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ABSTRACT

This paper focuses on the relationship between environmental sustainability and the financial performance of SMEs in terms of profit development and revenue development. The analysis uses a unique dataset of 337 Dutch and Chinese firms. The results suggest a significant positive association between environmental sustainability and firm performance. It appears, however, that different indicators of environmental sustainability display a distinct relationship with the two performance measures. When firms have a policy on the re-usage of materials they perform significantly better in terms of profit development and when firms have a policy on the reduction of pollution they perform significantly better in terms of revenue development. Furthermore, we also find that firms that communicate to their employees about their sustainability efforts perform better in terms of profit development. Finally, weak support is found for a moderating effect of communication to employees on the positive relationship between sustainability and profit development.

Keywords: sustainability, entrepreneurship, performance, institutions

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1. Introduction

Already in 1966 economists proposed the notion that: “*Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist.*” (Boulding, 1966, p. 3). Although the continuity and dynamics of economic growth are still surrounded by many ambiguities (Sørensen and Whitta-Jacobsen, 2005), it is generally acknowledged that an ‘ecological constraint’ is present. Meadows et al. (1972) even predicted that the environmental limits would cause the collapse of the world economic system in the middle of the 21st century should the exploitation of the planet’s resources continue at the same pace. We are, as a society, using finite resources and renewable resources at a rate higher than the natural growth rate of these resources, implying that the amount of available resources is continuously diminishing. In addition, pollution of the environment plays a major role in the issue of sustainability in the sense that it affects environmental sustainability in a negative way. If we continue to use resources at the same pace and produce our products in the same way, it will not be possible to sustain our environment. Environmental sustainability can, in this respect, be defined as the preservation of the environment over a longer period of time.

The environmental sustainability of our planet has a profound impact on the economy. The pollution of air, soil and water is increasingly damaging the ecological system and this in turn may jeopardize the rate of economic growth. A sustainable economy can, therefore, be seen as essential for creating long term economic growth. However, given the complexity of resource usage and the impact of pollution on the ecosystem, it is often difficult to determine what to do in order to actually move towards a more sustainable economy. Media broadcasting has increased the knowledge and awareness of the possible consequences of environmental degradation and has also made the general public more appreciative of the importance of the environment and created business opportunities.

Firms often associate a change towards environmental sustainability with higher costs. Whether a change towards environmental sustainability is in general truly not beneficial from a financial perspective (either in the short-run or long-run) is not certain. The increased societal attention of today, however, has created business opportunities. These opportunities appear to trigger a switch in the alleged contradiction between sustainability and performance. Conversely, for some firms the demand for sustainability is a threat which forces them to undertake sustainable activities. The motivation to become more sustainable can thus be summarized in threefold: Positive financial opportunities, a threat of financial loss, or intrinsic motivation to contribute to sustainability.

The relationship between sustainability and firm performance is not expected to be linear. When there are opportunities to enhance the performance of a firm by becoming more sustainable, this often does not imply that the firm should become as sustainable as possible. At some point, becoming more sustainable might worsen the financial position of a firm. The decision every firm faces is to determine to what extent it is desirable to undertake the activities of sustainable development. Firms, however, do not always possess the required information about the presence of opportunities and threats regarding sustainability.

The business environment in which a firm operates is likely to have a substantial influence on the frequency and magnitude of business opportunities that are related to becoming more sustainable. Regional differences - such as political, economical, social and technological aspects – can have a profound impact on the presence of these opportunities. A factor that can play a prominent role in this regard is the communication of sustainability. Firms can communicate with their customers about their activities to achieve sustainability and, in so doing, attract more customers. Likewise, firms can communicate with their employees about their sustainability activities and in this way improve worker morale and productivity (Lankoski, 2006). On the other hand, these communication activities, or public relation affairs, require financial investments and do not necessarily enhance the financial performance of a firm. Again the expected costs and benefits have to be weighed up. We formulate the following research question:

“What is the relationship between environmental sustainability and firm performance, and what is the role of the communication of sustainability in this regard?”

In the context of this research question a distinction should be made between the relationship between sustainability and financial performance on the one hand and the propensity of firms to become sustainable on the other. There can be various incentives for firms to undertake activities in sustainability but this does not automatically imply that these activities will enhance the firm's financial performance. Similarly, a lack of sustainable activities is not always negatively related with financial performance.

The majority of papers in scientific journals approach this topic from a strictly theoretical point of view. The limited number of empirical studies can, to some extent, be explained by the fact that the issue is highly complex, which makes it difficult to measure sustainability at the firm level accurately. In this paper, various theoretical perspectives on the relationship between sustainability and firm performance will be presented and empirically tested. Given the diversity and frequent opposition of the pertinent perspectives, this study can be seen as one of the first to explore the empirical validity of different theoretical perspectives on the relationship between sustainability and performance.

The empirical part of the paper focuses on firms in the coastal zones of Shanghai and Rotterdam. Both these cities have very successful international ports and are in that respect comparable. Conversely, the (rapidly) developing nature of Shanghai and the developed nature of Rotterdam imply considerable differences between these two areas as well. Data from 177 Chinese and 180 Dutch companies were collected and represent the focal point of the empirical research in this paper. The sample consists of firms operating in the manufacturing industry. Since, on average, many physical resources are being used in this industry, there could be many opportunities to exploit sustainability successfully by being more efficient in the use of resources compared to other industries (Ambec and Lanoie, 2008).

We use two measures of financial performance of firms: profit development and revenue development. These two indicators are hypothesized to have a distinctly different relationship with sustainability at the firm level (Porter and Van der Linde, 1995). To the best of our knowledge, there are no other studies that have attempted to measure the relationship between environmental sustainability and firm performance while making a comparison between a port in a developed country (Rotterdam) and a port in a part of the world that is rapidly developing and catching up (Shanghai).

This paper is structured as follows. A review of the literature on the relationship between sustainability and firm performance is presented in Section 2. In Section 3, the data and the research method used for the empirical analysis are described. Section 4 presents the results of the empirical analysis. Finally, in Section 5 the outcomes are discussed and conclusions are drawn.

2. Theoretical background

2.1 Sustainability at the firm level

The word sustainability originates from the verb *to sustain*. This verb, according to the Oxford dictionary, means to “*keep (something) going over time or continuously*”. It can accordingly be argued that our current usage of resources cannot be sustained indefinitely. In scientific theory as well as in practice there are, however, many differing conceptualizations surrounding sustainability with minor to substantial differences in meaning and scope. Over 300 definitions can be found (Ehrenfeld, 2008), which can be seen as indicative for the complexity of the topic.

The general economic paradigm related to sustainability states that the market does not redistribute all resources in the most efficient manner due to the nonexistence of ownership rights on resources such as air and water, resulting in an externality. An often 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 positive as well as negative for the affected party, and accordingly we speak of positive or negative externalities. When the issue of sustainability is involved this is mostly in the context of a negative externality.

