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Drivers and Obstacles towards Eco-Innovation of European Entrepreneurs

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Abstract

This dissertation sets out to investigate drivers and obstacles towards eco-innovation for entrepreneurial small and medium-sized businesses, which have been hitherto largely neglected in academia. Recently, increasing attention for eco-innovation resulted in scholarly research in the form of various small-scale data collections and case studies. Utilizing the European Commission's Flash Eurobarometer survey 315 with 5.222 responses, this dissertation provides one of the first European large-scale data analyses, complemented by 22 eco-innovative entrepreneur interviews. The profound triangulation enables a comprising insight into results of the probit regression model. This approach aims to identify clearly distinct drivers and obstacles, as well as ensembles of obstacles, towards eco-innovation of European entrepreneurs based on products/services, processes, and organizational methods, following Kemp and Pearson's contribution to the scholarly field of eco-innovation. In this manner, the analysis identified eleven drivers and eight obstacles, as well as five ensembles of obstacles towards eco-innovation of European entrepreneurs. Based on the findings of this dissertation, policy-makers should consider an improvement of market and customer information access for European entrepreneurs, increasing the consumer awareness about eco-innovations, effective enforcing precise and standardized regulations across EU member states, initiation of subsidies that have long-term environmental beneficial effect among affected industries, and initiatives which gear up research institutes and universities for commercially driven development activities of more evolved SMEs. With this in mind, this dissertation derives new and deeper insights about which differentiated drivers and obstacles towards eco-innovations of European entrepreneurs are perceived and also how to address them.

Resumo

A presente dissertação visa a investigação dos motores e dos obstáculos à eco-inovação para pequenas e médias empresas, que até à data foram analisados em pequena escala nalgumas colecções de dados e em estudos de casos. Utilizando o inquérito Flash Eurobarometer 315 da Comissão Europeia com 5.222 respostas, esta dissertação fornece uma das primeiras análises europeias de dados em grande escala, complementada por 22 entrevistas a empreendedores eco-inovadores. A triangulação de dados possibilita uma compreensão dos resultados do modelo de regressão probit. Esta abordagem visa identificar claramente os motores e obstáculos para a eco-inovação por parte de empresários europeus. A análise é feita com base em produtos / serviços, processos e métodos organizacionais, seguindo a contribuição de Kemp e Pearson para o campo acadêmico de eco-inovação. Desta forma, a análise identificou onze motores e oito obstáculos, bem como cinco conjuntos de obstáculos à eco-inovação. Com base nos resultados desta dissertação, as seguintes recomendações surgiram: os decisores políticos deveriam melhorar o acesso ao mercado e a respetiva informação do cliente para os empresários europeus, aumentar a sensibilização dos consumidores para as eco-inovações e aplicar eficazmente regulamentos precisos e normalizados em todos os Estados-Membros da UE, oferecer subsidios de efeito benéfico ambiental de longo prazo para as industrias que estão envolvidas e, finalmente, potenciar iniciativas que atraiam institutos de investigação e universidades para actividades de desenvolvimento comercialmente orientadas para PMEs mais evoluídas. Concluindo, esta dissertação retira insights sobre quais os motores e obstáculos para as eco-inovações e como lidar com estes.

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"How wonderful it is that nobody need wait a single moment before starting to improve the world. "

Anne Frank

Table of Contents

List of Tables

List of Appendix

1. Introduction

The term “climate change” is a well-known concept to everyone. Recently, its presence is more newsworthy than ever. The climate is no longer changing. The climate has already changed. Melting glaciers and ice deposits that were frozen for thousands of years are disappearing on the poles of the earth and are no longer only prominent examples when the topic of climate change is once again in place. The nations of this planet already feel the consequences of the unprecedented degradation of our natural environment, which is due to an ever-growing and reckless interest in economic growth. Intensely occurring weather catastrophes in Central Europe, curfew in the Chinese metropolises due to excessive air pollution, and the erosion of agricultural producers due to crop failures in Africa and South America are also new indicators of the need for an urgently needed rethinking and appropriate action. In this context, it is remarkable that the states of this earth according to the trend of increasingly marginal negotiations have recently committed themselves contractually with the Paris agreement in 2015, to implement future steps against climate change in their economic plans. The topicality of this issue is being intensified in times of increasing populism in Europe and North America. As the future President of the United States of America, Donald Trump describes climate change as a hoax and is in principle questioning the country's leading role in the Paris agreement. Nevertheless, it seems clear that even the most powerful man in the world will not be able to stop the evolution of the active states like China, India, and the European Union, even though the coming four years of his presidency will be very questionable for the success of the Paris agreement. As The Economist Magazine[1] predicts, the United States of America will not be able to afford to move in an obsoletely energy-efficient manner one day, while competing powers will already take advantage of a sustainable economy. The path to such an economy depends on each and every one of us, and in particular on those who will offer environmentally friendly, sustainable products and processes in the future. The fact that this is no longer a wish in Europe has already been shown in the Lisbon Strategy at the beginning of the 2000s. It states that the EU aims to become *“...the most dynamic and competitive knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment by 2010.”* (European Commission 2004). Since then, several initiatives have been launched to support eco-innovation within the EU. Furthermore, various scientists have devoted themselves to the identification of drivers and obstacles, which have an influence on the introduction of ecologically sustainable products

[1] Article: http://www.economist.com/news/leaders/21710807, accessed 09.12.16

and processes. To date, however, it has become clear that the majority of companies that launch new disruptive eco-innovations – namely SMEs and entrepreneurial forerunners - have received little attention in the scientific literature (Díaz-García et al. 2015; Lenox & York 2012). Also, previous findings in entrepreneurship are based on too few empirical and quantitative studies (Thompson et al. 2011). In this sense, the goal of this dissertation is to provide a large-scale quantitative contribution to the findings on "Drivers and Obstacles towards Eco-innovation of European Entrepreneurs."

The publicly accessible Flash Eurobarometer dataset 315, as well as a survey of several European eco-innovators, is used to clarify the main research question: *"Which drivers and obstacles do European entrepreneurs face to introduce or implement eco-innovations?"*

Thus, this dissertation provides detailed insights on the following sub-questions:

1) Which drivers for eco-innovation are experienced by European entrepreneurs?

2) Which obstacles for eco-innovation are experienced by European entrepreneurs?

3) Which specific ensembles of drivers for eco-innovation are experienced by European entrepreneurs?

4) Which specific ensembles of obstacles for eco-innovation are experienced by European entrepreneurs?

5) Which drivers and obstacles for eco-innovation can be addressed by policy-makers?

Additionally, the review of recognized economy and climate journals creates a scientific basis for the empirical investigation, which helped to apply a suitable methodology for this dissertation. In conclusion, this thesis presents the obtained outcomes and juxtaposes them together to ultimately ensure propositions for legislators and future research towards eco-innovation, which became more important than ever referring to the recent global developments.

2. Literature Review

This section depicts the theoretical background of eco-innovation and its drivers and obstacles within the general field of entrepreneurship. Thus, the first subsection clarifies the various types of entrepreneurship terminologies to allocate eco-innovation in the scholarly field of entrepreneurship. The second subchapter defines eco-innovation and provides an explanation of distinct forms of eco-innovation supporting a better comprehension of eco-innovative products, processes, and methods. Lastly, the third subsection summarizes drivers and obstacles in the previously defined field of entrepreneurship and types of eco-innovation.

2.1 Framing Eco-Innovation in the Field of Entrepreneurship

At the very beginning of this eco-innovation research paper, it is of essential use to frame the applied definitions and terminologies about the research field of entrepreneurship. The goal of this subchapter is to clarify the interrelation of entrepreneurship and eco-innovation.

Initially, the terminology of entrepreneurship has been expressed in scientific literature during the early beginnings of the 20th century. Since then, commercial entrepreneurship evolved in numerous studies, and the comprehension to date is mainly based on the contributions of Schumpeter (1934) and Kirzner (1973). In fact, they complementarily define entrepreneurs as individuals that find arbitrage opportunities in the market and exploit imperfect information, which results in new market equilibrium. However, a new approach setting the scholarly field of entrepreneurship is *"to understand how opportunities to bring into existence future goods and services are discovered, created, and exploited, by whom, and with what consequences"* (Venkataraman 1997). Wherefore, commercial entrepreneurs, act upon opportunistic behavior to identify, take advantage, and create future markets for goods and services (Venkataraman 1997).

Moreover, scholars discovered various types of entrepreneurship during the past decades, which require a brief explanation in contemplation to frame eco-innovation within the field of entrepreneurship. Namely, these types include social entrepreneurship (Mair & Martí 2006; Peredo & McLean 2006), sustainable entrepreneurship (Schaltegger & Wagner 2011; Dean & McMullen 2007) and green entrepreneurship (Berle 1991). Due to inconsistent application of terminology such as the use of e.g. sustainability in different manners as well as various definitions of these entrepreneurship subcategories lead to a somewhat obscure differentiation of entrepreneurship types (Thompson et al. 2011). Thus, this research paper uses the contribution of Thompson et al. (2011), which allows drawing clear distinctions between social, sustainable, green, and commercial entrepreneurship. Based on this, the

outcome of the research paper can clearly be ascribed to a location within the field of entrepreneurship.

According to Thompson et al. (2011), social entrepreneurship encompasses individuals' unselfish motivations to minimize today's social deficiency by business matters. Therefore this research paper adopts the following definition: *"Social entrepreneurship research examines how social opportunities are discovered and exploited and how altruistic motivations affect the identification, evaluation, and exploitation of opportunities to alleviate social ills"* (Thompson et al. 2011). Correspondingly, it is decisive to stress social entrepreneurs specifically differ from other subcategories in their non-profit motivation and solely alleviative intention. Hence, social entrepreneurs appear occasionally as NGOs in the market environment, which might also be the case for sustainable entrepreneurs.

Nevertheless, sustainable entrepreneurship expands the focus not only to social deficiency but also to economic and environmental problems (Thompson et al. 2011; Schaltegger & Wagner 2011). Referring to: *"Sustainable entrepreneurship research considers the influence of organizational design and explores the process of discovery, evaluation, and exploitation of opportunities that simultaneously address economic, environmental, and social market failures."* (Thompson et al. 2011), it is crucial for entrepreneurs of this subcategory to reach consistent long-term benefits in the "triple bottom line." In particular, compared to social and environmental entrepreneurship, sustainable entrepreneurs do not aim to achieve social welfare at the cost of profits or nature and vice versa.

Indicated by Hall et al. (2010), scholars recently committed additional attention to the impact of environmental intentions on entrepreneurship. These contributions were mainly based on case studies e.g. the evolvement of the US wind energy sector (Sine & Lee 2009) and hence, lack empirical or quantitative-based analysis (Thompson et al. 2011). Furthermore, there still exist assorted terms such as *"environmental entrepreneurship*" (Thompson et al. 2011), *"green entrepreneurship"* (Berle 1991) and *"ecopreneurship"* (Schaltegger 2002), which is summarized to "green entrepreneurship" in this dissertation for reasons of scope, simplification and its mainly accepted terminology in novel literature. Defining green entrepreneurship Thompson et al. (2011) suggest: *"Environmental entrepreneurship research investigates how environmentally relevant institutions influence entrepreneurial action by examining how individuals recognize, exploit, and create economic growth while simultaneously creating environmental benefits*." Therefore, a conventional definition of green entrepreneurship includes the emphasize to the focus on creating economic benefits by introducing green products or services while decreasing environmental failure (Lenox & York

2012). Green entrepreneurship should not be considered as a subcategory of social or sustainable entrepreneurship but rather be seen as related to commercial entrepreneurship. This is due to the fact that perceived environmental opportunities are exploited to explicitly generate monetary profit, which embodies the shared core intention of green and commercial entrepreneurs (Lenox & York 2012). Before defining eco-innovation in the next chapter, the framing of entrepreneurship enables an allocation of eco-innovation within the comprehension of the different forms of entrepreneurship.

