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Sustainable innovation processes within small and medium-sized enterprises

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Summary

Aim of this study

This dissertation aims to provide a deeper understanding and conceptualization on the internal and external factors that influence the sustainable innovation processes within Dutch small and medium-sized enterprises (SMEs) in general and in production sectors specifically. The research topic of sustainable innovation processes within SMEs is embedded within the field of sustainable development, corporate sustainability and the problems these concepts intend to address. These problems can also be described as the sustainability challenge for business. Technological and economic developments have led to both economic growth and human welfare, but also resulted in large scale negative impacts on both humans and ecosystems. The current financial and ecological crises also reveal shortcomings in the economic system, the upcoming end of fossil resources, far reaching consequences of climate change and biodiversity degradation. This calls for action from a wide range of stakeholders to move towards sustainable development.

Sustainable innovation can be regarded as the implementation concept of sustainable development. The business approach of sustainable development is translated in corporate sustainability (also known as corporate social responsibility). Within this concept, companies integrate social, environmental and economic issues in their core business operations in order to create value, ensure long run survival, and incorporate stakeholders' concerns in business decisions. Corporate sustainability is about continuity, longevity and economic viability, while also sustaining the opportunities of (developing) countries and future generations to fulfil their needs. Sustainable innovation is defined here as the *development and renewal of products, services, processes and organization, which improve the business performance on social, environmental and economic issues on the short and long term*. Sustainable innovation discerns itself from conventional innovation by its ambitions, direction and integration of stakeholder concerns. Sustainable innovation processes include the necessary decision processes and activities to produce sustainable innovations, including their creation, implementation and commercialisation.

Although most recorded best practices and scientific literature on corporate sustainability or sustainable innovation cover large and/or multinational companies, it is not an issue for them alone. SMEs have a role to play as well. There are many differences between SMEs and large companies that surpass their definition in headcount. SMEs are by no means less (sustainable) innovative as large companies, but have their own way of doing business. Also, the approaches on sustainable development and innovation used with and within large, multinational corporations cannot be 'transplanted' within the context of SMEs, without regard for their specific characteristics, needs and abilities.

This dissertation aims to gain more insight in the factors that influence sustainable innovation processes within an SME context. This contributes to the body of scientific knowledge significantly, since there is no validated conceptual model on sustainable innovation processes specified for SMEs available to date. This model has to be build on insights and lessons learned from theories adjacent to the concept of sustainable innovation and corporate sustainability, including innovation theory, sustainable development, and SMEs/entrepreneurship.

This dissertation aims to contribute to the understanding of diversity within SMEs of their role, orientations, competences and contact with external stakeholders. It illustrates the translation of the transition towards sustainable development into business decisions and activities in order to achieve a better environmental, social and economic performance. The main research question of this study is formulated as follows:

Which factors are crucial for sustainable innovation processes within SMEs in production sectors?

Sub research questions involve the following:

1. What are SMEs?
2. What are sustainable innovation processes?
3. How do SMEs translate the concept of sustainable innovation into practice?
4. What (dis-)similarities between SMEs from different sectors can be found on factors influencing sustainable innovation processes?
5. How do SMEs perceive the influence of governmental instruments on their sustainable innovation processes?
6. Which internal and external factors influence sustainable innovation processes within SMEs?
7. To what degree are internal and external factors crucial for sustainable innovation processes within SMEs in production sectors?

To answer these research questions, it is necessary to clarify the concepts used in this dissertation. Defining the concepts also serves to contribute to consensus-building in the scientific community. In practice as well we see little consensus on the interpretation of sustainability and innovation. Defining the concepts, their operationalization and scope is therefore necessary to meaningfully analyze sustainable innovation processes within SMEs and is an important part within this dissertation. The concepts and their definition is mentioned below.

- *Sustainable development*: development that seeks to meet the needs of the present generation without diminishing the possibilities of meeting those of future generations.
- *Corporate sustainability*: the voluntary integration of environment, social and economical aspects in the core business operations of a company, involving stakeholder concerns in business decisions and cooperating within the supply chain on improving the business performance in the short and long term.
- *Innovation*: the renewal or improvement of products, services, technological and organizational processes, including its commercialization (introduction to the market); newness is relative to the company and/or market.
- *Sustainable innovation*: innovation in which the renewal or improvement of products, services, technological or organizational processes not only delivers an improved economic performance, but also an enhanced environmental and social performance, both in short and long term.
- *Sustainable innovation processes*: the decision making, design and implementation processes involved with sustainable innovation.
- *Small and medium-sized enterprises (SMEs)*: companies with less than 250 employees; stereotype characteristics are the dominant role of the owner manager, resource poverty in terms of capital, time, knowledge and skilled personnel, flexible organization capacities, focus on the short term, strong local and regional focus, high prevalence of family businesses and low degree of formalization.