The absence of ownership rights can result in the use of resources at zero cost even though the actual (societal) costs are greater than zero. This encourages excessive use of the resources rather than the socially optimal level of usage. In this scenario, no single individual will bear the burden of the cost, this will be incurred by a collection of individuals. What makes this phenomenon especially troublesome and complex is, for example, the fact that this burden is often passed on to future generations. The costs incurred by resource depletion will have an impact on the ability of future generations to exploit resources 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 raises the ethical issue of whether or not it is righteous to make future generations suffer the adverse consequences of the actions of previous generations.

The '3P' approach (People, Planet, and Profit), which describes the interdependence between social, environmental and economical aspects can be said to be the most popular and commonly used definition to describe the sustainability issue (Kemp and Martens, 2007). In fact, from a theoretical point of view, this concept clearly encompasses the holistic and interdisciplinary approach that is relevant in this regard. The environmental aspects of sustainability are relatively straightforward. This approach deals with the extent to which the environment is able to sustain itself. A less understood part of sustainability is the social aspect. This aspect is often referred to as the values of the involved stakeholders in certain activities. This could, for instance, constitute working conditions for a firm's employees. To be able to survive in the market, financial performance is also relevant. Financial continuity is therefore also one of the three relevant aspects of the sustainability issue.

The 3P approach argues that a balancing act is needed between economic, social and environmental values. The relationship between these three aspects can be positive or negative. For instance, activities that create environmental values can have a negative or a positive influence on the financial sustainability of a firm. The 3P approach, however, has an equiproportional focus on social, environmental and financial aspects. Since the subject of this paper focuses only on environmental sustainability the complete 3P approach is not suitable for this study. It is becoming acknowledged that social factors are interrelated with environmental and financial sustainability (as indeed the concept of the 3P approach reflects) and this is accepted as a limitation of this study.

Goodland and Daly (1996) clearly propose a distinction 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) 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'. Those 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 the natural growth and the natural absorption capacity of pollution. Even though this is the final goal, it can be argued that in order to reach this final state many innovations and developments, of which we have no knowledge at the present time, will be required in the future. This makes it difficult to determine the 'final state'; so 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).

Although the term sustainable development can be seen as a *contradictio in terminis* (either one sustains or one develops), the interpretation of the term does not have to be a paradox. It is generally accepted that the current exploitation rate of resources on the earth cannot be sustained for a substantial amount of time (Ehrenfeld, 2008). In this context, sustainable development would merely imply the development towards being more sustainable. Accordingly, it can be argued that the majority of firms around the world are not fully sustainable but instead undertake specific actions towards becoming more sustainable, i.e., it is the undertaking of sustainable development, not the absolute existence of sustainability. In this context it would therefore be more appropriate to use the concept of sustainable development in this paper.

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.

2.2 The link between sustainability and firm performance

Whether or not sustainability is an issue that humanity should be wary of and what the exact consequences of not being sustainable are, 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, under certain conditions, actually become a preferred strategic action for firms (irrespective of what the actual consequences are in terms of sustaining the resources on the planet). Society is increasingly willing to pay a premium for more sustainable products, hence creating business opportunities.

As mentioned in section 1 the growing market for sustainable products does not imply that the most sustainable firms will also perform better financially. Under the assumption that costs are involved in becoming sustainable, a different degree of sustainability might be preferred to a fully sustainable firm.

2.2.1 Incentives for sustainable entrepreneurship

Given the theoretical externality framework, it may appear to be 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 when looking at the short term. They used economic and market performance measures as indicators for financial performance. Wagner et al. (2001) also found a significant negative relationship when they used Return On Sales, Return On Equity and Return On Capital Employed as indicators of financial performance in the paper industry.

One potential explanation for the relative over-representation of empirical studies that display a positive relationship between environmental and financial performance could be that the desire of researchers to find and support a positive relationship has resulted 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 not, however, be confused with fraud, given that probably no conscious intent is present. Another possible explanation for the overrepresentation of positive studies could be that firms actualize certain activities only when they are sufficiently confident that this will have a positive influence on financial performance. Given the substantial amount of risk and uncertainty embedded in activities to reduce environmental impact, it could be the case that projects will be executed only when the expected gains will be high enough to cover the risk of a financially negative outcome.

2.2.2 Barriers to sustainable entrepreneurship

The most obvious barrier to environmental sustainable development of firms is the fact that many wasteful and polluting goods are relatively inexpensive in monetary terms because ecological costs are not incorporated in the price (as the externality framework inherently postulates). If the firm has the opportunity to purchase either a(n) (intermediate) product that has incorporated the ecological costs or a product that has not incorporated such costs, *ceteris paribus*, it is clearly not profit maximizing for the firm to purchase the product for the ‘full’ price. In fact, it might not even be profitable at all to incorporate such costs.

It can be argued that the market for sustainable business will continue to develop and that being sustainable may eventually even become the rule rather than the exception. Such market projections also produce possibilities for first-mover advantages among firms. In particular, given the presence of many complex workings in sustainable business, being early in this market will enable the firm to gain valuable knowledge about the market and hence acquire a competitive advantage. In contrast, it can be argued that there might be second-mover advantages in terms of learning effects and the relatively high development costs of new production methods. The presence of first-mover and second-mover opportunities is expected to be strictly firm specific and, to a large extent, involves the ability to retain first-mover knowledge.

Another aspect that is relevant when looking at the relationship between sustainability and performance is the amount of perceived opportunities being present. It has been said that the mindset within firms is a significant barrier to environmentally sustainable development (Porter and Van der Linde, 1995). It is argued that companies should not see being environmentally sustainable 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 firms to retain the status quo and make no efforts towards increasing sustainability. The lack of information is likely to blur the outcome of potential activities towards becoming more sustainable and thus increases the risk of these activities. In this context, sustainable activities

which are actually profitable might not have a positive Net Present Value (NPV) due to the high discount rate resulting from high uncertainty. Another barrier that could prevent the transition towards becoming (more) sustainable is the fact that a substantial adaptation in the organizational structure is often necessary, and this is accompanied by high costs (Shrivastava, 1995). This reasoning might diminish the propensity of firms to undertake sustainability activities, but this does not imply that the relationship between sustainability and performance is negative. In fact, as mentioned in the previous paragraph, when assuming a substantial amount of perceived risk and uncertainty, projects will be executed only when the expected gains will be high enough to cover the risk of a financially negative outcome. One could therefore expect a positive relationship between sustainability and financial performance.

2.2.3 Different measures of financial performance

Financial performance is commonly used as an indicator of a firm's financial health over a given period of time. The financial performance of a firm can be defined or measured in various different ways. Each of these different measures captures a slightly different aspect of financial performance. Some, such as profitability, gauge return; others, like sales growth and market share growth, gauge the growth of a firm. Some measure profitability (return on investment, return on equity), some liquidity (quick ratio, current ratio), and still others solvency (gearing). Some measures are indicators of commercial success (growth, market share) while others are indicators of financial success (profitability). In this regard it can also be argued that different firms have differing financial goals and therefore one financial performance indicator need not measure the success rate as perceived by the firm itself.