2.2 Review on Eco-Innovation Definitions

The key aspect discussed in this chapter is eco-innovation. Prior to this, it is of primary importance to briefly frame eco-innovations within the broad scholarly field of well-researched innovation. Therefore, this dissertation provides a common innovation definition combined with an allocation of innovation inside technological change, which connectively indicate a better comprehension of eco-innovation as a whole.

According to the Schumpeterian trilogy (Schumpeter 1947), technological change arises in three subsequent stages, namely invention, innovation, and diffusion. Hence, innovation should be seen clearly separated from the process of inventing. However, innovation also expands into diffusion, since services, processes or products will be adapted to e.g. customer feedback once they diffuse in the market. Thus, the Schumpeterian trilogy model appears too simplistic but still experiences broad application (Foxon et al. 2007).

Commonly, innovation is regarded as *"the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practice."* (OECD 2005) This definition shows innovations can be identified as such based on their novelty to the firm regardless of their previous existence in the market (Ozusaglam 2012).

Regarding the terminologies *"green innovation"*, *"environmental innovation"* or *"sustainable innovation"* (Schiederig et al. 2012), which are consistently defined as "eco-innovation" in this dissertation and which were subject to various scholarly fields like for example economics (Rennings 2000), management (Pujari 2006), and sociology (Spaargaren 2003) as well as in research for design, governance, users, and supply chain (Carrillo-Hermosilla et al. 2010; Kemp & Pearson 2007). Subsequently, the interest of policy-makers and the business world arose due to the inherent market potential and global climate and sustainability issues (Karakaya et al. 2014). Elaborating this, eco-innovation bear entrepreneurial opportunities in various areas (see Appendix 1) like renewable energy

technologies, pollution prevention schemes, waste management equipment, green financial products and organic agriculture (Arundel & Kemp 2009), and also support firms coping with fierce competition by providing competitive advantages (Chassagnon & Haned 2015). However, eco-innovation results were mostly drawn from analyzing big corporation data instead of including entrepreneurs and their SMEs (OECD 2010; Ozusaglam 2012).

Firstly mentioned by Fussler and James (1996), eco-innovation was defined as *"new products and processes that provide customer and business value but significantly decrease environmental impact*," which equally to green entrepreneurship (see Ch. 2.1) implies an initial focus on the monetary and alleviative aspect to environmental failure (Arundel & Kemp 2009). On the contrary, the OECD (2010) indicates that eco-innovation also occur in the form of *"not intended side-effects*," which reduce the environmental impact. Based on this, eco-innovation shows significantly congruent attributes to commercial-driven entrepreneurship. As it is explained in the following, connecting eco-innovation solely to green entrepreneurship due to similar terminology wouldn't correspond with the actual characteristics. In fact, eco-innovation emerges wherever reduction of environmental failure is the result of introducing new products, services, processes or methods on the firm level. Likewise green entrepreneurship (see Ch. 2.1), eco-innovation should be considered as related to commercial-driven innovation that additionally provides improved environmental performance. Complementary to this, previous results often ignored the positive environmental impact of *"normal innovations"* as well as distinct *"modes"* of eco-innovation regarding products, processes organizational methods (Kemp & Pearson 2007; Ozusaglam 2012). Consequently, Kemp and Pearson (2007) described eco-innovation as: *"Assimilation or exploitation of a product, production process, service or management or business method that it is novel to the firm or user and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives*," which embodies a core contribution to many subsequent research papers (Karakaya et al. 2014; Levidow et al. 2016; OECD 2010; OECD 2009; Ozusaglam 2012;). Coherently with the definition of innovation (Ozusaglam 2012), novelty is defined on firm level rather than to the entire market (OECD 2009), which indicates eco-innovations can be product or process adoptions that are better compared to the predecessor or other alternatives (Speirs et al. 2008). Referring to this, academia discusses if the broad formulation is critical for analysts since almost any innovator could be considered as an eco-innovator (Arundel & Kemp 2009). A possible key to a solution of this *"false problem"* is discovering differences in how companies innovate and the identification of

manifold drivers of distinct *"modes of eco-innovation"* previously mentioned (Arundel & Kemp 2009). According to OECD (2010), these *"modes"* appear within three dimensions of eco-innovation, in particular, *"targets*," *"mechanisms"* and *"impacts*." However, narrowing the scope of this research paper the focus is laid on *"targets"* and *"mechanisms"* of eco-innovation, which means focusing on products, processes, and methods as well as on ways changes are made in these *"modes*." This decision is based on two reasons. Firstly, the study of *"impacts"* would exceed the timely requirements of this cross-sectional dissertation and secondly, recalling the Schumpeterian trilogy (Schumpeter 1947), *"impact"* belongs to the stage of diffusion, which is considered to be only partly interrelated with the process of innovation (Foxon et al. 2007). Although, Andersen (2008) suggests further research in the field of diffusion the research frame at hand would be too liquefied. In the same way, Arundel and Kemp (2009) suggest future research on whether eco-innovations arise in the form of radical or incremental innovation. Nevertheless, related to the Schumpeterian trilogy, this suggestion is out of scope because it concerns the stage of invention rather than innovation.

Critically depicting the prevailing research on eco-innovation from different viewpoints of various contributors, a feasible eco-innovation definition for the purpose of this research paper is stated as following: *"Eco-innovation is the introduction of any new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle."* (European Commission 2011). Adapted from the European Commission (2011), this definition respects all premises discussed in this chapter and allows the allocation of for-profit or non-profit eco-innovation within the literature of innovation and entrepreneurship. Moreover, this section sets a targeted scope for identifying drivers and obstacles towards eco-innovation of European entrepreneurs in the next chapter. In conclusion, the literature shows that a necessarily broad applicable definition requires a manifold assessment and multi-layered interpretation in due consideration of firm's characteristics and activities, which as a result finds incorporation in the methodology of this dissertation.

2.3 Literature towards Drivers and Obstacles of Eco-Innovation

When analyzing eco-innovation in this dissertation, two influencing subjects are examined regarding their impact on being eco-innovative. These drivers and obstacles should be considered as influences that support or prevent eco-innovation of entrepreneurs. An overview of existing literature reveals a large number of research papers on drivers and obstacles of eco-innovation. However, research on eco-innovation of entrepreneurs remains

scarce while most scholars focused on large-scale industries or big corporations (Díaz-García et al. 2015). Furthermore, these studies derive limited results from specific countries around the world (Chassagnon & Haned 2015; Chen et al. 2006; Geng et al. 2010; van Hemel & Cramer 2002; Hojnik & Ruzzier 2016; Rennings & Zwick 2002; Shi et al. 2008) and present quantitative or qualitative outcomes based on either empirical data or case studies.

In total, 28 sources serve as science base for the assessment of drivers and obstacles of eco-innovation in this research paper, of which only five authors derived their conclusions based on SMEs (see Tab. 1).

Tab. 1 – Authors on Drivers and Obstacles towards Eco-Innovation of SMEs

Author	Journal	Year
Bocken et al.	Journal of Engineering and Technology Management	2014
Triguero et al.	Ecological Economics	2013
Bos-Brouwers	Business Strategy and the Environment	2010
Shi et al.	Journal of Cleaner Production	2008
van Hemel & Cramer	Journal of Cleaner Production	2002

Note: List of reviewed SME studies *Source:* Authors' own table

It is apparent that this small number of sources is insufficient to establish a viable hypothesis for testing. Hence, this dissertation applies an explanatory approach, which is including any available information on drivers and obstacles towards eco-innovation.

Recalling the review of eco-innovation definitions (see Ch. 2.2), up next it is necessary to conduct a manifold assessment of drivers and obstacles towards eco-innovation. Therefore, drivers and obstacles should be assessed by products/services, processes or methods of eco-innovation as well as on firm characteristics like e.g. fields of activity or company size.

2.3.1 Drivers towards Eco-Innovation

In respect to the simplicity of reading this chapter, all reviewed drivers are ranked according to their number of appearance in Table 2. This ranking provides an overview and reduces the quotation for easier reading. Notwithstanding, the ranking should only be perceived as a possible, non-binding indicator for drivers that may influence eco-innovation across the before mentioned *"modes"* (see Ch. 2.2). Due to the small sample of reviewed research papers, this indicator should only contribute to a better overall understanding of the present research as well as its used sources and not rank their value regarding significance. Even though ranking drivers in the table, the text describes driving impacts in similar groups to enhance the flow of argumentation and readability. At last, this subsection is a critical

summary of drivers and solely explains findings with respect to the previously established theoretical framework instead of drawing conclusions, which can be found in chapter 5. Conclusion.

Tab. 2 – Drivers towards Eco-Innovation

Eco-Innovation drivers (from literature)*	Reference
Personal reasons/inspiration (in management)	Bocken et al. 2014; Hojnik & Ruzzier 2016; Kurkkio et al. 2011; Papagiannakis & Lioukas 2012; Triguero et al. 2013
Cost reduction	Bos-Brouwers 2010; Chen et al. 2006; Rennings & Zwick 2002; Sarkar 2013; Shrivastava 1995
Firm's image	Bocken et al. 2014; Li 2014; Rennings & Zwick 2002; Sarkar 2013; Shrivastava 1995
Customer pressure	Hojnik & Ruzzier 2016; van Hemel & Cramer 2002; Lewis & Harvey 2001; Rennings & Zwick 2002; van den Bergh 2013
Business opportunity/potential revenues	Bocken et al. 2014; Bos-Brouwers 2010; van Hemel & Cramer 2002; Sarkar 2013
Competitive advantage	Chassagnon & Haned 2015; Li 2014; Nidumolu et al. 2009; Sharma & Vredenburg 1998
Capturing/Creating new markets	Rennings & Zwick 2002; Sarkar 2013; Shrivastava 1995
Protect or increase market share	Li 2014; Rennings & Zwick 2002
Higher product quality	Chen et al. 2006; van Hemel & Cramer 2002
Compliance with regulation	Rennings & Zwick 2002
Legislation	van Hemel & Cramer 2002
Industrial sector initiatives	van Hemel & Cramer 2002
Technological advancement	Bocken et al. 2014
Positive experience	Bocken et al. 2014
Governmental support	Bocken et al. 2014
Competitive pressure	Hojnik & Ruzzier 2016
Supply chain pressure	Lewis & Harvey 2001

* *Note:* ranked by n° of sources *Source:* Authors' own table

Personal reasons and inspiration of the management is found to be one of the primary drivers towards eco-innovation (see Tab. 2). In detail, scholars found management's environmental motivation especially important regarding process eco-innovation implementation (Kurkkio et al. 2011; Triguero et al. 2013). Additionally, Papagiannakis & Lioukas (2012) suggest that personally motivated management influences the environmental responsiveness of a firm.

Cost reduction (see Tab. 2) embodies a not environment-related driver referring to Rennings & Zwick (2002), who analyzed around 1.500 randomly selected firms excluding

mining, agriculture or public administration from five European countries. In comparison to the eco-innovation definition (see Ch. 2.2), decreasing costs is the main purpose of innovation and the reduction of environmental failure occurs as a *"side-effect"* (OECD 2010). Furthermore, eco-innovation of SMEs often exceeds the compliance with external regulation and aims at improvement of cost-effectiveness (Bos-Brouwers 2010). In this sense, also achieving a *Higher product quality* results in an increasing probability of benefiting from eco-innovation as a *"side-effect"* (Chen et al. 2006; van Hemel & Cramer 2002).

