et al. 1999, Olli et al. 2001, Nordlund et al. 2002, Cottrell 2003, Do Valle et al. 2004, Barr et al. 2005) Especially in relatively novel environmental behavior situations, a person's sense of his/her own competence affects his/her willingness to adopt a new behavior (De Young 1996).

However, according to several studies on self-reported behavior, environmental knowledge does not indicate environmentally friendly behavior (Finger 1994, Gamba et al. 1994, Gillilan et al. 1996, Cheung et al. 1999 LaRoche et al. 2002, Kilbourne et al. 2005). There seems to be a gap between knowledge and behavior. One explanation for this gap is that people do not even consider the underlying connections they have to the

natural environment. General environmental knowledge is probably important, but alone it is not enough to inspire environmentally responsible behavior. Both motivation and knowledge of what needs to be done are necessary. (Zimmermann 1996, Kilbourne et al. 2005)

On the contrary, lack of knowledge about environmental issues can be an important factor in determining environmental behavior styles and attitudes, and can lead to a decline in self-efficacy. Lack of knowledge can be used as an excuse for not behaving environmentally responsibly. It can lead to a feeling that one cannot participate in environmentally responsible behavior, as there is not enough knowledge. (Oskamp et al. 1998, Gamba et al. 1994, Heiskanen et al. 1995, Ewert et al. 2001, Barr et al. 2005)

Environmental knowledge is increasingly transmitted through the media. Global environmental changes are frequently discussed in the media and this often generates concern, fears, and anxieties. (Stern et al. 1993, Finger 1994, Suhonen 1994, van Es et al. 1996) According to Gluch et al. (2005), there is a risk that journalists who lack special training in environmental issues either do not grasp the scientific information themselves or they simplify the information in a way that distorts the original message. Environmental knowledge is also transmitted through education. The effect of education on environmental knowledge and behavior is treated in Chapter 2.4.8.

3.4.4 Learning in the Organization and Environmental Behavior

Agenda 21 presents clear expectations for strengthening the role of business and industry. Additionally, the agreement aims to strengthen the role of workers and trade unions and to promote education, public awareness, and training (Chapter 36). Thus, sustainable and environmentally sound development in all countries is heavily promoted (UNCED, 1992).

Human behavior encompasses learning processes on several levels. On the level of genetic predispositions, human behavior follows patterns of adaptation to natural living

conditions. On the level of individual personality, learning takes place within groups, cultures, religions, and social and physical environments in general. In this process, the individual follows the interaction between the social environment and his/her own strategies. Individuals also learn in given situations, mostly in a trial and error mode. (Stacey 2003, Zabel 2005)

Intrinsic motives are crucial in learning new behavioral manners. Learning will not occur without the vision and motivation of the firm's employees. Moreover, sanctions antagonize rather than motivate employees. (Hays et al 2001, Remedios et al. 2004) An EMS aids organizations in organizational learning through planning and implementing processes, and through feedback-based learning in given situations (Courville 2004). Cooperative and altruistic values are likely to be established within a process of fair and just interaction with other people. In the process of their individual development, many people experience social values that are based on empathy, altruism, and cooperation. They could be integrated in the individual values and attitudes in a long-term process of learning and education. (Zabel 2005) Short-term programs have been shown to have no active improvements in environmental behavior (Zelezny 1999).

Effective environmental training and education can build up employees' skills, creativity, and eagerness that further facilitate environmental behavior (Mangas et al. 1997, Welford 2000). The necessary change in culture can be achieved by increasing the environmental awareness of the whole organization, especially through staff training. Such education for sustainable development should include all the necessary information the staff need in their environmental decision-making. It is recommended to include information on basic environmental issues, on the environmental problems related to the firm's economy and ecology, and on the issues related to the employee's own role. (Iozzi 1989, Kuusisto 1994, De Young 1996, LaRoche et al. 2002, Cottrell 2003, Rohweder 2004, Wood et al. 2004, Barr et al. 2005, Wolff 2005) According to Gambro et al. (1996), problem-based learning is often more effective than fact-oriented approaches. Both cognitive and affective components of attitudes are important predictors of environmental behavior. This may mean that in order to change environmental behavior, both emotions and beliefs should be targeted in companies'

environmental training. Individuals' increased awareness affects their ability to build awareness of complex and integrative large-scale problems (Hines et al. 1987, Iozzi 1989, Oskamp et al., 1998, Pooley et al. 2000, Holt 2004, Rohweder 2007). Furthermore, environmental issues must be compatible with the level of knowledge, attitude, and moral development of the individual. (Newhouse 1990).

When educating and training people in environmental issues, more attention should be paid to behavior styles that contribute significantly to solving the main environmental problems, such as those related to energy use. In addition, two different measures of environmental behavior should be distinguished, namely the intent-oriented and impact-oriented measures. The intent-oriented measure focuses on behavior that is environmentally significant from an actor's point of view. This behavior is based on values and popular notions of environmentally significant behavior, such as self-reported recycling behavior. Such measures in general do not reflect the actual impact of behavior. The impact-oriented measure, on the other hand, focuses on the actual environmental impacts and quality of high-impact behavior styles, for example energy and water use. In organizations, it can be difficult to motivate employees to save energy as they neither know the real environmental impacts of their behavior nor pay the energy bills themselves. Therefore, the development of information on and education of programs concerning knowledge about health and comfort benefits, as well as about environmental impacts of different behavior styles seems worthwhile. (Gatersleben et al. 2002, McMakin et al. 2002, Poortinga et al. 2004)

The firm can invest in new learning technology, for instance in e-learning and web-based training. Both learning on the job and just-in-time learning facilitate the development of an organizational culture that anticipates change. A just-in-time approach to learning encourages a lifelong learning attitude among employees. (Packer et al 2003, Mele et al. 2005) Team work, mentor guidance, and internal and external training are methods to educate personnel in environmental issues. Employees' commitment to environmental issues depends on the culture of the organization. The directors' roles and their environmental behavior are crucial. If directors do not contribute to employees' environmental behavior, employees will not start to behave

environmentally friendly. (Huhtinen 2001, Bryson et al. 2006) Managers and direct supervisors can engage employees in environmental learning process by appreciating employees' own environmental efforts (Rasmus 2001).

In a change situation however, the role of change agents is crucial. If a change agent is perceived as legitimate and competent, the change he introduces to an organization will be readily accepted, especially if he comes from outside the organization. (Scurrah et al. 1971) Additionally, learning on and outside the job in the right mix strengthens organizational learning (Mele et al 2005).

3.4.5 Attitudes and Environmental Behavior

According to Rauwald et al. (2002), on a conceptual level, measurement of environmental attitudes is difficult because attitudes not only include general views of the world but also concerns about specific environmental issues and underlying value orientations. The attitude object can be either the environmental behavior, the environment itself, or a part of it. Attitude generally refers to environmental concern (Maloney et al. 1975, Hines et al.1987, Ajzen 1988, Vining et al. 1992, Moisander et al. 1995). It has been used in the form of either a multiple or a single component approach (Hines et al. 1987, Gamba et al. 1994, Fuhrer 1995).

General environmental values are positively related to personal norms, and personal norms further correlate significantly with environmentally responsible behavior (Corraliza 2000, Nordlund et al. 2002). According to Bratt (1999b), recycling behavior is an altruistic behavior that is a consequence of personal norms. He found that the assumed environmental consequences of recycling behavior as a habitual behavior have no impact on actual behavior. In comparison to using negative determinants, such as guilt and embarrassment, as personal norms, altruistic motives are often of relevance in explaining environmentally friendly behavior (Widegren 1998).

Both concern for the environment and specific recycling attitudes, such as the legitimacy of the activity, are significant predictors of self-reported recycling behavior but not of observed recycling behavior (Vining et al. 1992, Gamba et al. 1994, Moisander et al. 1995, Oskamp et al. 1998, Bratt 1999b, Dunlap et al. 2000, Olli et al. 2001, Gatersleben et al. 2002, Do Valle et al. 2004). However, global concern for the environment does not have a major impact on recycling and energy using behavior (Gaterleben et al. 2002, Barr et al. 2005).

Environmentalism is a post-materialistic value and those following it should be more likely than materialists to prefer environmental protection and quality over economic progress (Dietz et al. 1998, Blake 2001). Environmentalism does not generally receive enough support if no social motion supports it. Typical of social movements is that they try to impact and change society's structure. (Allardt 1991)

Verbal commitment is a strong indicator of behavior and does not seem to have significant relation to age and education (Cottrell et al. 1997, Cottrell 2003, Barr et al. 2005). However, verbally expressed environmentally friendly opinions do not guarantee actual environmentally friendly behavior (Allardt 1991, Barr et al. 2005).

The reason for the conflict between attitudes and behavior can be the conflict between personal and collective preferences. Environmental protection demands collective action, and collective action is formed by individual action. However, as the individual's own action is insignificant, people do not realize the effect of their actions on the environment. (Uusitalo 1991) People who believe that individual action can make a difference are more likely to act than are those who do not. On the other hand, people who believe that science and technology can solve environmental problems are less likely to see the need for personal action than those people who are optimistic and believe in individual action (Blake 2001).

People repeatedly make choices between decisions which have positive consequences for themselves and negative consequences for the environment, and vice versa. Collective behavior is seen as the result of each individual's own rational actions in

his/her self-interest. Individuals with a cooperative value orientation have been found to give more weight to the collective consequences of their behavior. They are also more willing to make personal sacrifices for the common good than those with an individualistic value orientation. The dilemma arises from the fact that the individual's effect on the environment, caused by his/her own behavior, is usually too marginal to serve as a rational motive for his/her environmental behavior. But as a member of society, it is in his/her collective interest that most people adopt an environmentally friendly lifestyle. (Widegren 1998, Nordlund et al. 2002)

3.4.6 Subjective Norms and Environmental Behavior

Measures in the ecological domain are affected by social pressure and moral norms. Therefore, environmentally responsible behavior has become socially acceptable or even desirable and necessary. (Ajzen 1988, Vining et al. 1992, De Young 1996, Bratt 1999a, Dunlap et al. 2000, Moisander et al. 2001, Cottrell 2003, Do Valle et a. 2004, Staats et al. 2004, Barr et al. 2005) Employees' values and attitudes usually develop through interaction with other colleagues. Impulses from the social environment such as social pressure, family members' examples, and role expectations are crucial for environmental behavior. (Chawla 1999, Olli et al. 2001, Zabel 2005)

Of the environmental behavior styles, recycling behavior is especially supported by social norms: it has become common and expected by other people (Gamba et al. 1994, Oskamp et al. 1998, Cheung et al. 1999, Ebreo et al. 1999, Bichta 2003, Barr et al. 2005). Thus, if asked whether one would recycle if neighbors did, individuals would be likely to say yes. Yet this positive expression does not appear to be reflected in actual behavior. (Allardt 1991, Barr et al. 2005)

The social norms maintained by an individual's social network can induce behavior that is in conflict with the individual's own attitudes (Ajzen et al. 1980, Newhouse 1990, Bratt 1999b). According to some studies, social norms do not influence recycling behavior without first inducing equivalent personal norms. But this indirect effect of

social norms on behavior has been found to be limited. Social norms do not induce behavior independently of one's own attitudes. (Ajzen et al.1980, Newhouse 1990, Kaiser 1998, Bratt 1999b) However, social pressure sometimes influences recycling behavior negatively because the influence of others might suggest a negative reaction causing the individual to rebel against recycling (Taylor et al. 1995). Nevertheless, people's belief that their individual contribution is insignificant and has no practical effect may inhibit recycling of materials. This perception of little individual influence becomes stronger when people assume that others are also not participating. (Do Valle et al. 2004)

3.4.7 Awareness of Financial and Environmental Consequences, and Environmental Behavior

Employees who are aware of the impact their firm has on the environment can be engaged in the challenge of solving environmental problems (Heller 2004). However, although people may be aware of these environmental impacts, they do not often realize their connection to their own behavior (Uusitalo 1991, Gambro et al. 1996, Gatersleben et al. 2002). Although climate change is a well-known global problem the connection between burning of fossil fuels and climate change is still relatively unknown (Gambro et al. 1996, Gatersleben et al. 2002). Individual energy saving is not motivated by environmental benefits but by lower energy costs (Fuhrer 1995). Yet the relationship between household income and all dimensions of environmental behavior is insignificant or negative. The amount of energy consumed grows with growing household income and size. (Olli et al. 2001, Gatersleben 2002, Poortinga et al. 2004) However, according to McMakin et al. (2002), motivating individuals to save energy when they do not pay the energy bills can be difficult. It has been found that people can be motivated by increasing knowledge about health, comfort, and the environmental benefits of energy saving.

Waste recycling has many positive effects on the economy and the environment as a whole. If individuals are made aware of the environmental benefits of recycling in

concrete terms, and if the public knowledge of recycling programs is sufficient, participation rates may increase. (Vining et al. 1992, Gamba et al. 1994, Oskamp et al. 1998, Cheung et al. 1999, Ebreo et al. 1999, Di Vita 2004, Do Valle et al. 2004, Barr et al. 2005) In addition, financial benefits increase participation in responsible behavior, as shown in the case of soft drink bottle recycling (Uusitalo 1986, Bratt 1999b, Bamberg 2002).

3.4.8 Background Variables and Environmental Behavior

A purely attitudinal motivational model to explain environmental behavior may be too limited (Poortinga et al. 2004). Situational, demographic, educational, and psychological variables can also affect one's environmental behavior (Barr et al. 2005).

Situational variables and environmental behavior
Personal circumstances, such as living in a city, have an effect on environmental behavior. Participating in environmental organizations and outdoor leisure time activities has a positive effect on environmental behavior. (Finger 1994, Kaiser 1998, Olli et al 2001, Teisl et al. 2003, Tanner et al. 2004) Environmental behavior is also supported through the firm's culture and the employee's professional standing in the firm (Turtiainen 1991, Juuvinmaa et al. 1994, Ewert et al. 2001, Bichta 2003). These external forces are transmitted through laws, social norms, infrastructure, and other living conditions (Rauwald et al. 2002, Barr et al. 2005, Zabel 2005).

In addition, contextual factors, such as individual opportunities and abilities, and the convenience of the behavior, determine environmental behavior. The same person may behave differently in one set of conditions than in another (Gamba et al. 1994, Guagnano et al. 1995, Oskamp et al. 1998, Chueng et al 1999, Corraliza 2000, Blake 2001, LaRoche et al. 2002, Do Valle et al. 2004, Barr et al. 2005). Furthermore, the perceived time available to undertake the action is of importance (Vining et al. 1992, Oskamp et al. 1998, Barr et al. 2005). Newspapers and magazines are the easiest and perhaps therefore the most often recycled waste, which has resulted in a generally high

paper-recycling activity (Gillilan et al.1996, Oskamp et al 1998, Barr et al. 2005). The more inconvenient the individual perceives recycling to be, the less likely he or she is to recycle, regardless of how important he or she believes recycling to be (Oskamp et al.1998, Corraliza 2000, LaRoche et al.2002). Some environmental behavior styles are more difficult to carry out than others, but factors on the personal level also influence judgments of the difficulty of given environmental behavior (Kaiser 1998).

If the behavior is goal-directed and takes place in stable contexts, such as paper recycling and consumer behavior, it usually turns into a habit. Past behavior often predicts present and future behavior and might involve a relatively low level of reasoning. In addition, decisions are not as conscious as on the level of attitudes. (Heiskanen et al. 1995, Cheung et al.1999, Verplanken et al. 1999) However, repeated behavior seems to strengthen positive attitudes towards recycling (Vining et al.1992). People should also be informed that recycling is a common activity. This might encourage more people to recycle as it conveys ideas about social appreciation and easy execution out. (Gillilan et al. 1996, Verplanken et al.1999)

Demographic variables and environmental behavior

Women are more concerned than men about the environment and environmental problems, such as ozone depletion, radon in homes, and pesticides (Burger et al.1998). Women are also more aware of the consequences of their own behavior (Dietz et al. 1998). Additionally, women's attitudes towards the environment are more affirmative (Uusitalo 1986). Correspondingly, women are more likely to engage in environmentally responsible behavior (Stern et al. 1993, Dietz et al. 1998, Ebroe et al. 1999, Blake 2001, Ewert et al.2001, Olli et al. 2001, Lam et al. 2002). On the other hand, Hines et al. (1987) in their meta-analysis of environmental behavior found no correlation between gender and behavior. Furthermore among activists, gender difference is insignificant (Olli et al. 2001).

One enlightening factor for differences in behavior styles is the experience and effects of parenthood. Women, especially mothers, focus on children's health as opposed to

fathers who focus on children's economic well-being. These two foci have opposite effects on environmental concern. (Stern et al. 1993, Davidson et al. 1996)

According to Ebreo et al. (1999), consumer's age has no explicit effect on consumption behavior. This, however, depends on the target behavior. Generally, age has a positive relation with nature-related products (product's effect on animal life), but no relation with conservation-related products (depletion of natural resources). However, old people are more likely to recycle, even though young people are generally more environmentally concerned than older people (Finger 1994, Diez et al.1998, Ewert et al. 2001, Olli et al. 2001, Gatersleben et al. 2002, Cottrell 2003, Barr et al. 2005). The study of Olli et al. (2001) confirms that environmental behavior is not necessarily rooted in a corresponding concern. It also concluded that the correlation between age and environmental behavior is the result of generational experiences rather than an effect related to age.

Psychological variables and environmental behavior
Feeling guilty is a constructing feeling that guides people towards more morally and socially environmentally responsible behavior. Feelings of guilt emerge when people feel they have behaved against the norms in their culture or society. Guilt feelings are connected only with the behavioral situation. For this reason, it is possible to free oneself of guilt by changing behavior. (Massa 2006) Using feelings of guilt as determinants of altruistic motives is often of relevance in explaining environmental behavior and is even considered as the most important motive for recycling (Uusitalo 1991, Vining et al. 1992, Oskamp et al. 1998, Widegren 1998). However, shifting the focus from fear and guilt to positive motivation might be better suited to promoting ecological behavior (Hartig et al. 2001).

Reasons for saving energy or buying green electricity without personal financial incentives are social and psychological. Behavior is motivated by altruism when people are willing to take environmentally responsible actions that benefit others, a willingness to "do the right thing". An egoistic motive for saving energy is, for example, the desire

to have comfortable homes and set children good examples. (McMakin et al. 2002, Clark et al. 2003)

Education and environmental behavior

The effect of education on environmental behavior is not clear. A higher level of education and awareness of consequences is often related to behavior (Uusitalo 1986, Thomson et al. 1991, Finger, 1994, Dietz et al. 1998, Oskamp et al. 1998, Kasapogly et al. 2002, LaRoche et al. 2002, Syme et al. 2002). However, the level of education has only a minor effect on environmental behavior, such as responsible consumption, waste handling, resource conservation, energy use, and recycling behavior (Widegren 1998, Olli et al. 2001, Gatersleben et al. 2002).

Education and an individual's major subject play mediating roles in the development of his/her set of beliefs and attitudes towards the environment (Hines et al. 1987, De Young 1996, Ewert et al. 2001, Cottrell 2003). According to Mangas et al. (1997), environmental courses increase environmental knowledge and change attitudes towards the environment. Graduates majoring in business have generally reported lower levels of environmental concerns than those individuals majoring in environmental studies and biology (Ewert et al. 2001). Additionally, people with higher education and environmental expertise can be expected to be more aware of technologies that lead to cost savings in the form of reduced waste, recycled materials, and energy saving (Poortinga et al. 2004, Rivera et al. 2005).

3.5 Conclusions

Companies have an important role to play in the promotion of sustainable development. Environmental problems, especially climate change, are challenges facing firms and their employees, as well as all individuals. These problems are a threat to all economic, social, and ecological welfare, i.e. for sustainable development. Human actions, such as the use of natural resources and the use and disposal of products, have an impact on the environment. Businesses therefore need to recognize and acknowledge the key

sustainable development issues. This green thinking provides a radical challenge. Moving towards sustainable development represents such a fundamental change in the values and visions of companies that it cannot be expected to occur quickly. Ecological and economic sustainable development as an ideal aim is demanding. Therefore, sustainable development can be seen rather as a path than a goal, and is a field of growing global importance.

Environmental issues and their solutions can be adjusted to from the point of view of four different frameworks of scientific thinking namely the humanistic, sociobiological, social, and technical-economic thinking explanations. The biggest problem related to the solutions for environmental issues is that they are often realized locally and usually not until after problems have appeared. Environmental problems are reality, but we have difficulties in realizing our own function and its influence on nature.

The greening of the firm depends on the aims, values, beliefs, and requirements of all stakeholders; employees, customers, non-governmental organizations, owners, and the authorities. Environmentally oriented employees can minimize the firm's environmental impacts and improve the follow-up of governmental regulation. The EMS in a firm is an instrument that helps companies to achieve their business and environmental targets. The EMS can include all the practical things that people carry out in the course of their daily work. Sustainability is not "why" but "how", and different environmental management tools help companies to achieve ecologically sustainable development.