Next to the definition and operationalization of these concepts, the antecedents and relations between the concepts is studied empirically. Until now, little empirical research has been done on the nexus between corporate sustainability, innovation and SMEs. There are many studies on the separate fields, as well as on environmental innovations (predominantly technological improvement and environmental management systems) within an SME context. The knowledge generated within this dissertation is important because of the relevance of SMEs for the Dutch economy. It also indicates their aggregated impact on environment and society, and the importance of innovation to take the necessary further steps in the transition towards sustainable development.

Data gathering & methodology

The research question is answered using results from empirical qualitative and quantitative research projects. The Dutch situation is the starting point for research on sustainable innovation processes within SMEs. The focus is on SMEs from production sectors, more specifically from the rubber and plastics industry, the building and construction sector, the installation sector and the graphic media industry. Production companies are a multifaceted part of the economy, including the commercial production and sale of goods from raw (natural) resources or intermediate products. All data were collected in the period July 2005 – February 2009. This period was marked by a relatively stable economic climate. 3 qualitative projects (interviewing), 1 quantitative project (questionnaire) have assisted the birth of this dissertation.

Results

The results include a summary of the four empirical chapters of this dissertation. They are briefly reviewed below.

Chapter 2

This chapter introduces the combination of insights from innovation theory, sustainable development practice and small business characteristics to unlock new knowledge on factors that influence the translation of sustainable innovation within small and medium-sized enterprises (SMEs) into practice. The sustainability themes and activities as described for large companies (i.e. in the sustainability reporting and management literature) were used as starting point in this study. It presents empiric results of the PRIMA Project conducted within the rubber and plastics industry (RPI) on sustainable innovation activities.

It was concluded that many sustainable innovations are directed at the improvement of technological processes (eco-efficiency) and to lower costs of production. These innovations can be seen as incremental. Companies with sustainability integrated in their orientation and innovation processes show value creation: the development of products new to the market (radical innovations) and cooperation with stakeholders. The PRIMA project shows that more insight in the combination of innovative characteristics of SMEs and the (e) valuation of their sustainable innovation efforts provides opportunities to improve the sustainability performance of SMEs.

Chapter 3

This chapter aims to provide more insight in the influencing factors of sustainable innovation processes within SMEs, by creating a new conceptual model. A case study was carried out in the rubber and plastics and building and construction industry. Evidence suggests four main conclusions: differences in how influencing factors are perceived within sectors are larger than those between sectors; internal factors have more influence than external factors; economic relations have more influence than other stakeholders; and positive influences have a different ranking than negative ones. Success is attributed to sustainability orientation and business competences, whereas failure originates in the network interface.

Chapter 4

While SMEs are traditionally considered as a homogeneous group with stereotype characteristics, this study gives evidence to the existence of more variety within SMEs and a strong indication that SME characteristics can explain differences in perceived influence of governmental instruments on sustainable innovation processes. A new conceptual model was developed to describe the explanatory power of six SME characteristics. It was used to test the research hypothesis “there is a positive relation between SME characteristics and perceived influence of governmental instruments on sustainable innovation processes” on eight different governmental instruments. The empirical, quantitative study was performed in the Dutch installation sector (2008). Results showed that the hypothesis is partially supported. The relevant SME characteristics provide guidelines to define target groups of SMEs and direct more customized and specialized instruments at them, with higher effect and efficiency levels.

Chapter 5

This chapter examines the crucial factors that influence sustainable innovation processes within small and medium-sized enterprises (SMEs). It combines insights from innovation theory, sustainable development and SMEs and presents a new conceptual model based on 31 internal and external factors. The research hypothesis is formulated as follows “there is a positive relation between the internal and external factors on sustainable innovation processes within SMEs”. To measure sustainable innovation processes, a proxy variable was constructed based on the eleven different sustainability themes which can be included in innovation processes of the company. The results from the empirical, quantitative study performed in the Dutch installation sector, rubber and plastics industry, building and construction sector and graphic media industry (2008-2009) provided evidence that only seven high influence factors contribute significantly to the regression model: *duty*, *skilled personnel*, *suppliers*, *trade associations*, *degree of formalization*, *customers* and *national governmental institutions*. This contradicts earlier findings that when measured individually or in categories, respondents tend to attribute influence to almost all factors.

Overall conclusions

Results from the quantitative study performed in four production sectors revealed that only seven factors contribute significantly to sustainable innovation processes within SMEs. These factors have a crucial influence on these processes and are therefore presented as ‘high influence’ factors in this dissertation. These high influence factors include (in order of contributing proportion) duty, skilled personnel, suppliers,

trade associations, degree of formalization, customers and national governmental institutions. It is concluded that measured in their relative context, only a few factors matter. These findings have resulted in the formulation of a new conceptual model, see figure 1.