Likewise, *Firm's image* as a positive driver is one of the most reviewed reasons to eco-innovation (see Tab. 2). Rennings & Zwick (2002) concluded that improving the firm's environmental image also moves beyond complying with environmental regulations.

A rather controversy driver is *Customer pressure* (see Tab. 2). On the one hand, firms tend to improve their environmental image to comply with the inspiration of more and more environmental aware customers who demand "greener" products and business operations (van den Bergh 2013; van Hemel & Cramer 2002). Besides, Hojnik and Ruzzier (2016) analyzed 223 Slovenian companies of various industries and found pressure by customers to be the third biggest influencer for eco-innovation since firms act as market-oriented entities. On the other hand, Bocken et al. (2014) who studied front-end eco-innovation processes of 42 Dutch SMEs ascertains *Customer pressure* as least important. Complementarily, drivers like *Competitive pressure* (Hojnik & Ruzzier 2016) or *Supply chain pressure* (Lewis & Harvey 2001) tend to be less relevant for SMEs as well (Bocken et al. 2014). Nevertheless, external *Initiatives of industrial sectors* (see Tab. 2) were found to be a collaborative driver towards eco-innovation for SMEs.

Taking advantage of future *Business opportunities/potential revenues* (see Tab. 2) appears to be a well-recognized process driver according to SME research (Bocken et al. 2014; Bos-Brouwers 2010) and emphasizes the commercial purpose of green entrepreneurship and eco-innovation again (see Ch. 2.1 and 2.2). Another auxiliary process driver for eco-innovation of SMEs is *Governmental support* (see Tab. 2), which provides financial incentives or consulting (Bocken et al. 2014). Not only future economic benefits were identified to drive eco-innovation, but also past *Positive experience* (see Tab. 2) were indicated to positively affect eco-innovation of not further specified Dutch SMEs (Bocken et al. 2014). Inherently, this finding implies that previous introductions of eco-innovations have an impact on following eco-innovative activity. With this in mind, a multivariate regression model represents a suitable analysis approach for considering the effect of previous eco-innovative activity on further eco-innovation introductions across any "modes" of eco-

innovation. However, this dissertation's scope is focusing on a non-multivariate regression model due to two reasons. Firstly, a clear distinction between the "modes" of eco-innovation as suggested by Kemp and Pearson (see Ch. 2.2), served as a basis for many high reputation articles. Secondly, the obtained qualitative data of this thesis revealed that mainly entrepreneurial eco-innovators only possess one eco-innovation, which is different from the majority of scholarly research related to large companies. Thus, a complex multivariate regression model exceeds the requirements for an analysis of eco-innovative SMEs.

Business opportunities for SMEs are often coherent with the driver *Capturing/creating new markets* (see Tab. 2), as indicated by and Shrivastava (1995) and Sarkar (2013). In market regards, two additional drivers are highlighted (see Tab 2): *Competitive advantage* (Chassagnon & Haned 2015; Nidumolu et al. 2009; Sharma & Vredenburg 1998) for a sustainable achievement of *Protecting or increasing market share* (Li 2014; Rennings & Zwick 2002). Critically seen, these sources do not differentiate between SMEs or big corporations, do not consider eco-innovations in terms of types of industry, products, processes or methods and derive their results from geographical locations like the Pearl River Delta in China (Li 2014) that could face specific circumstances, which are not generally applicable from a European perspective. Thus, these drivers should be perceived as diagnostically less conclusive.

Technological advancement (see Tab. 2) embodies an evaluated driver on Dutch SME level, which delves into the internal capabilities of a firm's processes (Bocken et al. 2014). Keeping in mind that types of industry are not further specified in the sample of Bocken et al. (2014), this driver could be mistaken for some companies, even though 90% indicated *Technological advancement* as *"critically important."*

Finally, most drivers were indicated as exceeding legislative or regulative requirements in this chapter. However, Rennings and Zwick (2002) as well as van Hemel and Cramer (2002), of which the latter conducted research on eco-design of products based on 77 Dutch SMEs active in metal, machinery, wood, furniture and minor other industries, detected *Compliance with regulation* and *Legislation* to be driving impacts on eco-innovation.

2.3.2 Obstacles towards Eco-Innovation

Likewise chapter 2.3.1, obstacles are listed in Table 3 for simplicity reasons. The obstacles are listed according to the number of their appearance in literature. However, this ranking should not imply any valuation about their significance but provide a better comprehension of this research and its sources. Even though obstacles are ranked in the table, the text describes

obstacles in similar groups to enhance the flow of argumentation and readability. At last, this subsection is a critical summary of obstacles and solely explains findings with respect to the previously established theoretical framework instead of drawing conclusions, which can be found in chapter 5. Conclusion.

Tab. 3 – Obstacles towards Eco-Innovation

Eco-Innovation obstacles (from literature)*	Reference
Financial obstacles	Ashford 1993; European Commission 2004; Rogers & Tibben-Lembke 1998; Shi et al. 2008; Simpson 2012
Knowledge/information obstacles	Cooper 1994; European Commission 2004; Pujari et al. 2003; Simpson 2012
Labor force-related obstacles	Ashford 1993; European Commission 2004; Rogers & Tibben-Lembke 1998
Regulatory obstacles	Ashford 1993; European Commission 2004; Geng et al. 2010; Shi et al. 2008;
Consumer related obstacles	Ashford 1993; European Commission 2004; Zhu & Geng 2013
Technological obstacles	European Commission 2004; Foxon 2002; van Hemel & Cramer 2002
Managerial obstacles	Ashford 1993; Simpson 2012
Supplier related obstacles	Ashford 1993
Responsibility obstacles	van Hemel & Cramer 2002
No clear environmental benefit	van Hemel & Cramer 2002
Economic obstacles	European Commission 2004

**Note:* ranked by n° of sources *Source:* Authors' own table

Financial obstacles (see Tab. 3) indicate a lack of sufficient financial resources for environmental technologies (Ashford 1993; Rogers & Tibben-Lembke 1998; Simpson 2012). Mainly caused by short-term investment orientation, it becomes problematic for SMEs to attract venture capital according to the European Commission (2004) which published an action plan (ETAP) directed to all-size companies of the European Union. Moreover, the nascent development and infrastructure of environmental technologies in many European countries embody high uncertainty and initial costs for new technologies, which leads to low tolerance towards high-risk investments (European Commission 2004; Shi et al. 2008).

Knowledge/information obstacles (see Tab. 3) arise from weaknesses in training and cross-functional information distribution (European Commission 2004; Pujari et al. 2003). Based on a study of not further specified UK manufacturers Pujari et al. (2003) discovered that eco-innovation involves various fields of competence it is necessary to distribute information across functional boundaries, which is also supported by the findings of Cooper

(1994). Hence, an overall lack of knowledge and innovation know-how can prevent eco-innovation from realization (Simpson 2012).

Regarding the implementation of eco-innovative processes in logistics, Rogers and Tibben-Lembke (1998) found that a lack of personnel in charge is *Labor force-related obstacle* (see Tab. 3) for a successful utilization of eco-innovation. Complementarily, eco-innovation requires exceptional managerial and engineering work capabilities, hence SMEs who employ less labor face difficulties to assign sufficient workforce to eco-innovation projects (Ashford 1993). Additionally, *Managerial obstacles* (see Tab. 3) emerge from a weak commitment from top management, which compared to personally motivated managers (see Ch. 2.3.1) who drive eco-innovation, leads to limited tolerance of eco-innovative efforts (Ashford 1993). Hereupon, management's personal perceptions and biases embody a *Responsibility obstacle* (van Hemel & Cramer 2002), which excludes eco-innovation as an obligation towards more sustainable processes or products. According to van Hemel and Cramer (2002) potential eco-innovations, which are not perceived to *be environmentally beneficial* (see Tab. 3) are and example for an eco-innovation reluctant management.

On the one hand, *Regulatory obstacles* emerge if regulations or legislation leads to uncertainty for eco-innovators (Ashford 1993). On the other hand, regulations should not be too detailed, for instance, pollution limits rather cause compliance than incentivizing eco-innovations that exceed these limits to a maximum extent (European Commission 2004). Critically seen, this again emphasizes the importance of respecting the *"modes"* of eco-innovation as well as the main activities of a firm, which is both discussed in Chapter 2.2. Nevertheless, Shi et al. (2008) point out that also the ineffective enforcement of regulations by the government leads to an exploiting behavior of SMEs in China.

Consumer-related obstacles (see Tab. 3) describe mainly low market pressure by the absence of sufficient consumer demand (European Commission 2004). It is coupled with a lack of environmental awareness of customers and less information about eco-innovative product or services, for which reason firms tend to be reluctant towards the implementation of eco-innovations in products, processes or methods (Zhu & Geng 2013). Besides, companies also fear consumer loss by introducing eco-innovation that might be less reliable in the initial phase of their evolution (Ashford 1993), which might be less applicable for SMEs, since they innovate for market niches or create new markets instead of serving mass markets like incumbents.

Technological obstacles occur if the firm faces the absence of accurate *"green"* substitutes e.g. non-hazardous components (Ashford 1993). Other than this, if companies

already invested in technological infrastructure, "sunk costs" might deter the transition to new eco-innovative processes (Foxon 2002). Referring to *Managerial obstacles* again, nascent *"green"* technologies bear some uncertain reliability, which explains managerial reluctance regarding the implementation of eco-innovative technologies (Ashford 1993). Due to the complexity of technological transition, obstacles also emerge in the external environment of manufacturing firms. In particular, *Supplier-related obstacles* (see Tab. 3) originate from non-compatibility of processes or expertise (Ashford 1993).

Economic barriers for producing SMEs arise from high entry barriers through economies of scale of incumbents (Ashford 1993), which enable offering products at lower prices despite high initial investments. Aside from that, market prices of non-eco-innovative goods or services do not reflect external costs e.g. recycling or health care costs due to pollution (European Commission 2004). Hence eco-innovations seem more expensive, which lowers their demand.

According to Ashford (1993), obstacles towards eco-innovation can embody reverse reasons compared to drivers, and in addition to that, they might also be interrelated among themselves. For example, managerial reluctance can root from financial uncertainty (Ashford 1993). Therefore, the research in this dissertation focuses only on ensembles of obstacles towards eco-innovation. Furthermore, the separation of drivers and obstacles and their impact on eco-innovation might distort the results. As a consequence, drivers and obstacles are included jointly in the further data analysis of this dissertation. Complementarily, correlation and combination analysis of obstacle variables are suitable in respect to the findings of obstacle ensembles by Ashford.

3. Methodology and Data Collection

The methodology of this dissertation is determined by the research framework of Saunders et al. (2009), which is briefly described and justified in this chapter. In particular, the "research onion" (see Appendix 2) provides a decision tool for choosing the philosophy, approach, strategy, method, time horizon and technique of this research, which makes it a suitable framework for this dissertation.

The *pragmatic* research philosophy in this research paper suggests that all data collection methods have their limitations. Thus, multiple methods contributing their particular advantages enhance the outcome of this analysis.

Furthermore, the past research already provides a considerable number of data about drivers and obstacles for mainly undefined types and sizes of firms (see Ch. 2.3). The *deductive* approach of this dissertation uses these existing outcomes as a basis for its analysis of data to ascertain if these drivers and obstacles, as well as their interrelations, apply to entrepreneurial SMEs as well. Since impacts of drivers and obstacles as well as their interrelations are analyzed in this dissertation, the research follows an *explanatory* approach, which is suitable for interpreting influences on the phenomenon of being an eco-innovator by e.g. correlation or regression analysis.

