Master thesis

Environmental Sustainability and Firm Growth

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ABSTRACT

The presence and magnitude of business opportunities via becoming more environmentally sustainable is expected to vary greatly between firms. This study examines these differences by analysing the interaction effect of firm characteristics and sustainability on the dependent variable revenue-evelopment. The results indicate that for older firms and firms having consumers as a target group, a more positive relationship between sustainability and revenue-developement is present compared to younger firms and firms with other businesses as a target group. Furthermore, the communication of sustainability towards the firm's employees indicates a greater positive predictor of firm growth for older firms as compared to younger firms.

1   Introduction

Conventional wisdom states that being or becoming more sustainable means incurring costs. Indeed, many economic agents are assumed to focus on short term profits rather than on a long term change towards environmental sustainability which they associate with higher costs and a loss of previous investments. Increased societal pressure to sustain the environment has moderated this belief, however, and has created profitable business opportunities. Nonetheless, the presence of these business opportunities varies greatly between firms. Both the business environment that a firm operates in and the firm's specific characteristics are likely to have an influence on the frequency and magnitude of business opportunities in becoming more sustainable.

Given the growing market for sustainable products, one could expect sustainable firms to grow accordingly. Yet it cannot be stated that the most sustainable firms will also grow the most, largest, or fastest. Under the assumption that costs are involved in becoming sustainable, a different degree of sustainability might be prefered to a fully sustainable firm. Conversely, it is very well possible that more sustainable firms actually grow less compared to less sustainable firms. This paper will therefore focus on the following research question:

> *Which types of firm experience a more positive relationship between sustainability and*
> *firm growth, and what is the role of the communication of sustainability in this regard?*

The types of firm referred to in the research question are categorized by size, innovativeness, age, target group, communication of sustainability, and country of origin. In scientific literature, relatively few empirical studies have been published in relation to these specific characteristics. The majority of papers in scientific journals approach this topic from a strictly theoretical point of view. The lack of empirical studies can partly be explained by the fact that the issue is highly complex, which makes it difficult to adequately measure sustainability at the firm level. In this paper, several relevant theories will be presented and, when possible, these theories will be empirically tested. Given the diversity and frequent opposition of the pertinent theories, this study can to some extend be seen as exploratory in nature.

The geographical focus of this paper is confined to the coastal zones of Shanghai and Rotterdam. For that purpose, data from 337 Chinese and Dutch companies have been collected and represent the focal point of the empirical research in this paper.

First, the general externality framework will be elaborated upon and used to describe the environmental sustainability issue from an economic perspective. This will lead up to the conceptualization of the specific sense in which the term 'sustainability' is used in this paper. Second, the general relation between environmental sustainability and financial performance will be discussed. Thereafter, empirics and theories will be expounded in order to explain which types of firm could exploit being sustainable relatively more successfully. Fourth, the empirical data and methodology underlying this paper will be described, followed by an estimation of the results. Lastly, the results will be discussed and conclusions will be drawn, subsequently followed by an account of the limitations of the present study, directions for further research, and policy implications.

2   Concept of sustainability

In the last decades many different concepts concerning environmental sustainability have been constructed and promoted, with minor to significant differences in meaning and scope. This multitude of definitions, which is proposed to exceed 300 (Ehrenfeld, 2008), clearly indicates the complexity of the topic. In the following paragraphs a descriptive overview is provided that includes the most relevant aspects of the issue. Furthermore, a distinction is made between ecological-economical perspectives and macro-micro perspectives.

Most definitions and frameworks surrounding environmental sustainability view the world from a macro perspective. The underlying study of this paper is aimed at the level of the firm, thus implying a micro perspective. However, due to the interconnectedness of various aspects in macro and micro dimensions, a global perspective is necessary in order to obtain a holistic and more complete view of the topic (Ariff, 1995).

2.1   **Economists versus Ecologists**

"Ecologists look at sustainability from the point of view of an ecological system of which humans are just one part... Human interests are not regarded as paramount." (Perman et al., 2003, p. 93) Ecologists tend to view the ecological world as a stock of resources which has a 'natural growth' (i.e. a renewable resource). If in a certain period the harvest is lower than the natural growth, stock size will increase and vice versa. A 'sustainable yield' is obtained when the amount of harvest equals the natural growth. Ceteris paribus, this can be sustained indefinitely.

The maximum sustainable yield is, according to many ecologists, the ideal rate. In economics however, this is often not efficient. Economists, contrary to ecologists, regard human interest (i.e. human utility) as the ultimate goal and ecology as a considerable constraint on human utility.

The economists' emphasis on human interest implies that, from a purely economic perspective, zero pollution does not necessarily have to be efficient, and is often arguably inefficient (Perman et al., 2003). Instead, the optimum amount of pollution can be determined in an externality framework which will be explained in the following section.

2.2   **Externalities**

The general paradigm related to environmental sustainability states that the market does not redistribute all resources in the most efficient way due to the inexistence of ownership rights on resources like air and water, resulting in an externality. The most frequently used definition of an externality is:

"An external effect, or an externality, is said to occur when the production or consumption decisions of one agent have an impact on the utility or profit of another agent in an unintended way, and when no compensation/payment is made by the generator of the impact to the affected party." (Perman et al., 2003, p. 134)

Note that an externality can be of both a positive as well as a negative nature, and accordingly we speak of positive or negative externalities. When concerning the issue of environmental sustainability this is mostly in the context of a negative externality.

Lacking ownership rights can result in the use of these resources at zero cost even though the actual costs are greater than zero. This provides incentives for excessive use of the resources rather than to the socially optimal level of usage. In this scenario, no single individual will burden the cost, but instead a collectivity of individuals incurs the costs.

What makes this phenomenon especially troublesome and complex is the fact that this burden is often carried on to future generations. e.g.: The costs incurred by resource depletion will have an impact on the ability to exploit resources for future generations rather than on the generation that is responsible for generating the costs. This inter-temporal dimension of the externality not only adds to the multifariousness of the situation, but it also brings about the ethical issue of whether or not it is right to make future generation suffer the adverse consequences of the actions of previous generations.

The conventional solution to an externality problem is the internalization of the externality. This internalization can take place when property rights are assigned and transaction costs are not prohibitively high (Coase, 1960). Yet these conditions are difficult to meet in the environmental externality context. The assignment of property rights on resources such as water and air would not only be highly impractical, but it can also be considered immoral to own and sell resources that are essential to human life. In addition, since basically all people are involved in this matter, bargaining costs would be exceptionally high, making it almost certainly not worthwhile to internalize the externality at all. Finally, the future generations that are incurring the costs are obviously not actively able to compensate the producer of the externality in any way.

It can thus be stated that the internalization of the sustainability problem cannot take place by means of the conventional path. There is a substantial number of scientific papers arguing that the internalization will occur naturally through technological innovations and support a more laissez-faire policy (Anderson and Leal, 1991; Beckerman, 1974; Taylor, 1994). However, most economists acknowledge the necessity of government intervention (Weitzman, 2007). In addition, Bakel et al. (2007) states that the issue is too complex and interconnected to be solved by individual firms.

2.3   Uncertainty and irreversibility

When determining which actions to undertake in order to internalize a particular environmental externality, many complications arise. One of the most apparent issues is the anticipation of future scenarios. The ecological system is evidently an extremely complex mechanism with many interdependent factors. Scientists are not aware of many (some might argue most) of the workings of the ecological system at the current moment. Besides projections with risk there are also many consequences and situations where the outcomes are completely unknown (Knight, 1921).

It can be stated that among both scholars and managers there is very little consensus about the effect that resource depletion has on the environment (Redclift, 1989). In addition, valuing amenities like the existence of polar bears besides their role in the ecology is both practically difficult and most probably economically inefficient (one would have to inquire the value that every individual places on these amenities).

Another aspect that complicates an accurate valuation of the environment is irreversibility and the uncertainty that surrounds it. For example, when a certain species is extinct this is

considered to be irreversible. Likewise, it is believed that the emission of anthropogenic greenhouse gasses can reach a threshold level after which the expected consequences are irreversible (Lyytimäki and Hildén, 2007).

As argued in Penn State (2005): *"Think about the situation where you are in a canoe on a river with a waterfall. You may want to know the location of the waterfall early enough to be able to avoid going over the waterfall. The situation for climate thresholds is similar. One may want to see early warning signals before it is too late to avoid the threshold response."*

When translating uncertainty and irreversibility to a firm perspective, one could argue that the uncertain outcomes of becoming sustainable mitigate the propensity of firms to actually become more sustainable. The motivation for firms to become more sustainable is however not per se profit maximization but could very well be to internalize the externality. In this line of reasoning, a firm could be willing to incur additional costs or uncertainty in order to become more sustainable. From a research perspective it is difficult to distinguish between a profit maximizing motivation and a motivation to decrease environmental impact. In section 3 a further elaboration will be given on the incentives of firms towards becoming more sustainable.

2.4   Conceptualization

As mentioned before, there are many differing conceptualizations surrounding sustainability and the environment. This may partially be attributed to the fact that it is a new normative concept (Ehrenfeld, 2008). In addition, Ehrenfeld argues that due to the ethical dimension, sustainability concepts can be seen as 'essentially contested concepts' which entails that there is *"...an ongoing, never-ending dispute about both the meaning and the degree to which one can attain whatever is named by the concept."*(Gallie, 1956, p. 97)

Given the multitude of available conceptualizations, an extensive overview is not the aim of this paper. The general externality framework as presented above is applicable to the majority of definitions. In the following part, a descriptive overview will be given of certain valuable and applicable concepts that are relevant to the scope of this research.