In this study financial performance will be measured by the development of revenues and profits. Both measures are often used as a primary goal for multiple firms. Revenue development can be seen as a growth indicator of the firm and also 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. Similarly, many firms are maximizing their profit making the development of profits a suitable indicator for financial performance as well. When looking at the relationship between financial performance and sustainability a different relationship has been proposed for the relationship between revenues and sustainability and the relationship between profit and sustainability (Porter and Van der Linde, 1995). A firm can, by being environmentally sustainable, differentiate its products and thus increase its revenue. Similarly, a firm can save costs on resources, regulatory costs, capital and labor and therewith increase its profits. In the next sections we will further elaborate on the relationship between environmental sustainability of the firm and the two indicators of performance that we focus on.

Revenue development

By differentiating a product, a firm can attract new customers and so increase the revenue of the firm. The increased societal attention towards environmental sustainability has resulted in an augmented consumer demand for products with a relatively low impact on the ecological environment. Consumers often negatively value the adverse 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. At the moment, the market for environmentally sustainable products can be seen as a niche market (though the market is expanding). Differentiating products can attract new customers and thereby increase revenue. This new market has created novel business opportunities, making it ever more preferable for firms to improve their level of sustainability. It can be argued that the market for sustainable business will continue to develop and that firms can increasingly attract more customers and therewith increase their revenues.

Currently, it is often a profitable strategy for firms to maintain what can be referred to as a 'disposable' economy which, to a large extent, is 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 creates a significant barrier for firms to move towards being more sustainable. In this context it can be argued that more sustainable products will last longer and therefore entail fewer repetitive purchases. This reasoning can imply a negative relation between sustainability and revenues.

Profit development

By reducing the costs of materials, energy and labor, a firm can reduce its overall costs and directly increase its profit. There is, however, also an indirect effect of sustainability by means of cost reduction. When a firm can decrease its costs, it has the opportunity to ask a lower purchase price and thereby may increase its sales. And, a firm that has increased its sales by actions to achieve sustainability can also increase the profit of a firm, providing that the profit margin remains the same or does not shrink substantially. Therefore, a distinction can be made between direct and indirect relationships between sustainability and profit development. The direct relationship is, however, expected to be greater than the indirect relationship.

The pivotal role of government in the internalization of the sustainability externality is clearly illustrated by the increase in regulations applying 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 will be able to attain a competitive advantage by reducing the amount of pollution it emits and thereby decrease future regulatory costs. As an example, Dupont lobbied to ban CFCs (Chlorofluorocarbons) because the firm had superior technology concerning substitutes for this polluting chemical (Reinhardt, 2000). When regulations result in market incentives, as in the case of tradable permits for CO₂ emissions, firms can gain a competitive advantage by being relatively more sustainable. The reduction of regulatory costs is mainly cost reduction however and is not expected to have a substantial effect on revenue.

There are numerous cases of firms that have managed to reduce production costs by preserving resources. Firms like Ford, M3 and British Petroleum have reduced the use of 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 only marginal. Ambec and Barla (2006) provide an overview of empirical studies linked 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 carried out in order to draw a valid conclusion in this area. But it is clear that on certain occasions sustainable activities are cost reducing.

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 being able to obtain 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 reduction in labor costs can be the result of the firm’s improved image. 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. Also, employees might prefer to work for a (more) sustainable firm (possibly a fraction of workers might even be willing to accept a lower wage at a more sustainable firm).

In conclusion, cost reductions on resources, labor, and capital can have a positive effect on the profit of a firm. Similarly, increasing societal attention for sustainable production can create opportunities for firms to increase their revenues. A firm would, however, have to make a trade-off between investment costs made to engage in these activities and the benefits realized through cost reductions. Given the proposition that many firms engage in sustainability activities only when they are sufficiently confident that these will have a positive influence on their financial performance, we propose the following hypothesis:

Hypothesis 1: The extent to which a firm undertakes sustainability activities has a positive relationship with the financial performance of a firm.

Please note that it is expected that this relationship will hold both for revenue development as well as for profit development.

2.3 Communication of sustainability

Communication of sustainability and profit development

As mentioned before, the sustainability of a firm can have an effect on the costs of labor. Firms’ employees can appreciate the sustainability activities of the firm and therefore become more motivated and productive. Similarly, a firm with a sustainable image can help to attract better qualified and motivated personnel because potential employees might prefer to work for a firm that has a sustainable image. Communicating sustainability to employees can therefore lead to a decrease in the costs of labor and so doing enhance the profit of the firm. Following this logic communication to employees could directly increase firm profits but also by making a firm’s sustainability efforts more profitable. That is, the degree to which employees

are better motivated or attracted to the firm, may depend on the magnitude of the firm's sustainable efforts. To the best of our knowledge there are no studies that attempt to test this statement but the above mentioned reasoning leads us to formulate the following hypotheses:

Hypothesis 2: A firm's communication to its employees about efforts related to sustainability positively relates to profit development.

Hypothesis 3: A firm's communication to its employees about efforts related to sustainability positively moderates the relationship between sustainability and profit development.

In this regard we expect that communicating sustainability to the firm's employees will not have a moderating relationship with the revenue development of a firm.

Communication of sustainability and revenue development

Consumers are now demanding more and more that firms produce products and services that are consistent with prevailing environmental values. By communicating sustainability externally 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 reputation 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 reduce profit can be made profitable when one is able to communicate these aspects to consumers and thereby increase revenue (or profit). The possibility 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).

In addition to 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 by becoming more sustainable, customers have to be made aware of this fact to induce them to pay a

premium or purchase larger quantities. The above mentioned reasoning leads to the following hypothesis:

Hypothesis 4: A firm's communication on efforts related to sustainability towards customers positively moderates the relationship between sustainability and revenue development.

In this regard we expect that communicating sustainability to customers will not have a moderating relationship on the profit development of a firm. The enhancement of profit due to revenue increases could be offset by the costs of communication.

2.4 Comparison of Netherlands and China

The extent to which 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). Central differences can be distinguished when examining specific countries such as China and the Netherlands, and these include the following differences:

Political: No extensive description with reference to the differing political systems is given within the scope of this paper. However, as mentioned previously, the government is arguably an essential player in the internalization process of the sustainability externality. Therefore a tentative elaboration of the consequences of the differing political systems regarding the externality will be provided.

The Chinese government has comparatively more power than the government of the Netherlands, making unpopular government intervention less susceptible to negotiations. As a result, policies to internalize the externality could be implemented more easily in China. 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 face this problem to a greater degree since the Dutch governmental system can be depicted as a more democratic system than that of The People's Republic of China¹.

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

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 granted through an electoral system for the inhabitants of China.

Economic: The political system of the People's Republic of China has precluded expansion of the Chinese economy for a long period of time, but from 1976 onwards the death of Chairman Mao and the subsequent (political) reorganization of the country paved the way 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 GDP in China was more than four times that of the Netherlands in 2007. In contrast, their GDP per capita – an indicator of the development of a country (Bernhardt, 2007) – is 18 times smaller than the GDP per capita in the Netherlands. This relationship can be translated into relatively high value-added industries in the Netherlands and low value-added industries in China.