The data collection strategy of this dissertation is based on different *surveys*, due to the European Commission publicly allocates wide-ranging survey data on its Flash Eurobarometer portal as well as business contacts to eco-innovators through its eco-innovation initiative.

Besides, the given opportunity of data triangulation allows a *sequential mixed-method* assessment. In the first stage, the quantitative data of the Flash Eurobarometer survey 315 is analyzed in due consideration to existing literature. In the second stage, the outcomes of the latter analysis serve as a basis for the conception of a *semi-structured* interview with European eco-innovators, which examines further qualitative context and reasons for the meaning behind the obtained data of European entrepreneurs. Further details about the survey and interviews are provided in the following chapters.

Due to time constraints of this dissertation, research is conducted during a short period, and thus the comprehension of results has to be framed as *cross-sectional*. In this case, survey data from 2011 and interviews conducted in 2016 show a difference of 5 years between both data sources, which are considered in the limitations of this research paper.

After the justification of the methodology choice in consideration of Saunders et al. (2009), the following two chapters go into detail about techniques and procedures on how the data sources are analyzed.

3.1 Empirical Research Methods and Data Collection

This subsection provides explanations about the choice of datasets and about the techniques that are used to derive initial quantitative results regarding drivers and obstacles towards eco-innovation. The modification and empirical analysis of quantitative data are conducted with the R-Studio software, which is freely available for public research.

3.1.1 Data Set

The Flash Eurobarometer survey 315 – *"Attitudes of European Entrepreneurs towards Eco-Innovation"* by order of the European Commission serves as the quantitative dataset of this dissertation. Firstly published by the Gallup organization in 2011, it is publicly available at the gesis online portal of the Leibniz Institute Mannheim. The literature review revealed that the Flash Eurobarometer survey 315 was published together with an equally named official report. This report presents mere descriptive results based on the Flash Eurobarometer survey 315 questions (European Commission 2011). Hence, there is a lack of further empirical research, which enters deeper explanatory results about influences on being an eco-innovative entrepreneur. Moreover, the dataset was used by Triguero et al. (2013) to analyze drivers towards eco-innovation solely. Having discussed their multivariate regression approach critically in Chapter 2.3.1, this dissertation follows a different path of Kemp and Pearson (2007) whose suggestion to distinct eco-innovation between products/services, processes, and organizational methods served as the basis for much following analysis in respectable environment journals. In fact, other than Triguero et al. (2013), who used a multivariate approach to examine also the impact of being eco-innovative on other "modes" of eco-innovation, this research paper clearly distinguishes impacts of drivers and obstacles per eco-innovator "mode" concerning the critical literature review in Chapter 2.2. Furthermore, Triguero et al. (2013) completely ignored obstacles towards eco-innovation in their regression analysis, which still leaves room for further valuable insights on being an eco-innovative entrepreneur. As a matter of fact, the Flash Eurobarometer 315 dataset still provides an appropriate data source for further empirical analysis.

The dataset contains answers of 5.222 European SME strategy decision makers in 27 member states of the European Union (see Appendix 3). A randomly selected number of around 200 firms per country from industry sectors agriculture, manufacturing, water supply

and waste management, construction and food services embody a reliable sample size. The survey consists of 14 questions about company characteristics, resources, and attitudes about drivers and obstacles towards eco-innovation, of which only some questions are of use for this research paper (see Ch. 3.1.2). Moreover, the definition of eco-innovation selected for this dissertation in Chapter 2.2 was presented to the participants before answering the questions. With regard to the scope on drivers and obstacles towards eco-innovation, the original dataset had to be modified. In detail, redundant columns with e.g. country codes and other index numbers as well as missing data were deleted. The resulting dataset with remaining 4964 answers is used to create dummies for dependent and independent variables, which are explained in the next chapter. Appendix 4 shows an introductory overview of the modified dataset structure.

3.1.2 Variables

The dependent variables for this research were derived from Question D5 of the Flash Eurobarometer survey 315 (see Appendix 5). Participants could choose if they introduced an eco-innovation during the past 24 months according to the adopted definition of Chapter 2.2. Also, they could mark with "YES," "NO" or "DK/NA," if they introduced a product/service, process or organizational method eco-innovation. Answers with "DK/NA" were omitted from the dataset. Six different dependent variables were created from the remaining data, which are displayed in Table 4.

Tab. 4 – Dependent Variables

Dependent Variable Name	Conditional Binary Coding
Eco-Innovator	At least one eco-innovation in any mode, TRUE = 1, FALSE = 0
All_Eco-Innovator	Eco-innovation in all three "modes", TRUE = 1, FALSE = 0
Product_Eco-Innovator	Eco-innovation only in product "mode", TRUE = 1, FALSE =0
Process_Eco-Innovator	Eco-innovation only in process "mode", TRUE = 1, FALSE =0
Method_Eco-Innovator	Eco-innovation only in method "mode", TRUE = 1, FALSE =0
No_Eco-Innovator	No eco-innovation in any "mode", TRUE = 1, FALSE =0

Note: Modified dependent variables constructed with question D5
Source: Authors' own table (adapted from Flash Eurobarometer survey 315)

Eco-Innovator takes the value 1 if the participant introduced at least one eco-innovation in any of the three "modes"; otherwise, it takes the value 0. The purpose of *Eco-Innovator* is to observe a general impact of independent factors, explained in the following paragraph, on

being eco-innovative without differentiating between distinct "modes." *All_Eco-Innovator* takes the value 1 if the participant introduced eco-innovations in all "modes"; otherwise, it takes the value 0. *All_Eco-Innovator* examines the perceptions of drivers and obstacles towards eco-innovation from the participants' point of view that are eminently eco-innovative and provides a very informed insight on influences on eco-innovative activities. The dependent variables *Product_Eco-Innovator*, *Process_Eco-Innovator*, and *Method_Eco-Innovator*, take the value 1 if the participant introduced an eco-innovation in one of the three distinct "modes"; otherwise, it takes the value 0. This decision is based on the suggestion of Kemp and Pearson (2007) to distinguish between various "modes" of eco-innovation. This approach assures the observation of specific impacts that can differ across the different "modes" of eco-innovators. Lastly, *No_Eco-Innovator* takes the value 1 if the participant didn't introduce any eco-innovation; otherwise, it takes the value 0. The intention of *No_Eco-Innovator* is to examine especially drivers and obstacles that are perceived by entrepreneurs who didn't eco-innovate but might do it in the future. On the one hand, these results identify drivers that specifically help entrepreneurs to start eco-innovating and on the contrary, it reveals the perception of obstacles that prevent entrepreneurs from eco-innovating. In summary, the developed dependent variables respect the current evolvement of eco-innovation knowledge by differentiating between multiple "modes" of eco-innovation. Moreover, perceived impacts for any eco-innovator or non-innovator as well as impacts on eminently innovative entrepreneurs can be analyzed to obtain a manifold and differentiated comprehension about drivers and obstacles towards eco-innovation of European entrepreneurs.

The previous literature review at hand already revealed various drivers and obstacles towards eco-innovation. Nevertheless, these outcomes mainly appear to be too broad to derive conclusions for entrepreneurial businesses. Therefore, this research paper is using the question Q8 of the Flash Eurobarometer survey 315 (see Appendix 6) for an explanatory examination of drivers towards eco-innovation of European entrepreneurs. Additionally, this research expands its explanatory analysis towards obstacles of eco-innovation with the use of question Q7 of the Flash Eurobarometer survey 315 (see Appendix 7).

Due to time and word count constraints, this dissertation is not aiming to verify all identified drivers and obstacles towards eco-innovation from literature. The scope of this research paper is limited to the 28 independent variables of the Flash Eurobarometer survey 315 (European Commission 2011), which are not necessarily connectable to the implications

for drivers and obstacles towards eco-innovation made in the literature review. A connection between this dissertation outcome and the current scholarly research literature is discussed in chapter 5. Conclusion. This approach allows the framing of results in respect to past research results, thus provides a better comprehension of drivers and obstacles towards eco-innovation for European entrepreneurs specifically.

The 14 independent variables for eco-innovation drivers are based on a 5-scale answer operator, which ranges from *"DK/NA*," *"Not at all important"* over *"Not important"* and *"Somewhat important"* to *"Very important*." However, for reasons of simplification binary variables were created which take the value 1, if the participant answered *"Somewhat important"* or *"Very important*." In fact, only eco-innovation drivers that are perceived as important for entrepreneurs are of interest for the scope of this research. Hence, all other answer possibilities take the value 0. Furthermore, the independent variables for eco-innovation obstacles follow the same procedure. Coherently, the answers *"Somewhat serious"* and *"Very serious"* take the value 1, if the participant marked them. Otherwise, *"Not serious*," *"Not at all serious"* and *"DK/NA"* take the value 0. For a better comprehension and a simpler overview of the independent variable names, meanings, and explanations of the respective variables can be inferred from Table 5 on the next page.

At last, the literature review highlighted the importance of additional influences from the business context of eco-innovators. Therefore, the empirical analysis of drivers and obstacles towards eco-innovation of European entrepreneurs includes control variables that are created from the questions D1, D3, D4, Q1, Q2, Q3 and Q6 of the Flash Eurobarometer survey 315. In particular, these control variables consider the country, industry, firm size, turnover trend, material/energy costs, material/energy costs trend and eco-innovation investments to correct the coefficients of drivers and obstacles in the applied regression model. The selection of these control variables is based on their appearance in the Flash Eurobarometer survey 315. Even though control variables are mentioned in this research paper, they are not analyzed or discussed because their interpretation exceeds the scope of driver and obstacle variables towards eco-innovation of European entrepreneurs.

Tab. 5 – Independent Variables

	Independent Variable Name	Explanation
Drivers (Q8)	*tech_man_cap*	Technological and management capabilities within the enterprise
	market_share	Secure or increase existing market share
	material_price	Current high material prices (as an incentive to innovate, to use less material and decrease the cost)
	material_scarcity	Limited access to materials
	future_mat_scarcity	Expected future material scarcity (as an incentive to develop innovative, less material-intensive substitutes)
	coll_institutes	Collaboration with research institutes, agencies and universities
	ext_info_support	Good access to external information and knowledge, including technology support services
	business_partner	Good business partners
	energy_price	Current high energy prices (as an incentive to innovative, to use less energy and decrease the cost)
	future_energy	Expected future increases in energy prices
	existing_regulations	Existing regulations, including standards
	future_regulations	Expected future regulations imposing new standards
	subsidy_access	Access to existing subsidies and fiscal incentives
	green_demand	Increasing market demand for green products
Obstacles (Q7)	*lack_int_funds*	Lack of funds within enterprise
	lack_ext_finance	Lack of external financing
	inv_uncertainty	Uncertain return on investment or too long payback period for eco-innovation
	lack_labor_tech_cap	Lack of qualified personnel and technological capabilities within the enterprise
	no_ext_info_support	Limited access to external information and knowledge, including lack of well-developed technology support services
	lack_partners	Lack of suitable business partners
	lack_coll	Lack of collaboration with research institutes and universities
	uncertain_demand	Uncertain demand from the market
	no_material_prio	Reducing material use is not an innovation priority
	no_energy_prio	Reducing energy use is not an innovation priority
	tech_lockin	Technical and technological lock-ins in economy (e.g. old technical infrastructures)
	incumbent_domination	Market dominated by established enterprises
	no_regulation_incentive	Existing regulations and structures not providing incentives to eco-innovate
	limit_subsidy_access	Insufficient access to existing subsidies and fiscal incentives

Source: Explanations adopted from question Q7 and Q8 of Flash Eurobarometer survey 315 (Authors' own table)

3.1.3 Descriptive Statistics and Regression Analysis

The multi-procedure descriptive analysis aims to reveal first insights into the data structure of eco-innovation drivers and obstacles as well as to their interrelation (see Appendix 8). Based on this, a probit regression model is used to identify the magnitude and significance of relevant drivers and obstacles.