Environmental behavior generally depends on a person's internal and external variables (Figure 7). A firm can be motivated to encourage its personnel to behave in an environmentally responsible way by emphasizing the competitive benefits and social legitimacy accruing from the behavior. It can hardly be denied that sustainable development requires substantial changes at the level of individual human behavior.
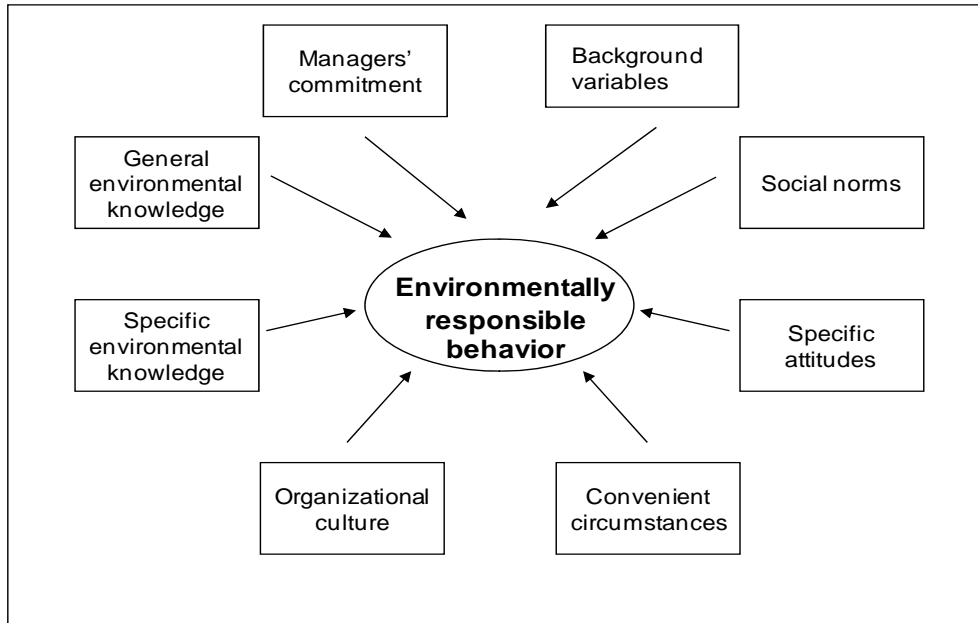
Figure 9.   Factors influencing environmentally responsible behavior.

The prediction of human behavior is a complex process. The methods used to study human behavior are the traditional attitude theory and the more recent and widely used theories of reasoned action and planned behavior. The two latter theories are based on the assumption that human beings are usually quite rational and make systematic use of available information. According to the literature, environmental behavior predicting variables are both general and specific environmental knowledge, social norms, and specific attitudes. Particularly crucial in environmentally responsible behavior is the convenience of the behavior, organizational culture, as well as the manager's commitment to promote environmentally responsible behavior among the firm's employees. Therefore, the relative importance of attitudes and subjective norms may vary from one behavior to another and from one individual to another. A summary of environmental behavior predicting variables is depicted in Figure 9.

4 Methodology and Research Process

Designing a research study comprises three general framework elements. First, the philosophical assumptions and theoretical perspectives about what constitutes knowledge need to be established. Secondly, the general procedures of the research, i.e. its strategies of inquiry are set. Finally, detailed procedures of data collection, analysis, and reporting are determined (Creswell 2003).

4.1 Methodological Choices

The epistemology – theory of knowledge – of this study relies on the theory that different attitudinal, situational, and cognitional variables have a role in employees' environmental behavior. Its epistemic utility lies in increasing the pro-environmental behavior among office workers in the service sector.

According to Habermas' original theory of interest, there are three basic theories that describe the different aims of knowledge: technical interest in the empirical-analytic sciences, practical interest in the historical-hermeneutic sciences, and emancipator interest in critical theory (Habermas 1977). In this study, knowledge has technical interest. This type of research is generally called positivist research, post-positivist research, empirical science, post-positivism, or quantitative research (Creswell 2003, Kyrö 2003).

This study follows the systematic approach to quantitative research, and is divided into the following process phases (from Flynn et al.1990):
1. Establishing the theoretical foundation
2. Selecting the research process
3. Selecting the data collection method
4. Implementation
5. Data analysis
6. Publication

Positivist research reflects a deterministic philosophy in which outcomes or effects are determined by reasons. The research approach aims at building knowledge or theories by attempting to predict phenomena and events. (Creswell 2003, Kyrö 2003) The positivist epistemology uses scientific methods that produce numerical data (McCarthy 1978, Niiniluoto 1984, Kyrö 2003). The positivist approach is oriented towards counting the occurrences and measuring the extent of the behaviors studied (Straub et al. 2005). Typically, positivist research reaches a conclusion by deductive or hypothetic-deductive reasoning (Kyrö 2003).

A scientific theory is confirmed and accepted until it is disproved. Science, according to positivist research, is about solving problems. The core of the research approach is that a scientific theory is one that can be empirically falsified. According to the technical interest in knowledge, one negating observation is all that is needed to discard a theory. However, it is recognized that observations may themselves be erroneous and therefore more than one observation is usually needed to falsify a theory. (Straub et al. 2005) When human attitudes and behavior are studied, one cannot be sure, or "one hundred per cent positive", about the claims of knowledge. Technical interest in knowledge emphasizes that the traditional notion of the absolute truth of knowledge is impossible. The corresponding philosophy of science is often called post-positivism. Developing numeric measurements of observations and studying the behavior of people are paramount to post-positivist research. A post-positivist researcher begins with a theory and then collects data that either support or refute the theory. (Straub et al. 2005, Creswell 2003)

In this study, the theory assumes that specific different variables influence people's environmental behavior and thus the theoretical perspective is actually post-positivism. The intent is to express the thoughts emerging from the theory with five ideas. Variables corresponding to these five ideas are then tested with the help of research questions. The study will not try to disprove or support the theory, but instead solve the problem of motivating employees to behave more environmentally responsibly. In this study, the logic of deduction is hypothetic-deductive. Viewed from a positivist point of view, the object of this study is to answer the research questions, i.e. find out if independent

variables like environmental knowledge, attitudes, EMSs, and the knowledge of the consequences of one's own behavior affect employees' environmental behavior, which is thus a dependent variable. Reality is approached from the viewpoint of causal explanation.

4.2 Self-Reporting as a Method

Self-reported behavior reflects respondents' perceptions or beliefs about their own behavior rather than their actual behavior. It is expected that everybody appreciates the quality of the environment and environmentally responsible behavior. (Gatersleben, 2002) Therefore, self-reports cannot be meaningfully used to show that a person performs a certain behavior. Moreover, while self-reports may reflect what actually happens, they do not explain it. (Ajzen 1988) Thus, survey research, especially in the case of environmental behavior research, cannot give an accurate picture of respondents' actual behavior. Self-reports of socially desirable behavior have generally been found to be overstated, while socially undesirable behavior has been under-reported. (Ajzen 1988, Määttä 1996, Oskamp et al.1998, Hartig et al. 2001) However, this overstating can be minimized. When people are notified beforehand that their behavior will be observed, descriptions of their behavior are more genuine than without the forewarning of observations. (Correl-Verdugo et al. 1999) Researchers must thus accept the absence of social context in surveys. It can be assumed that the effects of different contexts cancel each other out. (Olli et al. 2001)

According to Ewert et al. (2001), individuals today are so sufficiently informed about environmental issues, that they can identify socially acceptable ways of responding to studies, regardless of how they may actually feel about or perceive the specific issue. For this reason the overall responses are most likely biased towards pro-environmental responses. Ewert et al (2001) also showed in their study that students in particular responded to surveys in a "socially acceptable" way, regardless of how they truly feel or what they believe in. On the other hand, Kaiser et al. (1999) have found this only a marginal phenomenon. Gamba et al. (1994) found that 9 % of the respondents were

overstating. However, environmental issues are generally not that sensitive or embarrassing. It can thus be expected that concealing or overstating one's actions is unlikely (Määttä 1996).

Objective measures of environmental behavior would be better than those based on self-reporting, but such data are very hard to collect and, when available, are related to only a few specific types of behavior. For this reason, the advantage of using a self-reported questionnaire concerning environmental behavior is that a broad range of behavior styles can be taken into account. (Widegren 1998)

Classic reporting on human behavior uses no numerical units, but verbal descriptions of an individual's own behavior. A disadvantage of such reporting is its subjectivity. Nobody knows exactly what "almost always" or "sometimes" means. One person's "almost always" could be someone else's "sometimes". Answers might also reflect social norms regarding environmental behavior that the subject believes to be relevant in his or her surroundings. (Corral-Verdugo et al. 1999)

4.3 Research Process

The main research methods of this study comprise case study and survey study. These two methods are used to confirm or falsify the theory that environmental training courses or information campaigns in firms affect employees' environmental behavior.

4.3.1 Content of the Research Process

The answers to the five research questions formulated in Chapter 1.3 will build a framework around the research problem as shown in Figure 2 in Chapter 1.3. The aim of these research questions is to evaluate the essential motivational factors and drivers that improve employees' environmentally responsible behavior. The first of these factors is to evaluate to what extent general environmental knowledge impacts general

environmentally responsible behavior. The indirect effects of this factor through specific attitudes to and subjective norms of general environmentally responsible behavior are also of interest. The second factor is the social surroundings and atmosphere in the workplace and the employee's personal values and feelings towards the environment. The third factor is environmental training and the indirect effects of this on specific attitudes and subjective norms of responsible general environmental behavior are also of interest. The fourth issue to be evaluated is the correlation between the awareness about the environmental and financial implications of general environmentally responsible behavior. The fifth issue to be evaluated is the correlation between the EMS and the perceived difficulty of specific environmentally responsible behavior. Finally, the indirect effect of environmental training on general environmentally responsible behavior through increased awareness of environmental and financial consequences is also of interest.

4.3.2 Research Methods

Case study

A longitudinal experiment in employees' electricity saving behavior aims at revealing the effects "know-how" and "know-why" information have on employees' environmental behavior. The experiment was implemented at Helsinki Business College over a period of three years between 1997 and 1999. In the year 1998, a year-round information campaign took place. In the years 1997 and 1999, the College participated in the National Energy Awareness Week. The awareness weeks took place in October each year and were the first information campaigns to highlight energy saving challenges for the following year. In staff meetings held in 1998, the employees were also informed about the environmental and financial consequences of electricity use. The College motivated its personnel to save electricity by promising to spend the money saved on the employees' social activities. All full-time students on both the college diploma and polytechnic programs have studied one study credit of environmental issues (which corresponds to 40 hours of work.). Teachers informed their students about the campaign. For instance, with the help of a marketing teacher, students made posters

showing recommended actions related to electricity use. Posters included slogans, such as "Switch off the lights in empty classrooms" and "Use daylight – open the curtains". The posters were on display all over the building to remind passers-by of the campaign and of the electricity saving instructions. Additionally, all computers carried stickers, instructing users to "Switch off the computer after 5 pm". During the National Energy Awareness Week in 1998, students also had lectures related to the subject of saving energy, saving money and saving the environment. Four students arranged an electricity saving show for other students in classrooms. During the theme week, reminders and slogans about energy saving were also shown on the television monitors in the college facilities. The electricity saving campaign was intended for all staff members and students. Electricity consumption habits were chosen as the subject of the campaign for two reasons; global warming is one of the most serious environmental problems today, and the pollution caused by energy generation has been shown to accelerate it. Historically, campaigns related to electricity consumption have been the most effective and influential.

Survey study

For the survey study, a six-page questionnaire with closed questions or statements was designed, using previous studies as guidance (Ajzen 1988, Määttä 1996, Cottrell et al. 1997, Widegreen 1998, Corral-Verdugo et al. 1999, Corraliza 2000, Olli et al.2001). The questionnaire was structured to test the conceptual framework for employees' environmentally responsible behavior. Behavior was not observed as such, but respondents were asked to describe their behavior. The questionnaire was piloted with 13 people, both women and men of different educational backgrounds and ages, three of whom were experts in the environmental field. Based on their comments, some modifications to the questionnaire were made. The final survey questionnaire is presented in Appendix 1 and 2 (in Finnish).

The questionnaire was divided into eight parts. The first part measured specific attitudes and subjective norms with seven statements according to the Likert scale, the most widely used scale in survey research (Statements I in Appendix 1 and 2 (in Finnish)). This response scale can be used to measure knowledge, abilities, attitudes, and

personality traits. A typical test item when using the Likert scale is a statement. When responding to a Likert questionnaire item, respondents specify their level of agreement with a statement. Traditionally, a four or five-point scale is used, ranging from "completely agree" at one end and "completely disagree" at the other. (Heikkilä 2001) Respondents were asked to specify on a four-point Likert scale whether they "completely agree", "agree", "somewhat disagree", or "disagree" with each statement. Four of the statements assessed attitudes related to respondents' beliefs of environmental protection and their own responsibility for it (Ajzen 1988, Bratt 1999a). Three of the statements measured social pressure, i.e. employees' beliefs that specific colleagues or groups of colleagues think he or she should or should not perform a certain behavior.

The second part of the questionnaire focused on two kinds of self-reported environmental behaviors: intent-oriented behaviors and impact-oriented behaviors (Statements II in Appendix 1 and 2 (in Finnish)). The eleven statements represent different domains of everyday behavior styles related to recycling, energy use, material consumption, and transportation habits. Respondents were asked to specify on a five-point Likert scale whether they "always", "almost always", "sometimes" or "never" behaved according to the statement, or if it was impossible.

The third part of the questionnaire assessed respondents' assumed economic and environmental awareness of particular behavior with six multiple-choice questions (Statements III in Appendix 1 and 2 (in Finnish)). The alternative responses to the statements were "yes", "no", and "I do not know".

The fourth part of the questionnaire measured knowledge of behavioral instructions with five multiple-choice questions (Statements IV in Appendix 1 and 2 (in Finnish)). The alternative responses were "agree", "disagree", "I do not know", and "I have not been given instructions".

The fifth part evaluated general environmental knowledge with fourteen statements (Statements V in Appendix 1 and 2 (in Finnish). The response alternatives in these fourteen statements were "yes", "no", and "I do not know". General environmental

knowledge was defined as the sum index of answers to different statements indicating how much a respondent knows about environmental issues. Two of the statements were related to employees' opinions on both local and global environmental problems. These were excluded from the sum index.

In the sixth part, respondents were asked to select the best alternative from eight given sources of environmental information (Statements VI in Appendix 1 and 2 (in Finnish)).

The seventh part consisted of two multiple-choice questions on whether respondents had received environmental education during their studies or in their workplace (Statements VII in Appendix 1 and 2 (in Finnish)).

In the eighth part, respondents were asked to give background information of themselves, such as age, education, gender, and employer (Statements VIII in Appendix 1 and 2 (in Finnish)).

4.3.3 Data Collection

Data for the case study were derived from the electricity saving project conducted in Helsinki Business College from 1997 to1999. The campaign was implemented in 1998, and data from this year were compared to the situation in 1997 and 1999. The data collected were the electricity consumption figures of Helsinki Business College over the case study years. The figures were obtained from the College's electricity bills.

Data for the survey study were collected with a questionnaire. The questionnaire was distributed in two forms; as a computerized adaptive questionnaire in two firms which had the facilities necessary for conducting a computerized adaptive test, and as a traditional paper and pen questionnaire in the other two firms.

The aim of this study was to identify the variables that predict the environmentally responsible behavior of office workers in the service sector. The research questions

related to the influence that environmental knowledge, environmental attitudes, social pressure, and EMSs on environmental behavior. The participating firms in the survey study were therefore selected using the following criteria: The firm must

- operate in Finland.
- operate in the service sector.
- have white-collar employees.
- have employees of different educational background.
- have at least one employee who is responsible for environmental issues.

The sample was selected using a non-probability sampling method (Järvenpää et al. 1996). It was impossible to use probability-sampling methods due to the large number of firms in the service sector.

The number of firms selected for the study – four - was justified for two reasons. Firstly, the number of employees in firms in the Finnish service sector is huge and so widely dispersed that random or cluster sampling was not possible. Secondly, in order to ensure a representative sample of Finnish firms, four firms each representing the retail industry, banking, education, and public sectors were selected, namely Kesko, Nordea, Helia, and the City of Helsinki, Public Works Department. Results related to individual firms are not reported separately.

Data for the survey were collected at the beginning of 2003 with the help of environmental managers or heads of environmental issues in the companies. Six companies had originally been asked to take part in this study. One of the companies refused and one found it difficult to organize the sending of the questionnaire in practice. The attitudes of the managers in these companies towards environmental issues were, however, positive. The managers distributed the self-administered questionnaire to the workers. All participants participated voluntarily and anonymously. The computerized questionnaire was sent to approximately 13,000 employees, of whom a total of 659 responded. It is impossible to know how many employees read the questionnaire and what per centage of them filled in and returned the questionnaire. The response rate in the paper and pen test was 54 %: 100 out of 185 questionnaires were

returned. The final sample consisted of a total of 759 questionnaires from office workers from all four firms. Over two thirds of the respondents (N=514, 68 %) were female. Two of the respondents did not report their gender. Thus, the observed gender distribution in the study did not differ significantly from the general gender distribution in the Finnish service sector (*Chi*=3.073, *df*=1, *p<.05)*. The amount of women in the target population was 65 % in 2002 (Stat.fi 2002). The participants were divided into four groups based on their age: (1) from 20 to 30 years (N=96, 13 %), (2) from 31 to 40 years (N=170, 22 %), (3) from 41 to 50 years (N=256, 34 %) and (4) above 51 years (N=234, 31 %).

Sampling, even if empirical, is often viewed as unscientific in social science and thus it is suggested that one should not make any generalizations concerning the population (Alkula et al. 1994). In this case, the sample can be considered as reasonably representative, as the survey research did address different business sectors and the respondents were selected by using both population selection (two firms) and random selection (two firms). The reliability and validity of the sample selection and the whole study are discussed in Chapter 4.

4.3.4 Data Analyses

In quantitative survey research, the aim is to determine the relationship between one thing (an independent variable) and another (a dependent or an outcome variable) in a population (Järvenpää et al. 1996, Hopkins 2000, Nummenmaa 2006). In the present study, mathematical and statistical methods are used to explain the correlation between the dependent variable, environmental behavior, and the independent variables: environmental knowledge and campaigns, social pressure, attitudes, EMSs, and background variables.

Case study

In the case study, the percentage changes in electricity consumption in the years 1997, 1998 and 1999 were calculated. Electricity consumption consists mainly of lighting, use

of computers, air conditioning, and food preparation in the kitchen. Electricity consumption of air conditioning does not change significantly every year because air conditioning is steered by time. The number of food portions prepared depends on the amount of users of the canteen. Because the amount of students and employees rose in both 1998 and 1999, the effect of the kitchen on the electricity consumption has not been taken into consideration. In 1997-1999 the total amount of employees in HBC was 94, 95, and 99 respectively and the total amount of full-time students was 1062, 1443, and 1812 respectively. Furthermore, many external groups use the buildings on an occasional basis and the total user amount is unknown. In this study, the increase in electricity consumption in the kitchen has been assumed to be nearly the same in 1998 and 1999. Lighting and use of computers are essentially most relevant to electricity consumption and saving. The amount of computers in 1998 was 24 % higher than 1997 and in 1999 29 % higher than 1998. Specific consumption figures (consumption proportional to the amount of personnel and students) were not calculated. This indicator would have been flawed, as, for instance; the energy consumed by lighting in the classroom is independent of the amount of students there.

Survey study

The survey data were discrete and thus nominal and ordinal scale indicators were used. According to descriptive statistical figures, the data were skewed. Because of these limitations, the tests used in the analysis were of the nonparametric form. The results were analyzed using the statistical analysis software, SPSS 13.0 for Windows. The tests used were Pearson's chi-square independent test, the nonparametric correlation test, and the Kruskall-Wallis test. (Heikkilä 2001, Saaranen 2003, Nummenmaa 2006) Chi-square analyses were conducted in order to determine the sociodemographic characteristics of the survey respondents and to find the effects that attitudes, subjective norms, environmental knowledge, and environmental training would have on environmental behavior. However, in social research correlations are often rather low but can still be important. (Heikkilä 2001). Rather low correlations are therefore accepted but with a consideration.

Since it is impossible to directly observe or measure general environmental behavior, general environmental knowledge, attitudes towards own environmental responsibility or social pressure, these are measured as specific actions such as for example the recycling of organic waste. The general term or category, environmental behavior for instance, involves a set of specific actions. In this study, these specific actions were recycling, material saving, and electricity saving. The respondent's performance level related to a specific behavioral action was first scored from one (always) to four (never). The general index of environmental behavior was then computed by adding up the scores of the specific actions (Ajzen 1980, Kaiser 1998, Bratt 1999a, Olli et al. 2001, Cottrell 2003). Respondents were categorized into three groups according to their environmental behavior index (employees behaving responsibly, employees behaving rather responsibly, and employees behaving carelessly).

The general indices of attitudes and subjective norms were analyzed in the same way. The specific attitudinal beliefs of one's own environmental responsibility are scored from one (completely agree) to four (disagree). Respondents were then categorized into two groups according to their environmental responsibility: employees with positive beliefs and negative beliefs. The subjective norms index, on the other hand, also divides employees into two groups: those feeling social pressure and those feeling no social pressure.

Environmental knowledge was scored based on the number of correct answers given to the statements concerning reasons behind environmental problems such as climate change, acidification, and ozone depletion. The index of general environmental knowledge was computed by summing the scores for the individual statements. The employees were categorized into three groups based on their general environmental knowledge index: excellent, moderate, and little knowledge.

4.3.5 Validity and Reliability

Validity and reliability generally describe the quality of the research. There are different types of errors that reduce the quality of the research. Lack of responses, weaknesses in study instruments, sampling methods, and in the treatment of the data cause systematic and/or casual errors. (Heikkilä 2001) Validity is a determinant of whether or not a questionnaire measures what it was supposed to measure. Systematic errors arise from different sources and are probably the most difficult types of errors to deal with in a survey research. (Järvenpää et al. 1996, Heikkilä 2001)

The reliability of the research is related to its ability to give non-random results. Insufficient reliability usually arises from random errors, but systematic errors may also affect reliability. Random errors arise from the sample size and the study instruments, as well as from all the factors that are impossible to control in the test situation. The acceptable sample size in a survey is 300 to 1000 (Nummenmaa 2006). The sample size of this study meets this criterion.

