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Master thesis International Business:

The ‘smallness’ of SMEs and their large impact on the environment:
Contextual influences on the environmental practice recycling among European
SMEs

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Abstract

This study seeks to better understand the factors that contribute to the recycling as an environmental practice by European SMEs. Grounded in the technology-organization-environment (TOE) framework, a research model for assessing the contextual influences on European SMEs recycling activities is developed. Based on the TOE framework, eight hypotheses were formulated with eight factors (technological expertise, technological support, firm size, organizational resources, organizational expertise, firm industry, government regulation and customer demand) that might affect the recycling activities of SMEs. Survey data of the Flash Eurobarometer 456, with data regarding resource efficiency activities among a sample of 8868 European SMEs, were used to test the hypotheses. The analysis, conducted with binary logistic regression, showed several key findings. Within the TOE framework, technological expertise is the strongest factor that influences the adoption of recycling. Furthermore, technical support, firm size and financial resources also show significant results to positively influence the adoption of recycling among European SMEs. Lastly, firm industry partly influences the adoption of recycling, as firms in the service sector adopt less recycling activities than firms in the retail sector.

Key words: small and medium-sized enterprises, corporate social responsibility, TOE framework, adoption recycling activities, empirical research

Preface

This thesis was written to fulfil the master specialization in International Business, the master Business Administration, at the Radboud University Nijmegen. I really enjoyed diving into the subject of environmental business practices because it is an essential topic that is evolving in our lives. I feel that sustainability and the environment are becoming more important, and it interests me to see what the opportunities are for businesses, more specifically the opportunities regarding recycling among European SMEs. The process of conducting the research and writing the thesis was, even though it was not always easy, very interesting and it has taught me a lot.

I truly want to thank professor Wierenga for all her guidance, feedback, and inspiration during our thesis meetings. Furthermore, I want to thank dr. Saka-Helmhout for the helpful feedback on my proposal and being my second assessor and dr. Ligthart for his helpful consultation sessions regarding SPSS. Adding to that, I am very thankful for all my fellow students with whom I spend many hours in the central library motivating and helping each other out. Lastly, I want to thank my family and friends for their support and distractions when I was stressed or insecure about my skills. Without your help and support this thesis would not be where it is now.

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Chapter 1: Introduction

1.1 Introduction

Why do some firms adopt environmental practices, and some do not? A broad range of literature has shown the importance of corporate social responsibility (CSR) and environmental practices. In the last years, the interest of scholars in the areas of CSR and sustainability has increased considerably (Dorobantu et al., 2018). Rising pressures on firms on the natural environment have increased concerns among people all around the world (Turker, 2009). Furthermore, there is a growing number of studies on climate change and corporate sustainability (Goodall, 2008; Whiteman, et al., 2012). Companies are key actors in global emissions and climate change is strategically relevant for firms in terms of managing opportunities (Haanaes et al., 2011; Hoffman, 2007; Whiteman et al., 2011; Whiteman et al., 2012). The increasing awareness about climate change, population growth and resource depletion has caused the need for sustainable activities in organizations. Furthermore, firms are beginning to understand that embracing sustainability practices is the key to long-term success (Hecht et al., 2014; Porter & Kramer, 2006).

CSR encompasses all the social and environmental practices and policies of an organization, that are followed to increase the welfare of all stakeholders (Turker, 2009). CSR is a way for companies to integrate environmental responsibility within their business operations and their relationship with stakeholders of the firm (Dinu, 2011). The focus of this current thesis is on the environmental aspect of CSR, which is defined as the obligation to cover the environmental implications of the company's products, facilities, and operations (Mazurkiewicz, 2004). Even though CSR has received a lot of attention, most research about CSR is addressed to large businesses instead of small- and medium-sized enterprises (SMEs) (Dey et al., 2018; Perrini et al., 2007). Although large companies can play a big role in CSR, SMEs also play a big part in the climate problems because SMEs make up around 90% of the world's businesses (Raynard & Forstater, 2002). Despite the individual impact of SMEs is small, the cumulative impact of SMEs on the environment is significant (European Commission, 2018). However, research addressed to large businesses is not applicable to SMEs, because SMEs might lack organizational capacity in terms of people, financial resources, and infrastructure to engage in CSR practices, which makes them different from large firms (Kechiche & Soparnot, 2012). Therefore, research on SMEs is more important than ever.

SMEs see sustainability as a major challenge (Longoni & Cagliano, 2015). More specifically, SMEs face the pressure to be commercially viable and responsible at the same time. As a result, CSR can be seen as a difficulty for SMEs, because it is hard to stay competitive and be able to meet the social and environmental requirements of supply chains and buyers at the same time (Maloni & Brown, 2006). Furthermore, research shows that SMEs are concerned about environmental issues, but these positive personal attitudes are not translated into environmental improvements (Perez-Sanchez et al., 2003). Obviously, it is important to translate these concerns into actual environmental improvements, for SMEs to have a positive impact on the environment.

SMEs are perceived to have environmental impacts on a large scale and environmental management is becoming an important topic for SMEs (Puppim de Oliveira & Jabbour, 2017). Besides that, the article of Perrini et al. (2007) shows that SMEs implement less environmental management- and CSR strategies than large firms do. Also, the Eurobarometer (European Commission, 2018) shows that only around 57% of the SMEs in the European Union are saving material, 60% are minimizing waste and only 41% are recycling. Why do some SMEs implement these actions and some not? This thesis gives insights in the contextual factors that influence the environmental practices of SMEs, with the focus on the environmental practice recycling. Recycling is an environmental practice a firm can pursue, and it is applied to avoid using new materials or resources. More specifically, recycling means: “processing of mixed streams of post-consumer products or post-producer waste streams using expensive technological equipment, including shredding, melting and other processes to capture (nearly) pure materials” (Reike et al., 2018, p. 257). Moreover, Potting et al. (2017) define recycling as the processing of materials to obtain the same (high grade) or lower (low grade) quality. Recycled materials do not maintain the original product structure and they can be re-applied everywhere (Reike et al., 2018). The benefits of recycling include reducing energy consumption, reducing waste in landfills, and diminishing pollution (Nodoushani et al., 2016). Adding to that, by enhancing recycling, the pressure on demand for primary raw materials will reduce, the reuse of valuable materials which would otherwise be wasted will increase, and the greenhouse gas emissions and energy consumption because of material extraction and processing will decrease (Wijkman & Skånberg, 2015).

Recycling is one of the six types of environmental innovation, which means using new or modified processes, systems, techniques, and products to reduce or avoid environmental harm (Kemp & Arundel, 1998). This thesis investigates the adoption of recycling and because recycling is one of the six types of environmental innovation this concept is important. Environmental innovations are defined as the development of processes, services or products aimed at reducing environmental harm and they include recycling by reusing waste or materials (Berrone et al., 2013; Brunnermeier & Cohen, 2003). Furthermore, recycling is part of circular economy, which is frequently defined as a combination of reduce, reuse and recycling activities (Kirchherr et al., 2017). More specifically, the broader definition of circular economy is “an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations” (Kirchherr et al., 2017, p. 224). Circular economy turns goods that are at the end of their life, into resources that are useful for others, and therefore closes loops in industrial ecosystems and minimizes waste (Stahel, 2016). Consequently, by closing loops and using resources for the longest time possible, a circular economy could considerably lessen waste, reduce green-house-gas emissions by up to 70% and increase workforces by 4% (Stahel, 2016; Wijkman & Skånberg, 2015).

As a result of the rising awareness about environmental issues, the measures across the world concerning recycling are increasing. Firstly, the EU waste management law is established to save the environment and human health, by stressing the importance of proper waste management, recovery of resources, and recycling techniques, to reduce the pressures on resources and enhance the use of resources (Eur-Lex, 2020). Secondly, the Waste Framework Directive formed boundary conditions to increase the material recovery by setting a waste hierarchy that specifies recycling as a preferred action for waste recovery (Eur-Lex, 2020; Ragossning & Schneider, 2019). The Waste Framework Directive set the target that businesses must recycle at least 55% of their municipal waste by 2025 and 65% by 2035 (European Environmental Bureau [EEB], 2018). However, at this moment only 48% of the municipal waste in the EU is recycled (European Commission, 2019) and only 74% of construction and demolition waste, 43% of municipal solid waste and 37% of waste electrical and electronic equipment is recycled in Europe (European Environment Agency, 2021). In addition, under European SMEs only 41,8% of the firms take actions to recycle by reusing

waste or materials (European Commission, 2018). To conclude, these numbers show that there is improvement needed to reach the regulated target set by the Waste Framework Directive, to comply with the regulations of the EU waste management law, and to reduce environmental problems (Nodoushani et al., 2016).

1.2 Problem statement

Over the past decades, global warming has become an important problem that has put pressure on SMEs to apply environmental responsiveness activities (Perez-Sanchez et al., 2003). Recycling has a positive impact on reducing environmental problems (Nodoushani et al., 2016). Although there is research on the environmental part of CSR, there is a lack of focus on SMEs (Dey et al., 2018; Perrini et al., 2007). Also, there is not much research about the recycling activities of SMEs. There is research about the prospects, impediments, and prerequisites of circular economy among SMEs (Sharma et al., 2021), waste management and recycling in Japan (Yolin, 2015), drivers of environmental processes among Turkish SMEs (Ağan et al., 2013), the influence of energy prices on adoption of recycling (Triguero et al., 2014), and about the influence of policy mixes regarding waste as a specific resource efficiency challenge (Wilts et al., 2016). But nevertheless, none of these studies look at the adoption of recycling among SMEs and the contextual influences on that specific topic. Furthermore, there is agreement about the value of environmental innovations, but there is not a lot of information on why some organizations engage in more environmental innovation than others and under which conditions organizations undertake environmental innovations (Berrone et al., 2013). Also, the contextual factors that affect SMEs pursuit of environmental CSR may vary from those of large organizations (Kechiche & Soparnot, 2012). Hence, by looking into the contextual influences on SMEs' recycling, it can help us to understand how SMEs can reduce environmental impact by recycling by reusing material or waste.

1.3 Scientific relevance

There is an increasing awareness of the concerns about the environment, and sustainability is an important topic nowadays (Dorobantu et al., 2018; Turker, 2008). Although there is an increase in research about environmental practices and sustainability of firms, most research is not related to SMEs (Perrini et al., 2007). Investigating this topic concerning SMEs is important, because SMEs make up around 90% of the world's businesses (Raynard & Forstater, 2002) and the cumulative impact of SMEs on the environment is significant (European

Commission, 2018). The situation of SMEs differs of that of large businesses; SMEs might lack organizational capacity in terms of people, financial resources, and infrastructure to engage in CSR practices (Kechiche & Soparnot, 2012). Furthermore, the CSR practices of SMEs differ from large firms; large firms are more likely to address environmental management strategies and carry out more formal CSR strategies (Perrini et al., 2007). Lastly, the Eurobarometer shows that among European SMEs only 41,8% of the firms take actions to recycle and larger firms also have a higher percentage of recycling adoption than SMEs (See table 1) (European Commission, 2018). Thus, the differences between SMEs and large firms and the difference in the adoption rate of recycling makes this thesis scientifically relevant. In addition, there is still little research on the adoption of distinct sorts of environmental practices, under which recycling is one. Hence, the aid of this thesis is to fill the gap of research on SMEs' contextual influences on the adoption of recycling.

Table 1
Recycling adoption by firm size

| Number of employees | No recycling | % | Recycling present | % | Total |
|----------------------------|---------------------|----------|--------------------------|----------|--------------|
| 1-9 | 3860 | 63,6 | 2213 | 36,4 | 6073 |
| 10-49 | 2917 | 59,2 | 2008 | 40,8 | 4925 |
| 50-249 | 1539 | 53,6 | 1332 | 46,4 | 2871 |
| > 250 | 462 | 42,3 | 629 | 57,7 | 1091 |
| DK/NA | 35 | 59,3 | 24 | 40,7 | 59 |
| Total | 8813 | 58,7 | 6206 | 41,3 | 15019 |

(European Commission, 2018)

1.4 Societal relevance

More than 90% of the European citizens see climate change as a severe problem and 18% of the Europeans believe that climate change is the most serious problem that the world is facing right now (European commission, 2021b). Adding to this, within the European Union, 58% of the people think that business and industry are responsible for tackling climate problems (European Commission, 2021b). Since climate change is an important issue on the public agenda, this also includes SMEs adopting environmental practices. Regarding plastic waste, for example, the research of Dilkes-Hoffman et al. (2019), shows that the public views plastic waste as a serious environmental issue and that there is a negative association with the use of plastic. By studying the factors that influence the recycling adoption of European SMEs, this

thesis has practical relevance. It gives insights into the contextual influences on recycling, for European SMEs that want to adopt or improve recycling activities.

1.5 Research objective

The aim of this study is to identify the contextual influences that impact the adoption of recycling activities of European SMEs. Contextual factors include the internal and external aspects of an enterprise's context (Oliveira & Martins, 2011). As Jenkins shows (2004), size is a factor that influences the environmental performance of firms, but there are other internal and external dynamics that explain environmental behaviour of firms. Therefore, it is important to investigate the internal and external context of SMEs, to define the other characteristics that influence pro-environmental behaviour among SMEs. The preceding introduction leads to the following research question: *“What are the effects of a firm's contextual factors on the adoption of the environmental practice recycling among European SMEs?”*. By formulating an answer to this research question, the objective of this thesis is to give insights in the contextual influences on SMEs concerning the adoption of the environmental practice recycling by reusing materials or waste. The technology, organization, and environment (TOE) framework will be used to give insight into the technological, organizational, and environmental influences on SMEs' recycling adoption.

1.6 Outline

The remainder of this thesis is organized as follows. In the next chapter, the theoretical framework for this research is described. The relevant literature regarding CSR, SMEs and the TOE framework is discussed. Chapter three elaborates on the methodology and in chapter four the results of the analysis are shown. The final chapter includes a conclusion, with the provided outcomes of the hypotheses, the answer to the research question and the discussion of this thesis.

Chapter 2: Theoretical framework

In order to achieve the aim of the present study and explore the effect of firm's contextual factors on the adoption of recycling, it is essential to assess the theoretical backgrounds of this subject. In this chapter the theoretical framework of this thesis is discussed, that provides the foundation on which this research is built. The chapter starts with discussing the central concepts of CSR, SMEs, and the TOE framework where firm contextual variables are covered, and the hypotheses are formulated. Finally, the conceptual framework is shown.

2.1 Corporate Social Responsibility

The definition of CSR varies across countries, organizations, and researchers (Massoud & Abdul-Wahed, 2010). This varying definition could be because of the lack of consensus on what CSR really means (Panapanaan et al., 2003). For instance, Turker (2009) argues that CSR encompasses all the social and environmental practices and policies of an organization, that are followed to increase the welfare of all stakeholders. Foss and Klein (2018) argue that CSR is the act of maximizing the welfare of all stakeholders that are legitimate. Finally, Frederick (2018) sees CSR as a business that deliberately and consciously acts to enhance the social well-being of those who are affected by the firms' operations. Concerning the aim of CSR, Uddin et al. (2008) argue that the purpose of CSR is to make business activities and business culture sustainable in different aspects, namely the economic, social, and environmental aspects. The focus of this thesis is on the environmental aspect of CSR, which is defined as the obligation to cover the environmental implications of the company's products, facilities, and operations (Mazurkiewicz, 2004). As Mazurkiewicz (2004) argues, this implies eliminating waste and emissions, maximizing the efficiency and productivity of resources, and minimizing practices that might affect the use of resources for future generations. Moreover, the environmental impact of firms refers to possible negative impact on the natural environment due to business activities, like overuse of resources and wastage (Uddin et al., 2008).

2.2 Specification SMEs

As stated before, the focus of this study is on European SMEs. This thesis uses the definition of the European Commission (2020a) to specify SMEs. The two main factors identified by the European Commission to define SMEs are staff headcount and turnover or balance sheet total. The European Commission distinguishes between micro, small and medium-sized companies. Microbusinesses have fewer than 10 employees and their annual turnover and balance sheet total do not exceed two million euros. Small businesses are those that have less than 50

employees and their annual turnover and annual balance sheet do not exceed 10 million euros. Lastly, medium-sized businesses have less than 250 employees, their annual turnover does not exceed 50 million euros and their annual balance sheet total is not beyond 43 million euros (European Commission, 2020a).

There has been less emphasis in research and in the media on SMEs than on large firms (Storey, 1994). Although SMEs do not attract national media attention often and they might not have a significant impact as individual SME (Spence et al., 2003), SMEs still represent 99.8% of all enterprises in the EU-27 non-financial business sector (European Commission, 2021a). Furthermore, the total number of SMEs in Europe is 25 million and European SMEs are responsible for 50% of Europe's GDP, which makes them important for Europe's competitiveness and prosperity (European Commission, 2020b). The research of the European Commission (2020b) also shows that only 25% of EU SMEs work on green products or services and only 41% of European SMEs are recycling by reusing materials or waste (European Commission, 2018).

2.3 SMEs and Corporate Social Responsibility

Literature about CSR practices of SMEs and why SMEs implement certain CSR practices is limited. Most research about CSR is addressed to large businesses instead of SMEs (Dey et al., 2018; Perrini et al., 2007; Spence & Rutherford, 2003). SMEs differ from large firms; they might lack organizational capacity in terms of people, financial resources, and infrastructure to engage in CSR practices (Kechiche & Soparnot, 2012). Furthermore, SMEs have different needs than large firms and the strategies of SMEs might differ from large firms, because SME owners see specific CSR strategies that managers of large firms are not willing or allowed to see (Perrini et al., 2007). Focusing on the different needs between SMEs and large firms, for instance, SMEs often do not have an image or brand that needs marketing or protection in a specific way and SMEs have less need for public reputation protection, because they are not as visible to the public as large firms. Besides that, SMEs need operational and financial stability because risks concerning these two aspects are of importance for their survival. Moreover, SMEs have the need to only consider change if they are sure that it will not put pressure on management time and their cash cows. Lastly, SMEs do not always feel the need to be environmentally responsible, since they are not ready to take risks if it impacts their profit

(Jenkins, 2004). As these differences are crucial, the following paragraphs go deeper into the differences between large firms and SMEs, concerning CSR.