It can be stated that the '3P' approach (People, Planet, and Profit) which describes the interdependence between social, environmental and economical aspects, is the most popular and commonly used definition to describe the sustainability externality (Kemp and Martens, 2007). In fact, from a theoretical point of view, this concept clearly encompasses the holistic and interdisciplinary approach needed for 'the sustainability problem'. However, the 3P

approach has an equiproportional focus on social aspects, which is not part of the scope of this paper. Therefore the 3P approach is not suited for this study. It is being acknowledged that social factors are interrelated (as indeed the concept of the 3P approach reflects) and this is accepted as a limitation of the study.

Goodland and Daly (1996) clearly distinguish between social sustainability, economic sustainability and environmental sustainability. While recognizing an overlap and linkages between the concepts, they maintain that the three concepts are best addressed separately. Goodland and Daly (1996) have constructed the following concept of 'environmental sustainability':

"...holding waste emissions within the assimilative capacity of the environment without impairing it. It also means keeping harvest rates of renewables to within regeneration rates." (Goodland and Daly, 1996, p. 1003).

In the literature there is still no consensus about whether to address the concept as 'sustainability' or 'sustainable development'. Ones in favor of the sustainability concept argue that sustainability should be attained and not managed (Ehrenfeld, 2008). Simply put, sustainability is a final state where consumption is not higher than growth. Even though this is the final goal, it can be argued that in order to reach this final state, many innovations and developments must take place that enable the characteristics of the 'final goal' to be unknown. Since it is unknown what the final sustainable state is exactly, it cannot be used as a practical goal. In contrast, sustainable development can be used as a target. This concept of sustainable development is most commonly defined as:

"Sustainable development is development that meets the need of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environmental Development, 1987, p. 1).

Even though the term sustainable development can be seen as a contradiction in terms (either one sustains or develops), the explanation of the term is not a paradox. It is generally accepted that the current state of the earth is unsustainable (Ehrenfeld, 2008). In this context, sustainable development would simply imply the development towards being more sustainable. Accordingly, the majority of the participating firms in this study (and around the world) are not fully sustainable. Instead, specific actions of firms towards being more sustainable have been surveyed. Thus, activities of sustainable development were measured

and not whether firms were fully sustainable or not. In this context it would therefore be more appropriate to use the concept of sustainable development.

Given the purpose of this paper, a combination of the concepts 'environmental sustainability' and 'sustainable development' is most applicable. Within this configuration, which could be called 'environmental sustainable development', there is a focus on the development towards a more synergetic interdependence between the environment and the economy.

3   Firm growth and sustainability

Whether or not sustainability is an issue that humanity should be wary about and what the exact consequences are of not being sustainable, is to some extent an irrelevant factor in the decision-making process of individual firms to undertake particular strategic actions. The fact of the matter is that sustainability is valued by society, which gives rise to a situation in which being more sustainable can actually become a preferred strategic action for firms under certain conditions (irrespective of what the actual consequences are in terms of sustaining the planet). Society is increasingly willing to pay a premium for more sustainable products, hence creating business opportunities.

In this matter performance can be measured in several ways. Financial performance is commonly used as a general measure of a firm's overall financial health over a given period of time. In this study, financial performance will be measured by the development of revenue. This measure is often used as a growth indicator of the firm and can be seen as a competitive strategy for consecutive firms (Baumol, 1967). Baumol argues that the primary goal of many enterprises is some growth-related factor such as sales revenue, unit sales or market share.

As mentioned in section 1, the growing market for sustainable products, does not imply that the most sustainable firms will also grow the most, largest, or fastest. Under the assumption that costs are involved in becoming sustainable, a different degree of sustainability might be prefered to a fully sustainable firm. In addition, multiple factors could influence this relationship which will be elucidated in forthcoming sections.

As Waddock and Graves (1997) stated, there are three distinct perspectives that explain the relation between environmental and financial performance: (1) A "negative association," where superior environmental performing firms incur a competitive disadvantage due to the higher cost that is required in order to enhance environmental performance; (2) a "neutral association," where there is no causal linkage between environmental performance and

financial performance; and (3) a "positive association," which suggests that there is a financial reward to superior environmental performance.

3.1 **A negative association**

Given the theoretical externality framework, it can be seen as surprising that there is a relatively limited amount of empirical results that indicate a negative association between environmental and financial performance. Jaggi and Freedman's (1992) study of 13 pulp and paper companies found a relatively small, but significant, negative relationship between environmental and financial performance in the short run. Wagner et al. (2001) found a significant negative relationship as well.

The most straightforward barrier towards environmental sustainable development of firms is the fact that many wasteful and polluting goods seem relatively inexpensive because ecological costs are not incorporated (as the externality framework inherently postulates). If the firm has the opportunity to purchase either a good that has incorporated the ecological costs or a good that has not incorporated these costs, ceteris paribus, it is clearly not profit maximizing for the firm to purchase the good for the 'full' price. In fact, it might not even be profitable at all to incorporate these costs.

If it is assumed that everyone values the sustainability of the environment to some extent, the Pareto optimal could be reached if everyone would implement the new activity/policy. However, when these actions decrease the performance of a firm, every individual firm has an incentive to deviate and not implement the activity/policy.

It has also been said that the mindset within firms is a significant barrier to environmental sustainable development (Porter and Van der Linde, 1995). It is argued that companies should not see the environment as *"an annoying cost or postponable threat"* (Porter and Van der Linde, 1995, p. 114). A lack of knowledge and information about the issue of sustainability encourages the firms to retain the status quo. The lack of information is likely to blur the outcome of potential activities towards being more sustainable and thus increases the risk of these activities. In this context, sustainable activities which are actually profitable might not have a positive NPV due to the high discount rate resulting from high uncertainty. Another barrier that could prevent this transition is the fact that a substantial adaptation in the organizational structure is often necessary, which is accompanied by high costs (Shrivastava, 1995).

Currently, a profitable strategy for firms is to maintain what can be referred to as a 'throw-away' economy, which is to a large extent at odds with a sustainable economy since it creates a substantial amount of waste. Businesses in this economy have an incentive to maintain this type of industry since it generates substantial repetitive purchases which leads to profit maximization (Hirschman and Holbrook, 1992). This generates a significant barrier for firms to move towards being more sustainable.

3.2   **A positive association**

A vast amount of studies support the notion that environmental sustainability helps to reduce costs and risks and improves market position. A firm can, by being environmentally sustainable, differentiate their products, save resources on regulatory costs, and save on costs of resources, capital and labor. Porter and Van der Linde (1995) argue that the positive relationship between sustainability and performance can be differentiated in revenue-enhancing effects and cost-decreasing effects. Even though revenue-enhancing effects seem more applicable to this study, a cost-decreasing effect can have an indirect effect on revenue as well. When a firm can decrease its costs, the firm has the opportunity to ask a lower purchasing price and thereby increase its sales. In this section, a distinction will be made between direct and indirect relationships between sustainability and revenue development. The direct effect on revenue development is however expected to be greater compared to the indirect effect on revenue.

At the moment, the market for environmentally sustainable products can be seen as a niche market (though the market is expanding). Many consumers favor sustainable products, and a certain fraction of consumers is even prepared to pay a premium for these kinds of products. Differentiating your products can therefore attract new customers and thereby increase revenue.

The pivotal role of government in the internalization of the sustainability externality is clearly illustrated by the increase in regulations for firms with regard to pollution and waste. An environmentally sustainable strategy could in this context create first-mover advantages for firms. Since much stricter regulations are expected to be implemented in the coming years, a firm can attain a competitive advantage by reducing the amount of pollution they emit and thereby decrease future regulatory costs. As an example, Dupont has lobbied to ban CFC's because the firm had superior technology concerning substitutes of this polluting chemical (Reinhardt, 2000). Especially when regulations result in market incentives, like in the case of

tradable permits on CO^2 emissions, firms can attain a competitive advantage by being relatively more sustainable. The reduction on regulatory costs is mainly cost decreasing however and is not expected to influence revenue substantially.

The increased societal attention towards environmental sustainability has brought about an augmented consumer demand for products with a relatively low impact on the ecological environment. Consumers often negatively value the impact that firms, products, and humans have on the environment and are consequently willing to pay a premium for products with a lower ecological impact. This new market has created novel business opportunities, making it ever more profitable for firms to improve their level of sustainability. It can be argued that the market for sustainable business will continue to develop and that being sustainable shall eventually become the rule rather than the exception. Such market projections also produce possibilities for first-mover advantages among firms. Especially given the presence of many complex workings in sustainable business, being early in this market enables the firm to gain valuable knowledge about the market and hence acquire a competitive advantage. In contrast, it can be argued that second-mover advantages might be present in terms of learning effects and the relatively high development costs of new production methods.

There are numerous cases of firms that have managed to preserve resources by enhancing their sustainability. Firms like Ford, M3, and British Petrolium have saved on materials, energy, and/or services to an extent that surpasses their initial investment costs. Porter and Van der Linde stated: *"Reducing pollution is often coincident with improving the productivity with which resources are used."* (Porter and Van der Linde, 1995, p.98). Their statement is however frequently criticized, especially by economists, on the assumption that these 'win-win' situations are merely marginally present. Ambec and Barla (2006) provide an overview of empirical studies connected to Porter and Van der Linde's statement and conclude that there is more evidence against than in favor of their statement, but suggest that more research should be conducted in order to draw a valid conclusion in this area.