5 Data Analysis and Research Results

The interdependence and correlation between environmental behavior and the different variables – general environmental knowledge, specific attitudes, subjective norms, EMSs, awareness about the financial and environmental implications of environmental behavior, and background variables – are analyzed by using mathematical and statistical methods. Based on these analyses, the research questions are answered.

5.1 Environmental Behavior

The specific actions measured are recycling, material saving, and electricity saving (Statements II 1–11 in Appendix 1 and 2 (in Finnish)).

Note: 1= Recycling of office paper, 2= Recycling of newspapers, 3= Recycling of cardboard, 4= Recycling of energy waste, 5= Recycling of organic waste, 6= Switching off the computer at the end of the working day, 7= Switching off the lights in empty rooms, 8=Copying double-sided, 9= Printing double-sided, 10= Not using disposable dishes, 11. Not using a private car.
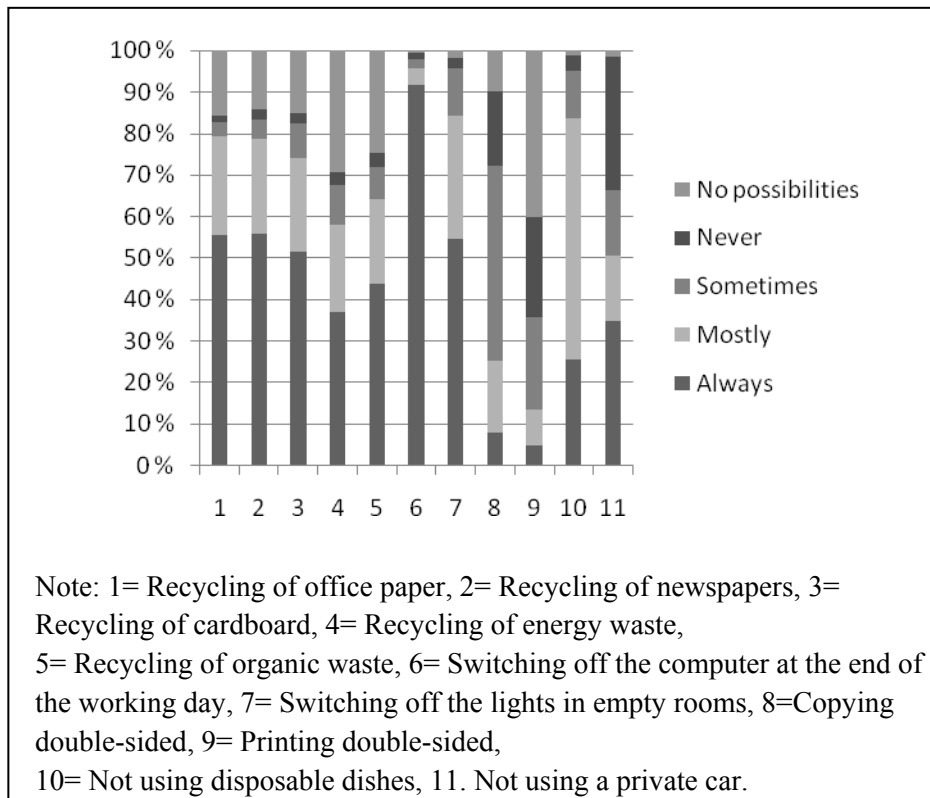
Figure 10. Environmental behaviors in terms of specific actions.

When measuring environmental behavior in terms of specific actions, percentages of self-reported frequency of eleven different environmental behavior styles have been

used. The frequencies of the different environmental behavior styles are depicted in Figure 10. Employees behave in the most environmentally responsible way when using computers. A significant 91.1 % of all employees always switch off the computer at the end of the working day (*N*=689). Employees are the most careless when printing double-sided. Only 4.5 % (N=34) of all respondents print double-sided; on the other hand, 39.9 % (N=301) of employees do not have the opportunity to print double-sided.

The correlations between the different environmental behavior styles are generally sector-based (Table 21 in Appendix 2). For instance, the recycling of office paper correlates positively with other recycling behavior styles. Likewise, behavior styles related to electricity and materials usage correlate positively inside the behavioral group. One third of all respondents (N=241, 32.0 %) always use their own car to go to work. The most important explanation for the use of a private car is poor public transport (*N*=151, 39.7 %). The major findings in environmental behavior are that there is a lack of recycling opportunities and that instructions are needed how to copy and print double-sided.

5.1.1 General Environmental Behavior

As a measure of general environmental behavior, a sum variable of self-reported intensity of 11 different items of environmental behavior styles has been used (Statements II 1–11 in Appendix 1 and 2 (in Finnish)).
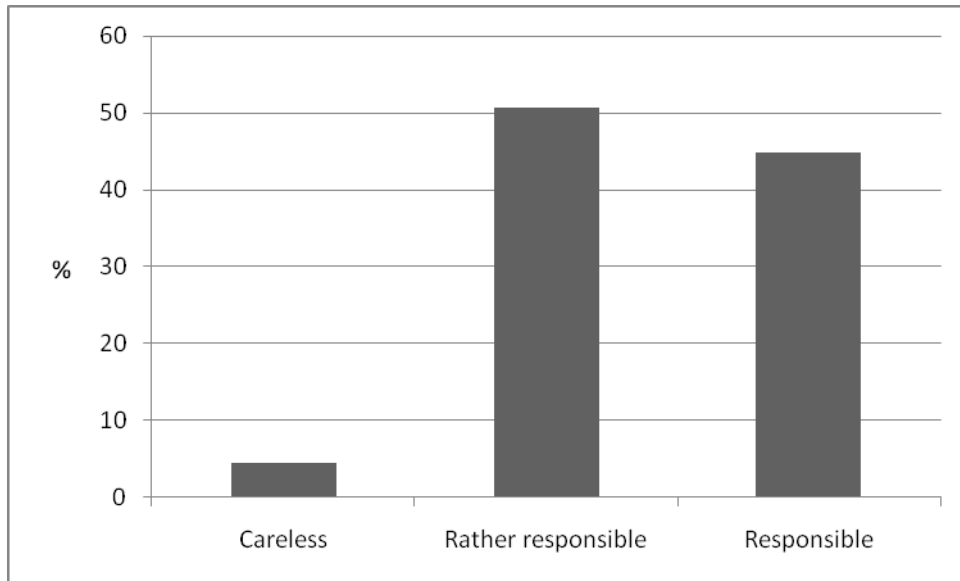
Figure 11. General environmental behavior styles.

The sum variable formed (Cronbach's alpha=.61) was divided into three categories: responsible (values 8 to 11), rather responsible (values 4 to 7), and careless (values 0 to 3). This categorization was made in order to find out the level of respondents' general environmental behavior. The consistency is a consistency of the number of different behavior styles each person claimed in each of these statements, not a consistency involving the different behavior styles themselves. Almost half of all employees show general environmental behavior that can be considered as responsible (N=341, 44.9 %, p =.032). Employees' general environmental behavior is depicted in Figure 11.

5.1.2 Sociodemographics and Environmental Behavior

Gender

According to Pearson's chi-square test and Spearman's correlation test, women's general environmental behavior is more responsible than that of men (Table 22 in Appendix 3). 48.4 % (N=249) of women and 37.4 % (N=91) of men belong to the category "responsible". The difference is statistically significant, as shown in Figure 12.
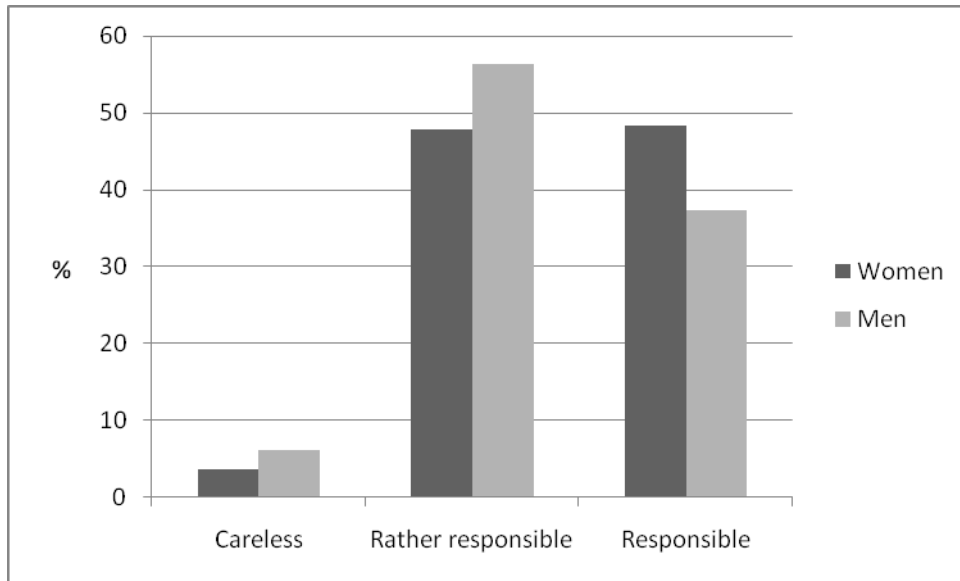
Chi=9.060, *df*=2, *p*=.011

Figure 12.   General environmental behavior styles by gender.

Women and men behave differently with respect to certain actions (Table 23 in Appendix 3). According to chi-square tests, there are statistically significant differences between women and men in all specific-behavior statements excluding Statement II 7 ("Switch off the lights in empty rooms"). Men are more responsible office paper recyclers than women as 59.9 % of men in the survey always recycle office paper (N_m =144) compared to only 53.6 % of women (N_w=275). Women, on the other hand, more responsibly switch off the computers more often when leaving the workplace (N_w=489, 95.3 % compared to N_m=198, 82.2 % of men). The biggest difference between the genders is in behavior styles related to sorting organic waste. 47.8 % (N_w=157) of women and 34.9 % (N_m=114) of men always sort their organic waste separately (*Chi*=22.173, *df*=4, *p*<.001). Additionally, 26.1 % (N_w=134) of women and 44.2 % (N_m=107) of men always use their own car when going to work. Men also use their own cars more during the working day (N_m=57, 35.4 % compared to N_w=19, 8.7 %).

Differences are statistically very significant (*p*<.001) only in the "never" alternatives in three statements. Of these women and men who have the opportunity to copy and print double-sided, 15.8 % (N_w=70) of women and 27.6 % (N_m=63) of men never take double-sided copies, and 35.2 % (N_w=96) of women and 49.0 % (N_m=86) of men never print double-sided.

Age

In general, older people are more responsible than the young. General environmental behavior correlates significantly with age (Table 22 in Appendix 3). 50.4 % (*N*= 118) of the oldest group and 31.3 % (*N*= 30) of the youngest group behave in an environmentally responsible way, but the difference in the group of "careless" respondents was insignificant, as depicted in Figure 13.
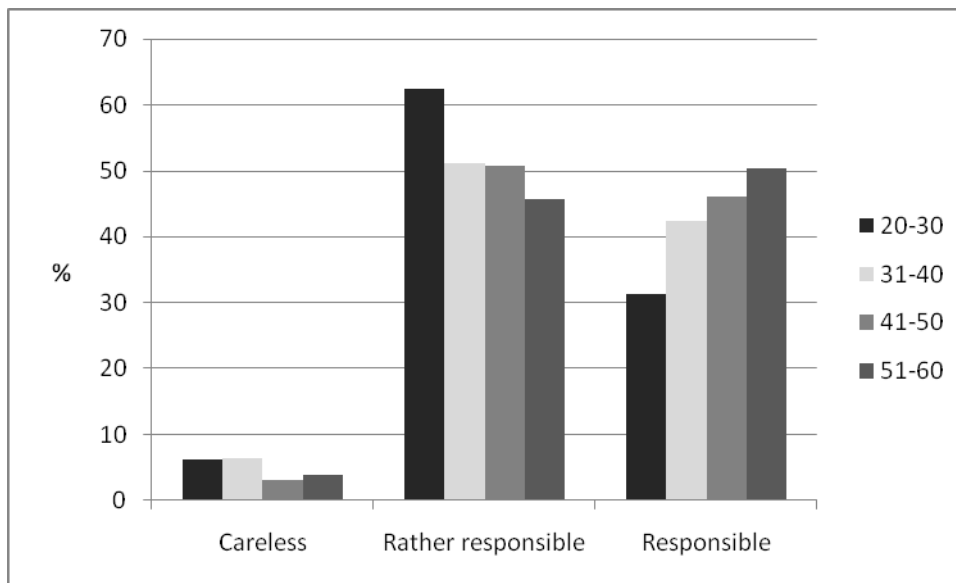
Chi=13,120, *df*=6, *p*=.041

Figure 13. General environmental behavior styles by respondents' age.

In four specific behavior statements, differences between separate age groups are statistically very significant. Environmental responsibility grows with age especially in recycling organic waste (*p*<.001), in switching off the lights in empty rooms (*p*<.001), and in copying (*p*<.001) and printing (*p*<.001) double-sided.

Education

The effect of education was tested by first examining the effects of business and technical education, and secondly the effects of secondary and higher education on general environmental behavior. Employees that have lower and/or business education are the most responsible. However, these differences are not statistically significant (Table 1 and 2).

Table 1.   General environmental behavior by field of education.

	Business	Technical	Other	No vocational	Total	Total
	%	%	%	%	%	N
Careless	5.7	3.6	5.3	1.3	4.7	25
Rather responsible	42.5	60.0	49.1	47.5	46.5	246
Responsible	51.7	36.4	45.6	51.3	48.8	258
Total N	280	55	114	80	100	529

Chi=8.728, *df*=6, *p*=.189

Table 2.   General environmental behavior by level of education.

	Secondary level	Higher level	No vocational education	Total	Total
	%	%	%	%	%
Careless	4.5	6.5	1.3	4.7	25
Rather responsible	42.9	51.4	47.5	46.5	246
Responsible	52.6	42.1	51.3	48.8	258
Total N	266	183	80	100	529

Chi=7.673, *df*=4, *p*=.104

The correlation between education and general environmental behavior is insignificant (Table 22 in Appendix 3). However, education correlates significantly with two of the specific behavior styles. Higher education impacts positively on office paper recycling activity and on printing behavior (Table 23 in Appendix 3).

The major findings from sociodemographics' effect on environmental behavior are that women and older employees are more responsible in their environmental behavior, but the gender and age differences are not big in careless groups. However, when measuring specific action behavior the results are not parallel. Women are more responsible recyclers of organic waste, but on the other hand, men recycle paper more often.

5.2 Environmental Knowledge and Environmental Behavior

Environmental knowledge was measured with 13 statements (Statements V 1–4 and 6–14 in Appendix 1 and 2 (in Finnish)). The direct effect of general environmental knowledge and its indirect effect through specific attitudes and subjective norms on general environmental behavior were estimated. Differences in the level of environmental knowledge caused by sociodemographics were also of interest.

5.2.1 Environmental Knowledge

According to the survey results, respondents assume that climate change is caused by sulphur and nitrogen emissions (N=508, 67.8 %), by CO_2 emissions (N=569, 76.2 %), by methane emissions from landfill waste areas (N=451, 60.4 %), and by ozone depletion in the stratosphere (N=413, 55.1 %). The sources of greenhouse gases, according to the respondents, are the burning of fossil fuels (N=501, 67.4 %), the decomposition of waste in landfill waste areas (N=329, 44.2 %), and driving cars (N=468, 63.0 %). Most of the respondents believe that climate change is taking place (N=445, 59.7 %); 26.3 % (N=196) of respondents answered "I do not know" when asked about climate change.

Gender causes statistically very significant (p<.001) differences in all statements concerning environmental knowledge. Women are more aware than men that methane causes climate change. Men believe more often than women that energy production and car driving cause climate change (Table 3 and 4). Additionally, men believe more often than women that CO_2 (N_m=206, 84.8 %, N_w =362, 72.0 %, p<.001) and women believe more often than men that ozone depletion in the stratosphere (N_w =327, 64.6 %, N_m=85, 35.0 %, p=.004) causes climate change.

Table 3.   Opinions of environmental changes caused by traffic by gender.

	Women	Men
	% *N*	% *N*
Increased ozone in the troposphere	4.7 24	2.6 6
Decreased ozone in the stratosphere	24.8 126	22.6 53
Climate warming	26.2 133	52.3 123
Increased quantity of aerosol particles	13.2 67	11.1 26
Increased acidity in the earth	6.1 31	4.7 11
None of these	0.2 1	1.3 3
Do not know	24.8 126	5.5 13
% *N*	100 508	100 235

Chi=69.740, df=6, p<.001

Table 4.   Opinions of environmental changes caused by energy production by gender.

	Women	Men
	% *N*	% *N*
Increased ozone in the troposphere	4.7 24	2.6 6
Decreased ozone in the stratosphere	24.8 126	22.6 53
Climate warming	26.2 133	52.3 123
Increased quantity of aerosol particles	13.2 67	11.1 26
Increased acidity in the earth	6.1 31	4.7 11
Nothing of these	0.2 1	1.3 3
Do not know	24.8 126	5.5 13
% *N*	100 508	100 235

Chi=70.654 df=6 p=<.001

According to the respondents, the depletion of ozone in the stratosphere is caused by an increased CO_2 concentration (N=221, 30.2 %) and by an increased CFC concentration (N=441, 59.5 %). They also mentioned sulfur and nitrogen emissions as the main reasons for increased acidification (N=555, 74.4 %). Car driving (N=346, 46.6 %) and energy production by fossil fuels (N=361, 48.5 %) were mentioned as additional sources of acidification. Women believe more often than men that ozone depletion is caused by an increased CO_2 concentration (N_w=169, 34.5 % compared to N_m =51, 21.3 %). Men, on the other hand, believe more often in the effect of increased CFC concentration on the ozone level in the stratosphere (N_m=178, 74.5 % compared to N_w=263, 52.5 %).

According to the respondents, air and water pollution are the most serious environmental problems in their working district (N=512, 68.1 % and N=137, 18.2 % respectively). The most serious global problem, on the other hand, is the lack of clean water (N=355, 47.3 %). Men view climate change as the most serious global problem more often than women (N_m=86, 35.5 % compared to N_w= 137, 26.9 %) (Table 5).

Table 5.   Responses to global environmental problems by gender.

	Women	Men	Total
	%	%	N
No problems	1.6	2.5	14
Lack of clean water	46.2	49.6	355
Climate change	26.9	35.5	223
Amount of waste	25.3	12.4	159
% N	67.8 509	32.2 242	100 751

Chi=18.222, *df*=3, *p*=.000

The major finding from environmental knowledge is that men are more aware of the factors causing climate change than women. Many of the respondents confuse climate change and ozone depletion in the stratosphere.

5.2.2 General Environmental Knowledge and General Environmental Behavior

General environmental knowledge is a score that is based on the number of correct answers given to the questions related to climate change, acidification, and ozone depletion. The statements measure knowledge of not only the environmental problems but also the reasons behind them. Based on these 13 statements, a sum variable was formed (Cronbach's alpha=.82), and the respondents were classified into three groups based on the values of the sum variable: "excellent knowledge" (values 10 to 13), "moderate knowledge" (values 5 to 9), and "little (or no) knowledge" (values 0 to 4). These groups are then used to determine the level of the respondents' general environmental knowledge.

Of the respondents 28.4 % (N=213) have little knowledge about environmental issues, 52.7 % (N=396) have moderate knowledge, and 18.9 % (N=142) have excellent knowledge. The level of general environmental knowledge does not seem to affect general environmental behavior (Chi=1.574, df=4, p=.814). 43.0 % (N=92) of respondents with little general environmental knowledge and 44.8 % (N=64) with excellent general environmental knowledge behave responsibly.

In general, men have studied environmental topics more often than women (N_m=66, 27.2 % compared to N_w=80, 15.7 %, p<.001), and they also have a noticeably higher level of general environmental knowledge (excellent knowledge N_m=96, 39.5 % compared to N_w=47, 9.2 %, p<.001). However, women's general environmental behavior is more environmentally friendly than men's, as depicted in Figure 12.

Of the respondents 19.4 % (N=146) have studied environment related topics during their vocational studies. The youngest group of the respondents has studied environmental issues the most often (Chi=75,393, df=3, p<.001). Despite this, age has no statistically significant effect on the level of general environmental knowledge (Chi=8.398, df=6, p=.210).

Higher education (polytechnic or university) gives a higher level of general environmental knowledge than secondary education (vocational school or college) (*Chi*=50.787, *df*=4, *p<*.001)**.** The respondents with technical education have had more environmental courses than the respondents with business education (*N*=28, 52.8 % compared to *N*=35, 12.5 %, *p<*.001). Of all the respondents, those with technical education also have the highest level of knowledge about environmental issues (C*hi*=38.745, *df*=6, *p<*.001).
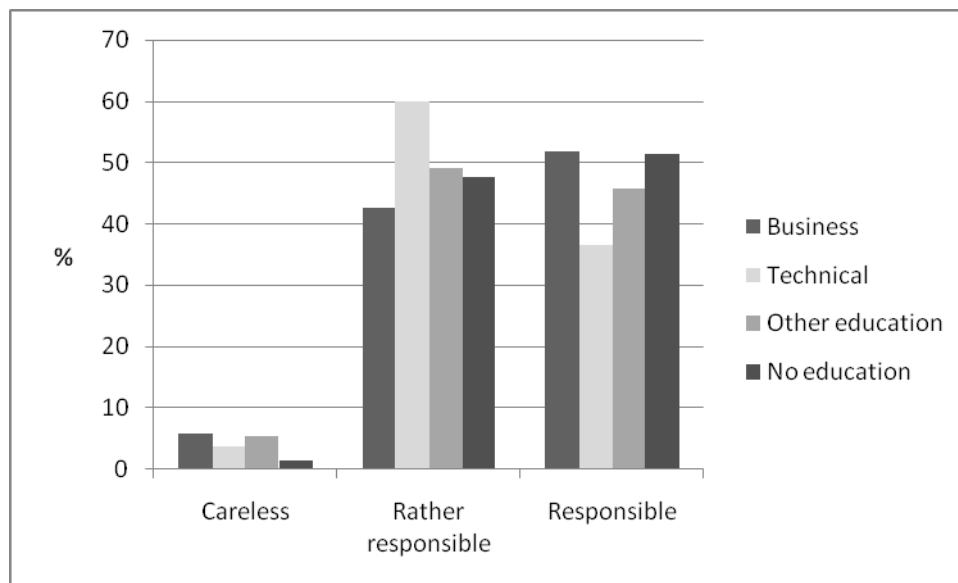
Chi=8,728, *df*=6, *p*=.189

Figure 14.   General environmental behavior by education.