The ranking of drivers and obstacles per "mode" which indicate a first classification of importance, is realized by a frequency count of each independent variable. However, total participant numbers vary across the eco-innovator "modes"; thus, frequency counts are not comparable between different types of eco-innovators. As a result, a mean table analysis compares the total percentages for each independent variable, which shows the differences between the eco-innovator types. Moreover, a Pearson's Chi-Square significance test is conducted for each independent variable analyzing, if a response depends on the respective eco-innovator type. Nonetheless, the Pearson's Chi Square value neither displays the magnitude of impact on being eco-innovative nor considers other influence factors.

This dissertation also includes an analysis of obstacle combinations as suggested by Ashford (1993). The descriptive ensemble analysis is based on correlation coefficients and a mean table of combinations summing up crossed independent variables of obstacles. The correlation analysis (see Appendix 9) examines the fluctuation of two independent variables and indicates the strength of parallel increase or decrease of a variable depending on the other. Hence, it contributes to the overall comprehension of specific answer patterns but does not imply causality. Additionally, the mean table of combinations (see Appendix 10) presents the percentages of independent variable pairs for obstacles analyzing the occurrence of obstacle patterns per eco-innovator "mode."

Nevertheless, all mentioned descriptive methods of this thesis solely provide an overview of the data due to their delineative nature. A great insight into causalities and influencing factors towards being eco-innovative is obtained by the utilization of a regression model. Namely, this research conducts a generalized linear regression model (GLM) analysis. The usage of an ordinary least square (OLS) regression was rejected, since the probability distribution of the model of interest accounted values outside the scale of 0 to 1 (see Appendix 11). Since probabilities below 0% to 100% do not stand to reason, a binomial probit regression compared to a logit model, suited the purpose of this dissertation the best because it indicates a better goodness of fit by log likelihood tending more to 0 and McFadden R^2, which is an artificially-made indicator used as a supportive aspect for the model decision. Critically seen, displayed probit regression coefficients cannot be interpreted

directly as they do not present percentages. Therefore, average marginal effects are calculated for each independent variable and displayed in the regression table instead of the typical probit coefficients (see Appendix 12 & 13). For the original probit model consult Appendix 14 and 15. The usage of average marginal effects allows a direct interpretation of influence on being eco-innovative assuming binary independent variables equal 1.

3.2 In-depth Interviews with Eco-Innovators

22 semi-structured interviews with European eco-innovators were conducted to obtain qualitative data to the previously analyzed empirical results. The website *"Eco-Innovation – When business meets environment"*[2] of the European Commission provides a database of around 5.200 eco-innovation projects in Europe. Thus, it embodies a suitable platform to connect with potential interview partners.

3.2.1 Interview Partners

The selection of interviewees is based on the control variables of the probit regression model. Hence, interviewees were chosen according to their firm size maximum 250 employees, and main activity, which makes these responses comparable to the empirical outcome of the descriptive and regression results. In total, eco-innovators from 14 European countries provided qualitative insights in their drivers and obstacles towards eco-innovation. However, since the questionnaire asked for sensible internal data, like e.g. cost structure and turnover trends, it was designed for anonymous responses and no detailed interviewee profiles can be provided in this chapter.

3.2.2 Questionnaire and Phone Interviews

The *pragmatic* research philosophy of this dissertation enabled a data collection based on two different approaches. Firstly, an anonymous questionnaire was sent via Mail Chimp email service to a contact pool of 136 email addresses of eco-innovators, of which 13 answered the survey. Mail Chimp enables an overview about the reaction of email recipients. In particular, mailing lists, personal text customization, click rates and email-opening statistics enable reaching interviewees personally by phone or email for motivation reasons or if they have problems to answer the survey. The enhanced control over the recipient pool increases the number of respondents. Another reason for the decision towards a semi-structured questionnaire was to overcome the challenge of limited time availability of top management

[2] Website: http://ec.europa.eu/environment/eco-innovation/index_en.htm, accessed 22.11.16

interviewees. Thus, a questionnaire is quick and flexible to answer, which shows clear advantages compared to personal interviews.

Secondly, nine eco-innovators were contacted via phone, because of individual interviewee preferences. The phone interviews didn't ask for sensible company data because higher priority was given to the honesty of replies regarding the remaining general driver and obstacle questions. The responses were directly recorded to an Excel spreadsheet.

The semi-structure of the survey consists of open-ended text questions, which are based on the probit regression results and aim to investigate a deeper comprehension on why the empirical results showed a significant influence on eco-innovative activity. Moreover, the survey is automatically adapted to the "mode" of the eco-innovator, which makes it possible to ask for specific drivers and obstacles and their interrelation. An example script with all questions for All_Eco-Innovators can be consulted in Appendix 16 and a list of all responses is available in Appendix 17.

4. Results

The results of the descriptive, probit regression and qualitative data analysis are triangulated to derive an ample insight into eco-innovation drivers and obstacles. Maintaining a targeted scope on meaningful observations, the following subsections is geared to the significant probit regression outcomes of Table 6 and Table 7. All mentioned results of independent variables of the probit regression are based on the assumption that any other variables in the model are hold to 0. Other results from descriptive and qualitative research that find application in these subsections can be consulted in detail in Appendix 8, 9, 10 and 17.

4.1 Drivers towards Eco-Innovation

The independent variables *future_mat_scarcity*, *business_partner*, and *future_energy* have no significant influence on any of the six dependent variables. Therefore, they are not further mentioned in this subsection.

Tab. 6 - Average Marginal Effects of Drivers towards Eco-Innovation

	Dependent Variables					
	Eco-Innovator	All_Eco-Innovator	No_Innovation	Product	Process	Method
tech_man_cap		0,016*/0,016*				
market_share	0,055***/0,060***		-0,055***/-0,060***	0,052***/0,054***		
material_price					0,045**/0,045**	
material_scarcity		0,020***/0,021***				0,024*/0,024*
future_mat_scarcity						
coll_institutes	0,041**/0,043**	0,017**/0,023**	-0,041**/-0,043**	0,029**/0,034**	0,041***/0,040***	0,016/0,027**
ext_info_support					0,040**/0,039**	0,032**/0,029*
business_partner						
energy_price					0,048**/0,051**	
future_energy						
existing_regulations	0,049**/0,051***		-0,049**/-0,051***	0,042***/0,043***		0,042***/0,043***
future_regulations	-0,052**/-0,049**		0,052**/0,049**		-0,031*/-0,030*	
subsidy_access	-0,039*/-0,021		0,039*/0,021	-0,036**/-0,014		
green_demand	0,081***/0,084***	0,014*/0,015*	-0,081***/-0,084***	0,077***/0,080***	0,041***/0,040**	0,028**/0,030**

Note: Figure explanation (model including drivers & obstacles / drivers only model)
Source: Flash Eurobarometer survey 315 (Authors' table) (Significance = * : p<0.1, ** : p<0.05, *** : p<0.01)

The descriptive statistics (see Appendix 8) show that No_Eco-Innovators value drivers less important compared to All_Eco-Innovators, who on average value drivers more important than any other dependent variable. Furthermore, the Pearson's Chi-Square test showed highly significant outcomes for all tested drivers. Thus, an evaluation is based solely on the Chi-Square values and not on their significance. Last but not least, Eco_Innovator and No_Eco-Innovator show exact contrary results, which is due to their dummy variable nature.

A 1,6% higher probability of introducing all types of eco-innovations with a significance level of p < 10% was observed for respondents that valued *tech_man_cap*

important. On average, 88,1% of All_Eco-Innovators rated *tech_man_cap* important. Respondents differently argued with overall technological evolvement for transportation, existing internal capabilities of serving a technical market need in aviation, good access to skilled employees in Slovenia and personally motivated/willing personnel in Belgium.

market_share ranks 3rd and 4th position in frequency of any dependent variable. Moreover, 84,8% of Eco-Innovators and 87,3% of Product_Eco-Innovators valued *market_share* important. The Chi-Square results of 80.375 for Eco-Innovators and 62.130 for Product_Eco-Innovators rank 3rd and 2nd in their respective category. As a result, assessing *market_share* as important increases the probability of being Eco-Innovator by 5,5% and 5,2% for Product_Eco-Innovators significantly at p<1%. Various respondents argued with the reason that a disruptive eco-innovation often represents the only product of a small SME and thus a market must be created at first. However, partnering with a proportionally strong company would help to enhance the product presence in the market.

material_price was indicated as important by 83,4% of Process_Eco-Innovators and ranks on 4th position of this "mode." The Chi-Square value of 49.685 is the 3rd highest of all Process-Eco-Innovator values. The probit regression reveals a significant probability increase at p<5% by 4,5% of being Process_Eco-Innovator if rating *material_price* as important. The Survey results point out, that Process_Eco-Innovators do not face current high material prices but introducing eco-innovative processes is attractive for transforming cost into a value stream or enabling higher profit margins by reducing costs, which also could attract potential investors/partners of SMEs.

Regarding *material_scarcity,* 74,6% of Method_Eco-Innovators show a slightly higher mean compared to other "modes." Additionally, a difference of 19,1% between No_Eco-Innovators and All_Eco-Innovators is observed. Comparing Chi-Square values, it can be seen that All_Eco-Innovators with 48.292 and Method_Eco-Innovators with 50.466 score twice as much as other dependent variables. The probit regression reveals, valuing *material_scarcity* important increases the probability of being All_Eco-Innovator by 2%, which is very significant at p<1%. Also, a probability increase of 2,4% at p<10% significance on Method_Eco-Innovator is observed. The qualitative research is not able to contribute any additional in-depth insights regarding *material_scarcity.*

coll_institutes shows the lowest frequencies and means, which also differ between any eco-innovators and No_Eco-Innovator by more than 13,2%. Noticeably, the Chi-Square values rank among the 3rd highest scores of each respective dependent variable. In general, valuing *coll_institutes* as important increases the probability of being an Eco-Innovator by

4,1% at p<5%, while All_Eco-Innovator's probability increases by 1,7% at p<5%. An increase in the probability of 4,1% at p<1% occurs for Process_Eco-Innovator, while the likelihood of being Method_Eco-Innovator increases by 2,7% at p<5%. The probability of being Product_Eco-Innovator increases by 2,9% at p<5%. According to small SMEs, research institutes and universities can assist with know-how or research information, and also help to allocate finance in the form of grants. Contrary, SMEs with 10-49 employees mainly pointed out universities develop or research too slowly for fast paced commercially driven companies, and also lack know-how for technologically complex eco-innovations.