It can also be argued that superior environmental performance may reduce the costs of capital and labor. Banks nowadays commonly screen firms on their environmental performance, which results in more sustainable firms attaining credit with greater ease. Montel and Debailleul (2004) argue that this assessment serves as an indicator of the level of risk through a mitigation of regulatory and legal risks. A decrease in the costs of labor can occur through a better image of the firm. Lankoski (2006) argues that a boost in environmental performance reduces the costs of illness, absenteeism, and recruitment. Since a certain fraction of the

population values the environment, it is not unreasonable to assume that employees value the extent of sustainability of their own firm. A more sustainable image may increase the productivity of employees through a better morale and motivation. Working at a sustainable firm can increase the utility of the employee. Therefore, in a case of similar compensation, employees might prefer to work for the more sustainable firm (possibly a fraction of workers might even be willing to accept a lower wage at a more sustainable firm).

In the scientific literature one can find a relative overrepresentation of empirical studies that display a positive relationship between environmental and financial performance. A possible explanation for this is the desirability of researchers to find and support a positive relationship resulting in a publication bias. As stated by Gould (2002) *"In publication bias, prejudices arising from hope, cultural expectation, or the definitions of a particular scientific theory dictate that only certain kinds of data will be viewed as worthy of publication, or even of documentation at all."* (Gould, 2002, p. 764). This publication bias should however not be confused with fraud, given that no conscious intent is present.

Another explanation for the overrepresentation of positive studies could be that firms only actualize certain activities when they are sufficiently confident that it will have a positive influence on financial performance. Given the substantial amount of risk and uncertainty embedded in activities to reduce environmental impact, projects will be executed only when the expected gains will be high enough to cover the risk of a financially negative outcome.

In conclusion, cost reductions on resources, labor, and capital can have an indirect effect on the growth of a firm while the increasing willingness to purchase sustainable products by customers can have a direct positive effect on revenue. The latter can arguably be seen as a more substantial predictor for revenue development.

4   Firm Characteristics

Whether being or becoming more sustainable is a revenue-enhancing pursuit is not certain and is expected to depend on a variety of aspects. For some firms it might be a desired strategy while for others this may not be the case. The aim of this study is to shed light on the interacting relationship between firm characteristics, sustainability, and firm growth. The types of firm will be categorized according to their their size, age, communication of sustainability, target group, and country of origin. Relatively few empirical studies have been found that research these specific characteristics.

It is expected that the presence of business opportunities differs strongly per sector and even within sectors (Shrivastava, 1995; Walley and Whitehead, 1994; Marron, 2003). It is argued by Lankoski (2006) that becoming more sustainable is more likely to be profitable in highly regulated sectors. This claim is supported by several empirical studies (El Bizat, 2006; Reinhardt, 2000). Given the relative consensus concerning sector differences, it will not be the focus of this paper. In the following sections, some empirical studies and theories will be outlined that elucidate the relationship between sustainability and the aforementioned aspects.

4.1 **Size**

Small firms cannot be characterized as little big firms (Dandridge, 1979; Welsh and White, 1981). Accordingly, structural differences can be found in the way small and large firms engage in sustainability. There are however contradicting stances on the nature of such differences. Taylor and Walley (2003) argue that smaller and more entrepreneurial firms more aptly incorporate the moral dimension of sustainability since smaller firms operate with motivational factors tied down to the individual actor (i.e. the entrepreneur) in contrast with the multiple stakeholders at larger firms. Conversely, Leoutre and Heene (2006) argue that small businesses encounter additional barriers to becoming sustainable due to the fact that they have relatively fewer financial resources than larger firms. Sustainability arguably does not yield returns immediately; therefore a financial resource constraint might prevent firms from becoming sustainable. Consequently, Gonzalez-Benito et al. (2006) argue that larger firms face more intense societal pressure to become environmentally sustainable. The contrasting theories compromise making concrete expectations concerning this relationship.

4.2 **Innovation**

When discussing the relationship between sustainability and innovation, it is important to clearly conceptualize innovations. Schumpeter (1934) defined innovations as the carrying out of new combinations. An important question here would be *'New to whom?'* A product or process that is new for an individual might not be new for the firm, sector, country or the complete business community the individual is operating in. Would one still constitute this product or process as an innovation? Defining an innovation can therefore to some extent be seen as subjective. For the purpose of this paper a relatively broad definition of innovation is used: *'The carrying out of combinations that are new to the firm'*.

A substantial array of scientific papers supports the notion that the internalization of the environmental externality must proceed via technological innovations (Anderson and Leal,

1991; Beckerman, 1974; Taylor, 1994). Heaton (2000) argues that a large proportion of newly introduced innovation in fact enhances environmental performance (i.e. ICT) as a result of decreased pollution and a more frugal use of resources. Of course, innovations do not automatically imply better environmental performance. It can be argued though that better environmental performance automatically proceeds through innovation, given that one has to change the production process, thus giving rise to process innovation. Under this assumption, it can be argued that more innovative firms are better able to implement sustainability policies successfully, hence innovation could be an interaction variable with respect to the relationship between sustainability and performance. Accordingly, Arora and Cason (1996) argue that, with respect to environmental sustainability, the more progressive and innovatively insistent a firm is the more expectations are present for environmentally sustainable policies.

An innovation that enables the firm to move towards a more sustainable business can go through both product and process innovations. Process innovation will more likely decrease the costs of a firm and therewith its profitability. Conversely, product innovations can have a more substantial effect on the revenue development of a firm. One could therefore expect that firms that apply product innovations have a stronger relationship between sustainability and revenue development compared to firms that apply process innovations.

4.3   Age

The increased attention towards the environment and accompanied business opportunities has made both existing as well as new firms increasingly inclined to be sustainable. It can be argued however that older firms have to explicitly modify their company structure in order to become sustainable. This structural change is often accompanied by the need the invest money. The amount of this investment may be comparatively larger for older firms than for younger firms since the latter have a less embedded company structure than the former, which makes it less costly to adapt for younger firms (Prahalad and Bettis, 1986). Start-ups will clearly not have to incur this investment cost at all. In addition, it can be argued that given the increased attention towards sustainability in the past years, during the start-up period of relatively young firms greater incentives were present to start a sustainable firm compared to older firms. The arguments mentioned above would imply that younger firms have a competitive cost advantage towards becoming sustainable. No empirical research has been found that specifically studies the presence of this relationship.

4.4   **Target group**

It is generally accepted that the environmental performance of a firm can improve the company image and thereby increase the number of sales as customers are willing to pay a premium for more sustainable products. Yet there is no strong empirical evidence that customers are truly influenced by the 'green' image of a firm. (Ambec and Lanoie, 2007). This lack of empirical evidence might be due to the fact that even though consumers may be aware of the environmental products, they are unlikely to be aware of the firm's environmental performance as measured through the effective impact of their production processes on the environment. One could contend that even the very firms themselves may not be aware of these figures.

As mentioned earlier, the increased societal attention for sustainability is actively enforced by the government. Governments have increasingly engaged in 'green public purchasing' (Kunzik, 2003) which entails that governments asses environmental performance and use this as a criterion in determining their suppliers for goods and services. Purchasing by the government often consists of a substantial amount of a country's GDP. One could therefore expect firms with the government as a target group to have a more positive relationship between sustainability and revenue development as compared to firms with other businesses as their target group.

4.5   **Communication of sustainability**

Consumers are more and more demanding that firms produce products and services that are consistent with prevailing environmental values. By communicating environmental sustainability the firm attempts to increase the number of consumers and/or the products sold and thereby clearly attempts to positively influence the revenue development. As a result, firms have become more concerned with and conscious of the corporation's overall environmental reputation. This concurrent requirement to improve environmental development stimulates firms to seek out innovative ways to utilize environmental marketing and management as a source of enhancing reputational and competitive advantage, and therewith attract more customers (Miles et al., 2000). Shane and Spicer (1983) furthermore found that negative environmental information had a negative effect on returns due to changes in investors' future income projections.

By the act of communicating, a firm attempts to establish publicly that the company is keenly committed to the environment. However, communicating environmental commitment does

not necessitate that the firm is in reality performing well on environmental aspects. Environmental marketing can be and is in fact used as a profit maximizing tool in order to gain market share or a higher margin. A firm could a priori invest a small amount in environmental activities in order to use this in a marketing campaign and thus increase its performance. In this context, investing in (a small amount of) environmental activities which would otherwise be profit decreasing can be made profitable when one is able to communicate these aspects to consumers and thereby increase revenue (or profit). The opportunity to increase one's performance by communicating environmental activities without actually applying a similar strategy is illustrated clearly by Ambec and Lanoie (2008): *"Consumers may be aware of a company's environmental performance through its offer of green products, but they are less likely to be familiar with its environmental performance as measured by its emissions in water or the atmosphere."* (Ambec and Lanoie, 2008, p.47).

Besides providing a business opportunity, communicating its environmental impact to customers may actually be a necessity when a firm is more sustainable. In order to recoup the investment costs that might have been incurred in becoming more sustainable, customers have to be made aware of this fact in order for them to pay a premium or larger quantities.

As mentioned in section 3.2, the environmental performance of a firm can also have an effect on the productivity and recruitment of employees. Communicating the environmental performance within the firm can therefore be beneficial. No empirical studies have been found that attempt to test this statement.

4.6   **Country of origin**

Whether or not profitable opportunities are present is expected to differ significantly depending on the country in which the firm is operating. The business environment in a country can have a severe effect on the presence of business opportunities. A business environment can be defined using the Political, Economic, Social, and Technological (PEST) forces (Brooks et al., 2004). When examining distinct countries such as China and the Netherlands, central differences can be distinguished when concerning these aspects.

Political: For the scope of this paper, an extensive description with reference to the differing political systems is not given. However, as noted earlier, the government can be seen as a crucial player in the internalization process. Therefore a tentative elaboration of the consequences of differing political systems on the environmental externality will be provided.