However, the amount of employees behaving responsibly is smallest among those with technical education, although their level of environmental knowledge is the highest. Differences in environmental behavior between different educational groups are, however, statistically insignificant as is depicted in Figure 14. Among all employees, daily newspapers are the most important sources of general environmental knowledge (*N*=600, 80.2 %).

The amount of general environmental knowledge does not indirectly affect environmental behavior through specific attitudes and subjective norms (*Chi*=.884, *df*=2, *p*=.643 compared to *Chi*=1.088, *df*=2, *p*=.581). In addition, there was no

significant correlation between general environmental knowledge and specific attitudes and subjective norms (Table 24 in Appendix 2).

The major outcome from the impact of general environmental knowledge on general environmental behavior is that the level of general environmental knowledge does not correlate with environmental behavior. Gender is more important than education and general environmental knowledge in explaining environmental behavior.

5.3 Attitudes and Environmental Behavior

The impact of specific attitudes on environmental behavior, was measured by using four statements measuring employees' views or feelings about the level of environmental responsibility of their own behavior (Statements I 1–4 in Appendix 1 and 2 (in Finnish)).

5.3.1 Specific Attitudes

Nearly half of the respondents understand the environmental consequences of their own behavior (completely agree N=347, 45.8 %). Most of the respondents also realize that environmental protection is part of their work ("completely agree": N=523, 69.1 %). Only 13.4 % (N= 100) of the respondents are not interested in environmental issues. 57.2 % (N=431) completely agree with the argument that everyone's action is important in environmental protection. 61 % (N=475) of women and 49.2 % (N=117) of men (p=.018) state that everyone's environmental behavior has an influence on the environment. For both genders, the interest in environmental issues grows with age. The youngest group of employees is the least interested ("completely agree" N=26, 27.1 %) and the oldest group the most interested (completely agree N=60, 35.7%) in environmental issues (Statement I 4 in Appendix 1 and 2 (in Finnish)).

5.3.2 Specific Attitudes and General Environmental Behavior

From the four statements measuring specific attitude, a sum variable was formed (Cronbach's alpha=.77) with two groups: "positive attitude" (values 3 to 4) and "negative attitude" (values 0 to 2) to find out how people's beliefs of their own responsibility towards the environment affect general environmental behavior.
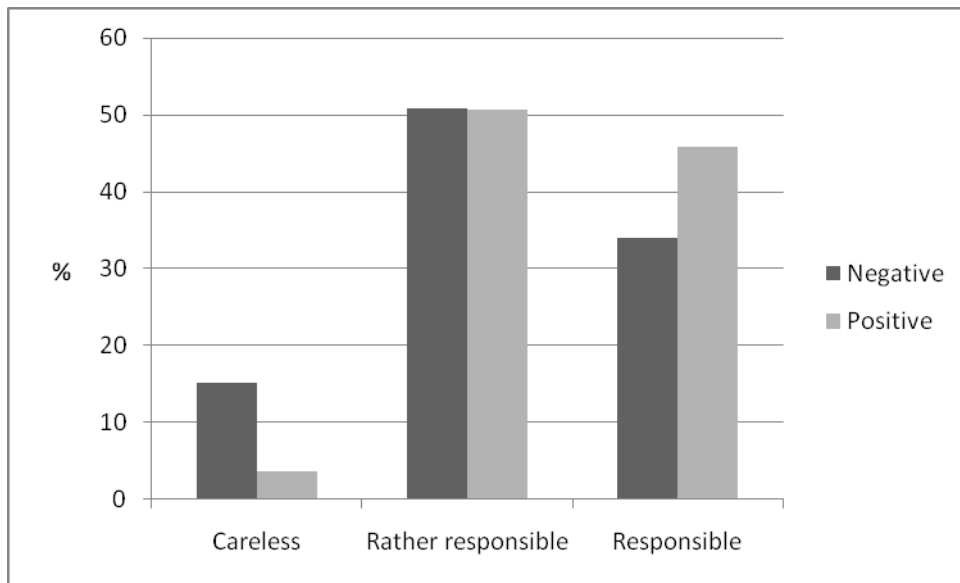
Chi=15.858, *df*=2, *p*<.001

Figure 15. General environmental behavior by specific attitudes.

Table 6.   General environmental behavior by specific attitudes.

	Negative attitudes	Positive attitudes	Total
	%	%	*N*
Careless	15.1	3.7	34
Rather responsible	50.9	50.6	384
Responsible	34.0	45.8	341
% *N*	7.0 53	93.0 706	100 759

Chi=15.858, *df*=2, *p*<.001

Most of the respondents (*N*=706, 93 %) have positive specific attitudes towards environmentally responsible behavior. Employees with positive specific attitudes behave in a more responsible way than those with negative specific attitudes (*N*= 323, 45.8 % compared to *N*=18, 34.0 %). The effect of specific attitudes on general environmental behavior is depicted in Figure 15, (see also Table 6). This result is statistically very significant (*p*<.001). The correlation between specific attitudes and general environmental behavior is also positive (Table 25 in Appendix 3).

The major finding from the impact of specific attitudes on general environmental behavior is that approximately half of the respondents understand the environmental consequences of their own behavior and think everyone's action is important. Specific attitudes correlate positively with environmental behavior.

5.4 Subjective Norms and Environmental Behavior

Perceived subjective norms were studied with three statements measuring employees' views about the social pressure they feel from their colleagues (Statements I 5–7 in Appendix 1 and 2 (in Finnish)).

5.4.1 Subjective Norms

The respondents are generally well or very well aware of their colleagues' environmental behavior (*N*=421, 56.2 %). They feel pressure and expectations of environmentally responsible behavior from their colleagues ("completely agree" and "agree", *N*=466, 64.2 %). Additionally, many respondents believe that their colleagues' behavior has an influence on their own behavior ("completely agree" *N*=397, 52.8 %). In the two-tailed non parametric correlation test, social pressure correlates significantly at the 0.01 level with the behavior that takes place in those social situations with colleagues present. Such situations include, for instance, sorting energy waste (r_s=.111**), sorting organic waste in the canteen (r_s=.155**), and taking double-sided copies (r_s=.102**).

Women are more aware of their colleagues' environmental behavior than men ("completely agree" and "agree" N_w=300, 58.8 % compared to N_m=119, 49.6 %, p=.036). The awareness of colleagues' behavior increases with age. The youngest group of employees are less aware of colleagues' behavior ("completely agree" and "agree" N=39, 41.1 %) and the oldest group most aware ("completely agree" and "agree" N=155, 66.8 %) of colleagues' behavior (Statements I 6 in Appendix 1 and 2 (in Finnish)).

The beliefs about colleagues' expectations of environmentally friendly behavior increase with age. The oldest group believed the most often ("completely agree" and "agree" N=169, 74.2 %) and the youngest group the least often of all ("completely agree" and "agree" N=42, 45.2 %) that their colleagues expect them to behave in an environmentally friendly way. Employees with lower education are more aware of colleagues' environmental behavior than those with higher education (Table 7).

Table 7.   Awareness of colleagues' environmental behavior by educational background.

	Secondary level	Higher level	Total	Business	Technical	Total
	%	%	N	%	%	N
Completely agree and agree	60.3	46.9	244	56.4	50.9	186
Disagree and rather disagree	39.7	53.1	200	43.6	49.1	149
% N	100 267	100 177	100 444	100 280	100 55	100 335

Chi= 61.107, *df*=36, *p*=.006

5.4.2 Subjective Norms and General Environmental Behavior

From the three statements measuring subjective norms, a sum variable was formed (Cronbach's alpha=0.55) with two groups: "social pressure" (values 2 to 3) and "no social pressure" (values 0 to 1). The groups were formed in order to find out whether the respondents feel pressure from their colleagues.
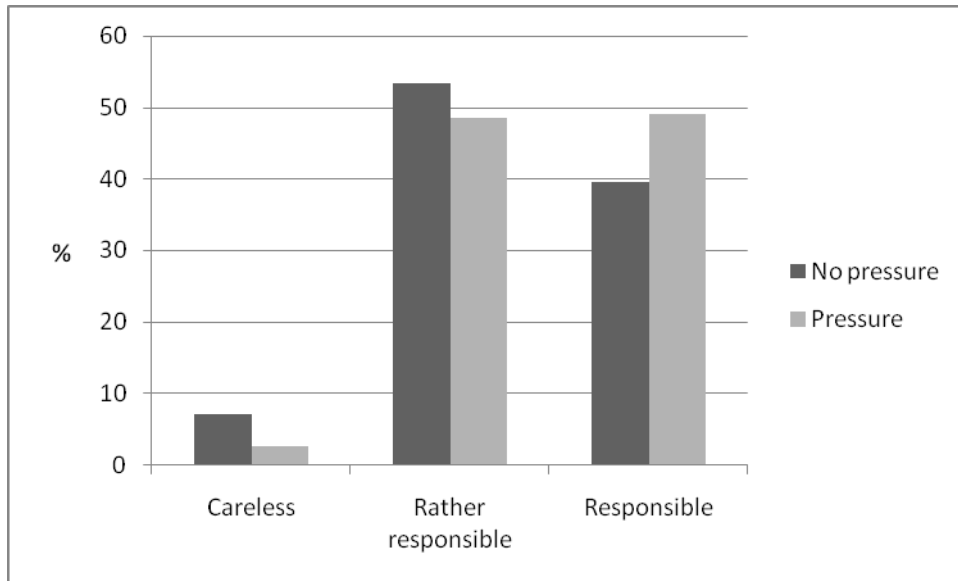
Chi=12.743, *df*=2, *p*=.002
Figure 16. General environmental behavior by experienced social pressure.

Thus, social pressure has an effect on respondents' general environmental behavior. Respondents who felt social pressure from their colleagues behaved in a more responsible way than others (*N*=211, 49.0 % compared to *N*=130, 39.6 %). The effect of social pressure on general environmental behavior is depicted in Figure 16, (see also Table 8).

Table 8. General environmental behavior by subjective norms.

	No social pressure	Social pressure	Total
	%	%	*N*
Careless	7.0	2.6	34
Rather responsible	53.4	48.5	384
Responsible	39.6	49.0	341
% *N*	43.2 328	56.8 431	100 759

Chi=12.743, *df*=2, *p*=.002

Women feel more social pressure than men, but the difference is not statistically significant (*N*=302, 58.8 % compared to *N*=128, 52.7 %; *p*=.115). The impact of social

pressure on behaving in an environmentally responsible way is the most obvious in the oldest group ($N_{oldest\ group}$=154, 65.8 % compared to $N_{youngest\ group}$= 40, 41.7 %). The major finding from the impact of subjective norms on general environmental behavior is that colleagues influence the individual's environmental behavior.

5.5 Environmental Training, Environmental Behavior Circumstances, and Environmental Behavior

Employers' commitment to environmental issues and the effectiveness of EMSs were measured by asking about employers' level of activity in organizing environmental courses, in giving environmental instructions, and in providing suitable circumstances for employees to behave in an environmentally responsible way. The direct effect of an EMS on employees' general environmental behavior was also studied, as well as its indirect effects through specific attitudes and subjective norms.

5.5.1 Environmental Training and Environmental Behavior

Over half of all respondents (*N*=442, 58.6 %) have had the opportunity to participate in environmental training organized by employers, and 49.1 % (*N*=217) of these employees have used this opportunity. Environmental training in organizations correlates with general environmental behavior, general environmental knowledge, specific attitudes, and subjective norms significantly at the 0.01 level in the two-tailed nonparametric correlation test (Table 25 in Appendix 3).

Table 9.   The Kruskall-Wallis Test (non parametric).

Ranks

VII2 took part in training		N	Mean rank
V General environmental knowledge	took part in training	217	386.62
	did not take part	224	408.37
	no training	309	343.86
		750	
II General environmental behavior	took part in training	217	407.68
	did not take part	225	374.86
	no training	312	358.41
		754	

Test statistics [a,b]

	V General environmental knowledge	II General environmental behavior
Chi-Square	14.925	8.457
df	2	2
Asymp.Sig.	.001	.015

[a.] Kruskal Wallis Test

[b.]Grouping variable: VII 2 I have taken part in the environmental training in the workplace.

According to the Kruskall-Wallis test, environmental training in the workplace has an effect both on general environmental knowledge (p=.001) and general environmental behavior (p=.015). The test results are presented in Table 9.

According to Pearson's chi-square test, the level of general environmental knowledge varies significantly between the groups that had no training and groups that had participated in training. Those who have participated in training have better general environmental knowledge than respondents who have not had training courses in their workplace (excellent knowledge N=44, 20.3 % compared to N=42, 13.6 %). However, the employees who have not used the opportunity to take part in environmental training have a better level of environmental knowledge than those who have participated in courses (excellent environmental knowledge N=57, 25.4 % compared to N=44, 20.3 %). They have had a higher education (polytechnic or university) which gives a higher level of general environmental knowledge than secondary education (vocational school or

college) (*Chi*=50.787, *df*=4, *p*<.001)**.** The test results are depicted in Figure 17, (see also Table 10).
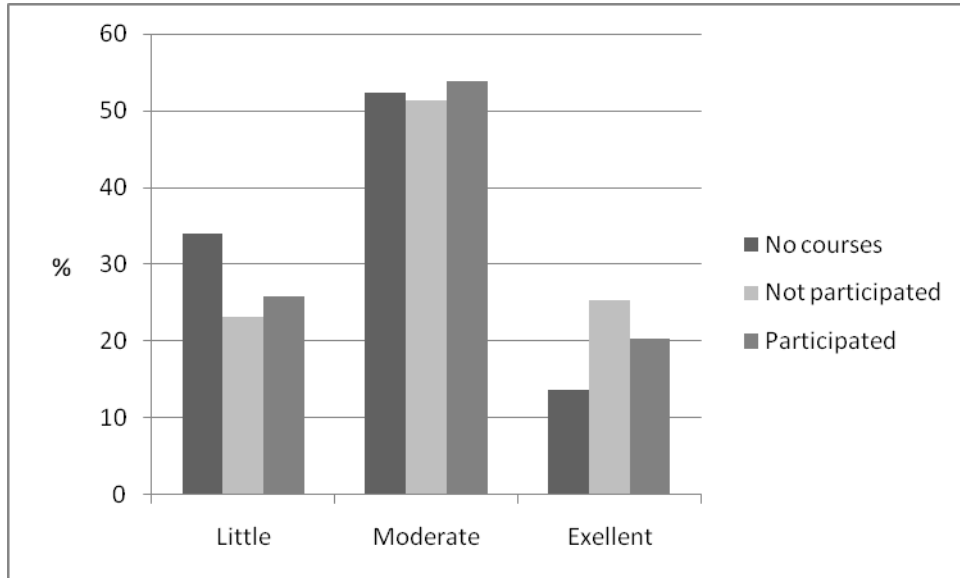
Chi=15.969, *df*=4, *p*=.003

Figure 17. General environmental knowledge by participation in environmental training.

Table 10. General environmental knowledge by participation in environmental training.

	Participated	Not participated	No courses	Total
	%	%	%	N
A little knowledge	25.8	23.2	34.0	213
Moderate knowledge	53.9	51.3	52.4	394
Excellent knowledge	20.3	25.4	13.6	143
% N	28.9 217	29.9 224	41.2 309	100 750

Chi=15.969, *df*=4, *p*<.001
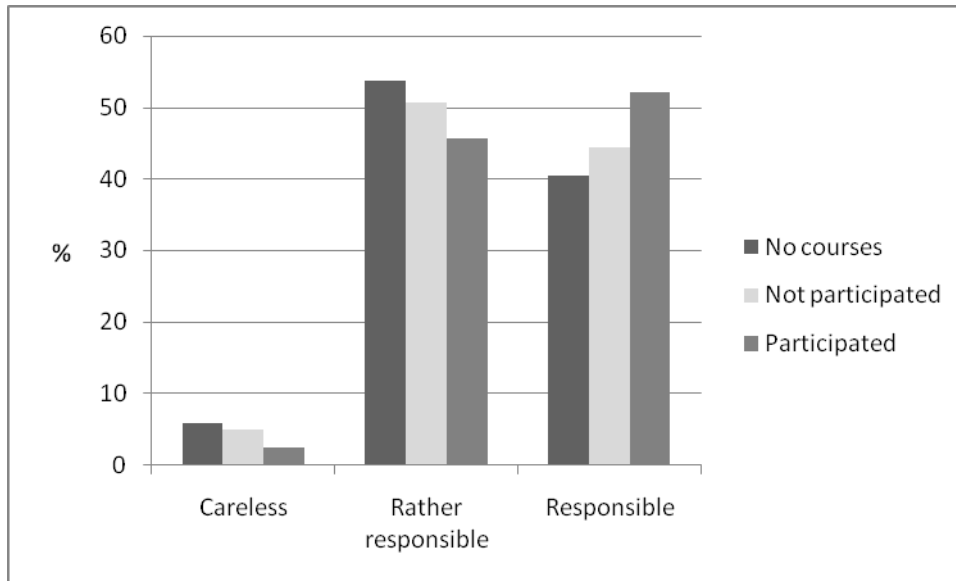
Figure 18. General environmental behavior by participation in environmental training.

According to Pearson's chi-square test, environmental training affects general environmental behavior. Of the respondents 52.1 % (N=113) who have taken part in training behave in an environmentally responsible way, compared to 40.4 % (N=126) of those who have not had a training course, as presented in Figure 18.

Women and men have been almost equally active when participating in the training offered. Women, however, have had less environmental training in the workplace, or they had not known about it (N_w=251, 49.0 % compared to N_m=61, 25.3 %, *p*<.001). The differences between age groups with regard to participation in training are significant. Older age groups are less active in taking part in training. Of the oldest group 32.3 % (*N*=75) did not take part in the environmental training organized by the firm, compared to the youngest group, of which 17.9 % (*N*=17) did not participate. Additionally, respondents with business education were more keen on participating in the organized training than respondents with technical education (*Chi*=34.976, *df*=6, *p*<.001). 52.8 % (*N*=28) of the respondents with technical education had not taken part in the environmental training offered, and 18.9 % (N=10) had had no environmental training courses in the firm. The corresponding figures for employees with business education are 25.0 % (*N*=70), and 48.2 % (*N*=135).

Environmental training courses have caused differences in respondents' environmental behavior. The effect of training is statistically insignificant only in recycling office paper, copying, and energy consumption (Table 11). The correlations with these different specific actions are significant at the 0.01 level in the 2-tailed nonparametric correlation test.

Table 11.   Specific behavioral actions by participation in environmental training or the unavailability of training.

	Participated in training	No training	
	%	%	p
Recycling office paper (always)	63.0	51.8	.072
Recycling newspapers (always)	64.4	52.9	.001
Recycling cardboard (always)	63.9	46.5	<.001
Sorting energy waste (always)	49.3	31.7	<.001
Sorting organic waste (always	55.6	39.5	.001
Double-sided copies (always)	9.3	6.1	.218
Double-sided prints (always)	6.5	3.2	.005
Switching off the lights (always)	54.0	49.4	.398

Environmental training correlates with the respondents' specific attitudes (Table 25 in Appendix 3). The specific attitudes are more responsible among those who have been able to take part in environmental training (it does not matter if they have participated or not in the training but have had the opportunity) than among the respondents who have not had training (Table 12).

Table 12.   Participation in environmental training by specific attitudes.

	Negative attitudes	Positive attitudes	Total
	%	%	N
Participated	2.8	97.2	217
Not participated	8.0	92.0	225
No training	9.3	90.7	312
%	7.0	93.0	100
N	53	701	754

Chi=8.813, *df*=2, *p*=.012

Table 13. Participation in environmental training by subjective norms.

	No pressure	Pressure	Total
	%	%	*N*
Participated	27.2	72.8	217
Not participated	52.0	48.0	225
No training	48.4	51.6	312
% *N*	46.2 327	56.6 427	100 754

Chi=33,167, df=2, p=<.001

The respondents who have participated in environmental training feel more social pressure than those that have not had training (*N*=158, 72.8 % compared to *N*=161, 51.6 %, *p*<.001) (Table 13). However, social pressure is low among those employees who have not taken part in the training offered (Table 13). Employees who have taken part in training courses are also more aware of their colleagues' environmental behavior. Additionally, they believe more often than others that their colleagues have expectations concerning their own environmental behavior, and that those expectations affect their own environmental actions (Table 14).

Table 14. Participation in environmental training by statements of subjective norms ("completely agree" and "agree").