Valuing *ext_info_support* as important increases the probability of being Process_Eco-Innovator by 4%, and of being Method_Eco-Innovator by 3,2% at p<5% respectively. The mean table shows 83,5% of Method_Eco-Innovators rated *ext_info_support* as important and the Chi-Square values of Method- (55.583), and Product_Eco-Innovator (48.750) are immensely higher compared to 21.020 of Product_Eco-Innovator. In-depth results show that stimulating open access to information can support the development of green products. Especially nascent SMEs with disruptive products have a need for customer and market information, which helps comprehension and the marketing of the goods.

energy_price ranks 1st in the frequency of All-Eco-Innovators, of which 90% indicated importance. However, the Chi-Square analysis shows 19.928 for All-Eco-Innovator, which is less than half of 48.187 of Process_Eco-Innovator. Thus, the Chi-Square implies the first insight into the result of the probit regression that reveals an increase in the probability of being Process_Eco-Innovator by 4,8% with significance at p<5%. The consultation of survey results shows that none of the respondents from multiple countries is facing currently high energy prices. Increasing energy prices are rather seen as a potential competitive advantage towards traditional producers, but they are not part of the strategical core setting of Process_Eco-Innovators.

76,2% of Process_Eco-Innovators *existing_regulations* as important, which is lower compared to other "modes." Moreover, All_Eco-Innovator with 20.661 and Process_Eco-Innovator with 21.415 score smaller Chi-Square values compared to Product- and Method_Eco-Innovator. The empirical analysis reveals, valuing *existing_regulations* important increases the probability of being Eco-Innovator by 4,9%, which is significant at p<5%. An additional significance is also shown for Product_Eco-Innovator & Method_Eco-Innovator with a chance increase of 4,2% at p<1%. Furthermore, qualitative results highlight that existing regulations drive eco-innovation as long as they open new markets for entrepreneurs and create demand.

future_regulations are ranked higher in frequency by No_Eco-Innovators compared to any eco-innovator. Besides, Process_Eco-Innovators score 14.822 in Chi-Square, which is lower compared to other "modes." The probit regression indicates, valuing *future_regulations* important increases the probability of being No_Eco-Innovator by 5,2%, which is significant at p<5%. Contrary, a decreasing likelihood of being Process_Eco-Innovator by -3,1% at p<10% significance can be observed. Deriving only qualitative Process_Eco-Innovator results, it can be seen that *future_regulations* are not part of eco-innovator strategy decisions since companies do not apply activities that aim to anticipate future legislation. Impacts of regulation will be taken into account at the time they come into effect since past ineffective regulation enforcement harmed the reliability of regulation requirements in e.g. the biofuel sector.

Valuing *subsidy_access* as important increases the probability of being No_Eco-Innovator by 3,9%, which is significant at p<10%. Besides this, a decreasing likelihood of being Product_Eco-Innovator by -3,6% at p<5% significance can be observed. The descriptive statistics of this independent variable rank rather low compared to other drivers. Complementary to this, respondents having introduced green products already, see a good access to subsidies very differentiated because it is perceived to be useful in creating short-term customer demand. Other than that, it could help to take up the development of eco-innovation or start up a business in the form of fiscal incentives until a large-scale production is achieved. However, more evolved SMEs like those in the survey reject this driver, since it doesn't seem to help with research or long-term success in marketing their products.

green_demand ranks 7th in the frequency of Product_Eco-Innovator and 11th for No_Eco-Innovator. Also, a 20,6% difference between All_Eco-Innovator and No_Eco-Innovator is observed. Regarding the Chi-Square analysis, all values score higher compared to other drivers, e.g. Eco-Innovator with 124.600 and Product_Eco-Innovator with 112.710. As a result, the probit regression reveals a significant impact of 8,1% at p<1% on Eco-Innovator. Moreover, Product_Eco-Innovator shows a probability increase of 7,7% at p<1%. The Less significant probability increase of All_Eco-Innovator with 1,4% at p<10%, Process_Eco-Innovator by 4,1% and Method_Eco-Innovator by 2,8% at p <5% is shown. Complementarily, the qualitative data shows evidence for an increasingly national and international customer demand for sustainable green products that drive eco-innovation, e.g. in photovoltaic, food, plastics, and cosmetics sectors, where companies are customer-oriented. Nevertheless, two respondents state that the clients do not entirely understand real green

products, which results in demand for unsustainable green products and trend surfing of SMEs.

4.2 Obstacles towards Eco-Innovation

The obstacles *lack_partners*, *no_material_prio,* and *no_regulation_incentive* revealed no significant impact on eco-innovative activity. Moreover, *lack_int_funds*, *lack_labor_tech_cap,* and *incumbent_domination* solely show decreasing probabilities, which imply that these independent variables are not rated as serious obstacles by any tested dependent variable. Thus, these variables are not further mentioned in this subsection.

Tab. 7 - Average Marginal Effects of Obstacles towards Eco-Innovation

	Dependent Variables					
	Eco-Innovator	All_Eco-Innovator	No_Innovation	Product	Process	Method
lack_int_funds		-0,018***/-0,019***			-0,035**/-0,035**	
lack_ext_finance						0,030**/0,034**
inv_uncertainty	0,036**/0,038**		-0,036**/-0,038**			
lack_labor_tech_cap				-0,025*/-0,024*		
no_ext_info_support	-0,049***/-0,043**		0,049***/0,043**			-0,037***/-0,028**
lack_partners						
lack_coll		0,018**/0,028***		0,010/0,026*		0,034**/0,047***
uncertain_demand	0,020/0,030*		-0,020/-0,030*			
no_material_prio						
no_energy_prio		0,019***/0,023***		0,020/0,025*	0,040***/0,046***	
tech_lockin	0,028/0,032*		-0,028/-0,032*			0,019/0,025*
incumbent_domination		-0,014**/-0,011				-0,024*/-0,016
no_regulation_incentive						
limit_subsidy_access	0,055***/0,054***	0,013*/0,016*	-0,055***/-0,054***	0,058***/0,055***		

Note: Figure explanation (model including drivers & obstacles / obstacles only model)
Source: Flash Eurobarometer survey 315 (Authors' table) (Significance = * : p<0.1, ** : p<0.05, *** : p<0.01)

lack_ext_finance shows a higher mean of 62,7% for Method_Eco-Innovator compared to other "modes." Complementarily, the Chi-Square value of 27.420 scores the highest at p<1% for the respective eco-innovator. The probit regression indicates that assessing *lack_ext_finance* as serious increases the probability of being Method_Eco-Innovator by 3%, which is significant at p<5%. The survey results are not including statements of Method_Eco-Innovators. Nonetheless, Process- and Product_Eco-Innovators pointed at the difficulty to find investors like e.g. banks, because eco-innovations are a long-term investment, often precarious, and therefore not attractive to the majority of investors. As a result, potential eco-innovators e.g. Product_Eco-Innovators, who struggle with enormous costs for research, development or materials and do not possess enough internal resources might fail to introduce an eco-innovation due to *lack_ext_finance.*

inv_uncertainty ranks 1st in the frequency of Eco_Innovator, which equals 70,4%. Likewise, 71,5% of Product_Eco-Innovators rated *inv_uncertainty* as a serious obstacle.

Although both means rank comparatively higher, only Eco-Innovator shows a higher Chi-Square value of 39.554 at p<1%. Accordingly, evaluating *inv_uncertainty* as serious increases the probability of being Eco-Innovator by 3,6%, which is significant at p<5%. Respondents elaborated that *inv_uncertainty* is mainly caused by too long amortization periods. Also, allocating potential external investors is difficult due to different rules, styles, and people in the respective network referring to a Slovenian Product- and Process_Eco-Innovator.

no_ext_info_support appears to have a lower frequency ranking in general. The difference in mean of No_Eco-Innovator with 40,6% to other eco-innovator "modes" is less, and its Chi-Square value of 7.385 is significant at p<1%. Thus, the probit regression indicates an increase in the probability of being No_Eco-Innovator by 4,9%, which is significant at p<1%. According to eco-innovative respondents, products and markets are very nascent. Hence, there is a lack of information, which could be useful for benchmarking or reduction of research and development costs in aviation. Especially market information about potential buyers and prices seems to be critical, which might result in the rejection of chemical eco-innovations.

lack_coll ranks 14th in the frequency of any tested dependent variable. Furthermore, All_Eco-Innovator with 47,7%, Method_Eco-Innovator with 42,3%, and Product_Eco-Innovator with 40,5% show the highest means. Likewise, the Chi-Square values of these three independent variables score comparatively higher with 38.148 for All_Eco-Innovator and 43.434 for Method_Eco-Innovator. The marginal effects indicate, valuing *lack_coll* as serious increases the probability of being All_Eco-Innovator by 1,8%, which is significant at p<5%. A further chance increase is observed for Product_Eco-Innovator by 2,6% at p<10% and Method_Eco-Innovator by 3,4% at p<5%. The qualitative data of eco-innovators reveals that more evolved SMEs do not perceive *lack_coll* as an eco-innovation obstacle because there are many opportunities to collaborate. However, as previously mentioned for *coll_institutes*, research institutes, and universities do not catch up with the pace of commercially driven organizations or provide valuable capabilities regarding very complex solutions in the engineering sector, for which reason more evolved SMEs mainly develop technology internally. On the contrary, smaller SMEs, which lack internal capabilities, collaborate with universities. Hence, *lack_coll* is a critical obstacle because the mentioned disadvantages hinder them to introduce an eco-innovation competitively.

uncertain_demand ranks 2nd in frequency and scores highly significant 22.335 in Chi-Square for Eco-Innovator. From the probit regression, it can be seen that valuing *uncertain_demand* as serious increases the probability of being Eco-Innovator by 3%, which

is significant at p<10%. Complementarily to the Eco-Innovator variable, which includes all "modes" of eco-innovation, qualitative reasons for this result are manifold. Respondents indicated various reasons for *uncertain_demand* that are mainly caused by low customer awareness, doubts, and resilience in adapting new eco-innovations. In particular, it is mentioned that greener or better products are not equal to immediate demand. Hence customers have to be heavily educated and convinced about the products. Examples for this are the safety-concerned aviation and automotive sector, wastewater and normal recycling processes, or organic food production. Related to this, one respondent stated that especially enduring the time of customer adaptation is critical for resource-poor SMEs.

no_energy_prio ranks 5th in frequency for All_Eco-Innovator, which is slightly higher compared to other tested dependent variables. Moreover, 66% of All_Eco-Innovators and 60,1% of Product_Eco-Innovators see this as a serious obstacle. The further significant impact is indicated by the Chi-Square value of Process_Eco-Innovator with 30.699. The probit regression ultimately shows, assessing *no_energy_prio* as serious increases the probability of being All_Eco-Innovator by 1,9%, which is significant at p<1%. Further probability increase is observed for Product_Eco-Innovator by 2,5% at p<10% and Process_Eco-Innovator by 4,0% at p<1%. Previously mentioned for *energy_price*, the qualitative data shows that many SMEs do not face high energy prices currently. Thus, they are not pressured to eco-innovate for reducing energy costs.

Valuing *tech_lockin* as serious increases the probability of being Eco-Innovator by 3,2%, which is significant at p<10%. Further probability increase is observed for Method_Eco-Innovator by 2,5% at p<10%. The descriptive analysis reveals that 59,2% of Method_Eco-Innovators rated *tech_lockin* as a serious obstacle and the respective Chi-Square scores 25.167. Besides, Eco-Innovator scores the highest in Chi-Square with 29.060. Regarding qualitative responses, eco-innovators pointed out that hold-up usually occurs on the customer side. For example, wastewater recycling plants can't be utilized in metropolitan regions; heavily safety-regulated aviation requires detailed component compliance; or SMEs that aim to implement more efficient processes have to be re-qualified for their B2B customers.

limit_subsidy_access ranks 1st in frequency for All_Eco-Innovators. Analyzing the means of eco-innovator "modes" it can be seen that mostly Product_Eco-Innovators with 69,2% indicated *limit_subsidy_access* as a serious obstacle. In addition, the Chi-Square values of Eco-Innovator with 46.415 and Product_Eco-Innovator with 51.494 score higher compared to other tested dependent variables. Valuing *limit_subsidy_access* as serious increases the

probability of being All_Eco-Innovator by 1,9%, which is significant at p<1%. Further likelihood increase is observed for Product_Eco-Innovator by 2,5% at p<10% and Process_Eco-Innovator by 4% at p<1%. According to the respondents, eco-innovations would not have been introduced without grants in many cases. Thus, subsidies have an effective short-term impact when they are accurate and precisely adapted to the needs of the eco-innovators. From a critical respondent's point of view, this is often not the case due to imprecise subsidies. With this in mind, it is mentioned that the environmental impact of subsidies is questionable, as in Italy where the agricultural sector transforms into biofuel energy production.