The 'Environmental Kuznets Curve' (EKC) states that environmental degradation shows an inverted U-shaped correlation with economic development (Kuznets, 1955). In the early stages of economic development, degradation and pollution increase, but beyond a certain level of GDP per capita the trend reverses. Relatively high economic development 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 compared 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, (e.g. because social security is less developed in China) the bargaining power of employers is arguably higher in China, resulting in less health conscious employment and looser safety regulations. This aspect could mean there is 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 (which is arguably to a larger extent the case in China compared to the Netherlands), this creates opportunities to reduce the cost of labor by becoming more environmentally sustainable.

Probably the two most important social characteristics in a culture that determine the way people look at sustainability are the level of selfishness and altruism. Sustainability is about taking into account the external costs that you are making and that will be a burden on either future generations or other people in our current generation. A selfish person will most likely not be willing to accept this burden himself. In some cultures selfish behavior will be more frowned upon or in some other way penalized compared to other cultures. In Western-Europe and North America, for instance, the culture is much more individualistic than Asian or Arab cultures (Hofstede, 2001). Individualistic behavior is not always compatible with sustainability since individualistic people focus comparatively more on their own present interest and do not consider the interests of other people belonging to this or future generations. In this regard, an individualistic culture may go together with capitalist societies. The more affluent societies have flourished due to capitalism and individualistic or selfish behavior lies at the centre of capitalism. Correlation does not automatically imply causation in this regard but it makes sense to say that a successful capitalist society is more individualistic.

Technology: Developing countries such as China are often characterized by a lower technological state and therefore can, to a larger extent than more advanced countries, 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 imitation enabled the Chinese economy to grow substantially from 1997 until 2000 while reducing the use of fossil fuels. This effect is decreasing however as the technological state of the country is rapidly increasing. Currently China has one of the largest R&D budgets in the world, which is a clear indication of the country's strategy towards developing new technology itself.

While the nature of opportunities available to exploit sustainability may differ substantially in China and the Netherlands (e.g. as a result of the fact that Chinese firms are comparatively more focused on low value-added industries compared to Dutch firms), there is no a priori reason to suspect that sustainability activities will relate differently to firm performance in the two countries. The expected higher valuation of sustainability by customers in the Netherlands compared to China could, however, imply that there are more opportunities to successfully differentiate a firm in a sustainable way in the Netherlands. A sustainable image as expressed by a firm through its communication efforts can, in this respect be better for the financial performance in terms of revenues of firms in the Netherlands as opposed to China. This leads to the formulation of the following hypothesis:

Hypothesis 5: A firm's communication to its employees and customers about efforts related to sustainability has a more positive relationship with firm performance in the Netherlands as compared to China.

We expect that this relationship holds both for revenue development and for profit development.

3. Statistical method

A binary logistic regression model was applied to explore the relationship between financial development and environmental sustainability. The binary logistic regression was used because 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.

The hypotheses 3 - 5 postulated in section 2 can be characterized as moderation effects, where the moderation variables are communication and country. 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 was divided into sub-samples based on the communication of sustainability and the firm's country of origin. Separate regressions were run for firms that either do or do not communicate sustainability and separate regressions were run for firms originating from the Netherlands and China. Results of the regressions were compared with each other by computing confidence intervals of the regression parameters. In case the

confidence intervals in the sub samples do not overlap a statistically significant difference can be inferred.

3.1 Data and sample

A questionnaire was constructed to gather data (see appendix C). Questions were constructed using examples from scientific studies (Krajnc, and Glavic, 2003; Orlitzky et al., 2003). The study focuses on the manufacturing industry, since it can be expected that there is considerable variation in the degree of sustainable activities within this industry. The interviews were conducted by 23 Master students (Master Entrepreneurship, Strategy and Organisation Economics) from Erasmus University Rotterdam in March in 2009. Contact information for all the manufacturing firms in the area of Rotterdam (approx. 1500 firms) was obtained through the Chamber of Commerce. All the firms were contacted by telephone to ask whether they were willing to participate in this study. In order to minimize a biased sample, the prospective respondents (owner- or senior-managers) were not notified about the specific content of the interview. The Chinese respondents were approached by e-mail (via a digital questionnaire) and during random 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 also in Chinese to increase the response rate and to obtain a more representative sample. Not all manufacturing firms in the area of Shanghai were contacted but the firms that were approached were distributed among various areas (industrial zones) of Shanghai. In the end, the total sample consisted of 177 manufacturing firms in the region of Shanghai and 180 in the Rotterdam manufacturing industry.

3.2 Measures

In the following sections the dependent, independent, moderating and control variables will be elaborated upon. To give an indication of the characteristics of the variables, their values and corresponding distributions in China and the Netherlands are shown in table 2 of appendix B.

3.2.1 Dependent variables

The dependent variables were used for the research attempt to reflect a company's financial performance, which is measured by its revenue development and profit development. Since only 120 of the 337 respondents actually indicated the annual revenue as an exact number and only 70 of the 337 respondents indicated the numerical profit/loss, using these variables would have resulted in a large loss of observations. Instead, the variables indicating whether or not the firm had higher, lower, or the same revenue and profits compared to the year before will be used and are named '*Revenue Development*' and '*Profit Development*' respectively. When assuming inflation, firms that have equal revenues and profits 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/profit (1) or stagnation/decrease of revenue/profit (0).

In total 280 observations are available concerning revenue development and 302 for profit development, which are roughly equally distributed over the two values of revenue development (increase or decrease/the same). Although the number of respondents was expected to be skewed towards positive revenue and profit development, the large number of manufacturing firms with equal or lower revenue than last year might be the consequence of the widespread economic downturn in 2008.

3.2.2 Independent variables

As mentioned in section 2.1, there is no universally accepted definition of environmental sustainability and none of the existing definitions was wholly adequate for our research. Accordingly, data was collected from the most common applications which can represent indicators of environmental sustainable development. We used the following binary indicators² of sustainability: whether the firm has a policy on 1) the reduction of pollution, 2) the recycling of waste, and 3) whether additional anti-pollution efforts are executed. The variables are subject to limitations in the sense that having sustainable activities is to some extent subjective and can be interpreted differently per firm (e.g. how does one make a distinction between a policy and a company culture). Neither is it possible to draw a distinction between the differing magnitudes of policies and activities. The answers provided by firm respondents were also on a self-reporting basis and, hence, there may be some bias towards socially desirable responses.

Using the three aforementioned indicators of sustainability, a Principal Component Analysis (PCA) was executed in order to obtain one or more scale variable(s) that designate the presence of the three variables. Tables 3.1 to 3.4 in appendix D provide an overview of the outcomes of the PCA. As commonly applied in scientific studies, factors with an Eigen-Value greater than 1 were used in this study (Field, 2005). Accordingly, one factor was used that explained approximately 54% of the variance in

² There are three questions that provide information about 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 coincide with a more positive financial performance compared 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 in a valid way.