	Colleagues' environmental behavior affects my behavior	I am aware of my colleagues' environmental behavior	I believe my colleagues have expectations concerning my environmental behavior	
	% *N*	% *N*	% *N*	*p*
Participated in	60.1 128	67.9 146	78.4 163	<.001
Not participated	52.5 117	49.3 110	56.4 123	<.001
No training	47.6 148	52.4 162	59.3 175	<.001

Environmental training correlates with and has a statistically very significant increasing influence on employees' awareness about the financial implications of their own behavior (r_s=.178**, Chi=32.924, df=4, p<.001) but does not have a statistically significant influence on employees' knowledge of the environmental consequences of his/her behavior (r_s=.074*, Chi=6.490, df=4, p=.165) Awareness of the costs also correlates with employees' environmental behavior (Table 26 in Appendix 3).

The major finding from the impact of environmental training on environmental behavior is that environmental training increases both general and specific environmental knowledge and environmentally responsible behavior when comparing the group which has participated in training with the one that has not had any training. It is also evident that environmental training has an indirect significant effect on environmental behavior through specific attitudes and subjective norms. Those employees who have participated in training feel more social pressure. The combination of knowledge gained in arranged environmental training and general environmental knowledge seems to increase responsible behavior. Nevertheless the employees who have not used the opportunity to take part in environmental training have a better level of general environmental knowledge but a lower level of specific environmental knowledge than those who have participated in courses (excellent general environmental knowledge N=57, 25.4 % compared to N=44, 20.3 %). They have had a higher education (polytechnic or university) which gives a higher level of general environmental knowledge than secondary education (vocational school or college).They behaved more responsibly than those who had had no training opportunities.

5.5.2 The Electricity Saving Campaign and Environmental Behavior

According to the electricity consumption figures in the case study, the electricity consumption of Helsinki Business College dropped by 53 MWh during the information campaign. Furthermore, the consumption increased by 41 MWh after the electricity saving campaign, as depicted in Figure 19.
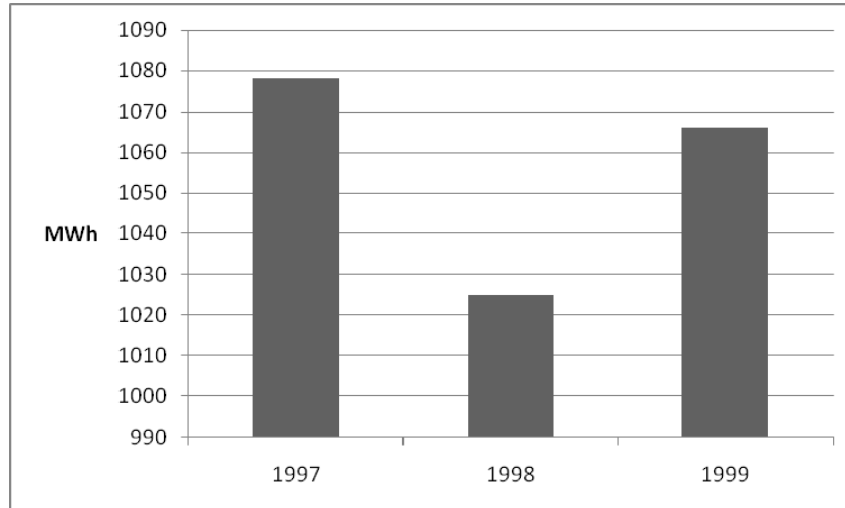
Figure 19. Electricity consumption in HBC in 1997 – 1999.

The consumption figures are not normalized on a per-capita because the use of lights is the same regardless of the amount of students in a classroom. The electricity consumption dropped 4.9 % during the electricity saving campaign in the year 1998. The amount of computers in 1998 was 24 % higher than 1997. After the campaign, in the year 1999, the consumption increased by 4.0 % and the amount of computers grew at the same time by 29 %. The case study treated only the consumption of electricity not the whole consumption of energy which implies that the weather conditions can be excluded. The building has district heating. Thus, an environmental campaign has a positive effect on environmental behavior, but the duration of the effect is short.

5.5.3 Environmental Information and Environmental Behavior

Note: 1= I have enough knowledge in order to recycle, 2=I have received enough instructions in order to behave responsibly (completely agree)
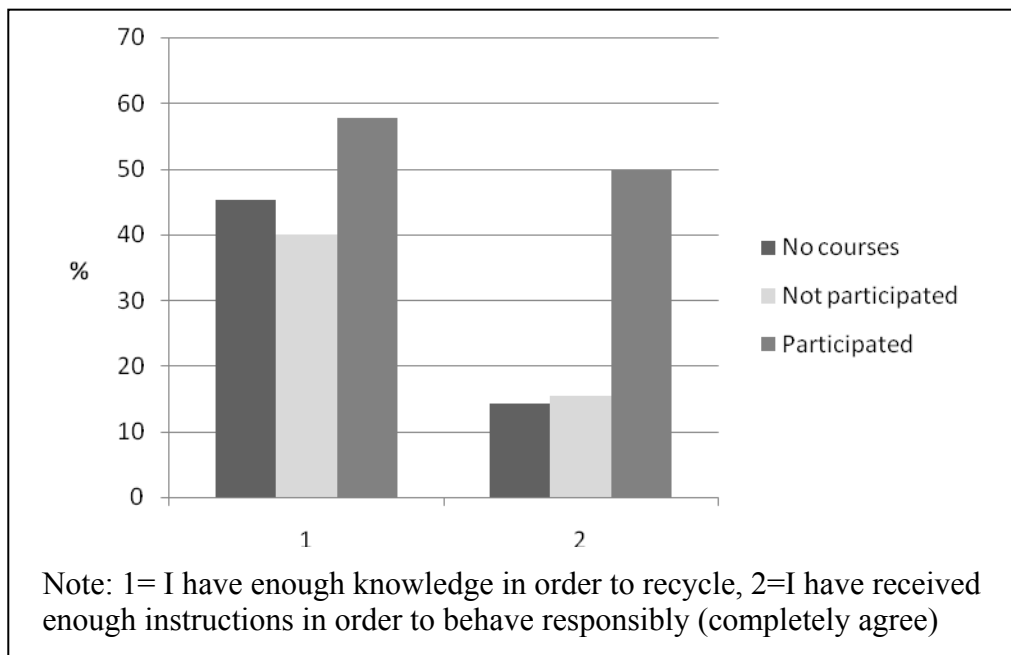
Figure 20. Satisfied with the environmental instructions by environmental training.

Among the respondents, those employees who participated in the training were the most aware of how to recycle (N=123, 57.7 % of those who have participated compared to N=89, 39.9 % of those who have not participated and to N=137, 45.2 % of those who have not had training). Additionally, they are better informed about instructions related to environmentally responsible behavior than those who have not participated in or have not had environmental training (N=107, 49.8 % of those who have participated compared to N=34, 15.5 % of those who have not participated and to N=44, 14.2 % of those who have not had training). The corresponding diagrams are presented in Figure 20.

Those employees who are completely satisfied with the environmental behavior instructions given by their employers behave in the most responsible way (N=114, 61.6 %). The corresponding diagrams are depicted in Figure 21, (see also Table 15). Men report more often than women that they have had enough instructions in order to behave in an environmentally responsible way (N_m=72, 30.0 % compared to N_w=112, 22.0 %).

Of the employees 16.0 % (*N*=119) need more information concerning recycling and sorting waste.
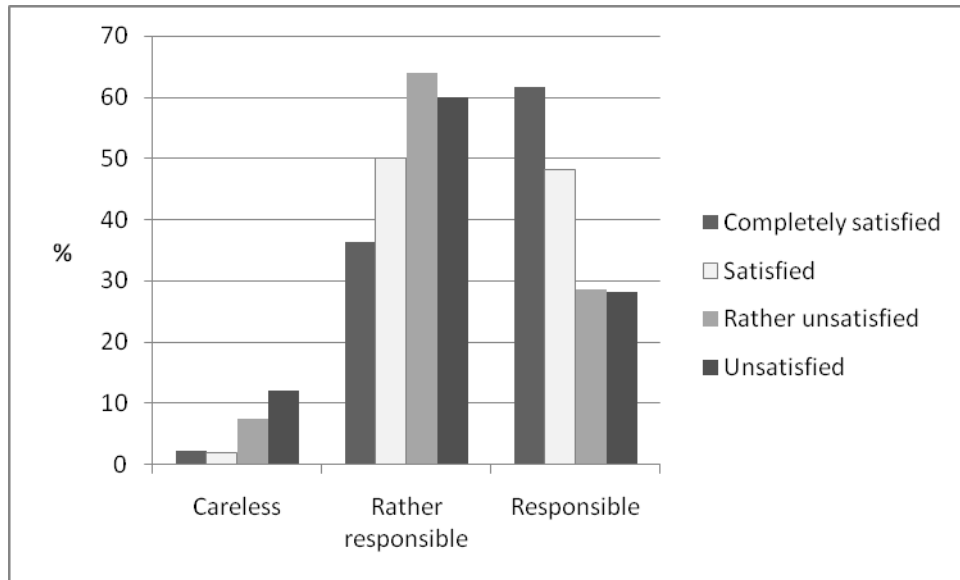
Chi=63.025 *df*=6 *p*<.001

Figure 21. General environmental behavior by the level of satisfaction with behavioral instructions.

Table 15.   General environmental behavior by the level of satisfaction with behavior instructions.

	Completely satisfied with instructions	Satisfied with instructions	Rather satisfied with instructions	Unsatisfied with instructions	Total
	%	%	%	%	*N*
Careless	2.2	1.9	7.4	12.0	32
Rather responsible	36.2	50.0	64.0	60.0	381
Responsible	61.6	48.1	28.6	28.0	336
% *N*	24.6 185	41.9 314	23.4 175	10.0 75	100 749

Chi=63.025 *df*=6 *p*<.001

Most of the respondents think that lights should be switched on during the whole working day and not be switched off for short times, e.g. for coffee breaks (lights on *N*=402, 53.7 %, switched off *N*=79, 10.5 %, no instructions given *N*=268, 35.8 %, *Chi*=15.432, *df*=2, *p*<.001). However, 79.6 % (*N*=600) of respondents always or mostly

switch off the lights in empty rooms. The respondents with secondary vocational education (*N*=173, 65.2 %) believe more often than those with higher vocational education (*N*=63, 35.6 %) that it is advisable to leave the lights on in empty rooms during the whole working day. This belief is less common among the youngest group (*N*=44, 46.8 %) than among the oldest respondents (*N*=128, 55.4 %). Furthermore, respondents with business education (*N*=167, 60.3 %) believe more often than those with technical education (*N*=17, 32.1 %) that lights should be left on in empty rooms, and women believe this more often (*N*=289, 56.9 %) than men (*N*=113, 46.9 %). Most of the employees know the recommended room temperature in offices (*N*=584, 72.6 %). On average, men (*N*=71, 29.2 %) reported a lower recommended room temperature than women (*N*=109, 21.3 %). Just over a quarter of all respondents do not know whether aluminium is organic waste or not (*N*=186, 27.7 %). The knowledge related to this statement increases with age (*N*=36, 44.4 % of respondents in the age group 20-30 compared to *N*=85, 56.3 % of respondents in the age group 31-40 compared to *N*=186, 80.9 % of respondents in the age group 41-50 compared to *N*=176, 84.2 % of respondents in the age group 51- 60, *p*<.001). Men are more aware than women of food remains being organic waste (N_m=220, 90.5 % compared to N_w= 419, 82.2 %).

The major finding of this chapter is that the environmental instructions given in environmental training do increase environmentally responsible behavior. However, the knowledge of certain behavioral instructions, for example what kind of waste is organic waste, is low.

5.5.4 Circumstances for Environmentally Responsible Behavior

The convenience of a specific environmental action varies. Not all respondents are able to recycle or use materials economically. Men have more suitable circumstances for responsible behavior than women do (Table 16). Of all respondents 18.0 % (N=134) consider sorting inconvenient or rather inconvenient and time-consuming. No statistically significant differences were found when analyzing the data by gender, education, and age.

Table 16. Respondents with no opportunities to recycle, sort, or save different materials.

	Total	Women	Men	
	% N	%	%	p
Office papers	15.6 118	18.5	9.5	0.038
Newspapers	14.2 107	16.6	9.1	0.039
Cardboard	15.2 115	16.0	13.6	<.001
Energy waste	29.3 221	30.7	26.4	0.018
Organic waste	24.8 186	25.5	23.2	<.001
Two-sided copies	9.9 74	12.4	4.6	<.001
Two-sided copies	39.9 300	46.2	26.6	0.001
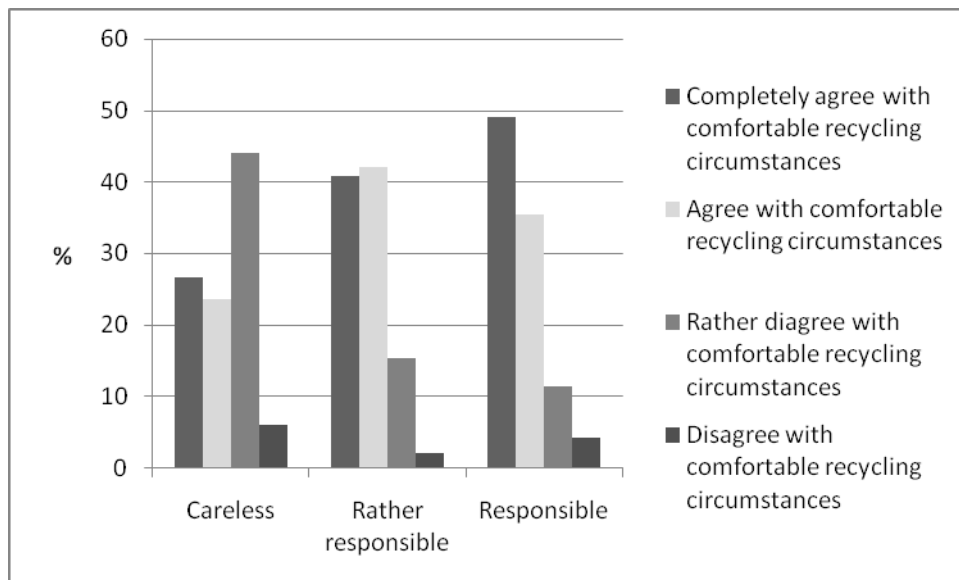
Chi=35.787 *df*=6 *p*<.001

Figure 22. General environmental behavior by experienced recycling convenience.

Recycling circumstances have a statistically very significant effect on environmental behavior. 49.1 % (*N*=164) of those who have appropriate recycling circumstances behave responsibly. The diagrams are depicted in Figure 22.

The major finding is that convenient circumstances for environmental behavior increase environmentally responsible behavior.

5.6 Awareness about the Financial and Environmental Implications of Environmental Behavior

Employees' awareness of environmental costs caused by their own action was measured with three statements (Statements III 1, 5, and 6 in Appendix 1 and 2 (in Finnish)). The statements were: sorting waste reduces costs, lowering the temperature by one degree reduces costs by 5 %, and waste sent to landfill causes more costs than organic waste sorted and recycled separately.

The awareness of the financial consequences related to sorting waste correlates with recycling behavior styles significantly at the 0.01 level (Table 26 in Appendix 3). Two thirds of all respondents are of the opinion that recycling reduces waste costs, and one quarter of all respondents answered "I do not know" (N=500, 66.0 % compared to N=190, 25.1 %). The youngest age group gave the lowest number of "I do not know" answers (age 20 to 30: N=18, 18.8 %; age 31 to 40: N=39, 22.9 %; age 41 to 50: N=82, 32.0 %; age 51 to 60: N=51, 21.9 %; p=.001). However, the youngest group also had the highest frequency of the response alternative "Recycling does not lower waste costs" (N=18, 18.8 %). Of the respondents 40.7 % (N=306) knew the effect that lowering room temperature by one degree has on heating costs, and 39.3 % (N=296) answered "do not know". 43.2 % (N=221) of women and 31.0 % (N=75) of men answered "do not know" (Chi=15.967 df=3 p=.001).

The respondents' awareness of the environmental impacts of their own actions was measured with four statements (Statements III 2-4 and Statement VI 2 in Appendix 1 and 2 (in Finnish)). Almost all respondents are of the opinion that recycling lowers environmental impacts (N=71, 93.9 %). The correlations between energy waste recycling and awareness of environmental consequences are significant at the 0.01 level. Moreover, the correlation between recycling organic waste and environmental awareness is significant at the 0.05 level (Table 26 in Appendix 3).

The respondents were also asked to choose the most important environmental effect caused by the exhaust gases of cars and the generation of energy. According to the

respondents, the most significant impact of car driving is the aerosol particles (N=293, 39.4 %). The most considerable impact of energy production, on the other hand, is global warming (N= 255, 34.4 %) (Table 17).

Table 17. Opinions of the environmental effects of traffic and energy production.

	Traffic	Energy production
	% N	% N
Increased ozone in the troposphere	8.1 60	4.2 31
Decreased ozone in the stratosphere	24.3 181	24.2 179
Climate warming	14.5 108	34.4 255
Increased quantity of aerosol particles	39.4 293	12.4 92
Increased acidity in the earth	3.5 26	5.7 42
None of these	0.7 5	0.5 4
Do not know	9.3 69	18.6 138
% N	100 742	100 741

Eight point one per cent (8.1 %) (N=60) of the respondents think that the exhaust gases of cars increase the concentration of ozone in the troposphere and 24.3 % (N=181) believe that exhaust gases lower it in the stratosphere (Table 17). Men think significantly more than women that cars' exhaust gases and energy production contribute to global warming (N_m=57, 24.2 % compared to N_w=51, 10.0 % for exhaust gases; N_m =123, 52.3 % compared to N_w=133, 26.2 % for energy production). Women generally chose more "do not know" alternatives. These differences between the genders are statistically very significant (Chi=69.740, df=6, p<.001 for exhaust gases and Chi=70.654, df=6, p=<.001 for energy production). The beliefs of the impacts of car driving on the environment also vary between different age groups. The youngest respondents think more often than the oldest that car driving increases the amount of aerosol particles (N=45, 46.9 % age 20 to 30 compared to N=70, 41.2 % age 31 to 40 compared to N=101, 40.2 % age 41 to 50 compared to N=77, 34.2 % age 51 to 65;

Chi=30.454, *df*=18, *p*=.033). The youngest respondents also believe more often than the oldest that energy production has a significant impact on global warming (*N*=41, 42.7 % age 20 to 30 compared to *N*=63, 37.1 % age 31 to 40 compared to *N*=81, 32.4 % age 41 to 50 compared to *N*=70, 31.1 % age 51 to 65; *Chi*=40.451, *df*=18, *p*=.002).

Another statistically very significant difference in knowledge related to the environmental changes caused by the exhaust gases of cars can be found between the respondents with secondary level education and the respondents with higher vocational education (*Chi*=53.379, *df*=12, p<.001). Additionally, the differences between the respondents with business education and the respondents with technical education are significant (*Chi*=59.664, *df*=18, *p*<.001). The employees with secondary and business education are more inclined to believe that car driving decreases ozone in the stratosphere and less likely to think that it increases global warming than those with higher and technical education (Table 18).

Table 18.   Opinions of environmental changes caused by traffic by educational background.

	Secondary level education	Higher level education	Business education	Technical education
	% *N*	% N	% N	% N
Increased ozone in the troposphere	12.8 34	1.7 3	10.5 29	1.9 1
Decreased ozone in the stratosphere	30.6 81	18.6 32	27.9 77	14.8 8
Climate warming	9.4 25	20.9 36	12.3 34	18.5 10
Increased quantity of aerosol particles	30.9 82	47.7 82	31.5 87	57.4 31
Increased acidity in the earth	5.7 15	1.7 3	5.4 15	0.0 0
None of these	0.0 0	1.7 3	0.0 0	5.6 3
Do not know	10.6 28	7.6 13	12.3 34	1.9 1
% *N*	100 265	100 172	100 276	100 54

Additionally, the differences in environmental awareness concerning energy production were statistically very significant between the respondents with secondary level education and the respondents with higher vocational education (*Chi*= 40,069, *df*=12, *p*<.001), and between the respondents with business education and the respondents with technical education (*Chi*=64,622, *df*=18, *p*<.001) (Table 19). The employees with higher education believe more often than those with secondary level education (*N*=77, 44.8 % compared to *N*=66, 24.9 %) that energy generation increases global warming. This statement was also supported by substantially more respondents with a technical background than those with a business education (*N*=27, 51.9 % compared to *N*=76, 27.6 %)

Table 19.   Opinions of environmental changes caused by energy production by educational background.

	Secondary level education	Higher level education	Business education	Technical education
	% N	% N	% N	% N
Increased ozone in the troposphere	6.4 17	1.2 2	5.5 15	1.9 1
Decreased ozone in the stratosphere	28.7 76	22.1 38	27.3 75	7.7 4
Climate warming	24.9 66	44.8 77	27.6 76	51.9 27
Increased quantity of aerosol particles	16.2 43	18.0 31	14.9 41	30.8 16
Increased acidity in the earth	5.7 15	2.3 4	4.7 13	1.9 1
None of these	0.0 0	1.2 2	0.0 0	3.8 2
Do not know	18.1 48	10.5 18	20.0 55	1.9 1
% N	100 265	100 172	100 275	100 52

Participation in environmental training correlates significantly with the awareness of the firm's environmental impacts at the 0.01 level (.294**). Men are more aware of the firm's environmental impacts than women (*Chi*=20.510, *df*=3, *p*<.001). The awareness of environmental impacts increases with age (*Chi*=19.387, *df*=9, *p*=.022). Respondents

with technical education are the most aware of the firm's environmental impacts (*Chi*=20.054, *df*=9, *p*=.018).

The major finding from this chapter is that awareness about financial and environmental implications correlates with recycling behavior. Awareness of reasons for global warming, and of the factors contributing to the decrease in the ozone concentration in the stratosphere and its increase in the troposphere is not high.