Perrini et al. (2007), stated that CSR pursued by SMEs differs from large firms, because large firms undertake more formal CSR strategies and are more likely to address environmental management strategies. Contrastingly, SMEs have a stronger willingness to recognize the importance of responsible behaviour along the supply chain (Perrini et al., 2007). Also, Baumann-Pauly et al. (2013) show that there is difference in communicating CSR commitments; large firms are more effective in communicating their CSR practices but often lack elaborated implementation, while SMEs are stronger in actually implementing CSR practices. Large firms got more attention regarding CSR and CSR research, but they are not naturally leaders in CSR activities (Baumann-Pauly et al., 2013). Moreover, research of Sweeney (2007) concluded that SMEs define CSR different than large firms. Large firms define CSR according to their four main stakeholders (employees, customers, community, environment), while SMEs define CSR as performing business in a responsible way and, in particular, by contributing to their local community.

Because SMEs differ in critical ways from large firms and their CSR is perceived different, it is important to look deeper into literature about SMEs. Different studies have examined the perception of SMEs about CSR. Sweeney (2007) compared literature about CSR among SMEs and found that most SMEs define CSR as the responsibility to a variety of stakeholders. Adding to that, Vo (2011) shows that SMEs see CSR as an ‘all embracing’ idea to have awareness of the impact of the business and a positive impact on the different stakeholders through decisions made in their business. SMEs see CSR as synonymous with sustainability; balancing social, economic and environmental demands (Vo, 2011). Lastly, Williamson et al. (2006) argue that the environment is a key component of CSR and sustainable development for SMEs, and that it shows whether they will voluntarily pursue beyond compliance activities.

2.4 TOE framework

This section will elaborate on the technological, organizational, and environmental (TOE) framework. The TOE framework developed by Tornatzky et al. (1990) identifies three aspects of a firm’s context that influence the process by which it adopts and implements an innovation

(Oliveira & Martins, 2011). The three aspects of a firm's context in the framework are the technological context, the organizational context, and the environmental context. These three contexts and their theories regarding environmental practices are discussed in the upcoming paragraphs. The framework originally presented in IT adoption research is a valuable analytical model for studying the adoption of different types of innovations (Hwang et al., 2016). As stated before, recycling is one of the six types of environmental innovation, which means using new or modified processes, systems, techniques, and products to reduce or avoid environmental harm (Berrone et al., 2013; Brunnermeier & Cohen, 2003; Kemp & Arundel, 1998). Furthermore, recycling is also part of the concept of green innovation (Chen et al., 2012), which is similar to environmental innovation. Green innovation activities refer to the decision of a firm to use green innovations to respond to environmental issues (Lin & Ho, 2011; Weng & Lin, 2011).

Several studies regarding environmental practices and green innovation adoption used the TOE framework to show how the three contexts of the firm have an influence on activities and innovations regarding these subjects. Hwang et al. (2016) and Chembessi et al. (2022) used the framework to analyse the green supply chain and circular economy of which recycling activities are part of. Furthermore, Weng and Lin (2011) investigated the determinants of green innovation adoption for SMEs and included recycling in their research. These studies reviewed the existing literature regarding green supply chains, circular economy and green innovations and used the TOE framework and theories concerning the technological, organizational, and environmental factors to find aspects that influence the adoption of these practices. Since the objective of this thesis is to give insights in the contextual influences on SMEs concerning the adoption of recycling, the TOE framework is suitable.

2.4.1 Technological context

The first context of the TOE framework is the technological context. This context looks at the technological attributes that are relevant to the innovation in question (Hwang et al., 2016). It refers to both the internal and external technologies relevant to the firm. More specifically, it includes the existing technologies in the firm and the available technologies in the market (Zhu et al., 2003).

Internal technology

The internal technologies of a firm refer to the firm's own technological expertise regarding resource efficiency activities (Zhu et al., 2003). Vermunt et al. (2019) stated that firms see lack of knowledge and technology as a barrier concerning recycling. The absence of technological know-how hinders SMEs to transform their linear business model into a circular business model, which includes recycling (Rizos et al., 2016; Van Eijk, 2015). Because linear technologies are extensively established in current businesses, it is hard to change technically into more linear business forms (Kok et al., 2013; Rizos et al., 2016). Hossain et al. (2016) found that technological resource readiness, the availability of technology in a firm and the integration of technology, has a positive influence on the adoption of innovations. Additionally, Chembessi et al. (2022) also found that the existing technologies in a firm are an important factor for the adoption of innovations. Because recycling is an innovation (Berrone et al., 2013; Brunnermeier & Cohen, 2003), the present study expects that its adoption is also influenced by existing technologies in a firm. Therefore, the following hypothesis is established:

H1a: Among European SMEs, there is a positive relationship between being able to rely on own technical expertise to be more resource-efficient, and the likeliness of adopting recycling activities.

External technology

As stated in the previous paragraph, technical expertise inside a firm is proposed to have a positive influence on recycling. But besides the internal technologies in a firm, knowledge about these technologies might also be owned by external parties (Chembessi et al., 2022; Wu & Chen, 2014). This external knowledge about technologies can be used as technical support for new technologies. Larger firms can support recycling technology development through own research and own development actions, but SMEs mostly depend on technology available in the market. Because, due to their size, SMEs are limited to observing technology trends in the operating market (Rizos et al., 2016). Several studies showed that external support for relevant technology is an important factor that matters to adopters of new innovations (Hossain et al., 2016; Huyskens & Loebbecke, 2007; Oni & Papazafeiropoulou, 2014). Linking this to recycling, this study expects that technical support will increase the adoption of recycling activities. Accordingly, the following hypothesis is established:

H1b: Among European SMEs, there is a positive relationship between technical support about new technologies to improve resource efficiency, and the likeliness of adopting recycling activities.

2.4.2 Organizational context

The second context of the TOE framework is the organizational context, which refers to several characteristics of a firm. It can include the size and scope of the firm, resources of the firm and the quality of the human resources of the firm (Hwang et al., 2016; Zhu et al., 2003). This thesis uses firm size, organizational resources, and environmental expertise to test the influence of this context. The scope of the firm, firm industry, is discussed in the environmental context.

Firm size

This aspect of the organizational context looks at firm size, focussing on the size difference regarding micro, small and medium sized SMEs. The aspect of firm size regarding (financial) resources, is discussed in the next paragraph, organizational resources. SMEs differ in size from zero to 250 employees and from zero to 50 million yearly turnover (European Commission, 2003). Because of these differences in firm size between micro, small and medium enterprises, it is important to investigate how firm size influences the adoption of recycling. Research has shown that smaller firms attract less public attention, which means that the strength of the reputational liability effect of a firm is positively dependent on firm size (Graafland, 2018; Williamson et al., 2006). When a firm of micro-size carries out CSR practices it will attract less attention of NGOs than a medium-sized firm does. Hence, this could lead to fewer environmental practices, including recycling, among smaller firms. The research of Graafland (2018) shows that the strength of the reputation liability effect increases with firm size, which means bigger firms will pursue more CSR practices. In line with the research of Graafland, Perrini et al. (2007) also conclude that larger firms implement more CSR strategies than smaller firms do. Moreover, Badulescu et al. (2018) show that firm size is positively correlated with CSR involvement. Linking these conclusions about the impact of firm size to the environmental CSR dimension of SMEs which includes recycling (Santos, 2011), the following hypothesis is specified:

H2a: Among European SMEs, there is a positive relationship between the size of a firm and the likeliness of adopting recycling activities.

Organizational resources and expertise

Hwang et al. (2016) concluded that organizational resources influence organizational innovativeness when an organization considers the adoption of green supply chains. Firms with green supply chains try to close the loop of the supply chain, by among other things reusing, remanufacturing, and recycling products and materials (Wells & Seitz, 2005). Resources of an

organization include financial resources and with this hypothesis, the focus is therefore on the financial resources of an organization. If a firm has financial resources available it can expand the firm's capacity to support innovations, while lack of financial resources can limit the level of innovation in a firm (Ombaka et al., 2015). Because SMEs have more financial constraints than large firms (Kechiche & Soparnot, 2012), the access to financial resources is critical for innovation among SMEs. Therefore, lacking financial resources is an important barrier for environmental innovations, including recycling (Triguero et al., 2016). This present study hypothesizes that firms with enough financial resources to be more resource-efficient, have a higher adoption rate of recycling activities. Consequently, the following hypothesis is established:

H2b: Among European SMEs, there is a positive relationship between own financial resources to be more resource-efficient, and the likeliness of adopting recycling activities.

Furthermore, organizational expertise is part of human capital which is part of the organizational context (Hwang et al., 2016; Zhu et al., 2003). Moktadir et al. (2018) investigated the drivers of circular economy which they define as “recycling with minimal extraction” (p. 1367). They found that knowledge about circular economy is one of the key drivers of circular economy and environmental sustainability practices. For environmental sustainability and green supply chains, which also include recycling, a firm needs specialized types of capabilities and expertise (Hwang et al., 2016). If firms lack this expertise, it could be a barrier to implementing recycling activities (Moktadir et al., 2018). Among SMEs, barriers for the adoption of recycling are the lack of experience and knowledge in an organization (Sharma et al., 2021). Furthermore, SMEs need the knowledge and capabilities to deliver the change for the implementation of a successful circular economy innovation, which includes recycling (Malik et al., 2022). This study expects that having environmental expertise positively influences the adoption of recycling. Hence, the following hypothesis is formulated:

H2c: Among European SMEs, there is a positive relationship between having environmental expertise and the likeliness of adopting recycling activities.

2.4.3 Environmental context

The last part of the TOE framework is the environmental context. The environmental context refers to the arena in which the firm conducts its business and includes the industry of the firm, the governmental practices like regulation and legislation and the customers of a firm (Hwang et al., 2016; Zhu et al., 2003).

Firm industry

Several studies showed a relationship between firm industry and the scope of circular economy practices implemented (Garcés-Ayerbe et al., 2019; Zamfir et al., 2017). Ungerman and Dědková (2020) also found that the number of firms that recycle vary considerably among sectors. Vives (2006), studied the commitment to engage in CSR activities in developing Latin-American countries. He concluded that SMEs in the manufacturing industry show a higher commitment to engage in CSR activities than SMEs in the commercial and service sector. Although this research is conducted in Latin America, the study from Zamfir et al. (2017) also found significant differences across sectors on SMEs adopting circular economy practices. They concluded that companies in the retail and manufacturing sector are more active in circular economy practices than firms in other sectors. Linking this to recycling, this present study expects that firms in the manufacturing and retail industry will engage in more recycling activities than firms in other industries do. Accordingly, the following hypothesis is established:

H3a: Among European SMEs, firms in the manufacturing and retail industry have a higher likeliness of adopting recycling activities.

Government regulation

Legislation and government support are important drivers of circular economy (Moktadir et al., 2018). Adding to this, the study from Agamuthu et al. (2009) showed that legislation is an important driver of sustainable waste management. Governments can impose regulations regarding the recycling of materials and waste (MacArthur, 2013), which is done by the Waste Framework Directive in Europe (EEB, 2018) and the EU waste management law (Eur-Lex, 2020). Furthermore, insights from institutional theory show that firms engage in more environmental innovations like recycling if there are greater regulatory pressures (Berrone et al., 2013). Lastly, Mazurkiewicz (2004) shows that legal and regulatory pressures are a political driver of the environmental aspect of CSR. Since recycling is an environmental innovation and part of the environmental aspect of CSR, this present study expects that environmental regulation positively influences the adoption of recycling. Consequently, the following hypothesis is specified:

H3b: Among European SMEs, there is a positive relationship between environmental government regulations (environmental regulatory pressures), and the likeliness of adopting recycling activities.

Customer demand

Institutional theory shows that normative pressures influence a firm to pursue legitimacy and trustworthiness (Sarkis et al., 2011). Normative pressures come from external stakeholders, including the customers of a firm (Hwang et al., 2016). Mazurkiewicz (2004) shows that the pressure from customers is an economic driver of the environmental aspect of CSR. There is increasing pressure from the customer side to change the linear economy into a circular economy, which includes the adoption of recycling (Moktadir et al., 2018). Therefore, one of the most important drivers to a circular economy is customer awareness (Siemieniuch et al., 2015; Moktadir et al., 2018). Customer awareness of environmental issues leads to customer demand for environmental-friendly business practices among which recycling is one (Gadenne et al., 2009). Therefore, this present study expects that customer demand for products that are more resource efficient, is a motivation for SMEs to adopt recycling activities. Accordingly, the following hypothesis is formulated:

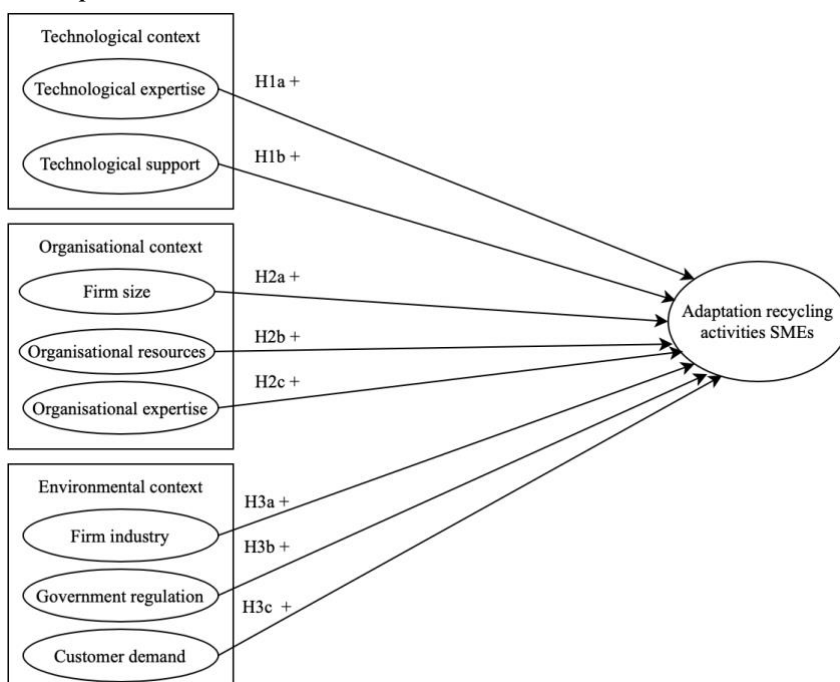
H3c: Among European SMEs, there is a positive relationship between customer demand for resource efficiency products, and the likeliness of adopting recycling activities.

2.5 Conceptual model

By linking all previously discussed concepts together, a conceptual framework, shown in figure 1, is developed that forms the basis of this thesis. All the expected hypotheses are linked to the TOE-framework, to show their influence on the adoption of recycling activities among SMEs.

Figure 1

Conceptual model



Chapter 3: Method

To realize the aim of the present study and examine the effect of a firm's contextual factors on the adoption of recycling, a quantitative method for the analysis of the data is best suitable. This chapter provides the description of the methodological process of this thesis. It starts with shortly introducing the research approach of this research and giving information about the sample among which the hypotheses will be tested. Thereafter, the dependent and independent variables are elaborated. Subsequently, the variable descriptions and the multivariate analysis method are shown. Lastly, the considerations regarding research ethics and the reliability and validity of this thesis are discussed.

3.1 Research approach

The objective of this research is to examine the effects of a firm's contextual factors on the adoption of environmental practices regarding recycling among European SMEs. The research strategy for this thesis is a quantitative data analysis conducted with SPSS. The unit of analysis in this research is European SMEs. Data from the Eurobarometer 456 will be used, and the data will be analysed by using binary logistic regression analysis.

3.2 Database and sample

To analyse the adoption of recycling activities among European SMEs, this study uses the data of the Flash Eurobarometer 456 survey about "SMEs resource efficiency and green markets" (European Commission, 2018). The reason for the choice of this database is that it is a large-scale dataset on the resource efficiency practices of SMEs, which makes it suitable to investigate recycling, a resource efficiency practice, among SMEs. The Flash Eurobarometer is conducted by the European Commission and reviewed current levels of resource efficiency activities and the state of green markets among European SMEs (European Commission, 2018). Topics of the survey include barriers for implementing resource efficiency actions, current and planned resource efficiency actions, the current state of green markets and the role and impact of external support used by SMEs to produce green products and services (European Commission, 2018). Among these resource efficiency actions, 'recycling by reusing waste or materials' will be investigated.

The total database has a sample of 15.019 firms, including the following countries: the 28 Member States of the European Union, Albania, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Iceland, Moldova, Norway, and the United States

(US). Out of the total 15.019 companies, 400 are from the US. Because this study only focuses on European SMEs, firms from the US are excluded. The data of the Flash Eurobarometer 456 was collected by telephone interviews done by the TNS e-call centre and the sample was selected from an international business database and some extra local sources in countries (European Commission, 2018). The data was collected in September 2017.

According to the European Commission (2003), SMEs can be defined according to their number of employees and their annual turnover or annual balance sheet. This thesis uses the number of employees as selection method for the sample and only uses the companies with less than 250 employees for the analysis. The survey results also include data from large firms, so these cases are deleted from the sample. Table 2 shows the number of respondents per type of SME, also showing the number of large firms excluded from this thesis.

Table 2

Data spread by type of SME according to the European Commission (2003)

| Type of SME | Sample size |
|---|--------------------|
| Micro (<10 employees) | 6073 (40.4%) |
| Small (<50 employees) | 4925 (32.8%) |
| Medium (<250 employees) | 2871 (19.1%) |
| 250 employees or more (excluded from this thesis) | 1091 (7.3%) |
| Total | 15019 (100%) |

Table 3 shows the final used sample of this present study according to SME size. To get the final sample, all large firms and SMEs outside Europe were excluded. Furthermore, the smaller countries with no data for environmental regulation, discussed later in 3.4.1, were excluded. Finally, this resulted in a total dataset of 8868 valid cases to perform the analysis with.