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 considerable complications. Firstly, there is a lack of commensurability of water, gas, electricity and other inputs on environmental level. 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 these variables on environmental policies are binary, also do 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 three variables. This newly constructed variable which we label '*Eco Treatment*' 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 applying the three policies. 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 Cronbach's alpha. A value of 0.568 is arguably sufficient to assume consistency (Norusis, 2004).

Besides using the newly constructed variable, the three separate sustainability indicators (a policy on the reduction of pollution, a policy on the recycling of waste, and whether additional pollution efforts were executed) were also used as independent variables.

3.2.3 Moderation variables

The moderation variables applied in this study constitute '*Communication of sustainability towards customers*', '*Communication of sustainability towards employees*' and '*Country of origin*'. The two communication variables are dichotomous and display '1' for firms that do communicate and '0' for the firms that do not communicate sustainability either to their employees or customers. The country of origin indicates a '1' for firms located in the Netherlands and '0' for firms located in China. Table 2, which gives some descriptive statistics, 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. There appears to be a negative correlation between the target groups business to customers (BtC) and business to business (BtB).

3.2.4 Control variables

Numerous factors can influence a firm's revenue development and profit development. The indicators of financial success arguably differ substantially per industry. The original dataset mostly described the products produced by the different companies, which provided the opportunity to divide them according to the "Standard Industrial Classification (SIC)" codes into different industries as dichotomous variables (0 = not in the industry and 1 = within the industry). In order to avoid numerical complications, industries were combined to create segregation between four types of industries ('*Chemical intensive industries*', '*Food and textiles*', '*Electronic intensive industries*' and '*Other manufacturing industries*'). Table 4 in appendix E displays an overview of the sub industries that belong to these four main categories.

Given the fact that size and age were found to be empirically significant predictors of revenue and profit development in different studies, albeit both negative and positive (Audretsch et al., 2002; Variyam and Kraybill, 1992; Niskanen and Jyrki, 2007), these factors will also serve as control variables. Size was measured using the number of employees and age was measured by the number of years the firm had been in

operating existence. The sample includes small and medium sized enterprises (SMEs) only or firms with up to 250 employees. In addition we also expect that innovation may affect firm performance. Therefore, dummy variables for product and process innovation also serve as control variables. Klomp and Van Leeuwen (2001) found, for example, that implementation of process innovation also contributed directly to a firm's overall sales.

The target group of firms is also not unlikely to have a relationship with revenue or profit development. Firms with the government as a target group might have a more stable selling quantity as compared to firms with other businesses or consumers as a target group. Especially in an economic downturn, as was the case in 2008, firms with consumers or other businesses might be more influenced compared to firms with the government as a target group.

4. Results

Table 5 in Appendix F presents the correlation matrix for all the variables. The dichotomous character of several variables results in relatively low variance which limits the probability of finding statistically significant results. For this reason the following levels of significance are used. Variables with a significance level smaller than 1% ($p \leq 0.01$) are considered as highly significant. Significance levels between 1% and 5% ($p \leq 0.05$) indicate a medium level of significance and finally, variables with a significance level between 5% and 10% ($p \leq 0.10$) are treated as weakly significant. Accordingly, confidence intervals are constructed which postulate 99%, 95% and 90% certainty. Variables with p-values higher than 10% and confidence intervals below 90% are treated as not significant. The overall fit of the model is 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-square is used. The model specifications did not show any VIF values in excess values of 10 (Field, 2005). Neither did the correlation matrix depicted in appendix F give any reason to suspect multicollinearity. The main results of the regressions of the different sub samples are presented in Appendix G.

General models: Tables 6.1 to 6.4 contain the regression results of the general models explaining profit development and revenue development. The EcoTreatment variable is found to have a significant positive relationship with profit development (see table 6.1), however, and also with revenue development (table 6.2), although at a lower level of significance. Hypothesis 1 is therefore supported. When looking at the three separate sustainability indicators it can be seen that when firms have a policy on re-usage a weakly significant positive relationship is found with profit development (table 6.3) (and no significant relationship with revenue development (table 6.4)). Furthermore, when firms have a policy on pollution reduction this is significant related (positively) to revenue development (table 6.4) (and not to profit development (table 6.3)).

Hypothesis 2 stated that communication about sustainability with employees would relate positively to profit development. As shown in table 6.1 and table 6.3 indeed a significant positive relationship is found between communication with employees and profit development. Therefore, the results provide support for hypothesis 2.

Sub-samples “Communication with employees”: Table 6.5 shows the results for the sub-samples of communication of sustainability within the firm with profit development as the dependent variable. Hypothesis 3 predicts that a firm’s communication to its employees about efforts related to sustainability positively moderates the relationship between sustainability and profit development. Table 6.5 indicates that Eco Treatment is significant positively related to profit development when firms are communicating about sustainability to their employees whereas there is no significant relationship with profit development for firms that do not communicate about sustainability to their employees. Using the confidence intervals, however, no statistically significant differences were found between the two sub-samples concerning the Eco Treatment variable. Therefore, overall hypothesis 3 is weakly supported.

Sub-samples “Communication towards Customers”: Hypothesis 4 states that a firm’s communication on efforts related to sustainability towards customers positively moderates the relationship between sustainability and revenue developments. In both sub-samples in table 6.6, Eco Treatment is statistically significant and positively related to revenue development; therefore hypothesis 4 is not supported.

Sub-samples “Country”: Hypothesis 5 predicts that a firm’s communication to its employees and customers about efforts related to sustainability has a more positive relationship with firm performance in the Netherlands as compared to China. For the Netherlands a significant positive relationship is found between communication about sustainability to employees and both profit development (table 6.7) and revenue development (table 6.8). For the Chinese subsample a significant positive relationship is found between communication with employees and profit development (table 6.7) - although the coefficient is lower as compared to the subsample for the Netherlands - and no significant relationship between communication with employees and revenue development (table 6.8). Despite these differences between the Netherlands and China, the analysis of the confidence intervals shows no statistically significant differences for the variable for communication with employees between the two subsamples. Regarding communication with customers no statistically significant relationship is found with profit development and revenue development for both subsamples. Therefore, overall, the results do not uphold hypothesis 5.

5. Discussion and Conclusion

This study concentrates on the relationship between environmental sustainability and firm performance using a unique database of Dutch and Chinese firms. The main finding of this study is that the constructed sustainability proxy displays a positive statistically significant relationship with respect to profit development as well as with respect to revenue development. Thus, activities focused on environmental sustainability seem to benefit a SME’s financial performance. When looking at the results of the three separate indicators of environmental sustainability it becomes possible to shed more light on how exactly sustainability relates to both aspects of firm performance. It is found that a policy on the re-usage of materials serves as a positive predictor for profit development, while a policy on the reduction of pollution serves as a positive predictor for the development of revenues. A policy focused on the re-usage of materials can save on the costs of materials and thereby increase the

profit of a firm. A firm's policy to reduce pollution often does not directly result in a reduction of costs. It could, however, imply a more sustainable image resulting in more customers being willing to purchase the firm's products.