The Chinese government has comparatively more power than the government of the Netherlands, which makes unpleasant government intervention less susceptible to negotiations. As a result, policies to internalize the externality could be implemented more straightforwardly. In addition, it can be argued that sustainability goals and policies are long term goals and thus supersede and compromise temporal governments (Kemp en Martens, 2007). The Netherlands will incur this problem to a greater degree since the Dutch governmental system can be depicted as a more democratical system compared to that of The People's Republic of China[1].

It can be argued that a barrier for imitation of sustainable activities enhances the probability of profitable exploitation (Reinhardt, 1999). Becoming more environmentally sustainable often means that one has to innovate. If these innovations can be imitated more easily, there will be a smaller chance that the innovation will create a competitive advantage and thereby ex-ante decrease investments to create these innovations. It can likewise be argued that the system for the protection of Intellectual Property Rights (IPR) is less developed in China compared to the Netherlands, (Feng, 2003) which decreases the number of business opportunities to becoming sustainable. The fact that China is currently the second largest investor in research and development in the world could however indicate that a less developed IPR system does not influence investment substantially.

Economic: The political system of the People's Republic of China has prevented the enlargement of the economy for a long time, but from 1976 onwards, the death of Emperor Mao and the subsequent reorganization of the country paved the road for the exceptional economical growth experienced in its recent history. The Netherlands on the other hand has been growing at a relatively lower pace, but for a much longer period of time. Table 1 in appendix A illustrates, among other macro-economic data, that China had almost four times the GDP of the Netherlands in 2007. In contrast, their GDP per capita – the indicator of the development of a country (Bernhardt, 2007) – is 18 times smaller than the GDP per capita of the Netherlands. This relationship can be translated into relatively high value-added industries in the Netherlands and low value-added industries in China.

It can thus be stated that in terms of economic performance, significant differences are present. The 'Environmental Kuznets Curve' (EKC) states that this has an influence on the perceived valuation of the environment (Kuznets, 1955). This theory states that environmental

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[1] The Communist Party of China (CPC) is the founding and ruling party of The People's Republic of China. The power of this party is not governed via an electoral system of the inhabitants of China.

degradation shows an inverted U-shaped correlation with economic development (i.e. GDP per capita). In the early stages of economic growth, degradation and pollution increase, but beyond some level of GDP per capita the trend reverses. Relatively high economic growth levels lead to environmental improvement. The environment can here be seen as a luxury good. When assuming that the environmental Kuznets curve is correct, it can be postulated that China will value the environment less than the Netherlands, given their lower GDP per capita. Stern (2004) however argues that this inverted U-shaped relationship has not been observed in practice.

Social: The less developed economic state in China as contrasted to that of the Netherlands also influences the social characteristics of the respective countries. Given the greater necessity for employment in China than in the Netherlands, (China does not have any national social security legislation) the bargaining power of employers is arguably higher in China, resulting in less health conscious employment and looser regulations on safety. This aspect could create less pressure on the Chinese society to change towards a more sustainable business strategy (i.e. via legislation). In contrast, Ambec and Lanoie (2007) argue that when emissions affect the health of the workers, this creates opportunities to decrease the cost of labor (as mentioned in section 3.2) by becoming more environmentally sustainable.

Technology: Developing countries such as China are often characterized by a lower technological state and therefore can, to a larger extent, take advantage of the present and newly invented technologies developed in other countries. China can thus experience relatively more transitional economic growth by implementing innovations that were made elsewhere. Parris and Kates (2003) argue that this reasoning enabled the Chinese economy to grow substantially from 1997 until 2000 while decreasing the use of fossil fuels. This effect is decreasing though since the technological state of the country is increasing rapidly. Currently China has the second largest R&D budget in the world, which is a clear indication of the strategy of the country towards developing new technology themselves. Given the vital role of innovations in the internalization of the externality, one could argue that China would have fewer opportunities to profitably exploit a sustainable business. No empirical studies have been found to support this statement.

5 Empirical analysis

5.1 Sample selection

In order to gather data, a questionnaire has been constructed which is supplied in appendix B. In order to obtain a sufficiently large sample, the scope of this study was limited to the manufacturing sector, which represents a relatively large amount of firms in both China and the Netherlands. The conduction of questionnaires was executed by 23 Master students from the Erasmus University Rotterdam. The Chinese respondents were approached by e-mail (via a digital questionnaire) and during visits to certain companies on site. The Chinese company visits included two kinds of interviews. Where possible, in-depth interviews were conducted; otherwise a general questionnaire was filled in. Where necessary, the interviews were conducted in English using translators. The questionnaire was furthermore translated into Chinese in order to increase the response rate and to obtain a more representative sample. Accordingly, the Dutch questionnaires were conducted via telephone interviews. In the end, the sample consists of 177 manufacturing firms in the region of Shanghai and 160 firms in the Rotterdam manufacturing sector.

5.2 Statistical methods

To explore the relationship between revenue development and environmental sustainability, a binary logistic model was applied. The binary logistic regression was used since the dependent variable was re-coded into a dichotomous format (variable can take on the values of either 0 or 1) and the independent variables are of the continuous, dichotomous, or categorical type[2].

The statements postulated in section 4 can be characterized as moderation effects, which means that certain firm characteristics and the extent of environmental sustainability form a relationship with each other that moderates the effect a variable has on a firm's revenue development. Given the fact that a binary logistic regression model is used, computing conventional interaction terms using a multiplication of the independent variables is not valid (Norton et al., 2004). Moreover, using a multitude of interaction terms in a regression model often results in multicollinearity complications. For this reason the sample is divided into sub-samples based on the specific firm characteristics being tested. Separate regressions have been run for firms that either have or do not have these certain characteristics. Thereafter, results of

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[2] Qualitatively it is most likely that the outcomes of Probit and Logit models estimate similar results, but the Logit model is chosen because of its computational ease.

the regressions will be compared with each other by computing confidence intervals of the regression parameters. Should the confidence intervals in the sub samples not overlap, a statistically significant difference can be concluded.

5.3   Descriptive statistics

In the following section the dependent, independent, and control variables will be elaborated upon. In order to give an indication of the characteristics of the variables, their values and corresponding distributions will be displayed.

5.3.1   Dependent variable

The dependent variable used for the research attempts to reflect the company's gorowth, which is measured by the development of revenues. The numerical revenue development a firm has made provides an applicable indication of a firm's growth. However, since 74 of the 338 respondents actually indicated the annual revenue as an exact number, using this variable may not be representative for the complete sample size. Instead, the variable indicating whether or not the firm had higher, lower, or the same revenue as the year before will be used and can be named *'Revenue Development'*. When assuming inflation, firms that have equal revenue compared to the previous year experience a decrease in purchasing power. This variable has therefore been re-coded into a dichotomous variable signifying the increase of revenue (1) or stagnation/decrease of revenue (0).

Table 2 below contains the descriptive statistics of the dependent variable in relation with the independent variables used in the regression models. In total 280 observations are indicated, which are roughly equally distributed over the two values of revenue development. Although the number of respondents were expected to be skewed towards positive revenue development, the large number of manufacturing firms with equal or lower revenue than last year might be caused by the widespread economic downturn of the past year. The independent variables indicate as well a relatively equel distribution on the dependent variable

5.3.2   Independent variables

As mentioned in section 2.4, there is no universally accepted definition of environmental sustainability and none of the existing definitions is wholly adequate for our research. Accordingly, data is collected from the most common applications which can represent indicators of environmental sustainable development. In total 8 questions attempt to indicate the environmental performance of a firm (questions 21 till 28 in Appendix B).

Table 2: Descriptive statistics

	Revenue Development	
	Higher	**Lower/ Same**
Total sample	162	118
Selection Variables		
Size: 1-5 Employees	56	50
Size: 6-100 Employees	77	47
Size: 101-250 Employees	29	21
Product Innovation	102	63
No Product Innovation	58	54
Process Innovation	130	85
No Process Innovation	27	30
Age: < 10 Years	64	34
Age: < 25 Years	48	46
Age: > 25 Years	48	38
Business to Business	140	106
Business to Consumers	54	27
Business to Government	35	14
Communication within the company	57	36
No Communication within the company	105	82
Communication towards customers	65	47
No Communication towards customers	97	71
China	90	60
The Netherlands	72	58
Sector 1	30	21
Sector 2	16	27
Sector 3	40	20
Sector 4	41	26

There are three questions which provide information on the time when certain policies were implemented. Interpreting results from these variables is however difficult. A firm with a younger policy is likely to be more effective due to more modern techniques. Conversely, sustainability policies are often thought to yield returns after a certain period of time arguing that older techniques would be prefered to younger ones. Furthermore, it is unclear whether this new policy is an improvement of an older existing policy or whether this is a firm's first policy. These contrasting effects make it impossible to interpret these results correctly.

Additionally, there are two questions concerning the usage of resources and their corresponding policies. Designing a consistent index of environmental sustainability based on these variables poses considerate complications for several reasons. First, there is a lack of commensurability of water, gas, electricity and other inputs on environmental level. Different resources have a different degree of depletion characteristics and polluting impact. Also, policies on different resources have different capacity for effectiveness and their outcomes are

incomparable. Available data does not differentiate between any of the former mentioned factors and since it is binary, also does not differentiate between strictness of policies and level of usage even within the respective input categories. The existence of a policy on a resource only makes sense when that resource is actually used requiring the resources and their corresponding policies to be connected. It is not possible to distinguish between firms that have a certain policy on a resource and firms that do not use the resource at all.

The most valid indicators of sustainability are: whether the firm has a policy on 1) the reduction of pollution, 2) the recycling of waste, and 3) whether additional pollution efforts are executed. However, having sustainable activities is to some extent subjective and can be interpreted differently per firm (i.e. how does one make a distinction between a policy and a company culture). Besides that, it is not possible to draw a distinction between the differing magnitudes of policies and activities. It can thus be stated that it is uncertain to what extent the variables in the dataset are valid since it cannot be assumed that the variables are correct predictors of the environmental sustainability of a firm.