Table 3

Current sample spread by type of SME according to the European Commission (2003)

| Type of SME | Sample size |
|-------------------------|--------------------|
| Micro (<10 employees) | 3890 (43.9%) |
| Small (<50 employees) | 3087 (34.8%) |
| Medium (<250 employees) | 1856 (20.9%) |
| Total | 8868 (100%) |

3.3 Dependent variable: recycling by minimizing waste or materials

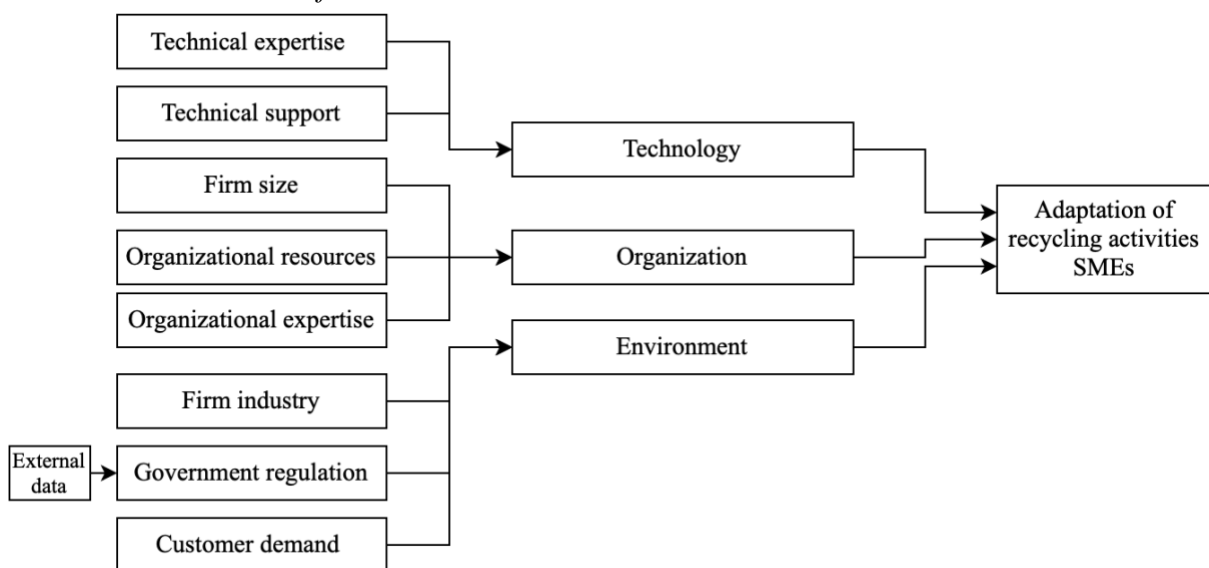
The dependent variable of this research is the variable “recycling by reusing waste or materials”, which is explained in the survey as recycling by reusing material or waste within the company. The respondents of the questionnaire were asked what actions their company undertakes to be more resource efficient. The answer options of this question were: saving water, saving energy, using predominantly renewable energy, saving materials, minimizing waste, selling your scrap material to another company, recycling by reusing material or waste, design sustainable products, other, or none. As stated before, the focus of this thesis is on the resource efficiency action “recycling, by reusing material or waste”. This variable has no missing values and 6206 (41.3%) of all the respondents of the Flash Eurobarometer 456 mentioned this type of resource efficiency as undertaken in their firm. The sample of this current study has no missing values on this variable as well, and 4110 (46.3%) of the European SMEs have adoption of recycling present.

3.4 Independent variables

To test the hypotheses of this research, several items considering resource efficiency practices which were included in the Flash Eurobarometer survey will be used for the operationalization of this study. Figure 2: Variables database TOE framework, shows the variables that will be used to test the different contextual aspects of SMEs regarding recycling activities. Table 4 in paragraph 3.6 gives an overview of the descriptions per variable.

Figure 2

Variables database TOE framework



3.4.1 Government regulation

To measure the regulative pressures on the environmental practices of firms, the environmental legislation per country will be investigated, which is shown by the Environmental Policy Stringency Index (PSI) (Botta & Koźluk, 2014). The OECD PSI index is an internationally comparable and country-specific measure of the stringency of environmental policy. Stringency is the degree to which environmental policies put an implicit or explicit price on environmentally harmful or polluting behaviour. The PSI index includes 28 OECD and 6 BRICS countries and is based on fourteen different environmental policy instruments, mostly related to climate and air pollution. The index ranges from 0 (not stringent) to 6 (highest degree of stringency) (Botta & Koźluk, 2014). Botta and Koźluk (2014) utilized several approaches to measure country environmental policy stringencies such as single policy change measures, composite measures of environmental regulation, environmental or related performance data and surveys on the perception of stringency. The PSI index is thus an index that measures the existing environmental measures and regulations in a country, as well as the actual perceived perception of the environmental stringency. Because PSI index only includes data for the 28 OECD countries and the 6 BRICS countries, the analysis will exclude the countries with no data on this variable to reduce the missing values.

3.5 Multivariate analysis method

To test the hypotheses of this thesis, logistic regression will be used as the multivariate analysis. Logistic regression is the appropriate analysis technique when the dependent variable is a categorical variable, and the independent variables are metric or non-metric variables. Logistic regression is limited to form two groups for the dependent variable (0-1), the binary nature of the dependent variable. The advantage of logistic regression is the possibility to easily incorporate nonmetric variables as independent variables (Hair et al., 2014). As the nature of the dependent variable “recycling by reusing material or waste” is binary, a logistic regression method is appropriate for this thesis. The two groups of the dependent variable are no recycling activities present (0) and recycling activities present (1).

Another advantage of logistic regression analysis is that it does not have to require the assumptions of homoscedasticity and normality as with multiple regression analysis and discriminant analysis. The assumptions of logistic regression are that the observations are independent, that there is linearity of the independent variables and that there is no high multicollinearity. Furthermore, the overall sample size should be 400 and the size of every

outcome group should be at least 10 times the number of estimated model coefficients. As the total sample size of this current analysis is 8868, the sample is big enough for this multivariate analysis method. The analysis will be conducted in IBM SPSS Statistics version 27.

3.6 Variable descriptions

Table 4 shows the variables included in this research. It shows the label of the variable, the value, the measurement per variable and literature substantiating the variable. All references in the table are from studies that also used the same variable of the Flash Eurobarometer 456 survey in their research. As PSI is external data and therefore not included in the Flash Eurobarometer 456 survey, this variable is substantiated separately in paragraph 3.4.1.

Table 4
Variable descriptions

| Label variable | Value | Measurement | References |
|---|---|---|--|
| What actions is your company undertaking to be more resource efficient? | Recycling, by reusing material or waste | 0 - 1 (no/yes) | Aristei & Gallo (2021); Bassi & Guidolin (2021); Darmandieu et al. (2022); Majid et al. (2020); Moreno-Mondejar et al., (2021) |
| Which type of support does your company rely on in its efforts to be more resource efficient? | Its own technical expertise | 0 - 1 (no/yes) | Moreno-Mondejar et al., (2021); Ratner et al. (2021) |
| Which of the following would help your company the most to be more resource efficient? | Demonstration of new technologies or processes to improve resource efficiency | 0 – 1 (no/yes) | Aristei & Gallo (2021); Ratner et al. (2021) |
| How many employees does your company have? | Firm size | 1 = 1-9 2 = 10 – 49 3 = 50 - 249 | Darmandieu et al. (2022); Majid et al. (2020); Moreno-Mondejar et al., (2021); Prime et al. (2020) |
| Which type of support does your company rely on in its efforts to be more resource efficient? | Its own financial resources | 0 - 1 (no/yes) | Aristei & Gallo (2021); Ratner et al. (2021) |
| Did your company encounter any of the following difficulties when trying to set up resource efficiency actions? | Lack of specific environmental expertise | 0 - 1 (no/yes) | Aristei & Gallo (2021); Bassi & Guidolin (2021) |
| Sector of activity (NACE) – Sections grouped | Firm industry | Manufacturing, Retail, Services, Industry | Bassi & Guidolin (2021); Majid et al. (2020); Moreno-Mondejar et al., (2021) |
| Did your company encounter any of the following difficulties when trying to set up resource efficiency actions? | Lack of demand for resource efficient products or services | 0 - 1 (no/yes) | Ratner et al. (2021) |

3.7 Research ethics

Multiple ethical considerations were considered when conducting this research. The ethical considerations were based on the Netherlands Code of Conduct for Research Integrity (Netherlands Code of Conduct for Research Integrity, 2018). The guiding principles of the code of conduct for research integrity are honesty, scrupulousness, transparency, independence, and responsibility. Honesty means the research process must be reported accurately and that the results of the analysis may not be presented more favourably than they are. Scrupulousness means using methods that are scientific and exercising the best care in design, reporting, and disseminating the research. Moreover, transparency implies ensuring that it is clear to other people what data the research was based on, how the data was obtained, how the results were achieved and what external stakeholders played as a role. Because this thesis relies on secondary data from the European Union, it is still important to show how the data is obtained, but this will be less extensive than with primary research data. The fourth principle, independence, means not being guided by non-scientific or non-scholarly considerations and requiring independence at all phases in the research. The last principle, responsibility, means recognizing that I, as a researcher, do not operate in isolation and should consider the legitimate interests of human and animal test subjects, commissioning parties, funding bodies and the environment. Because this thesis relies on secondary data, the interest of other humans, animals, commissioning parties, funding bodies and the environment will not be harmed directly, but it is still important to keep possible effects in mind. Furthermore, responsibility means conducting research that is scientifically and societally relevant. All these principles were considered to account for the quality and trustworthiness of this research.

Since this thesis relies on secondary data, research ethics concerning the collection of this data are important to consider. For the data of the Flash Eurobarometer 456 survey, TNS Political & Social Network that conducted the research took several conditions into consideration. The participants of the survey were informed that the survey was on behalf of the European Commission to gain insights into sustainable practices of SMEs among the participating countries before the survey was conducted. Furthermore, the telephone interviews were held in the language of the respondent, which minimized problems regarding understanding the questions. The respondents had the opportunity to not answer questions and anonymousness was ensured. Lastly, all participants of the study were able to look into the data via the website of the Flash Eurobarometer 456 survey (Gesis, n.d.; European Commission, 2018).

3.8 Validity and reliability

Validity and reliability are the heart of effective and competent business studies. According to Thanasegaran (2009, p. 1) reliability is “the degree to which measures are free from error and therefore yield consistent results”. Validity is “the extent to which a test measures what it claims to measure” (Gregory, 1992, p. 117). Something is measured valid if it measures what it is supposed to measure, without including other factors accidentally (Thanasegaran, 2009). To ensure the reliability of this thesis, a robustness check will be carried out, to check if the results will be similar and reliable. The dataset that is used for this research has a large and representative sample for the European SME population. To ensure validity, theory is used to base the variables used for this research on valid sources. Furthermore, to reach statistical validity it is ensured that the assumptions of logistic regression are checked.

Chapter 4: Analysis

This chapter gives an elaboration of the findings of the logistic regression analysis. First, the descriptive statistics and the missing value analysis are presented and discussed. Thereafter, the assumptions of logistic regression are tested, and the results of the logistic regression analysis are presented with the tests of the proposed hypotheses. Finally, this chapter shows the robustness checks pursued for the analysis. The syntax of the complete analysis is presented in Appendix 1.

4.1 Descriptive statistics

The total survey of the Flash Eurobarometer is conducted among 15.041 companies. This thesis only focuses on SMEs in Europe, so all firms with more than 250 employees or firms outside Europe were excluded from the analysis. Furthermore, the smaller countries with no data on environmental regulation (PSI index) were excluded, to overcome the problem of too many missing values in the analysis. Appendix 2 shows a table with all the included and excluded countries of this present study. Finally, this resulted in a total dataset of 8868 valid cases to perform the analysis with. The descriptive statistics of all the used variables for this thesis are presented in Appendix 3. The frequencies and proportions are displayed, to give a good view on the sample of this research. The 20 countries included in the analysis are about evenly distributed among the sample. The SMEs were divided into micro (44%), small (34.9%) and medium (21%), according to the definition of the European Commission (2003). The companies were distributed into four sectors; 22.2% manufacturing, 30.6% retail, 29.0% services and 18.1% industry. Before the start of the multivariate analysis, a univariate analysis is done to check the descriptive statistics per variable. The descriptive statistics of the final sample are shown in table 5 and the full output in appendix 3. To check the normality distribution of the variables, the skewness and kurtosis of all the variables used in the analysis were checked. All the variables have a skewness and kurtosis inside the range of +2 and -2, which means the variables are normally distributed.

Table 5*Descriptive statistics of final sample*

| Variable | Mean | SD | Median | Mode | Skewness | Kurtosis |
|--------------------------|-------------|-----------|---------------|-------------|-----------------|-----------------|
| Adoption recycling | .463 | .499 | 0.000 | 0.000 | .147 | -1.979 |
| Technical expertise | .592 | .491 | 1.000 | 1.000 | -.376 | -1.859 |
| Technical support | .252 | .434 | 0.000 | 0.000 | 1.140 | -.701 |
| SME size | 1.798 | .895 | 2.000 | 1.000 | 2.258 | 1.531 |
| Financial resources | .642 | .480 | 1.000 | 1.000 | -.591 | -1.651 |
| Organizational expertise | .800 | .400 | 1.000 | 1.000 | -1.501 | .253 |
| Firm industry | 2.43 | 1.025 | 2.000 | 2.000 | .075 | -1.128 |
| Government regulation | 2.818 | .559 | 2.818 | 2.133 | .123 | -1.066 |
| Customer demand | .823 | .381 | 1.000 | 1.000 | -1.696 | .878 |

4.2 Missing value analysis

The variables ‘country code’, ‘adoption of recycling present’, ‘technical support’, ‘SME size’, ‘sector of activity’ and ‘policy stringency index’ have no missing values. The variables ‘own technical expertise’, ‘own financial resources’, ‘organizational expertise’ and ‘demand for resource efficient products or services’ have less than 10% missing values. To look deeper into these missing values, the frequency tables per variable are checked. The variables ‘own technical expertise’ and ‘own financial resources’ have missing values because this is a routing after the question ‘Does your company offer green products or services?’, hence an answer is not applicable if the answer was ‘no’ there. The variables ‘organizational expertise’ and ‘demand for resource efficient products or services’ have missing values because this is a routing after the question ‘What actions is your company undertaking to be more resource efficient?’ and therefore an answer is not applicable here as well if the answer was ‘none’. To check if the missing values are completely at random, the Little’s MCAR test is carried out. The Little’s MCAR test is an overall test of randomness and defines whether missing data can be classified as missing completely at random. If missing values are completely at random, there is no underlying process that provides bias to the observed data (Hair et al., 2014). The outcome of the Little’s MCAR test, shown in appendix 3, is: $\chi^2(8868) = 3.991$, $p = .136$. The Little’s MCAR test shows that if there are no significant differences found, the missing data can be classified as missing completely at random (MCAR) (Hair et al., 2014). As the missing values of this current study show no significance for the Little’s MCAR test, it can be concluded that the missing values are completely at random.

4.3 Assumptions logistic regression analysis

When using logistic regression, there are no assumptions of normality and homoscedasticity like in multiple regression or discriminant analysis. The main assumption in logistic regression is the independence of observations, which means that the observations should not come from matched data or repeated measurements (Hair et al., 2014). This assumption is met; the data used is from independent observations. Concerning the sample size, the overall sample should have a size of at least 400, to achieve the best results with maximum likelihood estimation. Moreover, the size of each outcome group should be at least ten times the number of estimated model coefficients (Hair et al., 2014). The sample used for this analysis is 8868, the outcome groups of the dependent variable are both larger than 400 and the number of estimated model coefficients is nine, which means that the sample is large enough and this requirement is met as well. Another assumption of logistic regression is the linearity of the independent variables, which should be tested with the Box-Tidwell test (Hair et al., 2014). The linearity assumption means that each predictor has a linear relationship with the log of the dependent variable (Field, 2013). Binary predictors do not need transformations, only continuous predictors in the model need transformations to check linearity (Hair et al., 2014). The only continuous independent variables in this analysis are ‘SME size’ and ‘policy stringency index’. Of both these variables, an interaction term is created with the independent variable and its log value. These transformed variables are called TR_Policy and TR_SMEsize and are included in the logistic analysis to test their significance. The outcome of this logistic regression is shown in table 6.

Table 6
Box-Tidwell test

| Step 1a | B | S.E. | Wald | Df | Sig. | Exp(B) |
|-------------------------|----------|-------------|-------------|-----------|-------------|---------------|
| SME size | .055 | 1.047 | .003 | 1 | .958 | 1.056 |
| Own financial resources | .135 | .087 | 2.433 | 1 | .119 | 1.145 |
| Own technical expertise | .214 | .086 | 6.221 | 1 | .013 | 1.238 |
| External support | .108 | .092 | 1.394 | 1 | .238 | 1.114 |
| Technical support | .150 | .091 | 2.739 | 1 | .098 | 1.162 |
| Manufacturing | .107 | .110 | .947 | 1 | .330 | 1.113 |
| Retail | .078 | .093 | .713 | 1 | .399 | 1.082 |
| Demand | -.110 | .101 | 1.178 | 1 | .278 | .896 |
| TR_Policy | -.120 | .036 | 11.099 | 1 | .001 | .886 |
| TR_SMEsize | .028 | .508 | .003 | 1 | .956 | 1.028 |
| Contant | .319 | .415 | .589 | 1 | .443 | 1.376 |

Table 6 shows that the variable ‘SME size’ is non-significant, which means the linearity condition is met. The variable ‘policy stringency index’ is significant. An interaction that is significant, indicates that the main effect has broken the assumption of linearity of the logit

(Field, 2003). A significant interaction implies a nonlinear component and hence should be retained in the model (Hair et al., 2014). If all the continuous independent variables show linearity of the logit, it gives greater confidence in terms of trusting the results. A significant interaction indicates that including a polynomial term could be needed to include in the model. Therefore, the variable ‘policy stringency index’ is centred and transformed into polynomial terms. Table 7 shows the Box-Tidwell test with the polynomial terms for ‘policy stringency index’ included, to check if these polynomial terms are significant as well. Since the transformed data of PSI, Policy_2 and Policy_3, remained significant, the original variable has been used in the analysis. Because the assumption of linearity is therefore not fully met, the confidence in terms of trusting the results is lower.