Communicating the sustainability of the firm is used as a tool by multiple firms. As predicted, communication of sustainability within the firm is found to be a positive predictor of financial performance in terms of profit development. This result suggests that employees tend to value the sustainability of their firm which may make them more motivated and productive, making it beneficial for firms to actively communicate about their sustainability efforts to their employees. We can, however, not rule out the possibility that another variable that was not measured in this study drives the positive relationship between communication of sustainability to employees and profit development. Communicating sustainability within the firm could signify, for example, that the firm pays attention to its employees. Thus, in this context the communication of sustainability could indicate the managerial ability present at this firm and managerial ability can increase productivity and thereby reduce the costs of labor and resources and in doing so increase the profit of a firm. This reasoning is however fairly speculative and cannot be validly concluded.

We expected that when firms would communicate about sustainability to their customers this would positively moderate the relationship between sustainability efforts and revenue development. According to our results, however, the positive relationship of sustainability with firm performance is not dependent upon whether a firm actively communicates to its customers about its sustainability efforts. It is unclear how this result should be interpreted. It could indicate that there often is no need to put additional efforts in communicating about sustainability to customers e.g. because the customer is already aware of the sustainability of the product.

A result that is in line with our expectations is the significant positive coefficient of communication within the firm for the sub-sample with Dutch firms. This positive relationship was found for both revenue development and profit development. Communication to employees is, however, also a significant predictor for profit development in China (however not regarding revenue development). Given the fact that no statistically significant difference was found between the coefficients in the sub-samples of China and those of the Netherlands, a moderation relationship can not be concluded.

Interestingly, it appears that sustainability displays a significant positive value for Chinese firms on the development of profits but not on the development of revenues. Possibly, in China sustainability is more often used to reduce costs as compared to attracting new customers.

This study is subject to a number of limitations. One of the major difficulties when using cross-sectional data is determining the direction of causality. Good performance, for instance, is likely to create financial means to invest in sustainable activities. Moreover, since sustainability can be seen as a relatively novel normative concept, there is no clear consensus on the measurement of environmental performance which compromises comparability between different studies and the results found in this study. 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 various factors such as: Financial performance, environmental performance, company culture, etc.

We highlight a number of avenues for future research. Further research could, for example, examine whether the results found in this study are consistent across multiple country contexts. In order to draw more valid conclusions, future research could try to obtain more detailed data concerning the degree of sustainability of firms, performance of firms and firm specific characteristics. Also, using multiple performance indicators of firms would provide more insight in the relationship between sustainability and firm performance.

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). From a firm's perspective it may be said that there is an increasing appreciation of the environment, which enables firms to profitably reduce their negative impact on the environment. Results of this study tentatively suggest that environmental performance and financial performance of firms may go hand in hand. If this is indeed true this would reduce the need for policy intervention.

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Annexes

Appendix A: Country Specific Data

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

Categories	Unit	2003		2004		2005		2006		2007	
		China	Netherlands	China	Netherlands	China	Netherlands	China	Netherlands	China	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

Sources:

Total GDP: Euromonitor International from International Monetary Fund (IMF), International Financial Statistics; **Government expenditure:** Euromonitor International/International Monetary Fund (IMF), Government Finance Statistics/national statistics; **Annual rates of inflation:** Euromonitor International from International Monetary Fund (IMF), International Financial Statistics and World Economic Outlook/UN/national statistics; **Energy intensity:** Euromonitor International from national statistics; **Primary energy consumption:** BP Amoco, BP Statistical Review of World Energy; **Exports:** Euromonitor International from International Monetary Fund (IMF), International Financial Statistics; **Imports:** Euromonitor International from International Monetary Fund (IMF), International Financial Statistics; **Population: national estimates on January 1st:** Euromonitor International from national statistics/UN; **Productivity:** Euromonitor from trade sources/national statistics; **Unemployment rate:** International Labour Organisation/Euromonitor International; **Minimum wage per month:** Euromonitor from trade sources/national statistics.

Appendix B: Variable Descriptions

Table 2: Variable descriptions

	Country of origin	
	China	The Netherlands
Number of firms	177	180
Revenue higher than last year	90	72
Revenue lower/the same	60	58
Revenue development unknown	27	50
Profit higher	80	75
Profit lower/the same	82	65
Profit development unknown	15	40
Size: 1-5 employees	20	106
Size: 6-100 employees	101	49
Size: 101-250 employees	59	5
Product innovation	146	50
Process innovation	138	112
Age: <10 years	93	23
Age: <25 years	73	39
Age: 25 years or older	7	97
Business to business	149	144
Business to consumer	60	42
Business to government	27	24
Communication with employees	72	38
Communication with customers	92	42
Chemical intensive	37	28
Food and textiles	40	20
Electronic intensive	50	17
Other manufacturing industries	18	57
Reusage treatment	113	77
Pollution reduction	94	55
Additional pollution effort	110	46

Appendix C: Questionnaire

GENERAL

1. How many employees does your company have? If you don't know the exact number please 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

Please explain what kind of innovations you implemented?

4. When was your company established? If you don't know the exact year please give an estimation?	◇ ...
	◇ < 3 years ago
	◇ < 5 years ago
	◇ < 10 years ago
	◇ < 25 years ago
	◇ > 25 years ago
	◇ > I don't know
5. What is your company's main type of product?	...
6. Please indicate the target group for the products the company is producing (more than one answer possible)	◇ businesses
	◇ consumers
	◇ the government
	◇ I don't know

7. What was your company's market share in 2008? If you don't know the exact number please give an estimate%
	◇ 0% - 1%
	◇ 2% - 5%
	◇ 6% - 20%
	◇ 21% - 50%
	◇ > 50%
	◇ I don't know
8. Do you communicate aspects of company activities that are beneficial to the ecological environment? (multiple answer possible)	◇ No
	◇ Yes, within the company
	◇ Yes, towards the government
	◇ Yes, towards the costumers
	◇ I don't know
9. Do you communicate company activities or aspects regarding the social image (i.e. employee benefits) of the company (more than one answer possible)?	◇ No
	◇ Yes, within the company
	◇ Yes, towards the government
	◇ Yes, towards the costumers
	◇ I don't know

EMPLOYEES

10. What was the average percentage of company employees 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 hired by your company 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 diseases, 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 your company's workforce?	◇ < 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 employees entitled to 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 your employees?