4.3 Ensembles of Obstacles towards Eco-Innovation

This subsection presents quantitative combinations of independent variables. Qualitative reasoning from survey results repeated the argumentation of single obstacles and therefore, is not included in this chapter since it does not add any value. However, the purpose of this subsection is to provide a better overall comprehension of obstacles towards eco-innovation. Hence, the investigation of obstacle ensembles helps to add more insights to the context of the analysis of obstacles towards eco-innovation. For the purpose of variable reduction, which is necessary to include a testable small number of combination variables in the probit regression model, descriptive methods such as a correlation table (see Appendix 9) and a mean table analysis (see Appendix 10) were used to identify potential ensembles. Based on a minimum correlation of >=0,3, which is necessary for separating significant ensembles, 18 ensemble variables were constructed and tested in a second probit regression model including all previously tested independent variables. In Table 8, all combination variables showing a significant impact are listed. However, only significant positive results represent hold-up for European eco-innovative entrepreneurs. Thus, this subsection is not discussing negative ensembles variables.

Tab. 8 – Average Marginal Effects of Variable Ensembles

	Dependent Variables					
	Eco-Innovator	All_Eco-Innovator	No_Innovation	Product	Process	Method
lack_int_funds & lack_ext_finance					-0,054*	-0,048*
no_ext_info_support & lack_coll	-0,064*		0,064*			-0,043*
no_ext_info_support & lack_partners	-0,058*		0,058*			
inv_uncertainty & tech_lockin	-0,119***		0,119***		-0,074**	-0,069***
lack_labor_tech_cap & lack_partners		0,0003*				
no_material_prio & no_energy_prio		0,0003*				

Note: Variables not indicating hold-up (grey)
Source: Flash Eurobarometer survey 315 (Authors' table) (Significance = * : p<0.1, ** : p<0.05, *** : p<0.01)

no_ext_info_support & lack_coll show a correlation of 0,36. Moreover, 21,26% of No_Eco-Innovators perceived both independent variables as a serious obstacle. The analysis of the probit regression model revealed that this ensemble increases the probability of being No_Eco-Innovator by 6,4% at a significance level of p<10%.

no_ext_info_support & lack_partners are perceived as serious obstacles by 25,42% of No_Eco-Innovators. Furthermore, the correlation test indicates a value of 0,34. Including this ensemble variable in the probit regression model, it can be seen that the probability of being No-Eco-Innovator increases by 5,8% at p<10%.

inv_uncertainty & tech_lockin correlate with a value of 0,30. Besides, the mean table analysis revealed that 39,15% of No_Eco-Innovators rate both independent variables as serious problems. Consequently, valuing *inv_uncertainty & tech_lockin* as obstacle increases the probability of being No_Eco-Innovator by 11,9% at a high significance level of p<1%.

lack_labor_tech_cap & lack_partners are rated as serious obstacles for eco-innovation by 39,19% of All_Eco-Innovators. Besides, both independent variables correlate with 0,31. The probit regression analysis indicates that the probability of being All_Eco-Innovator marginally increases by 0,03% at a rather low but still significant level of p<10%.

no_material_prio & no_energy_prio are rated as serious obstacles by 44,42% of All_Eco-Innovators. Additionally, testing the correlation revealed a value of 0,36. Similar to the previous combination, the analysis of the probit regression model revealed that this ensemble increases the probability of being All_Eco-Innovator by 0,03% at a significance level of p<10%.

5. Conclusion

During the last decade, numerous drivers and obstacles towards general eco-innovation have been discovered, with the downside of being too imprecise for a proper application related to eco-innovative entrepreneurs. Therefore, this dissertation takes into account recent scholarly insights to identify and frame the applicability of selected drivers and obstacles towards entrepreneurial eco-innovation in Europe. As a result, eco-innovators were separated into the "modes" of Product_Eco-Innovators, Process_Eco-Innovators, and Method_Eco-Innovators (Kemp & Pearson 2007). Moreover, three additional eco-innovator types were analyzed in the form of Eco-Innovator for a general approach, All_Eco-Innovator to gain insights towards eminent eco-innovative activity and lastly No_Eco-Innovator for the identification of drivers and obstacles, which have to be taken into account for taking on eco-innovation. Allocating eco-innovation in a complex field of numerous influence factors, this dissertation derived in the following manifold but yet limited insights through the latter explained approach.

To begin with, eminently eco-innovative entrepreneurs see the importance of technology and labor capabilities for the successful introduction of eco-innovations. In particular, this dissertation finds good access to qualified personnel in Europe, which is contrary to the findings of Rogers and Tibben-Lembke (1998). However, the tested lack of technology and labor capabilities, comparable to Kurkkio et al. (2011), Triguero et al. (2013) and Ashford (1993), is interpreted by respondents as missing motivation and inspiration of management and other employees.

Furthermore, this dissertation, and among others, Li (2014) highlighted protecting or increasing market share as a driver for eco-innovation. Regarding entrepreneurial SMEs, eco-innovations represent mostly disruptive technologies, which create a new market and thus, uniquely aim to capture or to grow the market share. With this in mind, the majority of markets arise through regulations that require environmentally sound features. Contrary to van Hemel and Cramer (2002), who see the compliance with existing regulations as an important driver, this dissertation finds no strategical importance of compliance with existing or future regulations. In fact, entrepreneurial SMEs offer eco-innovations for customers who have to comply with existing regulations, thus it is the indirectly increasing demand for eco-innovations caused by the regulation compliance of clients. Indeed, respondents see effectively enforced regulations as the driver of long-term demand, which is comparable to Shi et al. (2008). Nevertheless, entrepreneurial eco-innovators mentioned extensive regulation and terminology differences across European countries, which exacerbate the international introduction of eco-innovation.

In addition, customer demand for eco-innovations shows the strongest impact on any eco-innovative activity, which is similar to the findings of Hojnik and Ruzzier (2016). Nonetheless, a lack of customer pressure, as also described by Zhu & Geng (2013), is caused by low awareness about the environmental impact of eco-innovation, resilience of doubting consumers also mentioned by Ashford (1993), and insufficient market information, which results in uncertainty about customer demand for eco-innovative processes and methods. Enduring a long time until the market adapts an eco-innovation is often too costly for small SMEs with limited resources, which leads to a rejection of eco-innovative activity. Referring to entrepreneurial SMEs who face new markets, necessary information is scarce, and hence, the marketing of eco-innovation is hampered. Referring to the latter, knowledge and information is critical for entrepreneurial eco-innovator for contrary reasons to Pujari et al. (2003) and Cooper (1994) who claimed the importance of internal information distribution for the introduction of eco-innovation. Since SMEs are formed of small-structured and highly educated personnel, they rather lack external market information or research and development skills, which they do not possess internally. Based on the empirical analysis of this dissertation, insufficient supply of external information as an obstacle towards eco-innovation often occurs together with a lack of collaboration with universities, research institutes or business partners. Moreover, evolved SMEs significantly indicate a lack of collaboration with universities, which is due to the inability of these institutes to gear up for the pace of commercially driven eco-innovative organizations. Other than that, a driving impact of external information is shown by the utilization of open-innovation and a strongly significant impact of collaboration with universities across all “modes” of eco-innovation, which is more related to nascent eco-innovators who do not possess sufficient internal capabilities and rely on external research and equipment.

Referring to the capabilities of eco-innovative SMEs, financial resources in the form of external investments such as governmental subsidies (Bocken et al. 2014) have a significant driving impact for entrepreneurs that haven’t introduced an eco-innovation, yet. In addition, this research shows that especially method eco-innovations lack external financial support. Related to this, uncertainty about investments in eco-innovative projects is often caused by consequences of changing technological lock-in related to customers (Ashford 1993) and costs, too long amortization periods, long-term return on investment and high risk caused by uncertain market conditions. Consequently, it makes eco-innovation, in general, less attractive for external investors (European Commission 2004). Even though eco-innovative entrepreneurs see subsidies as a powerful driver for accelerating the cost-intensive

development of eco-innovations and increasing demand in the short-term, the empirical analysis revealed that inaccurate subsidies fail to achieve environmentally beneficial impact in the long-term e.g. transform industries like agriculture into biofuel production in Italy. Hence, contrary to non-eco-innovative entrepreneurs, eco-innovative SMEs indicated limited subsidy access and argued that subsidies occur too blurry or cause uncertainty about demand (Ashford 1993) and in some cases favor larger companies in the market.

Furthermore, scarce materials and energy cost savings have marginal strategical importance for eco-innovative entrepreneurs due to currently low input costs. Complementarily, respondents see a lower consumption of energy as a competitive advantage of their products concerning added value or cost savings, which is comparable to Chassagnon and Haned (2015). Indeed, qualitative results reveal that eco-innovation is oriented towards customer requirements. Thus, clients with no strategic energy priority represent a significant obstacle towards process eco-innovation. In this manner, qualitative data revealed that the improvement of cost-effectiveness, as indicated by Bos-Brouwers (2010), can only be applied as a driver for SMEs if eco-innovation is introduced for a cost-sensitive sectors, e.g. mass manufacturing clients.

Consequently to the findings of drivers and obstacles towards eco-innovation of this dissertation the following propositions help policy-makers in the support of entrepreneurial eco-innovation.

Proposition 1: The access to more information about markets and customers helps European entrepreneurs to introduce eco-innovations and reduces investment uncertainty.

Proposition 2: An improvement of customer awareness about eco-innovation could reduce doubts and resilience towards environmentally beneficial products, processes and methods, which as a consequence increases the main driving demand for eco-innovation.

Proposition 3: Effectively enforcing precise and standardized regulations across European borders supports the eco-innovative activity of entrepreneurs by enhancing the market for their eco-innovations.

Proposition 4: Subsidies have to foster the long-term success of eco-innovations by considering sustainable subsidization models and the environmental impact on other industry sectors.

Proposition 5: Fostering a faster work pace of universities and research institutes supports commercially driven eco-innovators. A faster and closer coordination between eco-innovative businesses and universities supplies valuable external capabilities to evolved eco-innovative SMEs.

6. Limitations and Future Research

The past research for drivers and obstacles towards eco-innovation revealed various influence factors, which implies the complexity of this topic. However, this dissertation enabled a manifold insight into drivers and obstacles towards eco-innovation of European entrepreneurs through the application of a large-scale quantitative data set as well as qualitative reasoning from 14 different European countries, which exceeds the validity for a general knowledge base of previous case studies about eco-innovative companies.

On the contrary, this cross-sectional dissertation only provides currently perceived influence factors, which were tested on the basis of a five-year-old data set. Given the dynamic environment of eco-innovation, it should be mentioned that drivers and obstacles towards eco-innovation could have changed due to new policies, subsidies or many other circumstances that came into effect since 2011. Therefore, it makes sense to investigate changes in the outcome of this dissertation compared to present data in future research. Complementarily, data is derived from different European countries, which are in charge of their legislation and market conditions. Hence, drivers and obstacles towards eco-innovation can differ between nations even though the European Commission aims to foster eco-innovation by drafting regulations that have to be implemented in national legislation.