Table 7

Box-Tidwell test with polynomial terms included

| Step 1a | B | S.E. | Wald | Df | Sig. | Exp(B) |
|-------------------------|----------|-------------|-------------|-----------|-------------|---------------|
| SME size | .098 | 1.057 | .009 | 1 | .926 | 1.103 |
| Own financial resources | .136 | .088 | 2.379 | 1 | .123 | 1.145 |
| Own technical expertise | .263 | .087 | 9.113 | 1 | .003 | 1.300 |
| External support | .118 | .092 | 1.626 | 1 | .202 | 1.125 |
| Technical support | .139 | .092 | 2.289 | 1 | .130 | 1.149 |
| Manufacturing | .099 | .111 | .787 | 1 | .375 | 1.104 |
| Retail | .059 | .094 | .390 | 1 | .532 | 1.060 |
| Demand | -.063 | .102 | .382 | 1 | .536 | .939 |
| TR_Policy | .413 | .090 | 20.914 | 1 | .000 | 1.511 |
| TR_SMEsize | .005 | .513 | .000 | 1 | .992 | 1.005 |
| Policy_2 | .757 | .179 | 17.915 | 1 | .000 | 2.132 |
| Policy_3 | -2.090 | .318 | 43.257 | 1 | .000 | .124 |
| Contant | -1.518 | .501 | 9.178 | 1 | .002 | .219 |

The last thing to consider when performing logistic regression is multicollinearity. High multicollinearity means that the independent variables are too correlated with each other (Field, 2003). If this is the case, coefficients of important antecedents might become insignificant or coefficients can have unexpected signs (Hair et al., 2014). To check multicollinearity, a linear regression analysis is run to analyse the collinearity diagnostic. The variance inflation factor (VIF) should be below 10 to accept that the variables are not too correlated. For all the independent variables in this analysis the VIF is below 2 (see table 8), which means that the multicollinearity is low and that the independent variables are not too correlated with each other. Therefore, this assumption is met.

Table 8
Collinearity statistics

| Model | Collinearity statistics | |
|--------------------------|-------------------------|-------|
| | Tolerance | VIF |
| Own financial resources | .987 | 1.013 |
| External support | .984 | 1.016 |
| Technical support | .990 | 1.011 |
| Customer demand | .942 | 1.062 |
| Organizational expertise | .940 | 1.064 |
| SME size | .989 | 1.012 |
| Own technical expertise | .984 | 1.016 |
| Policy stringency index | .981 | 1.019 |
| Sector of activity | .988 | 1.012 |

Dependent variable: Adoption of recycling present

4.4 Logistic regression analysis

To test the hypotheses regarding ‘recycling adoption’ as the dependent variable, binary logistic regression is conducted. This is done via several blocks, to see how the models change when additional variables are added to the model. Three models are run, of which the first model includes the technological contextual variables, then the organizational contextual variables are added and finally the environmental contextual variables are included in the model. By adding these predictor variables to the model, the explanatory power of the model can increase and therefore also the added value of the predictor variables. The results of the models are shown in table 9: Output Logistic Regression.

The results in table 9 include the B coefficient, the standard error, the Wald statistic, the significance test and the Exp(B). Exp(B) shows the odds ratio of the variable; if the value is greater than 1 then, as the predictor value increases, the odds of the outcome to occur also increase (Field, 2003). Furthermore, the Omnibus test of model coefficients, the -2 Log likelihood, Cox & Snell R², the Nagelkerke R², and the Hosmer and Lemeshow test statistics are shown, to evaluate the goodness of fit and the improvement of fit compared to the previous model. If the Omnibus test of model coefficients is significant, it can be concluded that the model including the variables shows a significant better fit with the data than the previous model or the null model. This is the case with all the models (model 1: 32.637, p= .000; model 2: 58.709 p= .000; model 3: 92.723 p=.000), which means that model 1 is better than the null model that only includes the constant, that model 2 has a better fit than model 1, and model 3 has a better fit than model 2. The log-likelihood measures how much unexplained variability there is in the outcome. The change in the log-likelihood shows how much new variance has

been explained by the model relative to the previous model (Field, 2003). The analyses show a decrease in the log-likelihood by adding more variables to the model (Model 1: 11150.546; Model 2: 11124.475; Model 3: 11090.460). A decrease in the log-likelihood from the baseline model or from a previous model shows that the new model is a better fit with the data than the previous model and that it accounts for more variability in the dependent variable (Field, 2003). Therefore, the decreases in the log-likelihood show that the more variables are added to the model, the better the fit with the data to explain the adoption of recycling.

The Hosmer and Lemeshow test tests the fit of a model, using non-significance as an indicator of close correspondence between the actual and predicted values (Hair et al., 2014). The p-values of the Hosmer and Lemeshow test of all three models show non-significance (Model 1: $p = .710$; Model 2: $p = .236$; Model 3: $p = .061$), indicating a good predictive model. It tests the hypothesis of equality between observed and predicted frequencies; this hypothesis is not rejected which is positive for the analysis. Lastly, the model summary shows the pseudo-R-square statistics per model; the Cox & Snell R^2 and the Nagelkerke R^2 . The Cox & Snell and the Nagelkerke R^2 indicate the model fit, with higher values meaning greater model fit. They can be interpreted as reflecting the amount of variation in the dependent variable accounted for by the logistic model and the value 1.0 shows perfect model fit (Hair et al., 2014). The models used in this analysis all show low R^2 values (Model 1: Cox & Snell = .004, Nagelkerke = .005; Model 2: Cox & Snell = .007, Nagelkerke = .010; Model 3: Cox & Snell = .011, Nagelkerke = .015), but there is slight improvement when adding more main effects to the model. The improvement in the pseudo R^2 values can be explained by the contribution of the individual predictors, analysed in the next section. Because the pseudo R^2 values are low, it means that the model explains a small part of the variance in the dependent variable. If a model has low R^2 values it does not mean that is necessarily a bad model; a model can be perfectly substantial with low R^2 values, if the explanatory variables are kept in a narrow domain (Tjur, 2009). The low R^2 values in this current research, mean that there are other factors influencing recycling adoption that are not included in the current models.

The classification tables shown in Appendix 4, show contingency tables of observed versus predicted responses by the model, for all combinations of predictor variables. For a model to be acceptable, at least 50% needs to be correctly classified (Hair et al., 2014). Model 1 has an overall percentage of 53,2 correct predicted cases, model 2 shows 53% correct predicted cases and model 3 54,3%. All models are better in predicting SMEs that have

recycling activities present, than predicting firms that have no recycling activities present. It can be concluded that model 3, including all the predicting variables, shows the highest percentage of correctly predicted values.

To look at the fit within the model in terms of the individual predictors, the unstandardized regression slope and the significance of the individual variables are investigated, which are shown in table 9. The unstandardized regression slopes (B) represent the predicted change in logit per unit increase on the predictor variables in this analysis. These signs give an indication in the nature of the relationship between the predictors and the probability of adoption of recycling activities by an SME. Model 1 only includes the first part of the TOE-framework, the technological context, that investigates the influences of the firm's own technical expertise and the external technical support on the adoption of recycling. Both predictors show significant and positive results; own technical expertise $B = 224$, $p < .001$ and technical support $B = .134$, $p < .01$, indicating that having technical expertise and having external technical support both positively influence the adoption of recycling among SMEs. These results agree with the proposed hypotheses.

Table 9
Output Logistic Regression

| Variables | Model 1 | | | | | Model 2 | | | | |
|---------------------------|---------------|------|--------|-------|--------|---------------|------|--------|-------|--------|
| | B | S.E. | Wald | Sign. | Exp(B) | B | S.E. | Wald | Sign. | Exp(B) |
| Own technical expertise | .224 | .045 | 24.367 | .000 | 1.251 | .219 | .046 | 23.134 | .000 | 1.245 |
| Technical support | .134 | .051 | 6.959 | .008 | 1.143 | .119 | .051 | 5.492 | .019 | 1.126 |
| SME size | | | | | | .109 | .026 | 18.072 | .000 | 1.115 |
| Own fin. Resources | | | | | | .112 | .047 | 5.725 | .017 | 1.118 |
| Organizational expertise | | | | | | -.053 | .056 | .899 | .343 | .948 |
| Industry dummy | | | | | | | | | | |
| Services dummy | | | | | | | | | | |
| Manufacturing dummy | | | | | | | | | | |
| PSI | | | | | | | | | | |
| Demand resource efficient | | | | | | | | | | |
| Constant | -.131 | .037 | 12.493 | .000 | .877 | -.351 | .080 | 19.151 | .000 | .704 |
| Model summary | | | | | | | | | | |
| Model coefficients | 32.637 (.000) | | | | | 58.709 (.000) | | | | |
| -2 Log likelihood | 11150.546 | | | | | 11124.475 | | | | |
| Cox & Snell R square | .004 | | | | | .007 | | | | |
| Nagelkerke R square | .005 | | | | | .010 | | | | |
| Hosmer & Lemeshow test | .686 (.710) | | | | | 10.437 (.236) | | | | |

| Variables | Model 3 | | | | |
|---------------------------|---------------|------|--------|-------|--------|
| | B | S.E. | Wald | Sign. | Exp(B) |
| Own technical expertise | .232 | .046 | 25.316 | .000 | 1.261 |
| Technical support | .111 | .051 | 4.772 | .029 | 1.118 |
| SME size | .113 | .026 | 18.646 | .000 | 1.119 |
| Own fin. Resources | .099 | .047 | 4.478 | .034 | 1.104 |
| Organizational expertise | -.008 | .059 | .017 | .896 | .992 |
| Industry dummy | .001 | .066 | .000 | .990 | 1.001 |
| Services dummy | -.171 | .059 | 8.450 | .004 | .843 |
| Manufacturing dummy | -.054 | .063 | .739 | .390 | .947 |
| PSI | -.181 | .040 | 20.140 | .000 | .835 |
| Demand resource efficient | -.109 | .061 | 3.166 | .075 | .896 |
| Constant | .268 | .145 | 3.387 | .066 | 1.307 |
| Model summary | | | | | |
| Model coefficients | 92.723 (.000) | | | | |
| -2 Log likelihood | 11090.460 | | | | |
| Cox & Snell R square | .011 | | | | |
| Nagelkerke R square | .015 | | | | |
| Hosmer & Lemeshow test | 14.919 (.061) | | | | |

The second model includes the contextual influences of the technological and the organizational context and tests their influences on recycling adoption among SMEs. As can be seen in model 2, the influence of the technical context stays significant and positive; own technical expertise $B = .232$, $p < .001$ and technical support $B = .111$, $p < .05$. Zooming in into the organizational context, SME size and own financial resources show a positive and significant influence on the adoption of recycling; SME size $B = .113$, $p < .001$ and financial resources $B = .099$, $p < .05$. Regarding organizational expertise, hypothesis 2c predicted a positive relationship between environmental expertise and the likeliness of adopting recycling activities. Model 2 shows that this hypothesis is rejected, as the effect of organizational expertise is insignificant ($B = -.008$, $p = .896$).

The third model includes all the aspects of the TOE-framework, meaning that it tries to predict the influences of the technological, organizational, and environmental context on the adoption of recycling. The direct effect of own technical expertise is significant with an unstandardized regression coefficient $B = .232$, $p < .001$, which means that hypothesis 1a is accepted and that there is a positive relationship between being able to rely on own technical expertise and the likelihood of adopting recycling activities. The second effect of technical

support is also significant and positive, $B = .111$, $p < .05$. This supports hypothesis 1b that there is a positive relationship between technical support and the likeliness of recycling adoption. Looking at the influences of organizational context on recycling adoption it is found that SME size significantly and positively influences this, $B = .113$, $p < .001$. Therefore, hypothesis 2a is also accepted, which means that the size of a firm positively influences the adoption of recycling activities. The fourth direct effect of an SMEs own financial resources also positively and significantly predicts the dependent variable, $B = .099$, $p < .05$. This is according to the predicted hypothesis 2b, that there is a positive relationship between own financial resources to be more resource-efficient and the likeliness of adopting recycling activities. Hypothesis 2c predicts that there is a positive relationship between environmental expertise and the likeliness of adopting recycling activities among European SMEs. The model shows that hypothesis 2c is rejected, as the effect of organizational expertise on the dependent variable is insignificant ($B = -.008$, $p = .896$).

Hypothesis 3a, 3b and 3c look at the influences of the environmental context on the likeliness of the adoption of recycling activities among SMEs. Of the dummy variables for firm industry, only 'service' is significant ($B = -.171$, $p < .05$). The sector of activity that is the reference category and therefore is excluded from the model is retail, because this is the largest category. The negative B coefficient of service means that firms in the service sector have a lower adoption of recycling than firms in the retail industry. Therefore, hypothesis 3a that firms in the manufacturing and retail industry have a higher likeliness of adopting recycling activities is partly supported; firms in the service industry have a lower adoption of recycling than firms in the retail industry. However, the other elements of hypothesis 3a show no significant results, which means that the other sectors show no direct influence on the adoption of recycling. Environmental government regulation, measured by the PSI, has a significant negative influence on the dependent variable ($B = -.181$, $p < .001$). This means that higher environmental government regulation has a negative influence on the adoption of recycling, which is contrary to hypothesis 3b that predicted a positive relationship between environmental government regulations and the likeliness of adopting recycling activities. Lastly, hypothesis 3c predicted a positive relationship between customer demand for resource efficiency products and the likeliness of adopting recycling activities. The model shows that this hypothesis is rejected, as the effect of 'demand resource efficient' is non-significant ($B = -.109$, $p = .075$). Table 10 shows an overview of the supported and rejected hypothesis based on the executed analysis.

Table 10*Overview conclusions hypothesis after logistic regression analysis*

| Hypotheses | B | Sig. (p-value) | Supported/rejected |
|------------------------------|----------|-----------------------|---------------------------|
| Technology | | | |
| H1a: Own technical expertise | .232 | .000 | Supported |
| H1b: Technical support | .111 | .029 | Supported |
| Organization | | | |
| H2a: Size firm | .113 | .000 | Supported |
| H2b: Financial resources | .099 | .034 | Supported |
| H2c: Environmental expertise | -.008 | .896 | Rejected |
| Environment | | | |
| H3a: Industry | - | - | Partly supported |
| H3b: Government regulation | -.181 | .000 | Rejected |
| H3c: Customer demand | -.109 | .075 | Rejected |

4.5 Robustness analysis

Logistic regression is an analysis that has a high robustness (Hair et al., 2014), but it is still important to check the robustness of the current analysis. Robustness is defined as “the ability of a statistical technique to perform reasonably well even when the underlying statistical assumptions have been violated in some manner” (Hair et al., 2014, p. 48). First, the normal distribution of all the variables were checked. Of all the variables included in the analysis, the skewness and kurtosis were inside the appropriate range and therefore show no problematic results (see appendix 3). Besides that, the robustness of the analysis is checked by carrying out the same analysis with half the sample and checking if the results are comparable. The sample size of an analysis affects the significance of the difference between samples. A large sample can cause that small differences can be significant and with small samples large differences can be insignificant. This is because large samples have more power to detect effects and a small difference can be deemed as significant if the sample is large enough. Large samples have less noise and therefore small effects can be detected, but this does not mean that the effect found is meaningful (Field, 2003). Because large samples can find statistically significant results between essentially anything, it is good to check the robustness of the analysis by using half the sample size. This is done by randomly taking approximately 50% of the total sample used in the logistic analysis and carrying out the same logistic analysis as before. Table 11 shows the outcomes of model 3, which includes all the variables related to the three contexts of the TOE-framework. The total results of the robustness analysis are shown in appendix 5.

Table 11
Model 3 Robustness analysis

| Variables | Model 3 | | | | |
|---------------------------|---------------|------|--------|-------|--------|
| | B | S.E. | Wald | Sign. | Exp(B) |
| Own technical expertise | .265 | .061 | 18.643 | .000 | 1.303 |
| Technical support | .119 | .067 | 3.128 | .077 | 1.126 |
| SME size | .024 | .030 | .642 | .423 | 1.024 |
| Own fin. Resources | .152 | .062 | 5.985 | .014 | 1.165 |
| Organizational expertise | .016 | .078 | .045 | .832 | 1.017 |
| Manufacturing dummy | .016 | .082 | .036 | .849 | 1.016 |
| Services dummy | -.161 | .079 | 4.185 | .041 | .852 |
| Industry dummy | .056 | .089 | .393 | .531 | 1.057 |
| PSI | -.135 | .054 | 6.374 | .012 | .873 |
| Demand resource efficient | -.077 | .081 | .909 | .340 | .926 |
| Constant | .205 | .195 | 1.107 | .293 | 1.277 |
| Model summary | | | | | |
| Model coefficients | 47.159 (.000) | | | | |
| -2 Log likelihood | 6310.798 | | | | |
| Cox & Snell R square | .010 | | | | |
| Nagelkerke R square | .014 | | | | |
| Hosmer & Lemeshow test | 4.899 (.768) | | | | |

The results of the robustness check are compared with the total sample analysis carried out before. Looking at both the hypotheses regarding the technical context of the SMEs, it can be stated that the values of hypothesis 1a regarding own technical expertise are fairly the same as the outcomes of the total sample analysis. This means the robustness of hypothesis 1a is good. However, when looking at hypothesis 1b regarding external technical support, the significant results of the total sample analysis are now insignificant. This implies that the robustness of this variable is poor. Furthermore, there are some differences in values when looking at the organizational context. Hypothesis 2a regarding firm size was significant in the total sample analysis, but not in the analysis with half the sample, which shows low robustness of this hypothesis. Nevertheless, hypothesis 2b concerning financial resources, shows approximately the same values as in the total sample analysis, which means this hypothesis is quite robust. Furthermore, environmental expertise was already negative but non-significant in the previous analysis, but now shows a positive non-significant result in this analysis. This denotes a low robustness of this hypothesis since the negative sign turns positive. The last context to compare is the environmental context. Zooming in into the influences of industry on the adoption of recycling, the values of the robustness analysis are fairly the same as the analysis with the total sample. The dummies of the manufacturing and the industry sector are non-significant as with the previous analysis. The dummy service shows significant and

comparable results; -.171 in the total sample analysis and -.161 in the half sample analysis. As corresponds to the total sample analysis, government regulation is significant but negatively signed, which shows good robustness. Lastly, customer demand shows about the same B-coefficient as with the total sample analysis and is still non-significant. Overall, the robustness is quite good, but technical support, firm size and environmental expertise show a less good robustness when carrying out the analysis with half the sample. Table 12 shows an overview of the supported and rejected hypothesis based on the robustness analysis.