Using the three aforementioned indicators of sustainability, a Principal Component Analysis (PCA) has been executed in order to obtain one or more scale variable(s) that designates the presence of the three variables. Tables 3.1 till 3.6 in appendix C provide an overview of the outcome of the PCA. As commonly applied in scientific studies, factors with an Eigen-Value greater then 1 will be used in this study (Field, 2005). Accordingly, one factor will be used which explaines approximatelly 54% of the variance in the three variables. This newly constructed variable is likely to postulate a crude proxy for sustainability within the sample. The relatively high mean of all three variables indicates that a large proportion of the respondents acknowledged using the treatments. Both multicollinearity and singularity have not been detected given the sufficiently high value of the determinant of the correlation matrix. The Kaiser-Meyer-Olkin measure is above 0.5, as are the anti-image covariance values, which suggests an adequate sampling adequacy (Kaiser, 1974). The reliability (or consistency) of the factor was tested by computing the Cronbach's alpha. A value of 0,568 is arguably sufficient to assume consistency (Norusis, 2004).

Table 4 displays an overview of the characteristics of both independent and control variables as well as the variables that have been used as selection variables for the creation of the sub-samples.

Table 4: Independent variables

Variable	Values
Size	1-5 Employees 6-100 Employees 101-250 Employees
Innovation	Product Innovation (Yes/No) Process Innovation (Yes/No)
Age	< 10 Years < 25 Years > 25 Years
Target Group	Business to Business (Yes/No) Business to Consumer (Yes/No) Business to Government (Yes/No)
Communication	Comm. Within (Yes/No) Comm. Customers (Yes/No)
Country of origin	China (Yes/No) The Netherlands (Yes/No)
Sector*	Sector 1 (Yes/No) Sector 2 (Yes/No) Sector 3 (Yes/No) Sector 4 (Yes/No)
Sustainability	*Scale*

*Sector 2 has been used as the base category. Since the firms in this sector are relatively homogeneous they serve as a useful reference category.

The correlation matrix in appendix D (table 5) illustrates that differences are present concerning the firm characteristics in China and The Netherlands. Chinese firms are on average larger, younger, and make more use of innovations – especially product innovations. In addition, there appears to be a negative correlation between the target groups BtC and BtB.

5.3.3 Control variables

As mentioned in section 4.1, numerous factors influence firm revenue development. The sales of a firm arguably differ substantially per sector. The original dataset mostly describes the products produced by the different companies, which provided the opportunity to divide them according to the "Standard Industrial Classification (SIC)" codes into different sectors as dichotomous variables (0 = not in the sector and 1 = within the sector). In order to avoid numerical complications, sectors were combined in order to create segregation between 4 types of sectors (*'Sector 1', 'Sector 2', 'Sector 3'* and *'Sector 4'*). Table 6 in appendix E displays an overview of this segregation.

Given the fact that size and age were found to be empirically significant predictors of revenue development, albeit both negative and positive in different studies (Audretsch et al., 2002; Variyam and Kraybill, 1992; Niskanen and Jyrki, 2007), these factors will also serve as

control variables. In addition, Klomp and Van Leeuwen (2001) found that implementation of process innovation also contributes directly to a firm's overall sales. These variables therefore serve as both selection variables (for the creation of sub-samples) as well as control variables.

5.4   **Estimation results**

The dichotomous character of multiple variables result in relatively low variance which limits the probability of finding statistically significant result in comparison to variables with more variance. For this reason the following levels of significance have been used. Variables with a significance level smaller than 5% ($p < 0.05$) are treated as highly significant. Significant levels between 5% and 10% ($p < 0.10$) indicate a medium level of significance and finally, variables with a significance level between 10% and 15% ($p < 0.15$) are treated as weakly significant. Accordingly, confidence intervals have been constructed which postulate 95%, 90% and 85% certainty. Variables with higher significance levels than 15% and confidence intervals below 85% are treated as not significant. The overall fit of the model will be measured using Hosmer and Lemeshow Test which computes the goodness of fit. For comparison of the validity of regression results of the models the Nagelkerke R- squared will be used[3]. The model specifications did not show any VIF values in excess values of 10 (Field, 2005). Furthermore, the correlation matrix depicted appendix D also did not give reason to suspect multicollinearity. In the following paragraphs, the main results of the regressions of the different sub samples will be given (table 7.1 till table 7.9).

*General model***:** Table 7.1 contains the regression results of the general model. The Nagelkerke R square at 0.182 can be said to have substantial explanatory power. Furthermore, the Hosmer and Lemeshow Test at 0.228 can be interpreted as a sign of a well fitting model. The EcoTreatment variable shows a significant positive predictor for revenue development, however, only at a 15% level.

Sub-samples Size: As can be seen from table 7.2, the two sub-samples of Size 1 and Size 2 + 3 have a Nagelkerke R square value of 0,278 and 0, 212 and a Hosmer and Lemeshow Test of 0,492 and 0,967 respectively. This can be interpreted as a sign of good model fit. No statistically significant differences between the sub-samples have been observed.

Sub-samples Innovation: A comparison between the sub-samples of innovation was not possible due to numerical problems. A comparison between the sub-samples of firms that had

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[3] This measurement was chosen over other measurements such as the Cox and Snell R square because it corrects the Cox & Snell R Square in order to make it possible to reach the maximum value of one

Table 7.1: General model

	Coeff.	(SE)	
Size	,128	(,358)	
Age	,021	(,285)	
Product Innovation	-,387	(,506)	
Process Innovation	,488	(,525)	
BtB	-,486	(,757)	
BtC	1,119	(,501)	***
BtG	,043	(,519)	
Comm. Within	,563	(,382)	*
Comm. Customers	,061	(,399)	
Country	,432	(,622)	
Sector 1	,736	(,579)	
Sector 2 *(Base Category)*			
Sector 3	1,323	(,518)	***
Sector 4	-,012	(,496)	
Eco Treatment	,352	(,217)	*
Constant	-,753	(1,312)	
N	150		
Nagelkerke R²	,182		
-2 Log Likelihood	182,906		
Hosmer and Lemeshow (sig.)	10,555 (,228)		

* p < 0.15 — CI: 85%
** p < 0.10 — CI: 90%
*** p < 0.05 — CI: 95%

Table 7.2: Size

	Size 1 Coeff.	(SE)		Size 2 + 3 Coeff.	(SE)	
Size	,093	(,545)		-,162	(,421)	
Age						
Product Innovation	-,783	(1,025)		-,166	(,662)	
Process Innovation	,867	(,797)		-,034	(,916)	
BtB	-1,531	(1,833)		-,450	(,964)	
BtC	1,312	(,936)		,840	(,653)	
BtG	-,717	(1,079)		,736	(,686)	
Comm. Within	1,203	(,994)		,236	(,475)	
Comm. Customers	0,678	(1,122)		-,334	(,477)	
Country	-,267	(1,603)		,882	(,833)	
Sector 1	,280	(1,546)		1,186	(,695)	**
Sector 2 *(Base Category)*						
Sector 3	,163	(1,584)		1,607	(,594)	***
Sector 4	-,230	(,888)		,090	(,684)	
Eco Treatment	,272	(,443)		,370	(,274)	
Constant	1,006	(2,797)		,123	(1,530)	
N	45			105		
Nagelkerke R²	,278			,212		
-2 Log Likelihood	51,825			122,592		
Hosmer and Lemeshow (sig.)	6,413 (,492)			2,377 (,967)		

* p < 0.15 — CI: 85% — Size 1 : < 6 empl.
** p < 0.10 — CI: 90% — Size 2+3 : ≥ 6 empl.
*** p < 0.05 — CI: 95%

Table 7.3: Age

	Age 1 Coeff.	(SE)		Age 2 + 3 Coeff.	(SE)	
Size	-,014	(,567)		,362	(,557)	
Age						
Product Innovation	,987	(1,026)		-1,346	(,703)	**
Process Innovation	,709	(,902)		-,059	(,777)	
BtB	,003	-1.642		-,411	(1,149)	
BtC	-,277	(,858)		2,326	(,845)	***
BtG	1,182	(1,047)		-,296	(,734)	
Comm. Within	-,700	(,648)		2,034	(,691)	***
Comm. Customers	1,114	(,846)		-,231	(,596)	
Country	-,216	(1,301)		1,069	(,702)	*
Sector 1	,911	1,065		1,114	(,826)	
Sector 2 *(Base Category)*						
Sector 3	1,363	(,858)	*	1,716	(,779)	***
Sector 4	,065	(,904)		-,225	(,704)	
Eco Treatment	-,014	(,361)		,598	(,324)	**
Constant	-,750	(2,409)		-1,314	(1,849)	
N	59			91		
Nagelkerke R²	,213			,383		
-2 Log Likelihood	70,218			93,746		
Hosmer and Lemeshow (sig.)	5,159 (,740)			3,330 (,912)		

* p < 0.15 — CI: 85% — Age 1: < 10 years
** p < 0.10 — CI: 90% — Age 2+3: > 10 years
*** p < 0.05 — CI: 95%