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

ECONOMIC

17. Did your company make a profit or a loss in the year 2008, and if possible please give an estimate of this financial result?	<input type="checkbox"/> yes,, -
	<input type="checkbox"/> no,, -
	<input type="checkbox"/> I don't know
18. Was the profit or loss of 2008 lower, the same or higher compared to the financial result of 2007?	<input type="checkbox"/> lower
	<input type="checkbox"/> the same
	<input type="checkbox"/> higher
	<input type="checkbox"/> I don't know
19. Could you give an indication of the revenue that your company made in 2008?	<input type="checkbox"/>, -
	<input type="checkbox"/> I don't know
20. Was the revenue in 2008 lower, the same or higher compared to the revenue in 2007?	<input type="checkbox"/> lower
	<input type="checkbox"/> the same
	<input type="checkbox"/> higher
	<input type="checkbox"/> I don't know

ENVIRONMENTAL

21. Does your company use any of the following resources in the production process?	<input type="checkbox"/> water
	<input type="checkbox"/> gas
	<input type="checkbox"/> electricity

	◇ other resource(s)
22. Does your company have a policy regarding the environmental friendliness of the usage of resources 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. Has any treatment been applied to make it possible to recycle waste from your production process?	◇ 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 technologies 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 receive subsidies or does trying to meet these regulations drive up costs?

What is your vision and mission statement?

There are governmental aid programmes for companies that produce in a sustainable way. Are you familiar with these? Do you think the government does enough to promote these programmes?

Appendix D: Results Principal Component Analysis

Table 3.1 Sampling Adequacy

KMO Measure	0.544
Cronbach's Alpha	0.568

Table 3.2 Anti-Image Matrix

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

Table 3.3 Communalities

	Extraction
Reusage treatment	0.614
Pollution reduction	0.714
Additional pollution effort	0.289

Table 3.4 Explained Variance

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

Appendix E: Industry segregation

Table 4 Industry Segregation

	Sub-industry	N
Chemical intensive industries	Chemicals	65
	Rubbers and plastics	
	Pharmaceuticals	
	Non-metallic mineral products	
Food and textiles	Food	60
	Textiles	
Electronic intensive industries	Computer, electronics	67
	Electronic equipment	
	Machinery equipment	
Other manufacturing industries	Wood	57
	Paper	
	Printing	
	Motor vehicles	
	Other transport	
	Furniture	
	Repair	
	Other	

Appendix F: Correlation Matrix

Table 5 Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Size																			
2. Product innovation	.32**																		
3. Process innovation	.15**	.28**																	
4. Age	-.20**	-.27**	-.06																
5. Business to business	-.07	-.05	.04	.03															
6. Business to customers	.02	.10	-.04	-.08	-.45**														
7. Business to government	.04	.04	.08	-.02	.07	.14*													
8. Communication with employees	.10	.17**	.20**	-.13*	.12	-.06	.01												
9. Communication with customers	.24**	.23**	.17**	-.08	-.05	.06	.00	.22**											
10. Country	-.58**	-.53**	-.15**	.59**	.09	-.08	.00	-.18**	-.26**										
11. Profit development	-.04	-.01	-.01	.03	.03	.07	.07	.07	-.07	.04									
12. Revenue development	.05	.10	.11	-.08	-.05	.11	.13*	.05	.00	-.05	.65**								
13. Chemical intensive industries	.10	.06	.01	.03	.10	-.16**	-.12*	.04	.06	-.04	.00	.01							
14. Food and textiles	.00	.12*	-.05	-.09	-.28**	.35**	-.13*	-.13*	.07	-.13*	-.16**	-.18**	-.23**						
15. Electronic intensive industries	.17**	.16**	.07	-.15**	.08	-.12*	.16**	-.03	.07	-.22**	.02	.09	-.24**	-.23**					
16. Other manufacturing industries	-.26**	-.20**	.06	.13*	.08	-.07	.11*	.01	-.06	.31**	.03	.04	-.26**	-.25**	-.27**				
17. Eco Treatment	.32**	.23**	.25**	-.03	.15*	-.19**	.10	.15*	.33**	-.26**	.15	.17*	.26**	-.22**	.06	-.01			
18. Reusage treatment	.23**	.14*	.22**	-.11*	.06	-.10	.06	.13*	.21**	-.24**	.03	.10	.15**	-.15*	.12*	-.03	.78**		
19. Pollution reduction	.30**	.27**	.23**	-.11	.15**	-.17**	.03	.21**	.23**	-.27**	.00	.13*	.18**	-.06	.06	-.06	.84**	.41**	
20. Additional pollution effort	.33**	.21**	.10	-.06	.03	-.08	.04	.11	.29**	-.33**	.00	.05	.20**	-.12	.05	-.08	.54**	.17*	.26**

* indicates 10% significance level; ** indicates 5% significance level; *** indicates 1% significance level

Appendix G: Results

Table 6.1 General model: Profit development

	Coeff.	(Standard error)
<i>Sustainability variables</i>		
Eco Treatment	.484**	(.223)
Communication with customers	-.114	(.400)
Communication with employees	.940**	(.372)
<i>Control variables</i>		
Size	-.627*	(.370)
Product Innovation	-.334	(.472)
Process Innovation	.115	(.497)
Age	.279	(.283)
Business to business	.142	(.714)
Business to customers	.958	(.416)
Business to government	-.271	(.503)
Country	.072	(.612)
Chemical intensive industries	.105	(.543)
Food and textiles (<i>Base Category</i>)		
Electronic intensive industries	.826*	(.493)
Other manufacturing industries	-.636	(.520)
Constant	-.238	(1.280)
N		158
Nagelkerke R ²		.190
-2 Log Likelihood		193.633
Hosmer and Lemeshow (sig.)		8.945 (.347)

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.2 General model: Revenue development

	Coeff.	(Standard error)
<i>Sustainability variables</i>		
Eco Treatment	.352*	(.217)
Communication with customers	.040	(.401)
Communication with employees	.563	(.382)
<i>Control variables</i>		
Size	.120	(.358)
Product Innovation	-.372	(.510)
Process Innovation	.455	(.528)
Age	.003	(.287)
Business to business	-.486	(.757)
Business to customers	1.119**	(.501)
Business to government	.065	(.519)
Country	.460	(.625)
Chemical intensive industries	.724	(.580)
Food and textiles (<i>Base Category</i>)		
Electronic intensive industries	1.323**	(.518)
Other manufacturing industries	.011	(.499)
Constant	-.238	-(1.312)
N		150
Nagelkerke R ²		.182
-2 Log Likelihood		182.906
Hosmer and Lemeshow (sig.)		10.555 (.228)

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.3 General model: Profit development (using separate indicators for Eco Treatment)

	Coeff.	(Standard error)
<i>Sustainability variables</i>		
Policy Reusage	.753*	(.439)
Policy Pollution	.486	(.462)
Pollicy Regulation	-.093	(.514)
Communication with customers	-.022	(.412)
Communication with employees	.943**	(.375)
<i>Control variables</i>		
Size	-.620*	(.371)
Product Innovation	-.301	(.483)
Process Innovation	.058	(.503)
Age	.317	(.286)
Business to business	.191	(.723)
Business to customers	.960**	(.467)
Business to government	-.298	(.509)
Country	.022	(.623)
Chemical intensive industries	.138	(.547)
<i>Food and textiles (Base Category)</i>		
Electronic intensive industries	.767	(.502)
Other manufacturing industries	-.634	(.524)
Constant	-1.065	(1.230)
N		158
Nagelkerke R ²		.199
-2 Log Likelihood		192.294
Hosmer and Lemeshow (sig.)		9.195 (.326)