Table 12
Overview conclusions hypothesis robustness check

| Hypotheses | B | Sig. (p-value) | Supported/rejected |
|------------------------------|----------|-----------------------|---------------------------|
| Technology | | | |
| H1a: Own technical expertise | .265 | .000 | Supported |
| H1b: Technical support | .119 | .077 | Rejected |
| Organization | | | |
| H2a: Size firm | .024 | .423 | Rejected |
| H2b: Financial resources | .152 | .014 | Supported |
| H2c: Environmental expertise | .016 | .832 | Rejected |
| Environment | | | |
| H3a: Industry | - | - | Partly supported |
| H3b: Government regulation | -.135 | .012 | Rejected |
| H3c: Customer demand | -.077 | .340 | Rejected |

Chapter 5: Discussion and conclusions

This research aims to shed light on the contextual factors that influence the adoption of recycling among European SMEs. The technical, organizational, and environmental context were analysed, regarding their influence on adoption of recycling among European SMEs. The previous chapter showed interesting results from the outcomes of the analysis. These results of the analysis will be interpreted and discussed in this chapter, leading to their conclusions. Furthermore, the theoretical and practical implications of this research will be discussed. Lastly, limitations of this research and the directions for future research are presented, which are followed by the conclusion of this thesis.

5.1 Interpretation of the results: the contextual influences of recycling adoption

The binary logistic regression analysis in the previous chapter provided some interesting results. The direct effects that were tested in this research were technical expertise, technical support, firm size, financial resources, environmental expertise, firm industry, government regulation and customer demand. Multiple scholars have investigated the adoption of CSR and environmental practices among which recycling is one. The main findings of these scholars were connected to the TOE framework in this research and showed that the various aspects of the three contexts (TOE) have positive impact on the adoption of recycling. Therefore, all direct effects were hypothesized to positively influence the adoption of recycling among European SMEs. The results of the analysis will be interpreted per context in the following paragraphs.

5.1.1 Interpretation of the technological context

The first aspect of the TOE-framework, the technical context of a firm, included the internal technology in a firm and the external technology of a firm used for technical support. Several scholars stated that the existing technologies and technological knowledge in a firm positively influence the adoption of environmental innovations or circular business models, which were connected to recycling (Chembessi et al., 2022; Hossain et al., 2016; Rizos et al., 2016; Van Eijk, 2015; Vermunt et al., 2019). The results of the analysis showed a positive and significant impact of technical expertise on the dependent variable adoption of recycling. This indicates that the results of the binary logistic regression matched with the theories regarding this part of the technical context. Theories concerning the other aspect of the technical context, the external technologies used as technical support for a firm, showed that external support for relevant technology is an important factor that matters to adopters of new innovations (Hossain et al.,

2016; Huyskens & Loebbecke, 2007; Oni & Papazafeiropoulou, 2012). This was linked to recycling, meaning that there is a positive relationship between technical support about new technologies and the likeliness of adopting recycling activities. In all three models in the analysis technical support showed a positive significant effect on adoption of recycling, meaning that the outcomes of the analysis are in line with the theories concerning this topic. To conclude, both the internal technical knowledge in a firm and the external technical support show a positive impact on the adoption of recycling, which is consistent with the theory. This means this present study adds to the literature by showing that the technical context of SMEs has influence on their adoption of recycling. SMEs need to have their own internal technical expertise or external technical support to increase their ability to adopt recycling practices.

5.1.2 Interpretation of the organizational context

The second aspect of the TOE-framework, the organizational context, included firm size, organizational financial resources, and organizational environmental expertise. Concerning the size of a firm, several studies showed a positive relationship between firm size and environmental practices and CSR, including recycling (Badulescu et al., 2018; Graafland, 2018; Perrini et al., 2007; Santos, 2011). Both models that include firm size as a factor influencing recycling, show significant and positive results which is thus in line with previous research. Additionally, the analysis provided the result that the adoption of recycling is significantly and positively influenced by the presence of own financial resources to be more resource efficient. This outcome is in line with the literature that financial resources are needed to support the adoption of green supply chains and innovations (Ombaka et al., 2015; Wells & Seitz, 2005) and that the lack of financial resources is a barrier for environmental innovation, including recycling (Triguero et al., 2016). Finally, the influence of environmental expertise on recycling among SMEs was tested. Several scholars showed the need of knowledge and environmental expertise to implement circular economy practices, environmental sustainability practices and green supply chains, all also referring to recycling (Moktadir et al., 2018; Hwang et al., 2016; Sharma et al., 2021). Sharma et al. (2021) stated that a lack of expertise could be a barrier to implement recycling activities. The results of the analysis showed no significant results for environmental expertise, meaning that this thesis does not support previous research. In other words, this present study adds to the literature that the environmental expertise of European SMEs shows no influence on their adoption of recycling. The insignificance of environmental expertise is surprising because the research of Vermunt et al. (2019) also stated that the major barrier of resource recovery is the lack of knowledge and expertise for recycling

processes. Linder and Williander (2017) argued that knowledge and expertise are important aspects for a circular business model, which includes recycling. However, they also stated that the amount of knowledge needed varies per product upgrade strategy. Remanufacturing is disassembling, checking, cleaning, and repairing the full structure of a multi-component product (Gehin et al., 2008; Lieder & Rashid, 2015; Reike et al., 2018) and it involves more technological changes, and therefore knowledge and expertise, than recycling which is only the recovery for any purpose (Bakker et al., 2014). This difference in need for environmental expertise per aspect of a circular business model could be an explanation for the insignificance of hypothesis 2c; it could be that firms need less environmental expertise for recycling than for the other environmental practices that a firm can pursue.

5.1.3 Interpretation of the environmental context

The last aspect analysed in this thesis is the environmental context of the firm, covering the industry of the firm, environmental government regulation and customer demand. As stated in the theoretical framework, firms in the manufacturing and retail industry have a higher likelihood of adopting recycling activities (Vives, 2006; Zamfir et al., 2017). The analysis showed a significant and negative effect of the service sector, meaning that firms in the service sector adopt less recycling activities than firms in the retail sector. This is in line with the proposed hypothesis. All other sectors did not show significant effects; thus, the hypothesis is partly supported. Bayoud et al. (2012), stated that some sectors disclose more information about their CSR practices than other firms do. They showed that more environmentally sensitive industries, like the manufacturing industry, show higher levels of CSR disclosure. Thus, it could be that the perception of CSR practices per sector is biased, because of the differences in showed disclosure. This could be an explanation for the insignificant results regarding firm industry.

Contrary to the hypothesis that there is a positive relationship between environmental government regulations and the likelihood of adopting recycling activities, the results show a negative relation. An explanation for this could be that regulation can act as an enabler as well as a barrier for environmental practices (Porter & Van de Linde, 1995; Walker et al., 2008). This is because firms believe that regulation erodes the competitiveness (Porter & Van de Linde 1995). Furthermore, the outcome effect of environmental regulation differs per firm size; smaller companies can see it as a barrier because it can provide a cost advantage for larger firms (Darnall et al., 2010). Simpson (2012) investigated knowledge resources of a firm as a

mediator of the relationship between regulatory recycling pressures and environmental performance. The research stated that the internal capabilities like expertise and experience of a firm, may limit the performance outcomes of regulatory pressures. Both institutional and economy pressures faced by firms were significantly mediated by a firm's available knowledge and expertise (Simpson, 2012), which could be an explanation for the insignificance of hypothesis 3b in this thesis. This thesis shows that having technical knowledge or support, a larger firm, financial resources, and the knowledge are the enablers of adopting recycling. The regulative pressures do not positively influence the adoption of recycling among European SMEs.

The last theorized relation was the positive relationship between customer demand for resource efficiency products and the likeliness of adopting recycling. Based on several studies, it was concluded that customers, part of normative pressures, are an important driver for circular economy and environmental CSR practices (Gadenne et al., 2009; Mazurkiewicz, 2004; Muktadir et al., 2018; Siemieniuch et al., 2015). However, the results of this thesis do not show significant results concerning the relationship between customer demand and recycling adoption. The results do not provide evidence to support hypothesis 3c and therefore cannot join the outcomes of previous research. This means that this thesis adds to literature that customer demand for resource efficiency products is not influencing the adoption of recycling among European SMEs. A possible explanation for the lack of perceived normative pressures for recycling among SMEs, is that SMEs receive not as much pressures as large organizations in the same industry or sector (Johnstone & Labonne, 2009). As written in the theoretical framework of this thesis, smaller firms attract less public attention than large firms and therefore feel less strength of the reputational liability effect (Graafland, 2018; Williamson et al., 2006). The size of a firm is positively related to exerted normative pressures that influence the adoption of environmental practices (Delmas & Toffel, 2004), which could mean that normative pressures play a less important role among SMEs regarding the adoption of recycling practices. Another possible explanation for the insignificance is that regulative pressures outweigh the normative pressures on a firm. Regulative pressures have greater consequence for firms than normative pressures; the consequences of normative pressures are mostly only in the form of legitimacy sanctions (Berrone, et al., 2013). However, because environmental regulation showed a negatively influence on the adoption of recycling in this thesis, the theory of Berrone et al. (2013) also does not hold here.

5.2 Theoretical and practical implications

Over the past years, the interests of scholars in the areas of CSR and sustainability have been growing (Dorobantu et al., 2018) and there is an increase in research about the adoption of environmental practices among SMEs. This thesis adds to this literature by examining the specific environmental practice recycling and the contextual aspects of SMEs that influence the adoption of recycling. The research is constructed from three different angles: the technical context, the organizational context, and the environmental context of the firm. This research increases the theoretical understanding of the environmental part of CSR in smaller firms, which is important according to Morsing and Perrini (2009). They state that the ‘smallness’ of an individual SME is not proportional to the collective ‘grandness’ of SMEs and that an improved understanding of present CSR activities in SMEs has the potential of encouraging a high impact for the global society, the global economy and for the SMEs themselves (Morsing & Perrini, 2009). By using the quantitative Eurobarometer dataset that comprised data of a large-scale sample with different European SMEs, the generalizability of the results was increased. The outcomes of this thesis contribute to the international business literature, as it declares how the technical-, organizational- and environmental context of SMEs influence their adoption of recycling. These insights broaden the understanding of how SMEs can be influenced by their context and what factors limit the adoption of recycling.

These insights are practically relevant, to increase the adoption of recycling among SMEs. By knowing how the technological, organizational, and environmental context of SMEs influences their recycling and what limits their ability to recycle, managers and policymakers know which factors influence the adoption of recycling of firms. With this knowledge managers and policymakers are aware of contextual impact on recycling and can improve environmental issues by increasing the recycling of SMEs. For instance, regarding the technological context, SMEs need the technical knowledge and external technical support. By improving this knowledge through training or external knowledge gaining, the recycling adoption among SMEs can increase. Moreover, the outcome that firm size positively influences the adoption of recycling among SMEs is interesting for the government and municipalities when providing subsidies. To increase the recycling among smaller firms, which is important because of their cumulative impact on the environment (European Commission, 2018), they could consider to financially support smaller firms. Furthermore, SMEs themselves and their environment also benefit from the insights of this thesis. As they know that having technical expertise, having external technical support, and having the financial resources are important

drivers for the adoption of recycling, they need to internally or externally adopt these resources to increase their recycling and positively impact the environment. Finally, through the increase of recycling, there will be less pressure on resources and the use of resources will be enhanced (Eur-Lex, 2020), and the energy consumption and the waste in landfills will be reduced and there will be less pollution (Nodoushani et al., 2016).

5.3 Limitations and future research suggestions

This research contains several limitations which offer opportunities for future research. The first limitation is that this thesis relied on secondary data, which brought several limitations. Because the use of secondary data, this research was limited to the variables included in the dataset. Most variables were binary coded variables and therefore not as specific as it would be with continuous variables. The binary variables made it harder to interpret the outcomes and hence did show less insights. This thesis showed several significant results, but because the limited data, there is no deeper information on how these variables can really help the adoption of recycling and how other firms can adjust their contextual influences to improve their adoption of recycling. For instance, the results of this thesis show that having external technical support has a positive influence on the adoption of recycling. But there are no insights in how they influence the adoption of recycling and which knowledge is needed by the SMEs. Future research should go deeper into the significant findings of this research and examine the deeper explanations behind the contextual variables. Qualitative data could contribute to more in-depth results and explain the why and how of the contextual influences. Furthermore, most variables in the database relied on only one indicator. To improve the reliability, future research could include more indicators to measure variables to improve the reliability of each variable.

Another issue with the dataset is the self-reported measure of environmental practice adoption. The respondents of the questionnaire were asked what actions their company undertakes to be more resource efficient. One of these answers was recycling, which is analysed in this thesis. Self-reporting can cause internal, external and construct validity issues (Brutus et al., 2013), so future research should include a more objective measure on this, to protect the outcome being biased as firms can answer more socially desirable than the actions that they actually undertake to be more resource efficient. Another limitation concerning the secondary data is that the collection of the data used for this thesis was in 2017. Because sustainability, environmental practices and recycling are a hot topic nowadays (Quarshie et al.,

2016), there could have been changes in contextual influences since the last collection of data. Therefore, future research should include more recent data.

The second limitation was the limited data available for the policy stringency index to measure environmental regulation. Because not all countries had data for this variable, some countries were excluded from the analysis. As this thesis only focused on European SMEs, future research could also include SMEs outside Europe to look at the differences between several continents. Future research could look if developed countries have different contextual influences than developing countries and how recycling practices differ between these countries. This is relevant, because, for instance, if the contextual influences on recycling differ, distinct influences of the context are relevant to keep in mind. If the contextual influences are the same in distinct continents, the same recommendations could also work to increase the adoption of recycling among SMEs outside Europe.

The third limitation looks at the statistical limitations of this thesis. The first statistical limitation is that the assumption of linearity was not fully met. Since the transformed data of government regulation (PSI) remained significant, the original data has been used in the analysis. But as the assumption of linearity was therefore not fully met, the confidence in terms of trusting the results of this thesis is lower. Another statistical limitation is the robustness of the analysis. Overall, the robustness of the analysis is quite good, but technical support, firm size and environmental expertise show a less good robustness when carrying out the analysis with half the sample.

The fourth limitation of this thesis is that it only focused on the environmental practice recycling. Studies found that different environmental practices can be driven by different factors (Hoogendoorn et al., 2015), so it is good to investigate individual environmental practices which is done in this thesis. But besides recycling, future research is needed to investigate the contextual drivers on other environmental practices.

5.4 Conclusion

The growing awareness about environmental issues has resulted in new measures across the world (Contemporary, 2015), like the EU waste management law (Eur-Lex, 2020) and the Waste Framework Directive targets (EEB, 2018). The benefits of recycling include reducing energy consumption, reducing waste in landfills, and diminishing pollution (Nodoushani et al., 2016), and recycling is a way of environmental responsibility for a firm as it has a positive

impact on reducing environmental problems (Nodoushani et al., 2016). Furthermore, the pressure to act environmental responsible is increased considerably among SMEs (Perez-Sanchez et al., 2003) and environmental management is an important issue for SMEs, because SMEs are perceived to have environmental impact on large scale (Puppim de Oliveira & Jabbour, 2017).

At this moment only 41% of European SMEs is recycling, so it is important to get insights in why some SMEs recycle and some not. The aim of this research was therefore to get a better understanding of the technical, organizational, and environmental (TOE) context of SMEs and their influence on the adoption of recycling. This research therefore attempted to find an answer to the following research question: *“What are the effects of a firm’s contextual factors on the adoption of the environmental practice recycling among European SMEs?”*.

To answer the research question, the hypotheses were split up into three contexts: the technological, organizational, and environmental context, which were linked to the TOE framework developed by Tornatzky et al. (1990). Multiple aspects of the different contexts were examined. The technical context of a firm showed both positive and significant influence on recycling adoption through the internal technical expertise and external technical support. When analysing the organizational context of a firm, firm size, and the financial resources of a firm both showed a positive and significant influence on recycling. Surprisingly, the environmental expertise of a firm did not show significant results. Lastly, the environmental context of a firm was analysed, by looking at the type of industry, environmental government regulation and customer demand for resource efficient products. The analysis showed a significant and negative effect of the service sector, meaning that firms in the service sector adopt less recycling activities than firms in the retail sector. All other sectors did not show significant effects, meaning there is no clear influence of firm industry on the adoption of recycling. Government regulation showed a negative effect on the adoption of recycling, which was contrary to previous research. Finally, there was no evidence found that customer demand influences the adoption of recycling among SMEs.