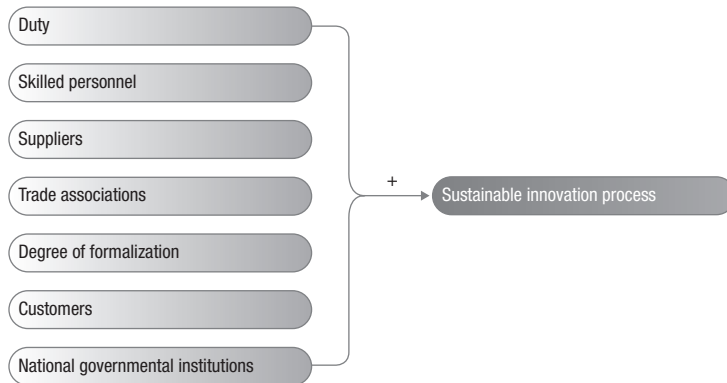


Figure 1: New conceptual model

Other important findings are:

- Sustainable innovation is portrayed as the implementation phase of sustainable development and corporate sustainability. As sustainable innovation is defined by the integration of people, planet and profit, an integral approach should not be abandoned. The whole is more than the sum of its parts. Only the combination of sustainability issues does justice to the complexity of the concept.
- There are different groups of SMEs, which implies that a specified approach will lead to higher effectiveness and efficiency of the stimulation of sustainable innovation processes within SMEs. This goes beyond the traditional tripartite classification of frontrunners, followers and laggards and uses SME characteristics, sustainability orientation, business competences and resources, network interface context and background of owner-manager.
- There are a number of 'high influence' factors which draw the outline for stimulation opportunities, but there are also other, contextual factors which can fine tune these different approaches.
- Knowledge on the workings of influencing factors can be used by SMEs or other stakeholders, like governments or intermediary organizations, to stimulate or steer sustainable innovation into a certain direction. However, it is clear that not all factors are easily manipulated because of their rigidity or attitudinal nature.
- The often used tripartite classification of companies in frontrunners, followers and laggards is too generic, and leads to situations in which suboptimal instruments or solutions are developed, which do not connect sufficiently with the needs and action perspectives of different types of SMEs.
- Despite the fact that within literature on SMEs and innovation a lack of resources (money, time, knowledge, personnel) often is designated to be the main barrier for innovation processes, this was not reflected in the results of this dissertation: it appears that many SMEs are able to overcome the shortcomings by enhancing the skills (and motivation) of their personnel and cooperating with stakeholders (predominantly in the supply chain). Skilled personnel is the only factor of business competences and resources within the seven 'high influence'-factors to have a significant contribution to sustainable innovation processes within SMEs.

In general, the success of a company is greatly determined by the motivation, skills, and qualities of its employees. These can be influenced by the owner-manager to a large extent by elements such as personal charisma, employment conditions, human resources development, work atmosphere, communication, and leadership style.

- The translation of sustainable innovation by SMEs is that of incremental, little steps and changes in products, processes, services and organization rather than radically new, transformative technologies from the pipelines of fundamental research. As the issues of sustainable development are abstract or not associated their own (daily) business operations from the owner-manager's perspective, this translation issue will be one of the most important topics of future research and practical applications in the years to come. This dissertation makes clear that sustainable innovation processes offer many opportunities for SMEs to improve their competitiveness, reduce costs and enlarge annual sales and turnover, while enhancing their environmental and social performance.
- The seven 'high influence'-factors are the only relevant factors for all sectors studied. However, they can have different relative weights within the different sectors, leading to different sustainable innovation outcomes. Therefore, it is possible that a sector is 'more sustainable innovative' than another.

Relevance

Scientific relevance

This dissertation contributes to the body of scientific knowledge significantly, since there is no validated conceptual model on sustainable innovation processes specified for SMEs available to date. Other scholars have studied these factors in varying settings of SMEs, innovation, environmental innovation, cleaner production, eco-efficiency or social innovation. It was indicated that there are "myriad factors affecting the diffusion of new cleaner technologies and how these factors interact [...]. Often potentially relevant factors related to the adoption of new technologies have not been included in the analysis. The factors may differ between sectors but this has not been systematically studied". This myriad of factors that influence innovation processes has created a myth on the importance of all factors alike. However, the contributing properties of various internal and external factors were/are still not completely understood. There is still little quantitative empirical evidence on factors influencing sustainable innovation processes within SMEs.