5.7 Validity and Reliability of This Study

Firstly, missing answers in some statements can cause systematic distortion. In this study, the proportion of missing replies generally varies between 0 % and 4.3 % depending on the question. However, the proportion of missing answers is particularly high in the statements IV 2 and 3 (11.3 % and 11.7 %, Appendix 1 and 2 (in Finnish)). Secondly, measuring environmental behavior and attitude with statements the social acceptability of which varies may be problematic. In this study, some statements concern such subjects that the respondent may be tempted to give socially acceptable answers. The respondent may unconsciously try to find the socially right answer. If this tendency is systematic it influences the validity of the data. If this tendency is random it reduces the reliability of the data. (Heikkilä 2001) However, this assumption can neither be proved nor discharged. Thirdly, a common disadvantage of research is subjectivity. In this study, it is not possible to tell if the respondents have understood the statement alternatives in the same way. This might have affected the whole survey data.

The situation in which the statements were answered might cause random error. The situation was uncontrolled, and it was not possible to clarify or improve the statements during the data gathering or afterwards. The respondents might also have gained hints about the "right" answer to one statement from other statements. This study tried to avoid this pitfall by testing the questionnaire carefully before sending it to the respondents. However, the respondents might have found correct answers from the

Internet or from their colleagues, as they filled in the questionnaire on the computer. This applies to the statements related to environmental knowledge in particular.

It is also possible that those employees with a generally environmentally friendly attitude and behavior have been more active in taking part in this survey than their colleagues. Thus the results of the study can be more positive than the reality.

One weakness of the survey method is that different respondents can understand the questions differently. Furthermore, they may understand them differently to what the researcher meant. This divergence can be due to difficult statements or unknown terms. For this reason, the statements had to be planned very carefully so that everyone, independent of age, gender, and education, would understand them in the way the researcher meant. According to Alkula et al. (1994), even in a carefully planned and implemented survey, nine out of ten respondents give the right information related to their age and gender. When asking about attitudes, on the other hand, as much as seven out of ten answers are inaccurate. Testing the questionnaire beforehand is a good way to alleviate the impact of this problem (Alkula et al. 1994). In the present study, the questionnaire was pretested, which can be assumed to have reduced the divergence problem.

The internal consistency of the questionnaire and the sum variables were estimated with Cronbach's alpha coefficient (Table 20). The reliability of the two and three-item sum variables was assessed using Spearman's correlation coefficient. (Nummenmaa 2006)

Table 20. Sum variables, statements and reliability (Cronbach's alpha).

Sum variable	Statements	Reliability[1]
Specific attitudes	I 1-4,	.77
Subjective norms	I 5-7	.55
General environmental behavior	II 1-14	.61
Effects of own behavior	III 1-6	.52
General environmental knowledge	V 1-4, V 6-14	.82
Firm as a source of environmental information	VI 2-3	.69

[1] The total reliability of the indicator is .84

The correlation coefficient of statements VI 2 and VI 3 is 0.528**. The correlation coefficient of statements I 5 and I 6 is 0.227(**), I 5 and I 7 0.269(**), and I 6 and I 7 0.413(**). In other words, the correlation coefficients between all pairs of statements are significant. The reliability of the questionnaire and, consequently, the survey study, is thus reasonably good. This means that the statements of the questionnaire were found to measure similar issues. Additionally, the case study and its data can be considered reliable as the primary data for the study was obtained from electricity bills.

5.8 Results and Findings

Voluntary actions of office workers in the service sector, where only a few obligatory measures are defined, will especially reduce energy-related CO_2 emissions. Because energy generation and energy consumption generate approximately 80 % of global greenhouse gas emissions, consumers and governments face increased pressure to take steps to reduce or to mitigate the effects of domestic energy consumption (Birol 2005). The Finnish ministries and eight different organizations and associations have set up voluntary energy conservation agreements. These agreements covered 60 % of

Finland's total energy consumption in 2005. Additionally, Motiva Ltd organizes a theme week each year, the National Energy Awareness Week, during which schools, companies, and other organizations concentrate on promoting energy efficiency. In 2005, a total of 205 companies took part in the theme week. Furthermore, the national Energy Auditing Programme includes additional energy saving approaches, such as an energy analysis for the industrial sector, energy inspections for SMEs, and energy audits for buildings. (Motiva 2005)

The object of this study was office workers and factors influencing their environmental behavior. The results of this study are presented in the following chapters in the order of the research questions posed in Chapter 1.3. A summary of the results is shown in Figure 23 below.
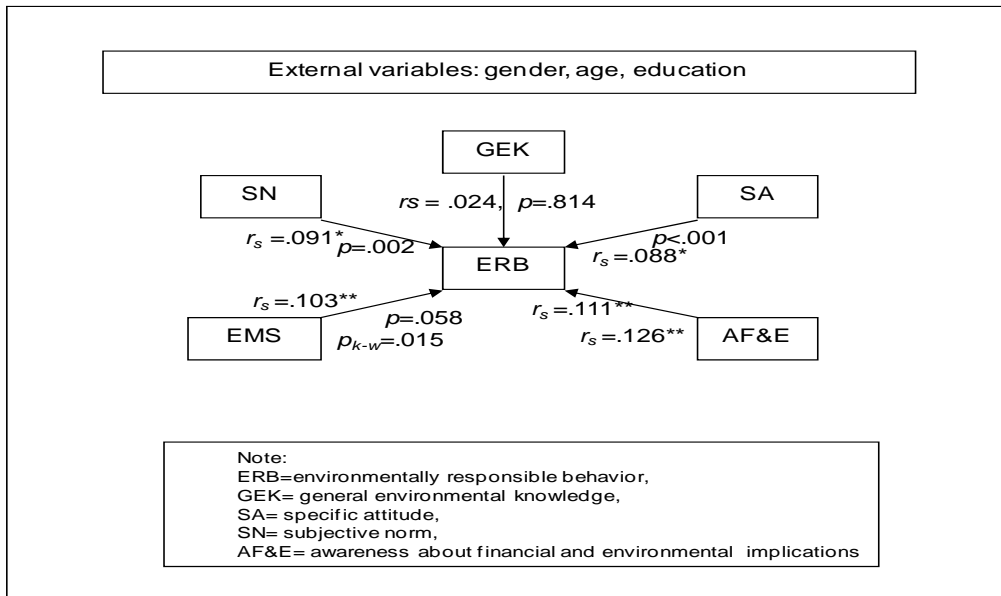
Note: *Correlations were computed using the nonparametric Spearman rank-order procedure (r_s). ** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed). Despite this the correlation coefficients are rather low. However, in social research correlations are often rather low but can still be important (Heikkilä 2001).*
    Environmentally responsible behavior's dependency on research questions' factors was computed using Pearson's chi-square independent test (p) and the Kruskall-Wallis test (p_{k-w}). Factors influencing environmentally responsible behavior are statistically significant when $p<.05$.

Figure 23.   Answers to the research questions with the help of Spearman's correlation coefficients (r_s), Pearson chi-square tests' significance values (p), and the Kruskall-Wallis test (p_{k-w}).

Q₁: Do general environmental knowledge and rational understanding of environmental changes lead to environmentally responsible behavior?

Based on the results of this study, it can be noted that general environmental knowledge and the rational understanding of environmental changes are not good predictors of environmentally responsible behavior ($r_s = .024$, $p=.814$). The environmental behavior of employees is generally rather responsible, but it does not depend on general environmental knowledge, i.e. knowledge of environmental problems and their causes. The respondents with excellent environmental knowledge did not behave in a more responsible way than the respondents with little environmental knowledge. The employees with a higher level of education had better knowledge of environmental issues than those who had low levels of education, but this did not affect their environmental behavior positively ($r_s=-.027$, $p=.187$).

On the contrary, the respondents did not always act according to their knowledge. For instance, most of the respondents switched off the lights in empty rooms although they believed that it was better to leave the lights on for the whole working day.

General environmental knowledge did not affect environmental behavior indirectly through specific attitudes (*Chi*= .884, *df*=12, *p*=.643) or subjective norms (*Chi*= 1.088, *df*=12, *p*=.581). The effect of general environmental knowledge on general environmental behavior is presented in Figure 23.

Q₂*: Do employees' specific attitudes influence their environmental behavior?*

It was noted that specific attitudes affect general environmental behavior. Those employees who experience responsibility for their own actions towards the environment behave significantly more environmentally friendly ($p<.001$). The correlation between general environmental behavior and specific attitudes is significant at the 0.05 level. However, specific attitudes have different effects on different specific behavior styles. The correlations between some specific behavior styles and specific attitudes are significant at the 0.01 level. Such behavior styles are electricity saving behavior and

recycling of energy and organic waste. The correlation between specific attitudes and habitual behavior actions such as paper recycling is low. The effect of specific attitudes on general environmental behavior is presented in Figure 23.

Q$_3$: *Do employees' subjective norms influence their environmental behavior?*

It was found that subjective norms affect on general environmental behavior. Those respondents who felt social pressure from their colleagues behaved in a more environmentally responsible way (p=.002). The correlation between general environmental behavior and subjective norms is significant at the 0.05 level but the correlation coefficient is low. However, subjective norms have different effects on different specific behavior styles. The correlations between some specific behavior styles and subjective norms are significant at the 0.01 level. Such behavior styles are printing and copying, as well as recycling of energy and organic waste. Social pressure has a low effect on habitual behavior styles. The effect of subjective norms on general environmental behavior is presented in Figure 23.

Q$_4$: *Do environmental training and good circumstances for responsible behavior as a part of the environmental management system (EMS) cause environmentally responsible behavior?*

This research question was studied using two research methods: a quantitative survey and a qualitative case study. In the survey study, the descriptive parameters related to the EMS were training, the amount of instructions given, and the suitability of circumstances for environmentally friendly behavior in the workplace. In the case study, the parameter measuring the effect of the EMS on environmentally responsible behavior was the information campaign.

Through the studies, it was noted that environmental training organized by employers increased environmentally responsible behavior directly. Those employees who had participated in training behaved in a more responsible way than those with no courses available or with no participation in courses (N=113, 52.1 % participated in training

compared to N=100, 44.4 % did not participate in training compared to N=126, 40.4 % offered no training). The effect of training on general environmental behavior is presented in Figure 23. The case study supports the survey results. Electricity consumption decreased 4.9 % during the information campaign. However, when the electricity saving campaign was over, consumption figures increased.

The level of general environmental knowledge is higher among those employees who participated in training courses than among those who were not offered environmental training. The effect is statistically significant (Chi=15.969, df=4, p=.003). Those employees who had participated in training courses were more aware of environmental behavior instructions than other employees. This result is statistically very significant (p<.001, r_s =.365**). However, environmental training did not affect the perceived ease of recycling (p=.258, r_s =.046). Yet the employees who have not used the opportunity to take part in environmental training have a better level of general environmental knowledge but a lower level of specific environmental knowledge than those who have participated in courses (excellent general environmental knowledge N=57, 25.4 % compared to N=44, 20.3 %). They have had a higher education (polytechnic or university) which gives a higher level of general environmental knowledge than secondary education (vocational school or college).

Environmental training correlates with the respondents' specific attitudes. The specific attitudes are more responsible among those who have been able to take part in environmental training (it does not matter if they have participated or not in the training but have had the opportunity) than among the respondents who have not had training. This result is statistically significant (Chi=8.813, df=2, p=.012). In addition, employees who participated in training courses felt more social pressure than those who had not participated in training or who had had no training opportunities. This result is also statistically very significant (Chi=33.167, df=2, p<.001).

The knowledge of arranged environmental training and general and specific environmental knowledge combined seems to increase responsible behavior.

Q5: *Do employees' awareness of financial and environmental consequences of their own environmental behavior correlate with environmentally responsible behavior?*

It was noted that awareness about the financial and environmental implications correlates significantly at the 0.01 level. The correlations were calculated using the two-tailed non parametric correlation test. The correlation coefficients are presented in Figure 23. For instance, awareness about the financial implications of recycling correlates with different specific recycling behavior styles significantly at the 0.01 level. Furthermore, environmental awareness related to recycling correlates significantly with the recycling of cardboard, energy waste, and organic waste at the 0.01 level

6 Discussion

Environmental problems, especially climate change, continue to expand, although some technological solutions to environmental issues have been successful. New methods for reducing pollution have undoubtedly contributed to a cleaner environment. Despite new methods, there is an increasing understanding that technology alone cannot solve all environmental problems. As human behavior is the root of all environmental crises, the role of the individual's actions is becoming ever more critical.

6.1 Discussion of Findings and Theoretical Contribution of the Study

In this study the model of the effects of environmental knowledge, attitudes, and EMSs on environmental behavior was tested. The study had the objective of clarifying the opportunities office workers and their employers in service occupations have to reduce their environmental impacts. The research questions covered the basic assumptions and variables behind environmentally responsible behavior.

Environmental behavior
Almost half of all employees show responsible general environmental behavior. A high proportion of respondents, 94 %, recycle office paper always or very often, assuming that they have the opportunity to do so. This finding is coherent with the literature: paper recycling activity has been found to be high also in other survey studies (Gillilan et al. 1996, Corraliza 2000, LaRoche et al. 2002). It is indeed possible that the survey study gives unrealistically positive results concerning environmental behavior, as the study handles questions and statements to which the respondents might have been tempted to answer in a socially acceptable way.

Unexpectedly, women reported more often than men that they have no opportunity to recycle the different recyclable waste fractions. Of the respondents 58 % answered that they always or mostly sort their energy waste. According to the responses, only 29 % of

the respondents had no opportunity to sort their energy waste. This might be explained by the confusion over the term "energy waste" itself (the concept was not explained in the questionnaire). For instance, only 11 % of the respondents were aware that they had no opportunity to sort energy waste in a firm that did not provide the recycling opportunity for energy waste. Environmentally responsible behavior seems to be relatively item-based. The recycling of office paper, for instance, correlates significantly with other recycling and waste sorting behavior styles, but not with material and energy saving behavior styles. Again, literature supports this finding; for example, consumers who recycle may not be the same consumers who pay more for ecological food (Dietz et al. 1998, Kaiser, 1998, Blake 2001, Gatersleben et al. 2002, LaRoche et al. 2002). However, the high correlation between different environmental behavior styles within the same behavioral field may partly be due to the nature of the study. Behavior styles were self-reported, which may have influenced the answers by making the respondents answer logically and in a socially acceptable way.

Environmental knowledge

Answers to the statements concerning environmental issues reflect concern for health. 39.4 % (*N*=293) of the respondents mentioned the increased quantity of aerosol particles as the most significant effect of driving a car. Additionally, the fear of ozone depletion is remarkable. Approximately one quarter of all respondents chose the exhaust gases of cars and energy production as the most important cause of ozone depletion. On the other hand, the increased ozone in the troposphere was rated as a less serious consequence of exhaust gases (*N*=60, 8.1 %). Relatively few respondents believed that the most serious environmental consequence of exhaust gases (N=108, 14.5 %) and energy production (*N*=255, 34.4 %) was climate change. Over half of all respondents did not believe in abnormal climate change. This finding was also consistent with previous studies: the connection between burning fossil fuels and climate change is generally not well known (Gambro et al. 1996, Gatersleben et al. 2002).

These opinions might have been influenced by the media. For instance, most of the respondents (*N*=600, 80.2 %) have acquired their environmental knowledge from daily newspapers. Additionally, climate change was not a popular topic at the time the

questionnaire was given, and trading emissions in the EU did not start until 2005. On the other hand, at the survey time, daily newspapers often reported on high aerosol particle concentrations in densely populated communities and the influences of these on health. At least once a year, every spring, newspapers write articles of ozone "gaps" in the stratosphere, but the influence of the exhaust gases of cars on ozone in the troposphere is not a popular subject. The media are more interested in environmental issues affecting people's health, such as ozone depletion and bird flu (the H_5N_1 virus) than in environmental issues having a damaging effect on just the environment, such as climate change.

Environmental knowledge and environmental behavior

The environmental behavior of employees is generally rather responsible but it is not dependent on general environmental knowledge. The respondents with excellent general environmental knowledge did not behave in a more responsible way than the respondents with little environmental knowledge. The level of general environmental knowledge was found to be relatively irrelevant and to have little effect on general environmental behavior. These unexpected findings may have been caused by the way general environmental knowledge was measured. The respondents could easily have obtained the answers from other colleagues, friends, family members, or the Internet. In this case, the knowledge of environmental issues had not been internalized. This finding is again partially supported by many previous studies: global environmental knowledge does not necessarily imply environmental behavior, and if environmental knowledge has increased, there has not been a significant increase in environmentally friendly behavior (Finger 1994, Gamba et al. 1994, Gillilan et al. 1996, Cheung et al. 1999, LaRoche et al. 2002, Barr et al 2005, Kilbourne et al. 2005).

However, several researchers who have used survey study methods have found a relationship between general environmental knowledge and general environmental behavior: environmentally responsible behavior is more likely to be adopted by people who have more knowledge about and understanding of environmental issues (Hines et al. 1986/87, Smith-Sebasto 1995, Cottrell et al. 1997, Cheung et al. 1999, Zelezny 1999, Ewert et al. 2001, Barr et al. 2005). This study does not necessarily contradict those

findings. It shows that the level of general environmental knowledge is higher among those employees who have participated in environmental training than among the employees who have had no training in the workplace. The environmental behavior of the trained employees is also more responsible. It is possible that general environmental knowledge helps to internalize the importance of environmentally friendly behavior. In addition, it might support the understanding of the instructions on how to behave responsibly and motivate the employees to go along with these instructions.

Nevertheless, the knowledge-behavior gap between knowledge of environmental instructions and electricity using behavior observed in this study is unexpected. Employees carefully switch off lights (fluorescent lamps) in the empty rooms although, according to their opinions, it is advisable to leave the lights on for the whole working day. This gap can be explained by assuming that people still remember the instructions for old fluorescent lamps. This previously internalized knowledge is obviously difficult to replace with new information. Consequently, the respondents still behave according to the instructions they have received at a time when only filament lamps were available and the advice given was to turn off all the unnecessary lights.

Attitudes and environmental behavior

According to the results of the study, responsible attitudes among the employees are very common. However, less than half of the respondents realize that their actions in the workplace have environmental consequences. Because of the nature of work in service occupations, employees may not have realized that environmental protection is as an important part of their work as employees in the industry sector. Thus, employees who believe that individual action can make a difference are more likely to act in an environmentally friendly way than those who do not believe so. These findings are confirmed by previous survey studies: households with strong positive attitudes toward recycling contribute to the municipal collection programs more efficiently than households with lower positive attitudes (Vining et al. 1992, Oskamp et al. 1998, Bratt 1999b, Cheung et al. 1999, Dunlap et al. 2000, Olli et al. 2001, Gatersleben et al. 2002, Nordlund et al. 2002, Do Valle et a. 2004). These results can also be explained by the fact that it is acceptable and desirable to be interested in environmental issues and to

feel responsibility for one's own behavior. However, in this study, it is possible that employees with environmentally friendly attitudes and behavior have participated more actively in the survey than their colleagues. Therefore, the results could be more positive than the situation is in reality. The specific attitudes might also be described as overtly positive compared to the whole population. According to the literature, verbally expressed environmentally friendly opinions do not guarantee environmentally friendly behavior (Allardt 1991, Barr et al. 2005).

Subjective norms and environmental behavior

In this study, half of the employees stated that they feel social pressure from their colleagues. However, social pressure from colleagues or even awareness of colleagues' environmental behavior is perhaps something that one is not inclined to admit. Thus, the subjective norms might be underestimated. Despite this, it was found that social pressure has an effect on respondents' environmental behavior. The effect of social pressure is especially significant in situations where colleagues are present. These findings are also parallel with many other survey studies: people's motivation to recycle increases due to the influence of family, friends, and neighbors (Gamba et al. 1994, Oskamp et al. 1998, Bratt 1999b, Cheung et al. 1999, Ebreo et al. 1999, Olli et al. 2001, Bichta 2003, Barr et al. 2005, Zabel 2005).

Environmental training and circumstances for environmental behavior and environmental behavior

The employees who had participated in environmental training courses were better aware of environmental behavior instructions. Training was also found to correlate with employees' awareness of the firm's environmental impacts. Trained employees had received enough instructions in order to behave responsibly, which they also did. Training had also significantly increased employees' awareness of the financial consequences of their actions. These results are in line with findings that professed knowledge, action how, and action why, predict environmentally responsible behavior (Gamba et al. 1994, De Young 1996, Moisander 1996, Cottrell et al. 1997, Kaiser et al. 1999, Ewert et al. 2001, LaRoche et al. 2002, Cottrell 2003, Do Valle et al. 2004, Barr et al. 2005). The results also follow Welford's (2000) finding that effective

environmental training and education can build employees' skills, which further enables environmentally responsible behavior.

The findings in this study concerning professed environmental knowledge are supported by the report of Ajzen et al. (1980). According to the report, the relationship between two variables is the strongest when their specificity is at the same level. Therefore, professed environmental knowledge supports responsible behavior concerning that specific action. According to the case study, clear instructions for electricity saving actions combined with information on the financial and environmental benefits of these actions clearly have an effect on electricity using behavior. Additionally, according to the survey study, environmental training in companies enhances specific knowledge about recycling instructions. Those employees who participated in training recycle the most.