5.5 Self-reflection

In order to finish this present study, it is important to critically reflect on my own role as a researcher during this study. As this was my first academic thesis, because I did university of applied sciences before this master, the beginning of this thesis trajectory was hard for me. There are many important things to consider when conducting scientific research, which are

different than non-scientific research. As I have read many scientific articles during my pre-master and master, I learned a lot about these differences. However, the start of writing my own thesis was hard for me. After the feedback of my supervisor and my fellow thesis students, I saw myself growing and my supervisor also stated that she saw progress in my writing skills. I learned a lot from my received feedback and started to enjoy the writing. Furthermore, I had some struggles with analysing the dataset. I followed courses in quantitative data analysis, but still, I would not say that I had advanced skills in handling big dataset and using datasets for my own research. During these quantitative courses I learned how to carry out several types of analysis in SPSS, but I realised that using a dataset for research is a lot more than only doing the analysis. Already in the beginning of your research you have to keep your dataset in mind and make connections with all available literature about your topic. Your research idea has to match with your dataset and your dataset has to be able to test what literature is showing or failing to show. This was a very iterative process, and it was very interesting to learn how to deal with such a big dataset and all available studies about my research topic. During the analysis I got some supervision from dr. Ligthart and his insight helped me to improve my analysis, which taught me a lot. As with all research, things do not always go as you had in mind, but in the end, you learn a lot from difficulties and mistakes.

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Appendix 1: Syntax SPSS

* Encoding: UTF-8.

DATASET ACTIVATE DataSet1.

*----- DATA TRANSFORMATIONS -----

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-

*Recode 'Lack of specific environmental expertise' into positive form.

RECODE q7.6 (0=1) (1=0) (9=9) INTO Expertise.

VARIABLE LABELS Expertise 'Organizational Expertise'.

VALUE LABELS Expertise 0 'Lack of specific environmental expertise' 1 'Environmental expertise present' 9 'Inap. (Not 1 in q1.1 to q1.8)'.
missing values Expertise (9).

variable level Expertise (NOMINAL).

EXECUTE.

*Recode 'Lack of demand for resource efficient products or services' into positive form.

RECODE q7.8 (0=1) (1=0) (9=9) INTO Demand.

VARIABLE LABELS Demand 'Demand for resource efficient products or services'.

VALUE LABELS Demand 0 'Lack of demand for resource efficient products or services' 1 'Demand for resource efficient products or services present' 9 'Inap. (Not 1 in q1.1 to q1.8)'.
missing values Demand (9).

Variable level Demand (NOMINAL).

EXECUTE.

* Recode 'size_employees' into 'SMEsize' to focus on SMEs only.

RECODE scr10t (1=1) (2=2) (3=3) (4=0) (5=9) INTO SMEsize.

VARIABLE LABELS SMEsize 'SME size'.

VALUE LABELS SMEsize 1 'Micro' 2 'Small' 3 'Medium' 0 'Large' 9 'DK/NA'.

missing values SMEsize (9).

variable level SMEsize (ORDINAL).

EXECUTE.

AUTORECODE VARIABLES=isocntry

/INTO AutoCountry

/PRINT.

RECODE q1.7 (0=0) (1=1) INTO AdoptionRecycling.

VARIABLE LABELS AdoptionRecycling 'Adoption of recycling present?'.

VALUE LABELS AdoptionRecycling 0 'No recycling activities' 1 'Recycling activities present'.

Variable level Demand (NOMINAL).

EXECUTE.

RECODE q5.2 (0=0) (1=1) (9=9) INTO OwnTechnicalExpertise.

VARIABLE LABELS OwnTechnicalExpertise 'Own technical expertise'.

VALUE LABELS OwnTechnicalExpertise 0 'Not mentioned' 1 'Its own technical expertise' 9 'Inap. (Not 1 in q9)'.
missing values OwnTechnicalExpertise (9).

EXECUTE.

RECODE q8.5 (0=0) (1=1) INTO TechnicalSupport.
 VARIABLE LABELS TechnicalSupport 'Technical support (demonstration new technologies)'.
 VALUE LABELS TechnicalSupport 0 'Not mentioned' 1 'Demonstration of new technologies to improve resource efficiency'.
 EXECUTE.

RECODE q13.3 (0=0) (1=1) (9=9) INTO ExternalSupport.
 VARIABLE LABELS ExternalSupport 'External Support'.
 VALUE LABELS ExternalSupport 0 'Not Mentioned' 1 'External Support' 9 'Inap. (Not 1 in q9)'.
 missing values ExternalSupport (9).
 EXECUTE.

RECODE q5.1 (0=0) (1=1) (9=9) INTO OwnFinancialResources.
 VARIABLE LABELS OwnFinancialResources 'Own financial resources'.
 VALUE LABELS OwnFinancialResources 0 'Not Mentioned' 1 'Its own financial resources' 9 'Inap. (Not 1 in q9)'.
 missing values OwnFinancialResources (9).
 EXECUTE.

* -----EXCLUDE IRRELEVANT COUNTRIES (OUTSIDE EU) AND FIRMS (>250 EMPLOYEES)-----.

RECODE AutoCountry (3 = 1) (4 = 1) (7 = 1) (8 = 1) (9 = 1) (11 = 1) (12 = 1) (13 = 1) (14 = 1) (15 = 1) (17 = 1) (18 = 1) (20 = 1) (28 = 1) (29 = 1) (30 = 1) (31 = 1) (34 = 1) (36 = 1) (37 = 1) (ELSE=0) INTO filtercountry.
 VARIABLE LABELS filtercountry 'Filter relevant countries'.
 VARIABLE LEVEL filtercountry (NOMINAL).

recode SMEsize (1=1) (2=1) (3=1) (9=1) (4=0) INTO filterfirm.
 VARIABLE LABELS filterfirm 'Filter variable relevant firms'.

USE ALL.
 COMPUTE filter_\$(filtercountry=1 and filterfirm=1).
 VARIABLE LABELS filter_\$ 'filtercountry=1 and filterfirm=1 (FILTER)'.
 VALUE LABELS filter_\$ 0 'Not Selected' 1 'Selected'.
 FORMATS filter_\$ (f1.0).
 FILTER BY filter_\$.
 EXECUTE.

*----- MISSING VALUES ANALYSIS-----.

* Check descriptive statistics (and frequencies).

DESCRIPTIVES VARIABLES=OwnFinancialResources ExternalSupport TechnicalSupport AdoptionRecycling
 nace_b Expertise Demand Policy SMEsize OwnTechnicalExpertise
 /STATISTICS=MEAN STDDEV RANGE MIN MAX KURTOSIS SKEWNESS.

FREQUENCIES VARIABLES=nace_b OwnTechnicalExpertise OwnFinancialResources ExternalSupport

```
TechnicalSupport AdoptionRecycling SMEsize Demand Expertise Policy
/STATISTICS=STDDEV RANGE MINIMUM MAXIMUM SEMEAN MEAN MEDIAN
MODE SKEWNESS SESKEW KURTOSIS SEKURT
/ORDER=ANALYSIS.
```

Check missing values per case.

```
COMPUTE Missingdata=NMISS(OwnTechnicalExpertise, OwnFinancialResources,
ExternalSupport,
    TechnicalSupport, AdoptionRecycling, SMEsize, Demand, Expertise, nace_b, Policy).
EXECUTE.
```

```
FREQUENCIES VARIABLES=Missingdata
/ORDER=ANALYSIS.
```

*Little MCAR test to check missing values.

```
MVA VARIABLES=SMEsize Policy nace_b OwnTechnicalExpertise
OwnFinancialResources TechnicalSupport
    AdoptionRecycling Demand Expertise
/MAXCAT=25
/CATEGORICAL=nace_b OwnTechnicalExpertise OwnFinancialResources
TechnicalSupport
    AdoptionRecycling Demand Expertise
/EM(TOLERANCE=0.001 CONVERGENCE=0.0001 ITERATIONS=25).
```

*-----DESCRIPTIVES-----.

```
*Analyze descriptives and frequencies to check distribution of the variables.
DESCRIPTIVES VARIABLES= isocntry AdoptionRecycling OwnTechnicalExpertise
TechnicalSupport SMEsize OwnFinancialResources Expertise nace_b Policy
    Demand
/STATISTICS=MEAN STDDEV RANGE MIN MAX KURTOSIS SKEWNESS.
```

```
FREQUENCIES VARIABLES= isocntry AdoptionRecycling OwnTechnicalExpertise
TechnicalSupport SMEsize OwnFinancialResources Expertise nace_b Policy
    Demand
/STATISTICS=STDDEV RANGE MINIMUM MAXIMUM SEMEAN MEAN MEDIAN
MODE SKEWNESS SESKEW KURTOSIS SEKURT
/ORDER=ANALYSIS.
```

*Check SMEs per country to see if the sample is skewed.

```
CROSSTABS
/TABLES=isocntry BY SMEsize
/FORMAT=AVALUE TABLES
/CELLS=COUNT
/COUNT ROUND CELL.
```

*-----ANALYSIS-----.

```
*Create dummies of the nominal sector variable.
RECODE nace_b (1=1) (ELSE=0) INTO Manuf_dummy.
VARIABLE LABELS Manuf_dummy 'Manufacturing dummy'.
EXECUTE.
```

```
RECODE nace_b (2=1) (ELSE=0) INTO Retail_dummy.  
VARIABLE LABELS Retail_dummy 'Retail dummy'.  
EXECUTE.
```

```
RECODE nace_b (3=1) (ELSE=0) INTO Services_dummy.  
VARIABLE LABELS Services_dummy 'Services dummy'.  
EXECUTE.
```

```
RECODE nace_b (4=1) (ELSE=0) INTO Industry_dummy.  
VARIABLE LABELS Industry_dummy 'Industry dummy'.  
EXECUTE.
```

*Check multicollinearity.

```
REGRESSION  
/MISSING LISTWISE  
/STATISTICS COLLIN TOL  
/CRITERIA=PIN(.05) POUT(.10)  
/NOORIGIN  
/DEPENDENT AdoptionRecycling  
/METHOD=ENTER OwnFinancialResources ExternalSupport TechnicalSupport Demand  
Expertise SMEsize  
OwnTechnicalExpertise Policy nace_b.
```

*Testing linearity in the logit using the Box-Tidwell transformation.

*Making SMEsize variable without 0, because only positive values are possible in Box-tidwell test.

```
COMPUTE Newvar_SMEsize=1+ SMEsize .  
EXECUTE.
```

```
COMPUTE TR_SMEsize=ln(Newvar_SMEsize)*Newvar_SMEsize .  
EXECUTE.
```

```
COMPUTE TR_Policy=ln(Policy)*Policy.  
EXECUTE.
```

*Look at the significance of the transformed variables, to do the Box-Tidwell test (if non-sign. the assumption concerning linearity is met).

```
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER SMEsize OwnFinancialResources OwnTechnicalExpertise  
ExternalSupport  
TechnicalSupport Manuf_dummy Retail_dummy Demand TR_Policy TR_SMEsize  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

*Making a polynomial term of 'policy stringency index' to check linearity.

*Center 'policy stringency index' before transforming into polynomial terms.

```
COMPUTE Policy_centered=Policy-2.818190820283278.  
EXECUTE.
```

```
COMPUTE PolicyC_2=Policy_centered**2.  
EXECUTE.
```

```
COMPUTE PolicyC_3=Policy_centered**3.  
EXECUTE.
```

```
*Add polynomial terms in Box-Tidwell test to check linearity.  
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER SMEsize OwnFinancialResources OwnTechnicalExpertise  
ExternalSupport  
TechnicalSupport Manuf_dummy Retail_dummy Demand TR_Policy TR_SMEsize  
PolicyC_2 PolicyC_3  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

```
*Logistic regression.  
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER SMEsize OwnFinancialResources OwnTechnicalExpertise  
ExternalSupport  
TechnicalSupport Manuf_dummy Retail_dummy  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

```
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER OwnTechnicalExpertise TechnicalSupport  
/METHOD=ENTER SMEsize OwnFinancialResources Expertise  
/METHOD=ENTER Industry_dummy Services_dummy Manuf_dummy Policy Demand  
/CLASSPLOT  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

```
*Logistic regression with polynomials.  
DATASET ACTIVATE DataSet1.  
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER OwnTechnicalExpertise TechnicalSupport  
/METHOD=ENTER SMEsize OwnFinancialResources Expertise  
/METHOD=ENTER Manuf_dummy Services_dummy Industry_dummy Policy Demand  
PolicyC_2 PolicyC_3  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

```
*Robustness check (analysis with half the sample).  
SET RNG=MC SEED=RANDOM.
```

```
USE ALL.  
COMPUTE filter_$=(uniform(1)<=.50).  
VARIABLE LABELS filter_$ 'Approximately 50% of the cases (SAMPLE)'.  
FORMATS filter_$ (f1.0).  
FILTER BY filter_$.  
EXECUTE.
```

```
DATASET COPY Sample_1.  
DATASET ACTIVATE Sample_1.  
FILTER OFF.  
USE ALL.  
SELECT IF (filter_$=0).  
EXECUTE.  
DATASET ACTIVATE DataSet1.
```

*Run analysis with the new dataset (half the sample).

```
DATASET ACTIVATE Sample_1.  
LOGISTIC REGRESSION VARIABLES AdoptionRecycling  
/METHOD=ENTER OwnTechnicalExpertise TechnicalSupport  
/METHOD=ENTER SMEsize OwnFinancialResources Expertise  
/METHOD=ENTER Manuf_dummy Services_dummy Industry_dummy Policy Demand  
/PRINT=GOODFIT CI(95)  
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Appendix 2: Countries included/excluded in analysis

Table A2

Countries included/excluded in analysis

| Countries | Included/excluded in analysis |
|-----------------------|--------------------------------------|
| Belgium | Included |
| Czech Republic | Included |
| Bulgaria | Excluded |
| Denmark | Included |
| Germany | Included |
| Estonia | Excluded |
| Greece | Included |
| Spain | Included |
| France | Included |
| Croatia | Excluded |
| Ireland | Included |
| Italy | Included |
| Republic of Cyprus | Excluded |
| Lithuania | Excluded |
| Albania | Excluded |
| Montenegro | Excluded |
| Turkey | Included |
| Iceland | Excluded |
| Norway | Included |
| Latvia | Excluded |
| Luxembourg | Excluded |
| Hungary | Included |
| Malta | Excluded |
| The Netherlands | Included |
| Austria | Included |
| Poland | Included |
| Portugal | Included |
| Romania | Excluded |
| Slovenia | Included |
| Slovakia | Included |
| Finland | Included |
| Sweden | Included |
| United Kingdom | Included |
| Former Yugoslav | Excluded |
| Republic of Macedonia | Excluded |
| Serbia | Excluded |
| Moldova | Excluded |
| United States of | Excluded |

Appendix 3: Descriptive statistics and frequencies

Table A3.1

Descriptive statistics

| Descriptive Statistics | | | | | | |
|--|----------------|--------------------|----------------------|----------------------|-------------------|-----------------------------|
| | N Statistic | Range Statistic | Minimum Statistic | Maximum Statistic | Mean Statistic | Std. Deviation Statistic |
| Adoption of recycling present? | 8868 | 1.000000000 | .000000000 | 1.000000000 | .463464140731 | .4986914626026 |
| Own technical expertise | 8069 | 1.000000000 | .000000000 | 1.000000000 | .592266699715 | .4914435751574 |
| Technical support | 8868 | 1.000000000 | .000000000 | 1.000000000 | .252480829950 | .4344600620041 |
| SME size | 8868 | 8.000000000 | 1.000000000 | 9.000000000 | 1.79826341903 | .8948364625165 |
| Own financial resources | 8069 | 1.000000000 | .000000000 | 1.000000000 | .641715206345 | .4795261178110 |
| Organizational Expertise | 8069 | 1.000000000 | .000000000 | 1.000000000 | .800099144875 | .3999504060548 |
| SECTOR OF ACTIVITY (NACE) | 8868 | 3 | 1 | 4 | 2.43 | 1.025 |
| POLICY STRINGENCY INDEX | 8868 | 2.016666531 | 1.8333333 | 3.849999904 | 2.81819082028 | .5593128739102 |
| Demand for resource efficient products or services | 8069 | 1.000000000 | .000000000 | 1.000000000 | .823398190606 | .3813549971015 |
| Valid N (listwise) | 8069 | | | | | |

Table A3.2
Total frequency table part 1

| | COUNT RY CODE - ISO 3166 | Statistics | | | | |
|---------------------------|-----------------------------------|-----------------------------------|----------------------------|----------------------|----------------|----------------------------|
| | | Adoption of recycling present? | Own technical expertise | Technical support | SME size | Own financial resources |
| Valid | 8868 | 8868 | 8069 | 8868 | 8868 | 8069 |
| Missing | 0 | 0 | 799 | 0 | 0 | 799 |
| Mean | | .463464140731 | .592266699715 | .252480829950 | 1.798263419035 | .641715206345 |
| Std. Error of Mean | | .0052956477700 | .0054709633318 | .0046135689721 | .0095023457841 | .0053382930204 |
| Median | | .000000000000 | 1.0000000000000 | .000000000000 | 2.000000000000 | 1.0000000000000 |
| Mode | | .0000000000 | 1.0000000000 | .0000000000 | 1.0000000000 | 1.0000000000 |
| Std. Deviation | | .4986914626026 | .4914435751574 | .4344600620041 | .8948364625165 | .4795261178110 |
| Skewness | | .147 | -.376 | 1.140 | 2.258 | -.591 |
| Std. Error of Skewness | | .026 | .027 | .026 | .026 | .027 |
| Kurtosis | | -1.979 | -1.859 | -.701 | 1.531 | -1.651 |
| Std. Error of Kurtosis | | .052 | .055 | .052 | .052 | .055 |
| Range | | 1.0000000000 | 1.0000000000 | 1.0000000000 | 8.0000000000 | 1.0000000000 |
| Minimum | | .0000000000 | .0000000000 | .0000000000 | 1.0000000000 | .0000000000 |
| Maximum | | 1.0000000000 | 1.0000000000 | 1.0000000000 | 9.0000000000 | 1.0000000000 |