Societal relevance

The societal relevance of this dissertation is mainly focused on practitioners from governments, trade associations and other (intermediary) organizations. They can benefit from the insights from this study on the understanding of the internal and external factors that influence sustainable innovation processes. Using the high influence factors from the conceptual model and the insights from this study on the differences between SMEs, governmental policy makers can gain more insight in the receptiveness of steering and stimulating of sustainable innovation processes within SMEs. It helps in defining specific target groups for policy and instruments, and to develop, mix and apply different types of instruments. It was concluded in this dissertation that policy and financial instruments (such as sustainable procurement by governmental institutions, grants and taxation) have more influence on sustainable innovation processes than advocacy or regulatory instru-

ments. Sustainable development and innovation offers numerous opportunities for governmental institutions to improve their own internal organization and to enhance the competences of politicians and government officials to assist SMEs in their sustainable innovation processes as well.

Recommendations for applied settings

The conceptual model on sustainable innovation processes within SMEs provides starting points for the development, evaluation and adjustment of instruments to stimulate sustainable innovation processes within SMEs by external stakeholders. As opposed to a starting point in which all factors seem to matter in stimulating sustainable innovation processes within SMEs, which can lead to either vague or overly detailed instruments, this study provides a firm set of seven 'high influence' factors to be included in designing and evaluating instruments with higher effect and efficiency levels.

This dissertation concludes that the often used tripartite classification of companies in frontrunners, followers and laggards is too generic, and leads to situations in which suboptimal instruments or solutions are developed, which do not connect sufficiently with the needs and action perspectives of different types of SMEs. Stakeholders who want to stimulate sustainable innovation processes within SMEs would benefit to discard this classification as starting point for the development of instruments. For many this would involve a fundamental new approach, which conflicts with the need to establish easily classifiable (or reachable) target groups. For example, many governmental bodies direct their efforts on frontrunners, which are already proactive in applying for grants or participating in demonstration projects. The formulation of different types of SMEs based on the conceptual model of this dissertation requires a more elaborate preparation, but will lead to better results.

The different governmental institutions look for new roles on the stimulation of sustainable innovation processes within companies, with growing attention for SMEs. However, ambitions and political statements alone are not enough to inspire action within SMEs, nor should it be left to international agreements on macro levels such as the Kyoto protocol and its successor to be decided upon during the (upcoming) IPCC Conferences in Denmark 2009 and Mexico 2010. Clear, consistent and accountable sustainability criteria need to be integrated in governmental programs and instruments today, to motivate SMEs to take their sustainability efforts one (or more) steps further. The current situation is marked by a fragmented corporate sustainability approach. To successfully stimulate corporate sustainability and sustainable innovation within SMEs, it is necessary to streamline the efforts from different departments and governmental levels and to benefit from insights in best practices and demonstration projects from both SMEs and governmental institutions.

Recommendations for future research

Even though this dissertation presents one of the first quantitative studies on this topic to date, more work is needed to confirm and validate the findings and assumptions underlying the conceptual framework, qualitatively as well as quantitatively. A number of pathways for future research can be discerned to fill in

the gaps left in this research and to develop the concept of sustainable innovation processes within SMEs in greater detail. The concept of sustainable innovation processes is relatively new and therefore a fruitful and promising field within scientific research. Some suggestions are summarized below.

- Including other types of sectors in future research, such as agriculture, financial, services, utilities and public sectors, will add to more insight on the different SME groups across sectors, or will identify differences between sectors that are more divergent than those within this research sample.
- This dissertation concentrated on 31 influencing factors of sustainable innovation processes. Research on sustainable innovation processes within SMEs would benefit from further explorative research on other factors such as family business, regional focus, 'general' innovativeness, clustered networks, environment or market uncertainty, economic climate and consumer behavior. Also, the influence background of the owner-manager could be further explored by other factors such as belief systems, ethical values, leadership qualities, risk taking preferences, etc.
- More insight is needed on the rigidity of the high influence factors of sustainable innovation processes within SMEs and how they can be manipulated by both SMEs themselves and external stakeholders. Differences in this manipulability are expected to occur within motivational, behavioral and structural factors.
- More research is needed to develop practical approaches to identify groups of SMEs in practice. Sustainable development is a dynamic concept, and companies are expected to move from one phase to another in course of time. A longitudinal approach would be preferable here.
- An international comparison will broaden the quantitative basis for conclusions on the contribution of internal and external factors. It would also allow for comparison between a nation state approach versus the transboundary (or global) character of sustainability issues.

In conclusion, when there is a better understanding of the mechanisms underlying sustainable innovation, more effective and efficient actions can be undertaken by SMEs themselves and stakeholders wishing to influence this development.