Table 7.4: Product Innovation

	Prod. Inn. Yes Coeff.	(SE)		Prod. Inn. No Coeff.	(SE)
Size	,039	(,402)			
Age	-,572	(,447)			
Product Innovation					
Process Innovation	,334	(,799)			
BtB	,054	(,890)			
BtC	1,157	(,606)	**		
BtG	,545	(,687)			
Comm. Within	,453	(,464)			
Comm. Customers	-,335	(,473)			
Country	1,310	(,886)	*		
Sector 1	,819	(,675)			
Sector 2 *(Base Category)*					
Sector 3	1,703	(,622)	***		
Sector 4	,892	(,689)		Final solution not found	
Eco Treatment	,282	(,276)			
Constant	-,597	(1,642)			
N	101			49	
Nagelkerke R²	,209			,493	
-2 Log Likelihood	120,082			44,919	
Hosmer and Lemeshow (sig.)	4,559 (,804)			3,425 (,905)	

* p < 0.15 — CI: 85%
** p < 0.10 — CI: 90%
*** p < 0.05 — CI: 95%

Table 7.5: Process Innovation

	Proc. Inn. Yes Coeff. (SE)	Proc. Inn. No Coeff. (SE)
Size	,195 (,384)	
Age	-,109 (,332)	
Product Innovation	-,370 (,533)	
Process Innovation		
BtB	-,655 (,846)	
BtC	1,328 (,562) ***	
BtG	-,015 (,560)	
Comm. Within	,379 (,412)	
Comm. Customers	,088 (,433)	
Country	,535 (,671)	
Sector 1	,909 (,598) *	*Final solution not found*
Sector 2 *(Base Category)*		
Sector 3	1,475 (,573) ***	
Sector 4	,213 (,547)	
Eco Treatment	,254 (,226)	
Constant	-,144 (1.392)	
N	127	23
Nagelkerke R²	,183	
-2 Log Likelihood	152,612	
Hosmer and Lemeshow (sig.)	10,661 (,222)	

Table 7.6: Target Group

	BtB Coeff. (SE)	BtC Coeff. (SE)	BtG Coeff. (SE)
Size	,047 (,363)	,637 (1,028)	
Age	,020 (,288)	,773 (,892)	
Product Innovation	,034 (,558)	-,645 (1,497)	
Process Innovation	,271 (,537)	3,123 (1,901) *	
BtB		,070 (1,374)	
BtC	1.198 (,534) ***		
BtG	-,038 (,538)	-,918 (1,640)	
Comm. Within	,589 (,399) *	,330 (1,251)	
Comm. Customers	,003 (,410)	2,222 (1,640)	
Country	,449 (,665)	2,744 (2,340)	
Sector 1	,473 (,582)	-2,310 (2,330)	*Final solution not found*
Sector 2 *(Base Category)*			
Sector 3	1,485 (,544) ***	-1,026 (2,029)	
Sector 4	-,018 (,494)	-2,950 (2,079)	
Eco Treatment	,362 (,225) *	2,086 (1,075) **	
Constant	-1,459 (1,074)	-1,060 (4,223)	
N	137	39	25
Nagelkerke R²	,182	,556	1,000
-2 Log Likelihood	167,850	28,606	.000
Hosmer and Lemeshow (sig.)	6,413 (,601)	4,782 (,781)	,000 (1,000)

* p < 0.15   CI: 85%
** p < 0.10   CI: 90%
*** p < 0.05 CI: 95%

Table 7.7: Communication within the Firm

	Comm. Within Yes Coeff. (SE)	Comm. Within No Coeff. (SE)
Size	,437 (,756)	-,192 (,497)
Age	1,161 (,593) ***	-,616 (,471)
Product Innovation	-,645 (,913)	-1,298 (,816) *
Process Innovation	-,883 (1,015)	1,050 (,799)
BtB	,066 (1,484)	-1,071 (1,164)
BtC	1,199 (,859)	2,184 (,832) ***
BtG	,065 (,768)	-,396 (,837)
Comm. Within		
Comm. Customers	-1,428 (,884) *	1,041 (,709) *
Country	,664 (1,118)	,497 (,931)
Sector 1	,291 (,999)	2,529 (1,027) ***
Sector 2 *(Base Category)*		
Sector 3	1,353 (1,032)	3,305 (,972) ***
Sector 4	,246 (,867)	,218 (,777)
Eco Treatment	,486 (,401)	,344 (,317)
Constant	-1,220 (1,952)	-,806 (1,522)
N	63	87
Nagelkerke R²	0,196	,437
-2 Log Likelihood	72,974	85,770
Hosmer and Lemeshow (sig.)	10,027 (,263)	5,105 (,746)

Table 7.8: Communication towards Customers

	Comm. Cust. Yes Coeff. (SE)	Comm Cust.: No Coeff. (SE)
Size	-,051 (,560)	,322 (,513)
Age	-,098 (,652)	,141 (,374)
Product Innovation	-,871 (,989)	-,776 (,728)
Process Innovation	,056 (1,083)	,388 (,709)
BtB	-1,083 (1,310)	,539 (1,221)
BtC	-1,083 (1,310)	2,379 (,781) ***
BtG	,336 (,790)	,106 (,824)
Comm. Within	-,641 (,692)	1,546 (,664) ***
Comm. Customers		
Country	1,773 (1,270)	,290 (,847)
Sector 1	1,803 (1,054) **	,457 (,831)
Sector 2 *(Base Category)*		
Sector 3	1,986 (,903) ***	1,733 (,832) ***
Sector 4	,358 (,854)	-,318 (,699)
Eco Treatment	,710 (,470) *	,408 (,285)
Constant	,056 (1,965)	-1,992 (1,427)
N	64	86
Nagelkerke R²	,267	,300
-2 Log Likelihood	69,741	97,115
Hosmer and Lemeshow (sig.)	10,466 (,234)	4,450 (,814)

* p < 0.15   CI: 85%
** p < 0.10   CI: 90%
*** p < 0.05 CI: 95%

Table 7.9: Country of Origin

	Country NL Coeff. (SE)	Country CN Coeff. (SE)
Size	,800 (,749)	,147 (,452)
Age	,313 (,443)	-,319 (,469)
Product Innovation	-1,432 (,890) *	-,462 (,802)
Process Innovation	,194 (,807)	,367 (,906)
BtB	-,620 (1,755)	-,377 (,946)
BtC	2,488 (1,125) ***	,863 (,615)
BtG	-,785 (,908)	,708 (,728)
Comm. Within	1,861 (,860) ***	-,087 (,518)
Comm. Customers	,462 (,897)	-,782 (,554)
Country		
Sector 1	1,006 (1,033)	1.246 (,790) *
Sector 2 *(Base Category)*		
Sector 3	,530 (1,177)	1.987 (,671) ***
Sector 4	-,713 (,770)	,464 (,802)
Eco Treatment	,346 (,381)	,328 (,281)
Constant	-2,253 (1,636)	-,252 (1,603)
N	61	89
Nagelkerke R²	,349	,240
-2 Log Likelihood	65,326	103,388
Hosmer and Lemeshow (sig.)	5,908 (,658)	9,174 (,328)

* p < 0.15	CI: 85%
** p < 0.10	CI: 90%
*** p < 0.05	CI: 95%

product- and process-innovation and the general model also did not indicate statistically significant differences.

Sub-samples Age: The two sub-samples of Age 1 and Age 2 + 3 have a Nagelkerke R square value of 0,213 and 0, 383 and a Hosmer and Lemeshow Test of 0,740 and 0,912 respectively, which can be interpreted as a sign of good model fit. Eco Treatment is a significant positive predictor for revenue development in the sub-sample Age 2. However, the difference between the two sub-samples concerning this variable is not statistically significant. A relatively strong empirical finding is the difference in predictive power of communication of sustainability within the firm on the dependent variable revenue development. The sub-sector Age 2 + 3 has a more positive predictive power, which is statistically significant, compared to firms in the sub-sector Age 1. The difference between both sub-samples is statistically significant using 95% confidence intervals.

Sub-samples Target Group: The target group BtG has too few observations for the regression to find a final solution. Therefore a comparison can only be made between BtB and BtC. The Nagelkerke R square is substantially higher in the BtC sub-sample compared to the BtB sample; 0,556 and 0,182 respectively. Both samples display a relatively high Hosmer and Lemeshow Test indicating a good model fit (0,781 and 0,601). Both target groups indicate a significant positive predictive power for Eco Treatment on Revenue Development and communication of sustainability within the firm has significant positive predictive power

concerning the BtB sub-sample. No statistically significant differences have been found between the coefficients of both samples.

Sub-samples Communication within the Firm: The two sub-samples of communication of sustainability within the firm have a Nagelkerke R square value of 0,196 for 'yes' and 0,437 for 'no' and a Hosmer and Lemeshow Test of 0,263 and 0,746 respectively. This can indicate that the sub-sample 'no' has more predictive power and a better model fit. Statistically significant differences were found between the two sub-samples concerning the age of firms using 90% confidence interval (a more positive coefficient for 'yes' compared to 'no') and the communication with customers using 85% confidence intervals (a more negative coefficient for 'yes' compared to 'no').

Sub-samples Communication towards Customers: In these sub samples Nagelkerke R square values of 0,267 for 'yes' and 0,300 for 'no' and a Hosmer and Lemeshow Test of 0,234 and 0,814 have been found respectively. Statistically significant differences were found between the two sub-samples concerning the target group BtC using 90% confidence interval (a more negative coefficient for 'yes' compared to 'no') and the communication of within the firm using 85% confidence intervals (a more negative coefficient for 'yes' compared to 'no' as well).

Sub-samples Country: The Nagelkerke R square value for the Chinese sample displays 0,240 and 0,349 for the Chinese sample. The Hosmer and Lemeshow Test are 0,658 and 0,328 respectively. No statistically significant differences were found.

6   Discussion

Even though this study serves a relatively exploratory purpose, results were found that are not in line with what one would expect. Given the fact that the underlying dataset is cross-sectional, defining causality based on the regressions results is compromised. Especially given the alleged interlinked effects with respect to sustainability, the interpretation of results should be done cautiously.