Table A3.2
Total frequency table part 2

| | | Statistics | | | |
|------------------------|---------|-----------------------------|---|-------------------------------|--|
| | | Organizational Expertise | SECTOR OF ACTIVITY (NACE) - SECTIONS GROUPED | POLICY STRINGENCY INDEX | Demand for resource efficient products or services |
| N | Valid | 8069 | 8868 | 8868 | 8069 |
| | Missing | 799 | 0 | 0 | 799 |
| Mean | | .800099144875 | 2.43 | 2.818190820283285 | .823398190606 |
| Std. Error of Mean | | .0044524216343 | .011 | .005939391779405 | .0042454094651 |
| Median | | 1.000000000000 | 2.00 | 2.766666650772100 | 1.000000000000 |
| Mode | | 1.0000000000 | 2 | 2.1333332061768 | 1.0000000000 |
| Std. Deviation | | .3999504060548 | 1.025 | .559312873910231 | .3813549971015 |
| Skewness | | -1.501 | .075 | .123 | -1.696 |
| Std. Error of Skewness | | .027 | .026 | .026 | .027 |
| Kurtosis | | .253 | -1.128 | -1.066 | .878 |
| Std. Error of Kurtosis | | .055 | .052 | .052 | .055 |
| Range | | 1.0000000000 | 3 | 2.0166665315628 | 1.0000000000 |
| Minimum | | .0000000000 | 1 | 1.8333333730698 | .0000000000 |
| Maximum | | 1.0000000000 | 4 | 3.8499999046326 | 1.0000000000 |

Table A3.3
Frequency table country

| | | COUNTRY CODE - ISO 3166 | | | |
|-------|-----------------|--------------------------------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Austria | 459 | 5.2 | 5.2 | 5.2 |
| | Belgium | 461 | 5.2 | 5.2 | 10.4 |
| | Czech Republic | 448 | 5.1 | 5.1 | 15.4 |
| | Germany | 455 | 5.1 | 5.1 | 20.6 |
| | Denmark | 461 | 5.2 | 5.2 | 25.8 |
| | Spain | 461 | 5.2 | 5.2 | 31.0 |
| | Finland | 456 | 5.1 | 5.1 | 36.1 |
| | France | 467 | 5.3 | 5.3 | 41.4 |
| | United Kingdom | 443 | 5.0 | 5.0 | 46.4 |
| | Greece | 470 | 5.3 | 5.3 | 51.7 |
| | Hungary | 474 | 5.3 | 5.3 | 57.0 |
| | Ireland | 450 | 5.1 | 5.1 | 62.1 |
| | Italy | 476 | 5.4 | 5.4 | 67.4 |
| | The Netherlands | 460 | 5.2 | 5.2 | 72.6 |
| | Norway | 293 | 3.3 | 3.3 | 75.9 |
| | Poland | 463 | 5.2 | 5.2 | 81.2 |
| | Portugal | 473 | 5.3 | 5.3 | 86.5 |
| | Sweden | 454 | 5.1 | 5.1 | 91.6 |
| | Slovakia | 463 | 5.2 | 5.2 | 96.8 |
| | Turkey | 281 | 3.2 | 3.2 | 100.0 |
| Total | | 8868 | 100.0 | 100.0 | |

Table A3.4
Frequency table adoption of recycling

| | | Adoption of recycling present? | | | |
|-------|------------------------------|---------------------------------------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | No recycling activities | 4758 | 53.7 | 53.7 | 53.7 |
| | Recycling activities present | 4110 | 46.3 | 46.3 | 100.0 |
| | Total | 8868 | 100.0 | 100.0 | |

Table 3.5
Frequency table technical expertise

| | | Own technical expertise | | | |
|---------|-----------------------------|-------------------------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Not mentioned | 3290 | 37.1 | 40.8 | 40.8 |
| | Its own technical expertise | 4779 | 53.9 | 59.2 | 100.0 |
| | Total | 8069 | 91.0 | 100.0 | |
| Missing | Inap. (Not 1 in q9) | 799 | 9.0 | | |
| Total | | 8868 | 100.0 | | |

Table A3.6
Frequency table technical support

| | | Technical support (demonstration new technologies) | | | |
|-------|--|--|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Not mentioned | 6629 | 74.8 | 74.8 | 74.8 |
| | Demonstration of new technologies to improve resource efficiency | 2239 | 25.2 | 25.2 | 100.0 |
| | Total | 8868 | 100.0 | 100.0 | |

Table A3.7
Frequency table SME size

| | | SME size | | | |
|---------|--------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Micro | 3890 | 43.9 | 44.0 | 44.0 |
| | Small | 3087 | 34.8 | 34.9 | 79.0 |
| | Medium | 1856 | 20.9 | 21.0 | 100.0 |
| | Total | 8833 | 99.6 | 100.0 | |
| Missing | DK/NA | 35 | .4 | | |
| Total | | 8868 | 100.0 | | |

Table A3.8*Frequency table own financial resources*

| | | Own financial resources | | | |
|---------|-----------------------------|--------------------------------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Not Mentioned | 2891 | 32.6 | 35.8 | 35.8 |
| | Its own financial resources | 5178 | 58.4 | 64.2 | 100.0 |
| | Total | 8069 | 91.0 | 100.0 | |
| Missing | Inap. (Not 1 in q9) | 799 | 9.0 | | |
| Total | | 8868 | 100.0 | | |

Table A3.9*Frequency table organizational expertise*

| | | Organizational Expertise | | | |
|---------|--|---------------------------------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Lack of specific environmental expertise | 1613 | 18.2 | 20.0 | 20.0 |
| | Environmental expertise present | 6456 | 72.8 | 80.0 | 100.0 |
| | Total | 8069 | 91.0 | 100.0 | |
| Missing | Inap. (Not 1 in q1.1 to q1.8) | 799 | 9.0 | | |
| Total | | 8868 | 100.0 | | |

Table A3.10*Frequency table sector of activity***SECTOR OF ACTIVITY (NACE) - SECTIONS GROUPED**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--|-----------|---------|---------------|--------------------|
| Valid | Manufacturing (NACE category C) | 1973 | 22.2 | 22.2 | 22.2 |
| | Retail (NACE categories G) | 2718 | 30.6 | 30.6 | 52.9 |
| | Services (NACE categories H/I/J/K/L/M) | 2574 | 29.0 | 29.0 | 81.9 |
| | Industry (NACE categories B/D/E/F) | 1603 | 18.1 | 18.1 | 100.0 |
| | Total | 8868 | 100.0 | 100.0 | |

Table A3.11*Frequency table policy stringency index*

| POLICY STRINGENCY INDEX | | | | | |
|--------------------------------|-----------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1.8333333730698 | 281 | 3.2 | 3.2 | 3.2 |
| | 2.0499999523163 | 450 | 5.1 | 5.1 | 8.2 |
| | 2.1333332061768 | 943 | 10.6 | 10.6 | 18.9 |
| | 2.2166666984558 | 461 | 5.2 | 5.2 | 24.1 |
| | 2.3833332061768 | 448 | 5.1 | 5.1 | 29.1 |
| | 2.4666666984558 | 461 | 5.2 | 5.2 | 34.3 |
| | 2.5750000476837 | 463 | 5.2 | 5.2 | 39.5 |
| | 2.6333332061768 | 474 | 5.3 | 5.3 | 44.9 |
| | 2.7666666507721 | 476 | 5.4 | 5.4 | 50.3 |
| | 2.9249999523163 | 455 | 5.1 | 5.1 | 55.4 |
| | 2.9458332061768 | 459 | 5.2 | 5.2 | 60.6 |
| | 2.9874999523163 | 463 | 5.2 | 5.2 | 65.8 |
| | 3.0999999046326 | 454 | 5.1 | 5.1 | 70.9 |
| | 3.2583332061768 | 293 | 3.3 | 3.3 | 74.2 |
| | 3.2916665077209 | 443 | 5.0 | 5.0 | 79.2 |
| | 3.4291667938232 | 456 | 5.1 | 5.1 | 84.3 |
| | 3.5666666030884 | 467 | 5.3 | 5.3 | 89.6 |
| | 3.6250000000000 | 460 | 5.2 | 5.2 | 94.8 |
| | 3.8499999046326 | 461 | 5.2 | 5.2 | 100.0 |
| | Total | 8868 | 100.0 | 100.0 | |

Table A3.12*Frequency table demand for resource efficient products or services*

| Demand for resource efficient products or services | | | | | |
|---|--|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Lack of demand for resource efficient products or services | 1425 | 16.1 | 17.7 | 17.7 |
| | Demand for resource efficient products or services present | 6644 | 74.9 | 82.3 | 100.0 |
| | Total | 8069 | 91.0 | 100.0 | |
| Missing | Inap. (Not 1 in q1.1 to q1.8) | 799 | 9.0 | | |
| Total | | 8868 | 100.0 | | |

Table A3.13*Little's MCAR test part 1*

| EM Means ^a | |
|-----------------------|------------------|
| SMEsize | Policy |
| 1.822282810757 | 2.81858857856364 |
| | 0 |

a. Little's MCAR test: Chi-Square = 3.991, DF = 2, Sig. = .136

Table A3.14*Little's MCAR test part 2*

| EM Covariances ^a | | |
|-----------------------------|-----------------|------------------|
| | SMEsize | Policy |
| SMEsize | .7921608268004 | |
| Policy | -.0058257614357 | .313292492031993 |

a. Little's MCAR test: Chi-Square = 3.991, DF = 2, Sig. = .136

Table A3.15*Little's MCAR test part 3*

| EM Correlations ^a | | |
|------------------------------|---------|--------|
| | SMEsize | Policy |
| SMEsize | 1 | |
| Policy | -.012 | 1 |

a. Little's MCAR test: Chi-Square = 3.991, DF = 2, Sig. = .136

Table A3.16
EM Covariances part 1

| | EM Covariances ^a | | | | | |
|---------------------------|-----------------------------|---------------|------------|-------------|-------------|-----------------------|
| | SMEsize | Policy | nace_ b | Expertise | Demand | AdoptionRe cycling |
| SMEsize | .80073229464 | | | | | |
| Policy | -.00782986015 | .31283089092 | | | | |
| nace_b | -.08807813649 | .02361441601 | 1.052 | | | |
| Expertise | -.00660838560 | .01220140996 | .007 | .159956250 | | |
| Demand | .00210928652 | .00221525361 | -.003 | .043020308 | .145421349 | |
| AdoptionRe cycling | .03226991629 | -.01220700466 | -.014 | -.002955286 | -.004933728 | .248693174 |
| TechnicalSu pport | .01733260457 | -.00565676547 | -.009 | -.007386825 | -.007989355 | .012665364 |
| OwnFinanci alResources | .01550723325 | -.01019495599 | -.011 | -.006310183 | -.009361325 | .007007109 |
| OwnTechnic alExpertise | .02091326111 | .01943559687 | .000 | -.001696284 | -.003347038 | .014156471 |

Table A3.17
EM Covariances part 2

| | EM Covariances ^a | | |
|-----------------------|-----------------------------|---------------------------|---------------------------|
| | TechnicalSupport | OwnFinancialReso urces | OwnTechnicalExpe rtise |
| SMEsize | | | |
| Policy | | | |
| nace_b | | | |
| Expertise | | | |
| Demand | | | |
| AdoptionRecycling | | | |
| TechnicalSupport | .1887555454766 | | |
| OwnFinancialResources | .0083147877721 | .2299503009298 | |
| OwnTechnicalExpertise | .0101388698595 | -.0066544755878 | .2415331786705 |

a. Little's MCAR test: Chi-Square = 870.037, DF = 5, Sig. = .000

Table A3.18
EM Correlations

| EM Correlations ^a | | | | | | | | | |
|------------------------------|----------|--------|--------|-----------|--------|--------------------|-------------------|-------------------------|-------------------------|
| | SME size | Policy | nace_b | Expertise | Demand | Adoption Recycling | Technical Support | Own Financial Resources | Own technical expertise |
| SMEsize | 1 | | | | | | | | |
| Policy | -.016 | 1 | | | | | | | |
| nace_b | -.096 | .041 | 1 | | | | | | |
| Expertise | -.018 | .055 | .016 | 1 | | | | | |
| Demand | .006 | .010 | -.007 | .282 | 1 | | | | |
| Adoption Recycling | .072 | -.044 | -.028 | -.015 | -.026 | 1 | | | |
| Technical Support | .045 | -.023 | -.020 | -.043 | -.048 | .058 | 1 | | |
| Own Financial Resources | .036 | -.038 | -.022 | -.033 | -.051 | .029 | .040 | 1 | |
| Own Technical Expertise | .048 | .071 | .001 | -.009 | -.018 | .058 | .047 | -.028 | 1 |

a. Little's MCAR test: Chi-Square = 870.037, DF = 5, Sig. = .000

Appendix 4: Outputs logistic regression analysis
Block 0:

Table A4.1

Case processing summary

| Case Processing Summary | | | |
|-------------------------------|----------------------|------|---------|
| Unweighted Cases ^a | | N | Percent |
| Selected Cases | Included in Analysis | 8069 | 91.0 |
| | Missing Cases | 799 | 9.0 |
| | Total | 8868 | 100.0 |
| Unselected Cases | | 0 | .0 |
| Total | | 8868 | 100.0 |

Table A4.2

Dependent variable encoding

| Dependent Variable Encoding | |
|------------------------------|----------------|
| Original Value | Internal Value |
| No recycling activities | 0 |
| Recycling activities present | 1 |

Table A4.3

Classification table

| | | Classification Table ^{a,b} | | | |
|--------------------|-----------------------------------|---|---------------------------------|---------------------------|-------|
| | | Predicted | | Percent age Correct | |
| Observed | | Adoption of recycling No recycling activities | Recycling activities present | | |
| Step 0 | Adoption of recycling present? | No recycling activities | 0 | 3959 | .0 |
| | | Recycling activities present | 0 | 4110 | 100.0 |
| Overall Percentage | | | | | 50.9 |

a. Constant is included in the model.

b. The cut value is .500

| | B | S.E. | Wald | df | Sig. | Exp(B) | |
|--------|----------|------|------|-------|------|--------|-------|
| Step 0 | Constant | .037 | .022 | 2.825 | 1 | .093 | 1.038 |

Table A4.4
Variables not in the equation

| | | Variables not in the Equation | | | |
|--------------------|-----------|---|--------|------|------|
| | | Score | df | Sig. | |
| Step 0 | Variables | Own technical expertise | 25.660 | 1 | .000 |
| | | Technical support (demonstration new technologies) | 8.230 | 1 | .004 |
| Overall Statistics | | 32.601 | 2 | .000 | |

Block 1:
Table A4.5
Omnibus test of model coefficients

| Omnibus Tests of Model Coefficients | | | | |
|-------------------------------------|-------|------------|----|------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 32.637 | 2 | .000 |
| | Block | 32.637 | 2 | .000 |
| | Model | 32.637 | 2 | .000 |

Table A4.6
Model summary

| Model Summary | | | | |
|---------------|------------------------|---------------|--------------|--|
| | | Cox & Snell R | Nagelkerke R | |
| Step | -2 Log likelihood | Square | Square | |
| 1 | 11150.546 ^a | .004 | .005 | |

Table A4.7
Hosmer and Lemeshow test

| Hosmer and Lemeshow Test | | | |
|--------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | .686 | 2 | .710 |

Table A4.8
Contingency table for Hosmer and Lemeshow test

| Contingency Table for Hosmer and Lemeshow Test | | | | | | |
|--|---|---|----------|--|----------|-------|
| | | Adoption of recycling present? = No recycling activities | | Adoption of recycling present? = Recycling activities present | | Total |
| | | Observed | Expected | Observed | Expected | |
| Step 1 | 1 | 1338 | 1330.037 | 1159 | 1166.963 | 2497 |
| | 2 | 388 | 395.963 | 405 | 397.037 | 793 |
| | 3 | 1625 | 1632.963 | 1801 | 1793.037 | 3426 |
| | 4 | 608 | 600.037 | 745 | 752.963 | 1353 |

Table A4.9
Classification table

| Observed | | Predicted | | Percentage Correct |
|--------------------|--------------------------------|---|------------------------------|--------------------|
| | | Adoption of recycling present? No recycling activities | Recycling activities present | |
| Step 1 | Adoption of recycling present? | No recycling activities | 1338 | 33.8 |
| | | Recycling activities present | 1159 | 71.8 |
| Overall Percentage | | | | 53.2 |

Table A4.10
Variables in the equation

| | | Variables in the Equation | | | | | Exp(B) | 95% C.I. for EXP(B) Lower | 95% C.I. for EXP(B) Upper |
|---------------------|--|---------------------------|------|--------|----|------|--------|------------------------------|------------------------------|
| | | B | S.E. | Wald | df | Sig. | | | |
| Step 1 ^a | Own technical expertise | .224 | .045 | 24.367 | 1 | .000 | 1.251 | 1.145 | 1.368 |
| | Technical support (demonstration new technologies) | .134 | .051 | 6.959 | 1 | .008 | 1.143 | 1.035 | 1.262 |
| | Constant | -.131 | .037 | 12.493 | 1 | .000 | .877 | | |

a. Variable(s) entered on step 1: Own technical expertise, Technical support (demonstration new technologies).