Based on the case study, monetary incentives for the staff of HBC may have increased their participation in the electricity saving campaign. The literature confirms the effect of this motivational factor on responsible behavior (Bratt 1999a, Bamberg 2002). The incentives at least contributed to an interest in electricity using behavior. Regular reminders of recommended actions increased electricity savings. Once the reminders stopped, on the other hand, electricity consumption increased almost back to its original behavioral level. This is in line with the studies of Zelezny (1999) and Zabel (2005) who noticed that short-term programs did not bring about active, long-term improvements in environmental behavior. Saving electricity is not easy. A 4.9 % drop in electricity consumption in a school building is significant and has a noticeable effect on environmental impacts and electricity costs. However, electricity consumption did not rise to the level it was in the comparison year 1997. It is possible that part of the staff and students had truly internalized the environmental training and still behaved more responsibly than in the comparison year 1997.

Environmental training did not, however, affect the perceived convenience or inconvenience of recycling. This is logical, given that recycling arrangements have most often remained the same before and after the training. Those employees who

experienced recycling as inconvenient behaved in a more careless way. This finding is supported by the literature: although the formation of environmentally responsible attitudes is important, neither the formation and maintenance nor behavior itself depends exclusively on education, but rather on the circumstances. (Oskamp et al. 1998, Corraliza 2000, LaRoche et al.2002, Barr et al. 2005).

Environmental training also influenced specific attitudes and subjective norms. Those who had taken part in the training were more aware of their own responsibility and role associated with the environmental behavior of the whole firm. These employees also felt more social pressure than those who had not participated or had had no training. Environmental training also influenced environmental behavior positively, both directly and through specific attitudes and subjective norms.

There are two explanations for this positive effect of the training on attitude and environmental behavior. Firstly, by arranging training the employer shows that environmentally friendly behavior is valued. Thus, managerial support and the manager's own actions are essential for environmentally friendly behavior (Rasmus 2001, Barr et al. 2005). Secondly, employees who took part in the training had possibly already had positive attitudes to environmental behavior before the training. The training only strengthened this.

According to the results of this study, participation in environmental training in companies is not very high. Additionally, the general environmental knowledge of inactive employees is unexpectedly high. However, those who had had environmental courses during their vocational education were less active in taking part in organized environmental courses in the workplace. One explanation for this inactivity might be the good general environmental knowledge the employees already possess. However, the general environmental behavior of these employees differs from the behavior of those who had no organized training. The knowledge of arranged environmental training and general environmental knowledge combined seems to increase responsible behavior. Training was found to affect not only environmental knowledge and behavior but also attitudes and experienced social pressure. Nevertheless, the motivational effect of

environmental training through an enhanced feeling of easy recycling opportunities is missing. The knowledge of behavioral instructions was also significantly lower among those employees who did not participate in environmental training. This reflected negatively on their environmental behavior.

Background variables and environmental behavior

According to the literature, the effect of education on environmental behavior is not clear. Many researchers have found a positive relationship between education and environmental behavior (Thomson et al. 1991, Finger, 1994, Dietz et al. 1998, Oskamp et al. 1998, LaRoche et al. 2002, Syme et al. 2002). On the other hand, as observed in this study, there is no significant relationship between education and general environmental behavior (Finger 1994, Dietz et al. 1998, Cottrell 2003). On a more specific level, this study also corresponds to the literature that education correlates with paper recycling activity (Widegren 1998, Olli et al. 2001, Gatersleben et al. 2002).

In this study, gender and age seem to have a more crucial role in environmental behavior than general environmental knowledge. Women, even those with little environmental knowledge, behave in a more responsible way than men. This result is parallel with earlier studies (Stern et al. 1993, Dietz et al. 1998, Ebroe et al. 1999, Blake 2001, Ewert et al.2001,Olli et al. 2001). Additionally, the eldest respondent group had the lowest amount of environmental knowledge but they behaved in the most responsible way of all the age groups. This result is also supported by the literature (Finger 1994, Diez et al. 1998, Ewert et al. 2001, Olli et al. 2001, Gatersleben et al. 2002, Barr et al. 2005). These findings can be explained with women's role as mothers. Women are generally worried about the environmental effects that can impact their children's health and future. Elderly people, on the other hand, may wish for longer life expectancy, which can increase their environmentally friendly behavior.

6.2 Means to Increase Environmentally Responsible Behavior in the Future

Primary motives for environmentally responsible behavior can be both conscious and unconscious, and different types of behavior are influenced by different motivational variables (Kallio 2001, Gatersleben et al. 2002, Bichta 2003). Clear target setting, attitudes, environmental education, situational variables, motivation originating from other people, feedback, and rewards are important means to support the employees' pro-environmental behavior (De Young 1996, Moisander et al. 2001, Ramus 2001, McMakin et al. 2002). Additionally, the encouraging example of leaders and the profile enhancement of environmentally responsible behavior as accepted behavior can increase environmentally friendly behavior (Rasmus 2001, Barr et al. 2005). Environmental issues should be included in the curriculum of primary education, as schools seem to be one of the most important sources of environmental information (Ewert et al. 2001). The United Nations designated the decade of 2005 - 2014 as the 'UN Decade of Education for Sustainable Development'. The broad goals at the national level are to provide an opportunity for refining and promoting the vision of and transition to sustainable development and to give an enhanced profile to the important role of education and learning in sustainable development. New courses for life-long learning should be arranged to ensure that all sectors of society have the skills necessary to perform in their world in a sustainable manner. (Unesco 2005)

The challenge in the current world of outsourcing and globalization is to accept much more responsibility for the entire life cycle of a product, and to see the environment and sustainable development as integral parts of a firm's competitive strategy. Therefore, in the future, corporate environmental strategies must be fully consistent with the move towards outsourcing and the management of supply chains. Qualitative growth, better knowledge about how to move materials from the point of consumption to the point of recovery, and solutions related to dematerialization are needed (Halme 2003, Welford 2003). To reach sustainable development, organizations' targets should include targets of strategic and operative management in all functions as illustrated in Figure 1. The

feedback related to the sustainability of one's own operations is especially necessary for the search of qualitative growth as seen in Figure 6 in Chapter 2.2.1 (Pohjola 2005).

6.3 Recommended Actions for Companies

In this study, the findings suggest that a model of social pressure and responsible attitudes towards the environment is too limited to explain environmental behavior. Even though specific attitudes and subjective norms explained the differences in employees' environmental behavior, the limitations related to commitment to organize and to participate in training were greater. Employers' and employees' commitment to EMSs, and both general knowledge of environmental issues and knowledge of behavioral action instructions increased environmentally responsible behavior among respondents.

It has been widely recognized that top managers' actions are important. Managers should encourage the establishment of a positive atmosphere for environmentally responsible behavior by behaving in an environmentally friendly way themselves, and by supporting internal and external environmental training. By setting an example, managers can facilitate environmental concern and receive legitimacy within the whole personnel. The job of managers is to ensure that employees have all the necessary tools to behave responsibly. According to this study, this requires regularly repeated environmental training and campaigns. In addition, favorable circumstances for employees' environmentally responsible behavior should be ensured. In the long run, environmentally responsible behavior should become a routine.

The environmental training program should include information about basic environmental issues, relate environmental problems to the firm's own economy and ecology, and provide information that is specific to the employee's own role. For instance, instructions and step-by-step guidance for certain behavior styles should be included. Improvements in environmentally responsible behavior in companies also require employees' active participation in training. Even though the effect of an

individual office worker is small, the effect of all employees on the environment and the organization's economy is great.

6.4 Limitations of the Study

Self-reporting of behavioral actions is an easy way to produce information. The researcher must, therefore, accept the absence of social contexts in self-reporting surveys and hope that the effects of different contexts cancel each other out. A more reliable way to obtain information and data of people's behavior would be observation. The respondents' descriptions of their behavior thus have been more genuine than otherwise (Corral-Verdugo et al. 1999). Because of the methodological choices, this study has a few limitations that need to be taken into account when interpreting the results. The limitations are listed in the following paragraphs.

The study was based on one survey and one empirical longitudinal case study. It is not possible, however, to fully evaluate the development of employees' environmental behavior with one survey that is conducted at one specific time. The study lacks the possibility to test causal directions, as there is no time-dependent survey data. This lack of longitudinal survey data should thus be acknowledged as a limitation of this study. The case study with the follow-up data concentrated only on one action and is therefore very narrow in scope. The study is also limited by the different data collection situations in the four companies surveyed. In two of the companies, employees answered the statements using the Internet, whereas in the two other companies the questionnaire was sent to employees personally. The use of the Internet may reduce the willingness to respond to the questionnaire. Those who are not experienced in using computers may not participate eagerly in the study. In turn, when people receive the questionnaire form personally, they may feel obliged to reply.

Additionally, this study may be limited by the self-reporting of behavioral actions. Even though the method is an easy way of producing information, its subjectivity is a disadvantage. Respondents do not know exactly what "often" or "sometimes" means.

Similarly, the statements measuring the same behavioral action or personality trait should measure what was intended. In this study, the reliability coefficients of the subjective norms (Cronbach's alpha=0.55), and of the awareness about the financial and environmental implications (Cronbach's alpha=0.52) are unsatisfactory. Because of this, any findings of their effects on environmental behavior need to be interpreted with caution.

The theory of reasoned action by Ajzen et al. (1980) provides a fairly solid framework to answer the research questions of this study. According to this theory, intention is a predictor of behavior. Behavioral intention was not asked about as such in this study, but it can be assumed that the respondent will reply in the same way to questionnaire statements concerning behavioral intention and corresponding action. However, people are nowadays well enough informed about environmental issues, and they can identify the socially acceptable ways to respond to the statements, regardless of their actual behavior. This may limit the study and give too positive a picture of employees' environmental behavior. A more trustworthy research method might have produced more reliable findings. For example, before taking the survey, people could be asked to write down their environmental actions, like sorting organic waste, over a short period. This would help the respondents in forming an accurate picture of their actual environmental behavior, and consequently make the survey responses more reliable.

When predicting behavior, Ajzen et al. (1980) have suggested that the relationship between two variables is the strongest when their specificity is at the same level. Therefore, asking about specific environmental knowledge, such as how to use energy efficiently, could have a stronger relation to responsible electricity consumption behavior than that which general environmental knowledge has to responsible electricity consumption behavior. In this study, more attention was paid to the relationship between general environmental knowledge than the relationship between specific environmental knowledge and environmental behavior. Based on this study, it is unclear what kind of behavioral information people need and how exact it should be.

7 Conclusions

The aim of this study was to identify the factors which stimulate employees in the service sector to behave in an environmentally responsible way. Another aim was to shed light upon the reasons which influences these stimulating factors. This chapter discusses the findings.

As a result of increased environmental challenges, it is important to think about the opportunities the individual has to make a difference. Environmental changes cannot occur without people taking responsibility for the environment. The problem is that people may believe that their individual actions are insignificant. Actions that have environmental impacts in service organizations are the use of materials and energy, logistic operations including traveling and freight transport, and the recycling and disposal of waste. Considering the amount of notes and assignments that each office worker produces, it is logical to assume that office workers belong to one of the most important segments producing waste paper. The amount of electricity office workers can save by switching off unnecessary lights and computers should not be underestimated. The aim of this study was to contribute to the field of environmental behavior studies in service sector organizations. This study was based on the approach that human behavior is subject to many internal and external circumstances. Thus, the effect that environmental knowledge, attitudes, social pressure, EMSs, and background variables had on employees' recycling, materials and energy saving behavior was studied.

It can hardly be denied that sustainable development requires substantial changes at the level of individual human behavior. Moreover, the need for sustainable development results from the global ecological and social conflicts arising from the current economic system and its underlying value structures. Sustainability will not be achieved until people accept more responsibility for the environmental consequences of their own behavior. Companies also have an important role in the promotion of ecological sustainable development. If an organization wants to motivate its employees to behave in a more environmentally friendly way, the main drivers causing changes in people's environmental and economic responsibility must be known. Environmental management

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is one of the ways to take care of environmental protection in organizations. However, the move towards sustainable development represents such a fundamental change in the values and visions of companies that it cannot be expected to occur quickly. According to the literature, there are different methods to reduce pollution which can be legislative, technical, financial, and behavioral. Environmental behavior is a complex process which is based on many factors. There is no apparent unity among researchers of the factors affecting environmental behavior. Several researchers claim that the intention to act in an environmentally responsible way is powerful and necessary. However, the opinions disperse when considering the effects of other factors and their strength on the behavioral intention. The inconsistency of behavior also seems to be a basic feature of environmental behavior.

In this study, the interest of knowledge was technical. The research methods used comprised a case study and a survey study to obtain answers to the five research questions posed. In the survey study, the questions handled the influence of environmental knowledge, environmental attitudes, social pressure, and EMSs on environmental behavior in companies. The influence of EMSs has been evaluated with the employers' willingness to arrange environmental training and convenient recycling circumstances. The companies selected were all from the service sector and represented different industries – retail industry, banking, education, and the public sector – which ensured that the sample was well representative of the Finnish service sector. The results related to individual firms were not reported. The case study concentrated on studying the effect of an environmental information campaign on employees' environmental behavior. Because of the methods of analysis that were used – cross tabulation and correlation studies – it was not possible to make strong conclusions on causality.

Overall, the framework that is based on a social-cognitive-psychological paradigm has the potential to advance the academic and practical understanding of environmental behavior. In this study, the differences in behavior in four diverse target groups were not significant. Therefore the results can be applied to the whole population of office workers in the service sector and also in other sectors. However, it may be that office workers in manufacturing plants where environmental requirements are more

demanding are more aware of environmental issues than office workers in the service sector. On the other hand, office workers' environmental impacts in the industry can be seen to be very insignificant in comparison with the impacts of the production of the factory and therefore interest of office workers' environmental behavior may be low.

This study demonstrated that environmental behavior depends on the behavioral situation, the behavioral "how" and "why" skills, and general environmental knowledge. It was also found that personal beliefs in the significance of a personal action and ecological responsibility and in colleagues' environmental actions predict environmentally friendly behavior. However, the most powerful and crucial means to increase environmentally responsible behavior is managers' commitment to support and increase environmentally friendly behavior in the company. In this study, the environmental training courses arranged and suitable recycling circumstances are evidence of managers' commitment to environmentally sustainable development. A good way of showing that the firm appreciates environmentally friendly behavior is to give employees the necessary information on why and how to behave environmentally responsibly. The importance of employers' actions in promoting environmentally responsible behavior is also crucial for employees who have not taken part in or have not had environmental training. Employees who declined the opportunity to participate in environmental training behaved in a more environmentally friendly way than employees who did not have this opportunity. However, those employees who declined from the opportunity to participate in environmental training had more environmental knowledge than those employees who had participated in the training or had no training, (see Chapter 4.5.1, Figure 17 and Table 10). Therefore environmental training has a two-sided relevance. Firstly, it provides general and specific environmental knowledge. Secondly, it addresses the fact that the employer values environmentally responsible behavior. According to this study, environmental training has a positive effect on employees' specific attitudes and causes social pressure among employees to behave environmentally responsibly. The pure awareness of environmental training affected specific attitudes positively but not subjective norms in the group who did not participate in the training.

Most of the findings of this study matched earlier studies. In the companies surveyed, environmental behavior was mainly sector-based and influenced by the convenience of the behavioral action. Other predicting factors, in accordance with the literature, were environmental knowledge, specific attitudes, and subjective norms. Additionally, environmental training and information campaigns were crucial in enhancing environmentally responsible behavior. They affected environmental behavior both directly and indirectly through attitudes and social pressure. These findings were neither acknowledged nor disproved in the literature. To the author's best knowledge, no study has investigated the effect of training courses and information campaigns on the environmental behavior of office workers.

Key messages
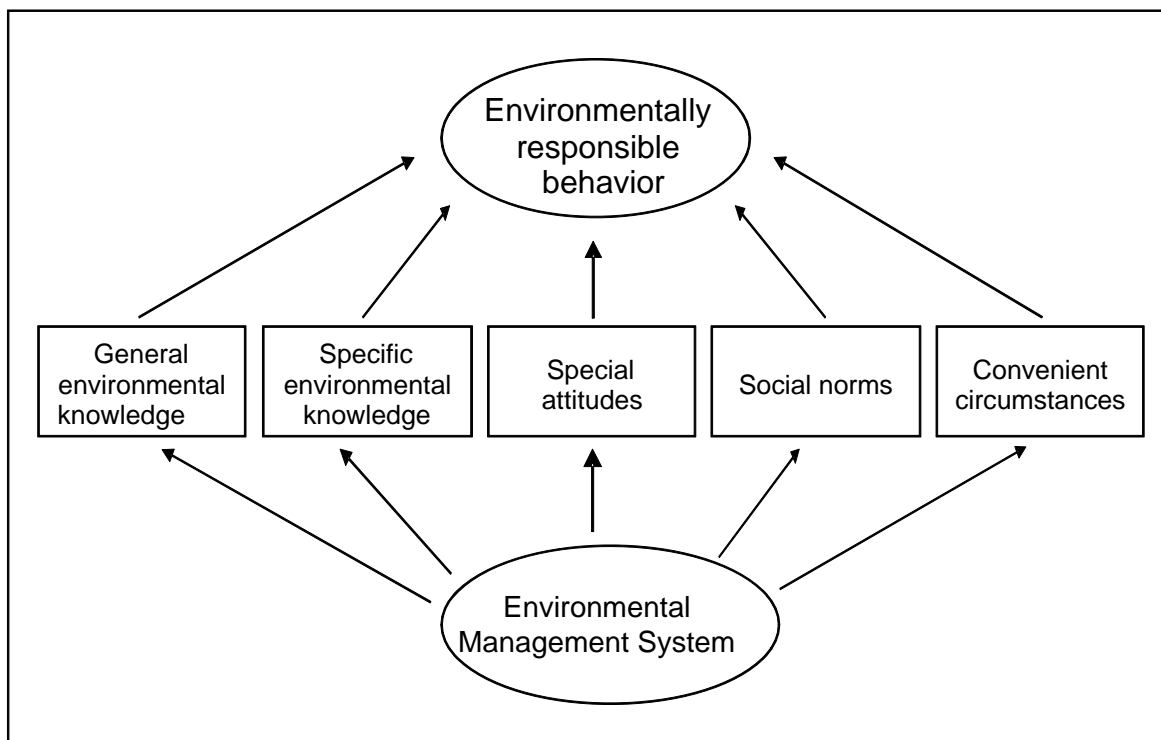
Figure 24.   Environmentally responsible behavior and factors affecting it.

Countless companies and their personnel all over the world – office workers, factory workers, shop assistants, managers, and owners – must engage in working towards sustainable development. It is hoped that by sharing this work in companies, managers and employees will increase their efforts to behave responsibly. It is also hoped that whatever the methods used for fostering on-going personal commitment to and action

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with regard to environmental behavior, more attention will be paid to the circumstances for behaving in a responsible way, to general and specific environmental knowledge, to the awareness of economic and environmental benefits, and to the feelings that arise in response to environmental crises presented in the media. The mind and heart combined are the way to sustainable ecological development in companies (Figure 24).

8 Suggestions for Further Research

Although this study shows that the benefits of environmental training and campaigns appear to increase environmental knowledge and positive attitudes toward environmentally responsible behavior and in that way support environmentally responsible behavior in the service sector, the exact effect of environmental training and campaigns on behavior is by no means clear. This demands further examination because research in this area so far has been lacking.

One conspicuous research topic is related to the key result of this study: environmental training and campaigns facilitate environmentally responsible behavior to some extent. Thus, the researchers need to identify the curriculum and educational methods for future environmental training courses. The types of environmental knowledge that help and motivate the adoption of behavioral instructions should be determined and put into practice.

More research is also needed in order to obtain reliable results about the direct effect of environmental knowledge and indirect effect of specific attitudes and subjective norms of environmental training and campaigns on environmental behavior. An empirical longitudinal study is needed, in which employees' actual behavior is measured or observed before, during, and immediately after a certain period of environmental training. In order to ensure employees' continuing environmentally responsible behavior, the duration of the motivational and informational impacts of training and campaigns should also be researched. This could help to determine if the education should be repeated and when the appropriate time for this would be.

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Appendixes

Appendix 1 Survey Questionnaire

The questionnaire is translated from the Finnish. Only the Finnish version was used in the survey. For this reason some of the statements and language items may appear unparallel in English.