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.4 General model: Revenue development (using separate indicators for Eco Treatment)

	Coeff.	(Standard error)
<i>Sustainability variables</i>		
Policy Reusage	-.337	(.448)
Policy Pollution	1.239**	(.490)
Pollicy Regulation	.035	(.539)
Communication with customers	.013	(.411)
Communication with employees	.508	(.386)
<i>Control variables</i>		
Size	.182	(.369)
Product Innovation	-.537	(.524)
Process Innovation	.391	(.554)
Age	-.035	(.299)
Business to business	-.665	(.765)
Business to customers	1.232**	(.513)
Business to government	.085	(.525)
Country	.419	(.648)
Chemical intensive industries	.776	(.591)
<i>Food and textiles (Base Category)</i>		
Electronic intensive industries	1.516***	(.539)
Other manufacturing industries	.130	(.512)
Constant	-1.117	(1.270)
N	150	
Nagelkerke R ²	.214	
-2 Log Likelihood	178.648	
Hosmer and Lemeshow (sig.)	10.962 (.204)	

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.5 Sub-samples “Communication with employees”: Profit development

	Coeff.	(Standard error)	Coeff.	(Standard error)
Selection Variable -->	Communication with employees: Yes		Communication with employees: No	
<i>Sustainability variables</i>				
Eco Treatment	1.000**	(.458)	.415	(.298)
Communication with customers	-1.430*	(.861)	.622	(.619)
<i>Control variables</i>				
Size	-.830	(.715)	-.996*	(.532)
Product Innovation	.318	(.760)	-1.261*	(.725)
Process Innovation	-1.680	(1.040)	.786	(.666)
Age	.996*	(.525)	-.083	(.410)
Business to business	-.873	(1.555)	.509	(.937)
Business to customers	1.282	(.799)	1.308**	(.656)
Business to government	-.272	(.775)	-.474	(.742)
Country	.250	(1.058)	.057	(.876)
Chemical intensive industries	.124	(.886)	.564	(.812)
Food and textiles (<i>Base Category</i>)				
Electronic intensive industries	1.192	(1.013)	1.777**	(.769)
Other manufacturing industries	-1.030	(.904)	-.545	(.750)
Constant	2.368	(2.564)	.084	(1.698)
N	68		90	
Nagelkerke R ²	.285		.235	
-2 Log Likelihood	77.083		102.311	
Hosmer and Lemeshow (sig.)	9.479 (.303)		8.316 (.403)	

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.6 Sub-samples “Communication with customers”: Revenue development

	Coeff.	(Standard error)	Coeff.	(Standard error)
Selection Variable -->	Communication with customers: Yes		Communication with customers: No	
<i>Sustainability variables</i>				
Eco Treatment	.811*	(.445)	.593*	(.306)
Communication with employees	.568	(.609)	1.453**	(.644)
<i>Control variables</i>				
Size	-1.314**	(.627)	-.292	(.522)
Product Innovation	.418	(.841)	-.459	(.702)
Process Innovation	-.761	(1.109)	.086	(.632)
Age	.180	(.642)	.460	(.386)
Business to business	-.921	(1.087)	2.143	(1.379)
Business to customers	.524	(.780)	1.696**	(.697)
Business to government	-.612	(.816)	-.078	(.736)
Country	-.137	(1.167)	.602	(.848)
Chemical intensive industries	1.808*	(.957)	-.953	(.802)
Food and textiles (<i>Base Category</i>)				
Electronic intensive industries	1.828**	(.894)	.395	(.756)
Other manufacturing industries	.179	(.927)	-1.418*	(.730)
Constant	1.874	(2.253)	-3.195	(2.022)
N	67		91	
Nagelkerke R ²	.309		.272	
-2 Log Likelihood	75.175		103.719	
Hosmer and Lemeshow (sig.)	8.190 (.316)		5.781 (.672)	

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.7 Sub-samples “Country”: Profit development

	Coeff.	(Standard error)	Coeff.	(Standard error)
Selection Variable -->	Country: The Netherlands		Country: China	
<i>Sustainability variables</i>				
Eco Treatment	.255	(.365)	.650**	(.299)
Communication with employees	1.456**	(.733)	.821*	(.497)
Communication with customers	-.269	(.816)	-.137	(.518)
<i>Control variables</i>				
Size	-.072	(.691)	-1.014**	(.483)
Product Innovation	-.642	(.739)	.565	(.782)
Process Innovation	-.073	(.748)	.240	(.859)
Age	.480	(.426)	.078	(.455)
Business to business	2.243	(1.564)	-1.143	(.935)
Business to customers	1.982**	(.964)	.604	(.589)
Business to government	-1.340	(.871)	.404	(.657)
Country				
Chemical intensive industries	.314	(.909)	.052	(.727)
Food and textiles (<i>Base Category</i>)				
Electronic intensive industries	.854	(1.087)	.743	(.602)
Other manufacturing industries	-.784	(.716)	-.782	(.930)
Constant	-3.413	(2.136)	1.249	(1.792)
N	65		93	
Nagelkerke R ²	.271		.249	
-2 Log Likelihood	75.354		107.983	
Hosmer and Lemeshow (sig.)	8.725 (.273)		6.298 (.614)	

10% significance

* level

** 5% significance level

*** 1% significance level

Table 6.8 Subsamples “Country”: Revenue development

	Coeff.	(Standard error)	Coeff.	(Standard error)
Selection Variable -->	Country: The Netherlands		Country: China	
<i>Sustainability variables</i>				
Eco Treatment	.358	(.384)	.357	(.291)
Communication with employees	1.861**	(.860)	-.076	(.520)
Communication with customers	.449	(.905)	-.786	(.554)
<i>Control variables</i>				
Size	.821	(.755)	.125	(.456)
Product Innovation	-1.432	(.890)	-.361	(.839)
Process Innovation	.200	(.809)	.320	(.916)
Age	.330	(.446)	-.343	(.473)
Business to business	-.620	(1.755)	-.377	(.946)
Business to customers	2.468**	(1.125)	.786	(.644)
Business to government	-.735	(.916)	.716	(.729)
Country				
Chemical intensive industries	1.078	(1.061)	1.246	(.790)
Food and textiles (<i>Base Category</i>)				
Electronic intensive industries	.555	(1.184)	1.987	(.671)***
Other manufacturing industries	-.633	(.802)	.471	(.802)
Constant	-1.737	(2.196)	.140	(1.881)
N	61		89	
Nagelkerke R ²	.349		.240	
-2 Log Likelihood	65.326		103.388	
Hosmer and Lemeshow (sig.)	5.902 (.658)		9.174 (.328)	

10% significance

* level

** 5% significance level

*** 1% significance level

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