Block 2:**Table A4.11***Omnibus test of model coefficients*

| Omnibus Tests of Model Coefficients | | | | |
|--|-------|------------|----|------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 26.072 | 3 | .000 |
| | Block | 26.072 | 3 | .000 |
| | Model | 58.709 | 5 | .000 |

Table A4.12*Model summary*

| Model Summary | | | |
|----------------------|------------------------|----------------------|---------------------|
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 11124.475 ^a | .007 | .010 |

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Table A4.13*Hosmer and Lemeshow test*

| Hosmer and Lemeshow Test | | | |
|---------------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | 10.437 | 8 | .236 |

Table A4.14*Contingency table for Hosmer and Lemeshow test*

| Contingency Table for Hosmer and Lemeshow Test | | | | | | |
|---|----|---|----------|--|----------|-------|
| | | Adoption of recycling present? = No recycling activities | | Adoption of recycling present? = Recycling activities present | | Total |
| | | Observed | Expected | Observed | Expected | |
| Step 1 | 1 | 385 | 371.361 | 276 | 289.639 | 661 |
| | 2 | 468 | 470.650 | 399 | 396.350 | 867 |
| | 3 | 329 | 341.288 | 328 | 315.712 | 657 |
| | 4 | 409 | 423.594 | 412 | 397.406 | 821 |
| | 5 | 400 | 404.794 | 418 | 413.206 | 818 |
| | 6 | 393 | 364.360 | 349 | 377.640 | 742 |
| | 7 | 438 | 425.327 | 451 | 463.673 | 889 |
| | 8 | 336 | 355.017 | 430 | 410.983 | 766 |
| | 9 | 444 | 448.814 | 559 | 554.186 | 1003 |
| | 10 | 357 | 353.797 | 488 | 491.203 | 845 |

Table A4.15
Classification table

Classification Table^a

| | Observed | Predicted | | Percentage Correct | |
|--------|--------------------------------|--------------------------------|------------------------------|--------------------|------|
| | | Adoption of recycling present? | Recycling activities present | | |
| | | No recycling activities | Recycling activities present | | |
| Step 1 | Adoption of recycling present? | No recycling activities | 1686 | 2273 | 42.6 |
| | | Recycling activities present | 1521 | 2589 | 63.0 |
| | Overall Percentage | | | | 53.0 |

Table A4.16
Variables in the equation

Variables in the Equation

| | B | S.E. | Wald | df | Sig. | Exp(B) | 95% C.I. for EXP(B) | | |
|---------------------|--|-------|------|--------|------|--------|---------------------|-------|-------|
| | | | | | | | Lower | Upper | |
| Step 1 ^a | Own technical expertise | .219 | .046 | 23.134 | 1 | .000 | 1.245 | 1.139 | 1.361 |
| | Technical support (demonstration new technologies) | .119 | .051 | 5.492 | 1 | .019 | 1.126 | 1.020 | 1.244 |
| | SME size | .109 | .026 | 18.072 | 1 | .000 | 1.115 | 1.060 | 1.173 |
| | Own financial resources | .112 | .047 | 5.725 | 1 | .017 | 1.118 | 1.020 | 1.225 |
| | Organizational Expertise | -.053 | .056 | .899 | 1 | .343 | .948 | .850 | 1.058 |
| | Constant | -.351 | .080 | 19.151 | 1 | .000 | .704 | | |

a. Variable(s) entered on step 1: SME size, Own financial resources, Organizational Expertise.

Block 3:

Table A4.17

Omnibus test of model coefficients

| | | Omnibus Tests of Model Coefficients | | |
|--------|-------|-------------------------------------|----|------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 34.014 | 5 | .000 |
| | Block | 34.014 | 5 | .000 |
| | Model | 92.723 | 10 | .000 |

Table A4.18

Model summary

| Model Summary | | | |
|---------------|------------------------|----------------------|---------------------|
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 11090.460 ^a | .011 | .015 |

Table A4.19

Hosmer and Lemeshow test

| Hosmer and Lemeshow Test | | | |
|--------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | 14.919 | 8 | .061 |

Table A4.20

Contingency table for Hosmer and Lemeshow test

| Contingency Table for Hosmer and Lemeshow Test | | | | | | |
|--|----|---|----------|--|----------|-------|
| | | Adoption of recycling present? = No recycling activities | | Adoption of recycling present? = Recycling activities present | | Total |
| | | Observed | Expected | Observed | Expected | |
| Step 1 | 1 | 489 | 472.998 | 319 | 335.002 | 808 |
| | 2 | 411 | 443.133 | 397 | 364.867 | 808 |
| | 3 | 426 | 425.135 | 381 | 381.865 | 807 |
| | 4 | 431 | 412.493 | 376 | 394.507 | 807 |
| | 5 | 396 | 399.329 | 409 | 405.671 | 805 |
| | 6 | 373 | 390.111 | 435 | 417.889 | 808 |
| | 7 | 365 | 377.937 | 443 | 430.063 | 808 |
| | 8 | 392 | 364.930 | 414 | 441.070 | 806 |
| | 9 | 361 | 351.056 | 446 | 455.944 | 807 |
| | 10 | 315 | 321.878 | 490 | 483.122 | 805 |

Table A4.21
Classification table
Classification Table^a

| Observed | Predicted Adoption of recycling present? | | Percentage Correct |
|---------------------------------------|---|------------------------------------|-----------------------|
| | No recycling activities | Recycling activities present | |
| Step 1 Adoption of recycling present? | No recycling activities | 1842 | 46.5 |
| | Recycling activities present | 1573 | 61.7 |
| Overall Percentage | | | 54.3 |

Table A4.22
Variables in the equation

| | | Variables in the Equation | | | | | 95% C.I.for EXP(B) Lower | 95% C.I.for EXP(B) Upper |
|---------------------|--|---------------------------|------|--------|----|------|-----------------------------------|-----------------------------------|
| | | B | S.E. | Wald | df | Sig. | Exp(B) | |
| Step 1 ^a | Own technical expertise | .232 | .046 | 25.316 | 1 | .000 | 1.261 | 1.152 1.380 |
| | Technical support (demonstration new technologies) | .111 | .051 | 4.772 | 1 | .029 | 1.118 | 1.012 1.235 |
| | SME size | .113 | .026 | 18.646 | 1 | .000 | 1.119 | 1.063 1.178 |
| | Own financial resources | .099 | .047 | 4.478 | 1 | .034 | 1.104 | 1.007 1.211 |
| | Organizational Expertise | -.008 | .059 | .017 | 1 | .896 | .992 | .885 1.113 |
| | Industry dummy | .001 | .066 | .000 | 1 | .990 | 1.001 | .879 1.140 |
| | Services dummy | -.171 | .059 | 8.450 | 1 | .004 | .843 | .751 .946 |
| | Manufacturing dummy | -.054 | .063 | .739 | 1 | .390 | .947 | .838 1.072 |
| | POLICY STRINGENCY INDEX | -.181 | .040 | 20.140 | 1 | .000 | .835 | .771 .903 |
| | Demand for resource efficient products or services | -.109 | .061 | 3.166 | 1 | .075 | .896 | .795 1.011 |
| | Constant | .268 | .145 | 3.387 | 1 | .066 | 1.307 | |

a. Variable(s) entered on step 1: Industry dummy, Services dummy, Manufacturing dummy, POLICY STRINGENCY INDEX, Demand for resource efficient products or services.

Appendix 5: Robustness check

Block 0:

Table A5.1

Classification table

Classification Table^a

| | Observed | Predicted | | Percentage Correct |
|--------------------|--------------------------------|---|------------------------------|--------------------|
| | | Adoption of recycling present? No recycling activities | Recycling activities present | |
| Step 1 | Adoption of recycling present? | No recycling activities | 0 | .0 |
| | | Recycling activities present | 0 | 100.0 |
| Overall Percentage | | | | 51.9 |

Table A5.2

Variables in the equation

Variables in the equation

| | B | S.E. | Wald | df | Sig. | Exp(B) | |
|--------|----------|------|------|-------|------|--------|-------|
| Step 0 | Constant | .075 | .030 | 6.516 | 1 | .011 | 1.078 |

Table A5.3

Variables not in the equation

Variables not in the Equation

| | Score | df | Sig. | | |
|--------------------|-----------|--|--------|------|------|
| Step 0 | Variables | Own technical expertise | 19.824 | 1 | .000 |
| | | Technical support (demonstration new technologies) | 5.143 | 1 | .023 |
| Overall Statistics | | 23.858 | 2 | .000 | |

Block 1:

Table A5.4

Omnibus test of model coefficients

Omnibus Tests of Model Coefficients

| | Chi-square | df | Sig. | |
|--------|------------|--------|------|------|
| Step 1 | Step | 23.883 | 2 | .000 |
| | Block | 23.883 | 2 | .000 |
| | Model | 23.883 | 2 | .000 |

Table A5.5
Model summary

| Step | -2 Log likelihood | Model Summary | |
|------|-------------------|----------------------|---------------------|
| | | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 6334.074 | .005 | .007 |

Table A5.6
Hosmer and Lemeshow test

| Hosmer and Lemeshow Test | | | |
|--------------------------|------------|----|-------|
| Step | Chi-square | df | Sig. |
| 1 | .000 | 2 | 1.000 |

Table A5.7
Contingency table for Hosmer and Lemeshow test

| | Contingency Table for Hosmer and Lemeshow Test | | | | |
|---|---|----------|--|----------|-------|
| | Adoption of recycling present? = No recycling activities | | Adoption of recycling present? = Recycling activities present | | Total |
| | Observed | Expected | Observed | Expected | |
| 1 | 729 | 729.084 | 647 | 646.916 | 1376 |
| 2 | 218 | 217.916 | 221 | 221.084 | 439 |
| 3 | 908 | 907.916 | 1047 | 1047.084 | 1955 |
| 4 | 354 | 354.084 | 467 | 466.916 | 821 |

Table A5.7
Classification table

| | | Classification Table ^a | | | |
|--------------------|---|--|-----|--------------------|------|
| | | Predicted | | Percentage Correct | |
| Observed | Adoption of recycling present? No recycling activities | Adoption of recycling present? Recycling activities present | | | |
| Step 1 | Adoption of recycling present? | No recycling activities | 729 | 1480 | 33.0 |
| | | Recycling activities present | 647 | 1735 | 72.8 |
| Overall Percentage | | | | | 53.7 |

Table A5.8
Variables in the equation

| | | Variables in the Equation | | | | | 95% C.I.for C.I.for EXP(B) Lower | 95% C.I.for EXP(B) Upper |
|---------------------|--|---------------------------|------|--------|----|------|---|--------------------------------|
| | | B | S.E. | Wald | df | Sig. | Exp(B) | |
| Step 1 ^a | Own technical expertise | .262 | .061 | 18.703 | 1 | .000 | 1.300 | 1.154 1.464 |
| | Technical support (demonstration new technologies) | .134 | .067 | 4.050 | 1 | .044 | 1.143 | 1.003 1.303 |
| | Constant | -.120 | .050 | 5.787 | 1 | .016 | .887 | |

a. Variable(s) entered on step 1: Own technical expertise, Technical support (demonstration new technologies).

Block 2:
Table A5.9

Omnibus test of model coefficients

| | | Omnibus Tests of Model Coefficients | | |
|--------|-------|-------------------------------------|----|------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 7.788 | 3 | .051 |
| | Block | 7.788 | 3 | .051 |
| | Model | 31.671 | 5 | .000 |

Table A5.10
Model summary

| Model Summary | | | |
|---------------|-------------------|----------------------|---------------------|
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 6326.286 | .007 | .009 |

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Table A5.11
Hosmer and Lemeshow test

| Hosmer and Lemeshow Test | | | |
|--------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | 6.356 | 8 | .607 |

Table A5.12*Contingency table for Hosmer and Lemeshow test*

| | | Contingency Table for Hosmer and Lemeshow Test | | | | |
|--------|----|---|----------|--|----------|-------|
| | | Adoption of recycling present? = No recycling activities | | Adoption of recycling present? = Recycling activities present | | |
| | | Observed | Expected | Observed | Expected | Total |
| Step 1 | 1 | 250 | 252.914 | 204 | 201.086 | 454 |
| | 2 | 253 | 245.539 | 216 | 223.461 | 469 |
| | 3 | 219 | 223.849 | 216 | 211.151 | 435 |
| | 4 | 239 | 238.851 | 239 | 239.149 | 478 |
| | 5 | 238 | 245.200 | 265 | 257.800 | 503 |
| | 6 | 218 | 211.624 | 233 | 239.376 | 451 |
| | 7 | 219 | 201.008 | 223 | 240.992 | 442 |
| | 8 | 183 | 190.735 | 242 | 234.265 | 425 |
| | 9 | 188 | 199.768 | 266 | 254.232 | 454 |
| | 10 | 202 | 199.512 | 278 | 280.488 | 480 |

Table A5.13*Classification table*

| | | Classification Table^a | | |
|--------------------|-----------------------------------|---|------------------------------------|-----------------------|
| | | Predicted Adoption of recycling present? | | Percentage Correct |
| | | No recycling activities | Recycling activities present | |
| Observed | | | | |
| Step 1 | Adoption of recycling present? | No recycling activities | 819 | 36.7 |
| | | Recycling activities present | 741 | 68.9 |
| Overall Percentage | | | | 53.4 |

Table A5.14
Variables in the equation

| | | Variables in the Equation | | | | | | 95% C.I.for EXP(B) Lower | 95% C.I.for EXP(B) Upper |
|----------------|--|---------------------------|------|--------|----|------|--------|--------------------------|--------------------------|
| Step | | B | S.E. | Wald | df | Sig. | Exp(B) | | |
| 1 ^a | Own technical expertise | .266 | .061 | 19.155 | 1 | .000 | 1.304 | 1.158 | 1.469 |
| | Technical support (demonstration new technologies) | .129 | .067 | 3.751 | 1 | .053 | 1.138 | .998 | 1.297 |
| | SME size | .026 | .030 | .788 | 1 | .375 | 1.027 | .969 | 1.088 |
| | Own financial resources | .163 | .062 | 6.890 | 1 | .009 | 1.177 | 1.042 | 1.329 |
| | Organizational Expertise | -.012 | .075 | .027 | 1 | .869 | .988 | .853 | 1.144 |
| | Constant | -.260 | .104 | 6.281 | 1 | .012 | .771 | | |

a. Variable(s) entered on step 1: SME size, Own financial resources, Organizational Expertise.

Block 3:

Table A5.15

Omnibus test of model coefficients

| Omnibus Tests of Model Coefficients | | | | |
|-------------------------------------|-------|------------|----|------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 15.488 | 5 | .008 |
| | Block | 15.488 | 5 | .008 |
| | Model | 47.159 | 10 | .000 |

Table A5.16

Model summary

| Model Summary | | | |
|---------------|-------------------|----------------------|---------------------|
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
| 1 | 6310.798 | .010 | .014 |

Table A5.17

Hosmer and Lemeshow test

| Hosmer and Lemeshow Test | | | |
|--------------------------|------------|----|------|
| Step | Chi-square | df | Sig. |
| 1 | 4.899 | 8 | .768 |

Table A5.18*Contingency table for Hosmer and Lemeshow test*

| Contingency Table for Hosmer and Lemeshow Test | | | | | | |
|---|----------|----------|--|-----|---------|-----|
| Adoption of recycling present? = No recycling activities | | | Adoption of recycling present? = Recycling activities present | | Total | |
| Observed | Expected | Observed | Expected | | | |
| Step 1 | 1 | 254 | 262.793 | 205 | 196.207 | 459 |
| | 2 | 248 | 246.978 | 211 | 212.022 | 459 |
| | 3 | 249 | 237.424 | 210 | 221.576 | 459 |
| | 4 | 231 | 230.070 | 229 | 229.930 | 460 |
| | 5 | 225 | 222.264 | 233 | 235.736 | 458 |
| | 6 | 216 | 216.025 | 242 | 241.975 | 458 |
| | 7 | 196 | 209.994 | 263 | 249.006 | 459 |
| | 8 | 202 | 203.787 | 259 | 257.213 | 461 |
| | 9 | 207 | 195.717 | 252 | 263.283 | 459 |
| | 10 | 181 | 183.949 | 278 | 275.051 | 459 |

Table A5.19*Classification table*

| Classification Table^a | | | | | |
|---|--------------------------------|--|------------------------------|--------------------|------|
| Observed | Adoption of recycling present? | Predicted Adoption of recycling present? | | Percentage Correct | |
| | | No recycling activities | Recycling activities present | | |
| Step 1 | Adoption of recycling present? | No recycling activities | 870 | 1339 | 39.4 |
| | | Recycling activities present | 737 | 1645 | 69.1 |
| Overall Percentage | | | | 54.8 | |

Table A5.29
Variables in the equation

| | | Variables in the Equation | | | | | | 95% | 95% |
|---------------------|--|---------------------------|------|--------|----|------|--------|---------------------------------|---------------------------------|
| | | B | S.E. | Wald | df | Sig. | Exp(B) | C.I.for EXP(B)) Lower | C.I.for EXP(B)) Upper |
| Step 1 ^a | Own technical expertise | .265 | .061 | 18.643 | 1 | .000 | 1.303 | 1.155 | 1.469 |
| | Technical support (demonstration new technologies) | .119 | .067 | 3.128 | 1 | .077 | 1.126 | .987 | 1.284 |
| | SME size | .024 | .030 | .642 | 1 | .423 | 1.024 | .966 | 1.086 |
| | Own financial resources | .152 | .062 | 5.985 | 1 | .014 | 1.165 | 1.031 | 1.316 |
| | Organizational Expertise | .016 | .078 | .045 | 1 | .832 | 1.017 | .873 | 1.184 |
| | Industry dummy | .056 | .089 | .292 | 1 | .531 | 1.057 | .888 | 1.258 |
| | Services dummy | -.161 | .079 | 4.185 | 1 | .041 | .852 | .730 | .993 |
| | Manufacturing dummy | .016 | .082 | .036 | 1 | .849 | 1.016 | .864 | 1.194 |
| | POLICY STRINGENCY INDEX | -.135 | .054 | 6.374 | 1 | .012 | .873 | .786 | .970 |
| | Demand for resource efficient products or services | -.077 | .081 | .909 | 1 | .340 | .926 | .790 | 1.085 |
| | Constant | .205 | .195 | 1.107 | 1 | .293 | 1.227 | | |

a. Variable(s) entered on step 1: Industry dummy, Services dummy, Manufacturing dummy, POLICY STRINGENCY INDEX, Demand for resource efficient products or services.