Eco Treatment: The general model indicates that the sustainable proxy has a significant positive relationship ($p < 0.15$) with revenue development. This result however strongly differs when looking at the consecutive sub-samples. The sub-sample of firms which are older than 10 years (sub-sample Age 2 + 3) has a positive and significant coefficient while the sub-sample of firms younger than 10 years has a negative coefficient when it comes to the

sustainability indicator. Even though the difference between the samples is not statistically significant, this could be an indicator for age differences being present. This empirical result, however, contradict what would be expected based on the literature. If older firms were to have a stronger positive relationship between sustainability and revenue development than younger firms, it is not valid to interpret this without simply speculating.

For both the firms with the target group BtB as well as BtC, a positive relationship was found between the sustainability proxy and revenue development. Even though the difference is not statistically significant, firms with the target group BtC have a coefficient which is more than 6 times higher than firms with the target group BtB. The difference is not statistically significant since the results in table 7.6 display a relatively high standard error. A difference between both of the target groups would be in line with the existing literature given the higher expected valuation that consumers place on sustainability, resulting in more consumers purchasing these products and therefore a positive revenue development.

Communication of sustainability: Communicating the sustainability of the firm is used as a tool by multiple firms in the sample size. It can be seen as somewhat surprising that the communication of sustainability within the firm is more often a (positively) significant predictor of revenue development compared to the communication of sustainability towards customers. In the literature this form of communication is recognized as a positive predictor for performance, however, comparatively more focus is being placed on the communication towards customers. Possibly the value employees place on the sustainability of their firm is being underestimated. Another explaination for this result to be present could be a variable that is not measured in this study. Communicating sustainability within the firm could indicate that the firm pays attention to their employees. In this context the communication of sustainability could indicate the managerial ability present at this firm. Both communication of sustainability and managerial ability can increase productivity and thereby decrease the costs of labor and resources. The lower production costs can enable the firm to decrease its selling price in order to increase their revenue. This reasoning is however fairly speculative and cannot be validly concluded.

When looking at the sub-samples of age, a highly significant difference can be found concerning the communication of sustainability within the firm as a predictor for revenue development. Firms that are older than 10 years have a substantially more positive relationship between this form of communication and revenue development compared to firms that are younger than 10 years. Given the fact that no empirical studies were found that

investigate this relationship, the results are unexpected. This result suggests that communicating sustainability towards the employees of the firm is significantly better for the performance of older firms than younger firms. A possible explanation for this relationship is that the values of a sustainable firm become apparent after a certain period of time. As put forward by Potts and Matuszewski (2004), a firm that is perceived to have high ethical standards can retain the best workers more succesfully.

A peculiar and difficult to interpret result is the significant negative relationship between the communication of sustainability inwardly (towards employees) and the communication outwardly (towards customers). The empirical results suggest that when communicating sustainability within the firm, the communication towards customers has a negative predictive power towards revenue development. Accordingly, when not communicating within the firm, the communication towards customers has a positive predictive power towards revenue development. Apparently, the firms that executed both forms of communication performed relatively poorly as compared to firms that did not. A possible explanation could be the fact that both forms of communication can be seen as substitutes in the sense that communication towards customers often also reaches the employees. The same reasoning can be employed to explain the communication towards employees of the firm. This could perhaps make the cost of both forms of communication not worthwhile.

Another counter-intuitive result is present in the sub-samples concerning the communication of sustainability towards customers. Within the sub-sample of firms that do communicate towards customers, the target group BtC is a more negative predictor compared to the sub-sample of firms that did not communicate this towards customers. This result might suggest that communicating towards customers might not be revenue-enhancing for firms with the target group BtC. Given the present literature on the valuation of consumers regarding sustainability, one would expect these results to be reversed.

A result that is in line with the existing literature is the significant positive coefficient of communication towards customers for the sub-sample with Dutch firms. Given the argumentation put forward in section 4.6, one would expect that the valuation of consumers towards sustainability is higher in the Netherlands in comparison to China. Therefore, the communication of sustainability towards customers might be a more preferred strategy in the Netherlands than in China. However, given the fact that no statistically significant difference was found between the coefficients in the sub-samples of China and the Netherlands, a difference cannot be concluded.

31

Lacking significance: The fact that no statistically significant differences were found in the sub-samples of size, target group, and country of origin can be seen as a meaningful result as well. This could indicate that no distinct difference concerning these types of rirms might be present in the opportunity in exploit sustainability to enhance revenue. It can also be seen as surprising that no significant negative relationships were found concerning the sustainability proxy towards revenue development.

7   Conclusion

7.1   Research question

In conclusion, it can be stated that in terms of the exploitation of sustainability, it is not unlikely that differences are present between types of firms. Having an older firm and the consumers as a target group might create relatively more opportunities to exploit sustainability in a revenue-enhancing matter compared to younger firms and firms with other businesses as a target group. Yet these differences are not robust enough to conclude them. The firm characteristics – size, country, and innovation – indicate no differences between the sub-samples which could indicate that no relationship is present.

A relatively strong empirical relationship was found indicating that firms that are older than 10 years have a substantially more positive relationship between communication of sustainability towards the employees of the firm and performance compared to firms that are younger than 10 years. In addition, a negative interaction between communication of sustainability within the firm and the communication towards customers was found, which is difficult to interpret.

It can be stated that the exploratory purpose of this paper has indicated possible relationships between the types of firms that are better able to exploit sustainability in a revenue-enhancing matter. These results, which are partly at odds with existing studies and theories, clearly indicate the complexity of the relationship between performance and sustainability, and the multitude of factors influencing this relationship.

7.2   Limitations

One of the major difficulties when using cross-sectional data is determining the direction of causality. Moreover, since sustainability can be seen as a relatively novel normative concept, there is no clear consensus on the measurement of both financial and environmental performance which compromises comparability between different studies and the results

found in this study. Another limitation that decreases the validity of the variables is the fact that many variables are dichotomous. The lack of variance that is inherent to dichotomous variables compromises the possibility of detecting relationships between variables.

A further limitation of the research is the language barrier and cultural differences, which may have resulted in different interpretations of the questionnaire by Dutch and Chinese respondents. Furthermore, all information was obtained on a voluntary basis which is likely to create a bias since the decision to participate by a firm might depend on several factors such as: Financial performance, environmental performance, company culture, etc.

7.3   Directions for further research

Further research should mainly focus on examining the results found in this study to investigate whether these results are consistent over multiple studies. Consequently, if consistent over multiple studies, research should focus on interpreting these results. In order to draw more valid conclusion, future research should focus on obtaining more detailed data concerning the degree of sustainability of firms, performance of firms and firm specific characteristics.

In order to shed more light on the interrelatedness of the involved factors in the environmental sustainability issue, a structural equation model could be applied. This model provides the opportunity to postulate causal relationships between the involved factors.

7.4   Policy implications

Government intervention is arguably of vital importance in order to internalize the environmental externality. However, given the risk, uncertainty, and irreversibility of environmental problems, it is difficult to determine the magnitude of the intervention from a macro perspective. The impact of resource depletion on the environment is unknown to such an extent that it is difficult to determine the efficient amount of government spending on the internalization of the externality (Weitzman, 2007). Policy should therefore be focused on research to determine the actual consequences of resource depletion and the probability of substantial damage to the environment

From a firm perspective it may be said that there is an increasing valuation for the environment, which enables firms to profitably decrease their negative impact on the environment. It can also be stated that firms are to some extent already being stimulated by the government to reduce their impact on the environment. Given the uncertainty concerning the efficient amount of internalization by the government, it is ambiguous whether firms

should be stimulated more. However, given the relatively low abatement costs in developing countries like China (Hettige et al., 1996) a policy implication could be focused on stimulating the environmental impact of firms in these countries. In order to actualize this, collaboration between country governments would be beneficial. The hurdle to overcome here would be the alignment of contradicting goals between countries.

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Appendix A: Country Specific Data

Table 1: Country Comparison between People's Republic of China and the Netherlands

Categories	Unit	2003 China	2003 Netherlands	2004 China	2004 Netherlands	2005 China	2005 Netherlands	2006 China	2006 Netherlands	2007 China	2007 Netherlands
Total GDP	€ (in bn)	1350	477	1589	491	1821	513	2106	540	2480	567
Government expenditure	€ (in bn)	156	211	181	213	210	217	251	235	293	251
Government expenditure	% of total GDP	12%	44%	11%	43%	12%	42%	12%	44%	12%	44%
GDP per capita	€	1,100	29,500	1,300	30,200	1,400	31,500	1,600	33,100	1,900	34,700
Annual rates of inflation	%	1.2%	2.1%	3.9%	1.2%	1.8%	1.7%	1.5%	1.1%	4.8%	1.6%
Energy intensity	€ (per tonne energy consumed)	7700	3700	7800	3700	8200	3800	8600	4100	9400	4300
Primary energy consumption	Mn tonnes of oil equivalent	1200	90	1400	93	1600	95	1700	93	1900	92
Exports	€ (in bn)	307	185	415	223	462	245	533	280	669	334
Imports	€ (in bn)	109	164	127	199	147	217	175	251	205	295
Population	National estimates (in mn)	1285	16	1292	16	1300	16	1308	16	1315	16
Unemployment rate	% of working population	4.3%	4.0%	4.2%	4.9%	4.2%	5.1%	4.1%	4.2%	4.0%	3.5%
Minimum wage per month	€	€ 46	€ 1,300	€ 52	€ 1,300	€ 57	€ 1,300	€ 65	€ 1,300	€ 72	€ 1,300

Appendix B: Questionnaire

GENERAL

1

How many employees does your company have? If you don't know the exact number could you give an estimation?	◊ …
	◊ 1 - 5
	◊ 6 - 25
	◊ 26 - 100
	◊ 101 - 250
	◊ > 250
	◊ I don't know

2

Please indicate if, in the past year, your company brought any new products on the market or entered any new markets.	◊ Yes
	◊ No
	◊ I don't know

3

Please indicate if, in the past year, your company implemented improvements in the production process.	◊ Yes
	◊ No
	◊ I don't know

Could you explain what kind of innovations you implemented?