I Attitude to environmental issues

Choose the right alternative

1 Completely agree   2 Agree   3 Somewhat disagree   4 Completely disagree

1 .I am aware of the consequences of my own behavior.	1 2 3 4
2. I am concerned about environmental protection in my workplace.	1 2 3 4
3. Everyone's environmentally responsible behavior is important.	1 2 3 4
4. I am interested in environmental issues and I am aware of environmental changes.	1 2 3 4
5. My colleagues' environmental attitude and behavior affect my environmental behavior.	1 2 3 4
6. I am aware of my colleagues' environmental behavior.	1 2 3 4
7. I believe that my colleagues have expectations concerning my environmental behavior.	1 2 3 4

II My own action

Choose the right alternative

1 Always   2 Almost always   3 Sometimes   4 Never   5 No possibility

1. I recycle office paper.	1 2 3 4 5
2. I recycle newspapers.	1 2 3 4 5
3. I recycle cardboard.	1 2 3 4 5
4. I recycle energy waste.	1 2 3 4 5
5. I recycle organic waste.	1 2 3 4 5
6. I switch off the computer at the end of the working day.	1 2 3 4 5
7. I switch off the lights in empty rooms.	1 2 3 4 5
8. I make double-sided photocopies.	1 2 3 4 5
9. I print double-sided.	1 2 3 4 5
10. I do not use disposable dishes.	1 2 3 4 5
11. I do not use a private car.	1 2 3 4 5

12. I use my own car because
   1   I need it for my work
   2   Public transport is not good
   3   It is easy and convenient
   4   Some other reason

1 Completely agree   2 Agree   3 Somewhat disagree   4 Completely disagree

13. I think recycling is difficult and takes time.	1 2 3 4
14. Recycling is difficult because my knowledge of recycling instructions is poor	1 2 3 4

III The connection between my own behavior and environmental changes

Choose the right alternative

1. Recycling reduces waste costs.
   1. Agree
      Argumentation_____
   2. Disagree
      Argumentation_____

2. Recycling reduces environmental impacts.
   1. Agree
      Argumentation_____
   2. Disagree
      Argumentation_____

3. Driving a car causes
   1. Ozone increase in the troposphere
   2. Ozone decrease in the stratosphere
   3. Climate warming
   4. Increase in aerosol particles
   5. Acidification
   6. None of these
   7. I do not know

4. Energy production with fossil fuels causes
   1. Ozone increase in the troposphere
   2. Ozone decrease in the stratosphere
   3. Climate warming
   4. Increase in aerosol particles
   5. Acidification
   6. None of these
   7. I do not know

5. One degree decrease in room temperature reduces energy costs by
   1. 7.5%
   2. 5%
   3. 4.2%
   4. I do not know

6. Landfilling of unsorted waste is
   1. More expensive than composting organic waste
   2. The same price as composting organic waste
   3. Ccheaper than costs of composting organic waste
   4. I do not know

IV Knowledge of environmental instructions

Choose the right alternative

1. Food residues can be put in the organic waste bin
   1. Agree
   2. Disagree
   3. I do not know
   4. No possibility to sort organic waste

2. Aluminium is organic waste
   1. Agree
   2. Disagree
   3. I do not know

3. Paper serviettes are organic waste
   1. Agree
   2. Disagree
   3. I do not know

4. Instructions for using fluorescent lamps
   1. They should be left on the whole the working day
   2. They should be switched off when leaving the room empty for a short time
   3. I have not been given instructions

5. Recommend room temperature is
   1. 18-19°C
   2. 20-22°C
   3. 23-24°C
   4. I do not know

V The reasons for environmental problems

1 Agree   2 Disagree   3 I do not know

1. Sulphur and nitrogen emissions caused by human action increase climate warming.	1 2 3
2. Methane gases from landfill areas increase climate warming.	1 2 3
3. Carbon dioxide emissions caused by human action increase climate warming.	1 2 3
4. Ozone depletion in the stratosphere increases climate warming.	1 2 3
5. There is no abnormal climate warming.	1 2 3
6. Ozone depletion in the stratosphere is due to increased carbon dioxide concentrations.	1 2 3
7. Ozone depletion in the stratosphere is due to CFC or freon concentrations.	1 2 3
8. Acidification of the environment is due to increased sulphur and nitrogen concentrations.	1 2 3
9. Acidification of the environment is due to increased CFC or freon concentrations.	1 2 3
10. The production of energy with fossil fuels increases climate warming.	1 2 3
11. Waste in landfills increases climate warming.	1 2 3
12. Driving a car increases climate warming.	1 2 3
13. Driving a car increases the acidification of the environment.	1 2 3
14. The production of energy with fossil fuels increases acidification.	1 2 3

15. The most serious environmental problem in my working district is (choose one)
    1. No problem
    2. Water pollution
    3. Air pollution
    4. Ground pollution

16. The most serious global environmental problem is (choose one)
    1. No problem
    2. Lack of clean water
    3. Climate warming
    4. The amount of landfill waste

VI Sources of environmental knowledge

Choose the right alternative

1. Sources from which you have obtained environmental knowledge during the last year (choose the most important)
    1. Newspapers, TV, and / or radio
    2. Professional environmental papers or articles
    3. Specialized literature of your own field
    4. Environmental training in the workplace
    5. Conversations in the workplace
    6. Conversations in leisure time
    7. Some other source of environmental information. What……
    8. I have not received environmental information during the last year.

1 Completely agree 2 Agree 3 Somewhat disagree 4 Completely disagree

2. I am aware of the environmental effects of my workplace	1 2 3 4
3. I have received enough instructions to behave environmentally responsibly	1 2 3 4

VII Environmental subjects during the studies

1. During my studies I have had one or more environmental course
    1. Yes
    2. No

2. I have taken part in environmental training in my work place
    1. Yes
    2. No
    3. No training

VIII Background information

Choose the right alternative

1. Gender
    1. Female
    2. Male

2. Age
    1. 20-30 years
    2. 31-40 years
    3. 41-50 years
    4. 51-65 years

3. Education
    1. Polytechnic
    2. University
    3. Business/technical school
    4. College
    5. No vocational education
4. Employer
    1. Industry
    2. Banking
    3. Education
    4. Public sector
    5. Retail industry

Appendix 2 Survey Questionnaire (in Finnish)

Kyselylomake

Arvoisa vastaanottaja!

Alla oleva kysely liittyy tutkimukseen, jossa pyritään selvittämään vastaajan käsitystä omista vaikutusmahdollisuuksista ja työnantajan roolista ympäristönsuojelutoimissa työpaikalla sekä koulutustaustan vaikutusta näihin. Tutkimus liittyy jatko-opintoihini TKK:n ympäristö- ja laatujohtamisen laboratoriossa.

Teidät on valittu mukaan tutkimukseen työnantajanne suosituksesta.

Vastaukset käsitellään luottamuksellisesti nimettöminä. Samoin yrityksestä saatavat tiedot ovat luottamuksellisia.

Työnantajanne voi hyödyntää tuloksia kehittäessään ympäristökoulutusta ja toiminta-mahdollisuuksia entistä ympäristöyötäisemmiksi.

Vastaaminen kysymyksiin kestää noin 5-10 minuuttia. Toivon Teiltä myönteistä suhtautumista asiaan, sillä tulosten luotettavuuden ja hyödyntämisen kannalta on tärkeää mahdollisimman monen osallistuminen.

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Annan mielelläni lisätietoja tutkimuksesta ja sen tulosten hyödyntämisestä.

Kiitokset vaivannäöstänne.

Tutkimus koskee **työpaikalla** tapahtuvaa toimintaa.

I. Suhtautuminen ympäristöasioihin

Valitse oikea vaihtoehto

1 Täysin samaa mieltä 2 Jokseenkin samaa mieltä 3 Jokseenkin erimieltä 4 Täysin eri mieltä

1. Tiedostan oman toimintani ympäristövaikutukset	1 2 3 4
2. Ympäristösuojelusta huolehtiminen työpaikalla koskee minua.	1 2 3 4
3. Yhden työntekijän toiminnalla on merkitystä ympäristönsuojelun kanalta.	1 2 3 4
4. Olen kiinnostunut ja seuraan ympäristömuutoksiin liittyviä asioita.	1 2 3 4
5. Päivisin kanssani tekemisissä olevien työntekijöiden asenne ja käyttäytyminen ympäristöasioissa vaikuttavat omaan toimintaani.	1 2 3 4
6. Olen tietoinen päivittäin kanssani tekemisissä olevien työtoverien ympäristökäyttäytymistä työpaikalla.	1 2 3 4
7. Uskon, että työtovereillani, joiden kanssa olen päivittäin tekemisissä, on odotuksia ympäristökäyttäytymiseni suhteen.	1 2 3 4

II. Oma toiminta käytännössä

Valitse oikea vaihtoehto

1 Aina 2 Lähes aina 3 Joskus 4 Ei koskaan 5 Ei erillistä lajittelumahdollisuutta

1. Lajittelen valkoiset toimistopaperit (kirjoitus- ja kopiopaperit, ATK-paperit ja tulosteet, ruutupaperit) niille kuuluvaan keräysastiaan.	1 2 3 4 5
2. Lajittelen lehdet ja mainokset (sanoma- ja aikakauslehdet, mainokset ja esitteet, värilliset kopiopaperit) niille kuuluvaan keräysastiaan.	1 2 3 4 5
3. Lajittelen pahvin erilleen muista roskista niille tarkoitettuun keräyspisteeseen.	1 2 3 4 5
4. Lajittelen energiajätteen niille kuuluvaan keräysastiaan.	1 2 3 4 5
5. Lajittelen biojätteen niille kuuluvaan keräysastiaan.	1 2 3 4 5

1 Aina 2 Lähes aina 3 Joskus 4 Ei koskaan 5 Tunnistin, joka huolehtii sammuttamisesta 6 Ei mahdollisuutta

6. Sammutan tietokoneen vähintään yön ja viikonlopun ajaksi.	1 2 3 4
7. Sammutan tyhjistä tikoista valot.	1 2 3 4 5
8. Kopioin kaksipuolisena.	1 2 3 4 6
9. Tulostan kaksipuolisena.	1 2 3 4 6
10. Työpaikallani käytän kertakäyttöastioita.	1 2 3 4
11. Työmatkat liikun omalla autolla.	1 2 3 4

Vastaa seuraavaan väittämään, jos käytät omaa autoa aina tai lähes aina, muussa tapauksessa siirry kysymykseen 13:

12. Käytän omaa autoa, koska
    1. Tarvitsen sitä työpäivän aikana.
    2. Julkisen liikenteen yhteydet ovat huonot.
    3. Se on helppoa ja mukavaa.
    4. Muu syy……………………………………………….

1 Täysin samaa mieltä 2 Jokseenkin samaa mieltä 3 Jokseenkin erimieltä 4 Täysin eri mieltä

13. Koen lajittelun hankalaksi ja aikaa vieväksi.	1 2 3 4
14. Koen lajittelun vaikeaksi, koska tietoni ovat riittämättömät.	1 2 3 4

III. Oman toiminnan ja ympäristömuutosten välisen yhteyden tiedostaminen

Valitse oikea vaihtoehto

1. Lajittelemalla jätteet vaikutan työnantajani maksamiin jätemaksuihin alentavasti.
    1. Samaa mieltä
    Perustelu………………………………

    2. Eri mieltä
    Perustelu………………………………
    3. En osaa sanoa

2. Lajittelemalla jätteet vähennän ympäristövaikutuksia.
    1. Samaa mieltä
    Perustelu………………………………
    2. Eri mieltä
    Perustelu………………………………
    3. En osaa sanoa

3. Autojen pakokaasupäästöt aiheuttavat (valitse yksi, merkittävin)
    1. Otsonipitoisuuden lisääntymistä maanpinnalla.
    2. Otsonipitoisuuden vähenemistä yläilmakehässä.
    3. Ilmaston lämpenemistä
    4. Pienhiukkasten määrän lisääntymistä ilmassa.
    5. Maaperän ja vesistöjen happamoitumista.
    6. Ei mitään näistä.
    7. En osaa sanoa.

4. Energian (sähkö, lämpö) tuottaminen fossiilisilla (öljy, kaasu, hiili) polttoaineilla aiheuttaa (valitse yksi)
    1. Otsonipitoisuuden lisääntymistä maanpinnalla.
    2. Otsonipitoisuuden vähenemistä yläilmakehässä.

3. Ilmaston lämpenemistä.
4. Pienhiukkasten määrän lisääntymistä ilmassa.
5. Maaperän ja vesistöjen happamoitumista.
6. Ei mitään näistä.
7. En osaa sanoa.

5. Yhden asteen lasku huonelämpötilassa tietää lämmitysenergian kulutuksessa ja kustannuksissa
1. 7.5 % kustannussäästöä.
2. 5 % kustannussäästöä.
3. 4.2 % kustannussäästöä.
4. En osaa sanoa.

6. Sekajätteen vieminen kaatopaikalle on
1. Kalliimpaa kuin biojätteen vieminen.
2. Samanhintaista kuin biojätteen vieminen.
3. Halvempaa kuin biojätteen vieminen.
4. En osaa sanoa.

IV. Tiedot ympäristönsuojelullisista ohjeista

Valitse oikea vaihtoehto

1. Biojäteastiaan voi laittaa ruoantähteet.
1. Samaa mieltä.
2. Eri mieltä.
3. En osaa sanoa.
4. Työpaikallani ei ole biojäteastiaa, siirry kohtaan 4.

2. Biojäteastiiaan voi laittaa uuniperunoiden alumiinikääreet.
1. Samaa mieltä.
2. Eri mieltä.
3. En osaa sanoa.

3. Biojäteastiaan voi laittaa paperiset lautasliinat.
1. Samaa mieltä.
2. Eri mieltä.
3. En osaa sanoa.

4. Ohjeet loistelamppujen käytöstä.
1. Annetaan palaa koko työpäivän ajan,
2. Huoneesta poistuttaessa lyhyehköksi ajaksi (esim. kahville) valot kannattaa sammuttaa.
3. Ohjeita ei ole annettu.

5. Suositeltava huonelämpötila työskentelyn kannalta on
1. 18-19°C
2. 20-22°C
3. 23-24°C

4. En osaa sanoa.

V. Ympäristömuutosten syyt

Valitse oikea vaihtoehto.

    1   Samaa mieltä 2 Eri mieltä 3 En osaa sanoa.

1. Ihmisen toiminnan seurauksena syntyvät rikki- ja typpipäästöt lisäävät ilmaston lämpenemistä.	1 2 3
2. Kaatopaikoilta ilmaan tuleva kaatopaikka-(metaani-)kaasu lisää ilmaston lämpenemistä.	1 2 3
3. Ihmisen toiminnan aiheuttama hiilidioksidipitoisuuden lisääntyminen lisää ilmaston lämpenemistä.	1 2 3
4. Ilmaston lämpenemisen syynä on otsonin väheneminen (otsoni"aukko") yläilmakehässä.	1 2 3
5. Epänormaalia ilmaston lämpenemistä ei ole tapahtunut.	1 2 3
6. Ohentuma yläilmakehän otsonikerroksessa johtuu pääasiassa kohonneista hiilidioksidipitoisuuksista.	1 2 3
7. Ohentuma yläilmakehän otsonikerroksessa johtuu pääasiassa kohonneista CFC- eli freonipäästöistä.	1 2 3
8. Maaperän ja vesistöjen happamoituminen johtuu kohonneista rikki- ja typpipäästöistä.	1 2 3
9. Maaperän ja vesistöjen happamoituminen johtuu kohonneista CFC- eli freonipäästöistä.	1 2 3
10. Ilmaston lämpenemistä lisääviä yhdisteitä syntyy tuotettaessa energiaa fossiilisilla polttoaineilla.	1 2 3
11. Ilmaston lämpenemistä lisääviä yhdisteitä syntyy jätteiden hajotessa kaatopaikalla.	1 2 3
12. Ilmaston lämpenemistä lisääviä yhdisteitä syntyy ajettaessa autolla.	1 2 3
13. Happamoitumista lisääviä aineita tulee ilmaan liikenteestä.	1 2 3
14. Happamoitumista lisääviä aineita tulee ilmaan tuotettaessa energiaa fossiilisilla polttoaineilla.	1 2 3

15. Mielestäni vakavin ympäristöongelma tällä hetkellä työskentelypaikkakunnallani on (valitsen yksi)
    1. Ei ole ongelmia.
    2. Vesien saastuminen.
    3. Ilman saasteet.
    4. Maaperän saastuminen.

16. Mielestäni vakavin globaali ympäristöongelma on (valitsen yksi)
    1. Ei ole ongelmia.
    2. Puhtaan veden puute.
    3. Ilmaston lämpeneminen.
    4. Kiinteiden jätteiden lisääntyminen.

VI. Ympäristötiedon lähteet

Valitse oikea vaihtoehto

1. Päivälehdet, TV ja/tai radio.
2. Ympäristöalan erikoislehdet.
3. Oman alan ammattilehdet.
4. Työnantajan järjestämä koulutus.
5. Viranomaisten tiedotteet.
6. Keskustelut työpaikalla.
7. Keskustelut vapaa-aikana.
8. Jokin muu lähde. Mikä……………………….
9. En ole saanut tietoa ympäristöasioista viimeisen vuoden aikana.

1 Täysin samaa mieltä 2 Jokseenkin samaa mieltä 3 Jokseenkin erimieltä   4 Täysin eri mieltä

2. Olen tietoinen edustamani yrityksen mahdollisista ympäristövaikutuksista.	1 2 3 4
3. Olen saanut riittävät ohjeet, miten toimia omassa työssäni ympäristöä huomioiden.	1 2 3 4

VII. Ympäristöasiat opiskelussa

1. Opintoihini opiskeluaikana on sisältynyt yksi tai useampi ympäristönsuojelukurssi,
   1. Kyllä
   2. Ei

2. Olen osallistunut työnantajan järjestämään ympäristöasioiden koulutukseen.
   1. Kyllä
   2. Ei
   3. Ei ole ollut koulutusta.

VIII. Taustatiedot

Valitse oikea vaihtoehto

1. Sukupuoli

    1. Nainen
    2. Mies

2. Ikä

    1. 20-30 vuotta
    2. 31-40 vuotta
    3. 41-50 vuotta
    4. 51-65 vuotta

3. Koulutustausta
    1. Ammattikorkeakoulu

        1. Tradenomi
        2. Insinööri, amk
        3. Muu, mikä…………

2. Korkeakoulu tai yliopisto
        1. Teknillinen korkeakoulu
        2. Yliopisto; tiedekunta………………………………
        3. Kauppakorkeakoulu
        4. Muu, mikä……………………………………………

3. Kouluasteen ammattitutkinto
        1. Merkantti
        2. Teknikko
        3. Muu, mikä……………………………………………

4. Opistoasteen tutkinto
        1. Merkonomi
        2. Insinööri
        3. Sairaanhoitaja
        4. Muu, mikä……………………………………………

5. Ei ammattitutkintoa

6. Työnantajani
        1. Teollisuus
        2. Palveluala
        3. Koulutusala
        4. Julkishallinto
        5. Kauppa

Appendix 3 Correlation tables

Table 21.   Correlation matrix for environmental behavior.

	1	2	3	4	5	6	7	8	9	10	11
1	1.000	.712**	.400**	.217**	.214**	-.049	-.008	.029	.082*	.069	.094**
2	.712**	1.000	.471**	.231**	.253**	-.045	-.008	.077*	.118**	.038	.149**
3	.400**	.471**	1.000	.442**	.296**	.091*	.041	.053	.073*	.028	.115**
4	.217**	.231**	.442**	1.000	.540**	.112**	.050	.153**	.082*	-.018	.005
5	.214**	.253**	.296**	.540**	1.000	.155**	.114**	.154**	.115**	-.014	.021
6	-.049	-.045	.091*	.112**	.155**	1.000	.186**	.049	-.050	.020	-.015
7	-.008	-.008	.041	.050	.114**	.186**	1.000	.098**	.089*	.034	-.044
8	.029	.077*	.053	.153**	.154**	.049	.098**	1.000	.266**	-.015	.008
9	.082*	.118**	.073*	.082*	.115**	-.050	.089*	.266**	1.000	-.082*	-.034
10	.069	.038	.028	-.018	-.014	.020	.034	-.015	-.082*	1.000	-.011
11	.094**	.149**	.115**	.005	.021	-.015	-.044	.008	-.034	-.011	1.000

Correlations were computed using the non parametric Spearman rank-order procedure (r_s)
** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).

Note: 1=Recycling of office paper, 2=Recycling of newspapers, 3=Recycling of cardboard, 4=Recycling of energy waste, 5=Recycling of organic waste, 6=Switching off the computer at the end of the working day, 7=Switching off the lights in empty rooms, 8=Copying double-sided, 9=Printing double-sided, 10=Not using disposable dishes, 11=Not using own car.

Table 22. Correlation matrix for general environmental behavior, gender, age, and education.

	GEB	Gender	Age	Education
GEB	1.000	-.109**	.113**	-.027

Correlations were computed using the nonparametric Spearman rank-order procedure (r_s)
** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).
Note: GEB=general environmental behavior

Table 23. Correlation matrix for specific behavior and gender, age, and education.

	Gender	Age	Education
1	-.081*	.108**	-.095*
2	-.049	.083*	-.076
3	.091*	.023	.066
4	.029	-.133**	.044
5	.079*	-.153**	-.051
6	.216**	-.080*	.064
7	.049	-.178**	.053
8	.081*	-.119**	.025
9	-.108**	-.024	-.119**
10	.033	.003	-.008

Correlations were computed using the nonparametric Spearman rank-order procedure (r_s)
** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).
Note: 1=Recycling office papers, 2=Recycling newspapers, 3=Recycling cardboard, 4=Recycling energy waste, 5=Recycling organic waste, 6=Switch off the computer when leaving the office, 7= Switch off the lights in empty rooms, 8=Double-sided copies, 9=Double-sided prints, 10=Not using disposable dishes.

Table 24. Correlation matrix for general environmental knowledge (GEK), general environmental behavior (GEB), specific attitudes (SA), and subjective norms (SN).

	GEK	GEB	SA
GEK	1.000		
GEB	.024	1.000	
SA	.031	.088*	1.000
SN	-.009	.091*	.140**

Correlations were computed using the nonparametric Spearman rank-order procedure (r_s)

** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).

Table 25. Correlation matrix for environmental training course (ETC), general environmental knowledge (GEK), general environmental behavior (GEB), specific attitudes (SA), and subjective norms (SN).

	ETC	GEK	GEB	SA
ETC	1.000			
GEK	.105**	1.000		
GEB	.103**	.024	1.000	
SA	.100**	.031	.088*	1.000
SN	.097**	-.009	.091*	140**

Correlations were computed using the non parametric Spearman rank-order procedure (r_s)
** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).

Table 26. Correlation matrix for specific statements, costs, and environmental impacts of recycling.

	Recycling lowers waste costs	Recycling lowers environmental impacts
1	.143**	.019
2	.136**	.025
3	.182**	.138**
4	.154**	.130**
5	.197**	.087*

Correlations were computed using the non parametric Spearman rank-order procedure (r_s)
** Correlation is significant at the .01 level (2-tailed). * Correlation is significant at the .05 level (2-tailed).

Note: 1=Recycling of office paper, 2= Recycling of newspapers, 3= Recycling of cardboard, 4= Recycling of energy waste, 5= Recycling of organic waste.