4

In what year was your company established? If you don't know the exact year could you give an estimation?	◊ …
	◊ < 3 years ago
	◊ < 5 years ago
	◊ < 10 years ago
	◊ < 25 years ago
	◊ > 25 years ago
	◊ > I don't know

5

What type of product in your company mainly producing?	…

6

	◊ businesses
Please indicate the target group for the products the company is producing (more than one answer possible)?	◊ consumers
	◊ the government
	◊ I don't know

7

	….%
	◊ 0% - 1%
	◊ 2% - 5%
What is the market share of your company during 2008? If you don't know the exact number could you give an estimation?	◊ 6% - 20%
	◊ 21% - 50%
	◊ > 50%
	◊ I don't know

8

	◊ No
	◊ Yes, within the company
Do you communicate aspects of the company activities that are beneficial to the ecological environment? (multiple answer possible)	◊ Yes, towards the government
	◊ Yes, towards the costumers
	◊ I don't know

9

	◊ No
	◊ Yes, within the company
Do you communicate company activities or aspects regarding the social image (i.e. employee benefits) of the company (more than one answer possible)?	◊ Yes, towards the government
	◊ Yes, towards the costumers
	◊ I don't know

EMPLOYEES

10

What is the average percentage of employees of your company that left or was laid off during the last year?	◊ < 5%
	◊ 6% - 10%
	◊ 11% - 15%
	◊ 16% - 20%
	◊ > 20%
	◊ I don't know

11

What is the average percentage of employees of your company that was hired during last year?	◊ < 5%
	◊ 5% - 10%
	◊ 10% - 15%
	◊ 15% - 20%
	◊ > 20%
	◊ I don't know

12

What is the average number of lost days caused by occupational disease, injury and sickness per year per employee?	◊ 0 days
	◊ 1 - 5 days
	◊ 6 - 10 days
	◊ 11 - 15 days
	◊ > 15 days
	………..days

13

What is the percentage of female workers in the workforce of your company?	◊ < 21%
	◊ 21% - 40%
	◊ 41% - 60%
	◊ 61% - 80%
	◊ > 80%
	………..%

14

Is employee satisfaction measured within your company?	◊ Yes
	◊ No
	◊ I don't know

How do you measure employee satisfaction, and with what frequency (daily, monthly, yearly?)

15

How many hours are offered to the employees for training purposes?	◊ Our company does not provide training for its employees
	◊ 0 - 10 hours per year per employee
	◊ 11 - 20 hours per year per employee
	◊ 21 - 30 hours per year per employee
	◊ > 30 hours per year per employee
	◊ I don't know

What kinds of training do you offer to your employees?

16

Please indicate the group-wide employee benefits provided by your company in addition to government schemes (more than one answer possible). Only indicate those that are in addition to the governmental schemes.	◊ Our company does not provide additional benefits for its employees
	◊ Child Care for Employees children
	◊ Pension plans
	◊ Health insurance
	◊ Maternity leave
	◊ Flexible working hours
	◊ Other
	◊ I don't know

ECONOMICAL

17

Did your company make profit or loss in the year 2008, and if possible could you give an estimate of this financial result?	◊ yes, ………………..,-
	◊ no, ……………….., -
	◊ I don't know

18

Was the profit or loss of 2008 lower, the same or higher compared to the financial result of 2007?	◊ lower
	◊ the same
	◊ higher
	◊ I don't know

19

Could you give an indication of the revenue that your company made in 2008?	◊ …………………………..,-
	◊ I don't know

20

Was the revenue in 2008 lower, the same or higher compared to the revenue in 2007?	◊ lower
	◊ the same
	◊ higher
	◊ I don't know

ENVIRONMENTAL

21

Does your company use any of the following resources in the production process?	◊ water
	◊ gas
	◊ electricity
	◊ other resource(s)

22

Does your company have a policy regarding the environmental friendliness of the usage of recourses in the manufacturing process? (multiple answers are possible)	◊ no policy
	◊ a general company policy
	◊ a policy focused on water
	◊ a policy focused on gas
	◊ a policy focused on electricity
	◊ a policy focused on other resource
	◊ I don't know

23

If yes, when was the first time you implemented such a policy?	◊ 0 - 2 years ago
	◊ 3 - 5 years ago
	◊ 6 - 10 years ago
	◊ I don't know

24

Is there a treatment applied that makes waste from the production process of your company reusable?	◊ yes
	◊ no
	◊ I don't know

25

If yes, how long ago did your company implement this treatment?	◊ 0 - 2 years ago
	◊ 3 - 5 years ago
	◊ 6 - 10 years ago
	◊ I don't know

What was the motivation to implement these policies? (regulations, cost reduction, sustainability)

If you ever considered policies of this kind, what were the main barriers that made you decide not to implement them.

26

Does your company apply techniques concerning the reduction of the pollution in water, air and/or soil?	◊ yes
	◊ no
	◊ I don't know

27

If yes, how long ago did your company implement this treatment?	◊ 0 - 2 years ago
	◊ 3 - 5 years ago
	◊ 6 - 10 years ago
	◊ I don't know

28

Does your company perform better on water, air and/or soil pollution than the legal minimum?	◊ yes
	◊ no
	◊ I don't know

Do the regulations set by the government affect your business?

Do you get subsidies or does it drive up costs when you try to meet these regulations?

What is your vision and mission statement?

There are governmental aid programs for companies that produce in a sustainable way. Are you aware of this and do you think the government puts enough effort into promoting these programs?

Appendix C: Results Principal Component Analysis

Table 3.1: Descriptive Statistics

	Values	Mean	SD
Reusage treatment	1 = Yes 0 = No	0.67	0.470
Pollution reduction	1 = Yes 0 = No	0.63	0.484
Additional pollution effort	1 = Yes 0 = No	0.80	0.399

Table 3.2: Correlation Matrix

	Reusage treatment	Pollution reduction	Additional pollution
Reusage treatment			
Pollution reduction	0,484 ***		
Additional pollution	0,139 ***	0,264 ***	

Determinant = 0,712

*** p < 0,01

Table 3.3: Sampling Adequacy

KMO Measure	0.544
Cronbach's Alpha	0.568

Table 3.4: Anti-Image Matrix

	Reusage treatment	Pollution reduction	Additional pollution
Reusage treatment	0.536		
Pollution reduction		0.529	
Additional pollution effort			0.632

Table 3.5: Communalities

	Extraction
Reusage treatment	0.614
Pollution reduction	0.714
Additional pollution effort	0.289

Table 3.6 Explained Variance

Component	Eigenvalues	Variance explained
1	1.617	54%
2	0.886	30%
3	0.498	17%

Appendix D: Correlation Matrix

Table 4: Correlation matrix

	Size	Product Inn.	Process Inn.	Age	BtB	BtC	BtG	Comm. Within	Comm. Cust.	Country of Origin	Rev. Develop.	Sector 1	Sector 2	Sector 3	Sector 4
Size															
Product Innovation	0.3 **														
Process Innovation	0.1 **	0.3 **													
Age	-0.2 **	-0.3 **	-0.1												
BtB	-0.1	0.0	0.0	0.0											
BtC	0.0 *	0.1	0.0	-0.1	-0.5 **										
BtG	0.0	0.0	0.1	0.0	0.1	0.1 *									
Comm. Within	0.1	0.2 **	0.2 **	-0.1 *	0.1 *	-0.1	0.0								
Comm. Customers	0.2 **	0.2 **	0.2 **	-0.1	0.0	0.1	0.0	0.2 **							
Country of Origin	-0.6 **	-0.5 **	-0.2 **	0.6 **	0.1	-0.1	0.0	-0.2 **	-0.3 **						
Revenue Development	0.1	0.1	0.1	-0.1	-0.1	0.1	0.1 *	0.0	0.0	0.0					
Sector 1	0.1	0.1	0.0	0.0	0.1	-0.2 **	-0.1 *	0.0	0.1	0.0	0.0				
Sector 2	0.0	0.1	0.0	-0.1	-0.3 **	0.4 **	-0.1 *	-0.1 *	0.1	-0.1 *	-0.2 **	-0.2 **			
Sector 3	0.2 **	0.2 **	0.1	-0.2 **	0.1	-0.1 *	0.2 **	0.0	0.1	-0.2 **	0.1	-0.2 **	-0.2 **		
Sector 4	-0.3 **	-0.2 **	0.1	0.1 *	0.1	-0.1	0.1 *	0.0	-0.1	0.3 **	0.0	-0.3 **	-0.2 **	-0.3 **	
EcoTreatment	0.3 **	0.2 **	0.2 **	0.0	0.1 *	-0.2 *	0.1	0.1 *	0.3 **	-0.3 **	0.2 *	0.3 **	-0.2 **	0.1	0.0

** $p < 0.01$

 * $p < 0.05$

Appendix E: Sector segregation

Table 6: Sector segregation

	Sub-sector	N
Sector 1	Chemicals Rubbers and plastics Pharmaceuticals Non-metalic mineral products	65
Sector 2	Textiles Food	60
Sector 3	Computer, electronics Electronical equipment Machinery equipment	67
Sector 4	Wood Paper Printing Motor Vehicles Other transport Furniture Repair Other	75