Moreover, in due consideration to the goodness of fit of the tested probit regression models, which indicate low Log-likelihood and McFadden R^2, the results of this dissertation solely contribute a limited validity to explain impacting factors for eco-innovation of European entrepreneurs.

For the future research, it is recommended to investigate additional variables of drivers and obstacles towards eco-innovation related to entrepreneurial businesses to increase the overall goodness of fit regarding the scholarly knowledge about the latter.

Moreover, ensembles of obstacles are analyzed in this dissertation on the base of correlation, which implies no causality. Therefore, especially qualitative research for interrelations of obstacles can add valuable insights about how hold-up can be addressed more efficiently in the future. The discovered combination variables of this dissertation represent a suitable beginning for further interrelation research. Also, combinations of drivers are not subject to the research of this dissertation due to the compliance with past findings of Ashford (1993) in the literature review. However, future research can investigate ensembles of drivers that jointly lead to a more successful introduction of eco-innovation.

Furthermore, this dissertation aims to provide propositions that serve as starting points for future research and actions. Thus, a possible future research can utilize the given propositions as testable hypothesis, on which base new national policy implications can be derived.

Last but not least, the scope of this research paper is set on the identification of drivers and obstacle as well as their combination towards eco-innovation of European entrepreneurs. However, the analysis of the probit regression models revealed that certain "modes" of eco-innovators reacted negatively to several independent obstacle variables, which implies differences in how obstacles are perceived and as a consequence should be enforced for different "modes" of eco-innovators. With this in mind, future research should gain further insights on how existing or future policies impact the different "modes."

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Appendix

Appendix 1 – Extract Eco-Innovation Categories

A. **Environmental technologies**

- Pollution control technologies including waste water treatment technologies
- Cleaning technologies that treat pollution released into the environment
- Cleaner process technologies: new manufacturing processes that are less polluting and/or more resource efficient than relevant alternatives
- Waste management equipment
- Environmental monitoring and instrumentation
- Green energy technologies
- Water supply
- Noise and vibration control

B. **Organizational innovation** for the environment:

- Pollution prevention schemes
- Environmental management and auditing systems: formal systems of environmental management involving measurement, reporting and responsibilities for dealing with issues of material use, energy, water and waste. Examples are EMAS and ISO 14001.
- Chain management: cooperation between companies so as to close material loops and to avoid environmental damage across the value chain (from cradle to grave)

C. **Product and service innovation** offering environmental benefits:

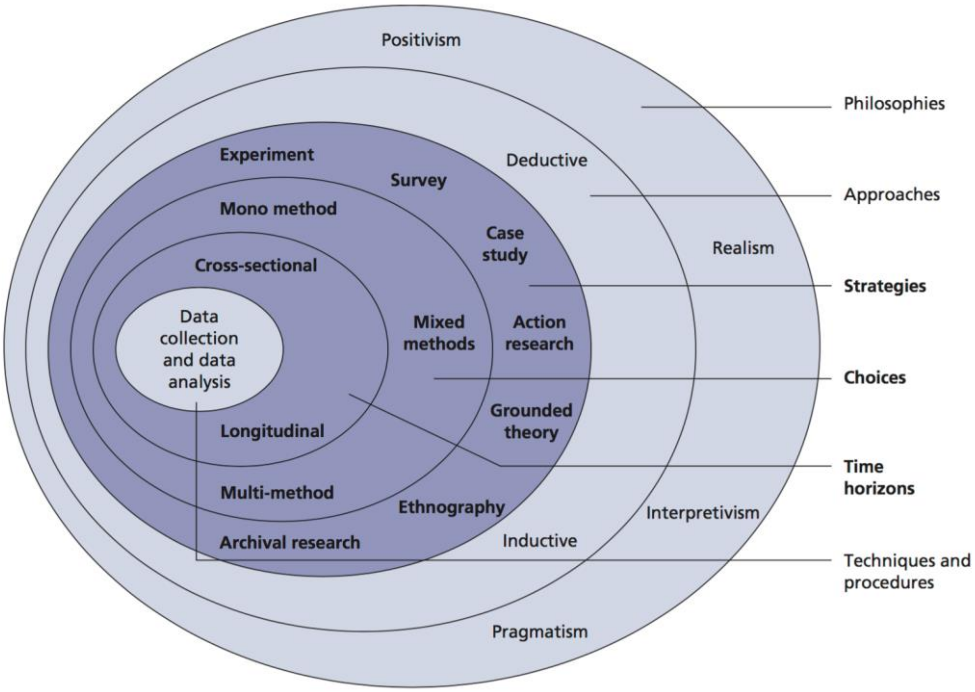
- New or environmentally improved products (goods) including eco-houses and buildings
- Green financial products (such as eco-lease or climate mortgages)
- Environmental services: solid and hazardous waste management, water and waste water management, environmental consulting, testing and engineering, other testing and analytical services
- Services that are less pollution and resource intensive (car sharing is an example)

D. **Green system innovations:**

- Alternative systems of production and consumption that are more environmentally benign than existing systems: biological agriculture and a renewables-based energy system are examples

Source: (Arundel & Kemp 2009)

Appendix 2 – Research Onion



Source: (Saunders et al. 2009)

Appendix 3 – Overview Survey Countries

Sizes of the samples

The targeted number of interviews varied dependent on the size of the country. In most countries, the targeted sample size was 200. However, in France, Germany, Italy, Spain and the UK, the sample size was increased to 250, while in Cyprus, Luxembourg and Malta, the sample size was reduced to 50.

	Total interviews conducted		Total interviews conducted
Belgium	201	**Malta**	50
Czech Republic	200	**Netherlands**	200
Denmark	201	**Austria**	200
Germany	250	**Poland**	200
Estonia	200	**Portugal**	201
Greece	201	**Slovenia**	200
Spain	250	**Slovakia**	200
France	250	**Finland**	205
Ireland	200	**Sweden**	200
Italy	251	**UK**	251
Cyprus	50	**Bulgaria**	204
Latvia	202	**Romania**	200
Lithuania	202		
Luxembourg	51		
Hungary	202	**TOTAL**	**5,222**

Source: (European Commission 2011)

Appendix 4 – Summary Statistics

Variable	TOTAL	Product_Eco-Innovator	Process_Eco-Innovator	Method_Eco-Innovator	No_Eco-Innovator
Modes					
eco.innovator	0.438				
all_eco.innovator	0.085	0.365	0.293	0.380	
product_innovation	0.232	1.000	0.479	0.482	
process_innovation	0.289	0.596	1.000	0.650	
method_innovation	0.223	0.464	0.502	1.000	
Drivers					
tech_man_cap	0.758	0.828	0.816	0.839	0.716
market_share	0.789	0.873	0.844	0.862	0.743
material_price	0.768	0.834	0.834	0.842	0.728
material_scarcity	0.585	0.642	0.633	0.678	0.555
future_mat_scarcity	0.623	0.700	0.679	0.714	0.587
coll_institutes	0.515	0.613	0.611	0.620	0.457
ext_info_support	0.749	0.801	0.817	0.835	0.708
business_partner	0.795	0.844	0.824	0.848	0.770
energy_price	0.819	0.874	0.879	0.881	0.781
future_energy	0.836	0.890	0.881	0.883	0.803
existing_regulations	0.716	0.794	0.762	0.803	0.675
future_regulations	0.736	0.789	0.774	0.795	0.709
subsidy_access	0.737	0.786	0.787	0.797	0.707
green_demand	0.688	0.815	0.773	0.787	0.623
Obstacles					
lack_int_funds	0.621	0.657	0.620	0.647	0.611
lack_ext_finance	0.557	0.615	0.572	0.627	0.537
inv_uncertainty	0.656	0.715	0.694	0.707	0.619
lack_labor_tech_cap	0.508	0.521	0.541	0.546	0.493
no_ext_info_support	0.423	0.464	0.458	0.462	0.406
lack_partners	0.423	0.459	0.440	0.466	0.411
lack_coll	0.340	0.405	0.381	0.423	0.309
uncertain_demand	0.662	0.712	0.689	0.706	0.634
no_material_prio	0.444	0.495	0.482	0.502	0.413
no_energy_prio	0.536	0.601	0.598	0.601	0.503
tech_lockin	0.525	0.568	0.570	0.592	0.491
incumbent_domination	0.511	0.561	0.536	0.539	0.486
no_regulation_incentive	0.587	0.655	0.638	0.650	0.550
limit_subsidy_access	0.601	0.692	0.651	0.671	0.559
Main activity					
agriculture_fishing	0.083	0.065	0.105	0.096	0.078
construction	0.285	0.289	0.231	0.278	0.304
water_supply	0.033	0.043	0.038	0.031	0.030
manufacture	0.530	0.529	0.567	0.524	0.515
food_service	0.069	0.073	0.059	0.072	0.073
Company size					
10-49	0.793	0.747	0.716	0.737	0.833
50-249	0.207	0.253	0.284	0.263	0.167
Turnover trend					
turnover_inc	0.288	0.342	0.364	0.363	0.243
turnover_dec	0.434	0.399	0.387	0.386	0.464
turnover_remain	0.259	0.238	0.226	0.230	0.275
turnover_DK/NA	0.019	0.020	0.022	0.021	0.018
Material-related					
mat_cost_low	0.317	0.305	0.307	0.326	0.323
mat_cost_high	0.590	0.605	0.603	0.589	0.577
mat_cost_other	0.093	0.090	0.089	0.086	0.100
mat_trend_highinc	0.244	0.268	0.277	0.282	0.227
mat_trend_inc	0.450	0.456	0.456	0.446	0.446
mat_trend_remain	0.170	0.146	0.133	0.135	0.186
mat_trend_dec	0.107	0.101	0.101	0.109	0.111
mat_trend_other	0.093	0.090	0.089	0.086	0.100
mat_future_inc	0.870	0.886	0.886	0.885	0.859
mat_future_remain	0.076	0.070	0.066	0.065	0.081
mat_future_dec	0.013	0.019	0.013	0.019	0.011
mat_future_DK/NA	0.040	0.024	0.036	0.031	0.048
Eco investment					
eco_investment_high	0.069	0.143	0.142	0.118	0.029
eco_investment_modhigh	0.094	0.175	0.160	0.147	0.053
eco_investment_moderate	0.248	0.323	0.360	0.361	0.175
eco_investment_low	0.354	0.259	0.250	0.269	0.407
eco_investment_none	0.156	0.044	0.041	0.053	0.237
eco_investment_other	0.079	0.055	0.047	0.052	0.099
N° of observations	4964	1154	1435	1109	2789

Note: Mean statistics for dummy variables equal to 1
Source: Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 5 – Question D5 of Flash Eurobarometer Survey 315

D5. During the past 24 months have you introduced the following eco-innovation
[READ OUT– ONE ANSWER PER LINE]

- Yes 1
- No 2
- [DK/NA] 9

a. a new or significantly improved eco-innovative product or service to the market..... 1 2 9
b. a new or significantly improved eco-innovative production process or method..... 1 2 9
c. a new or significantly improved eco-innovative organisational innovation..... 1 2 9

Source: (European Commission 2011)

Appendix 6 – Question Q8 of Flash Eurobarometer Survey 315

[ASK ALL]
Q8. I will list you some drivers that could accelerate eco-innovation uptake and development for a company. Please tell me for each of them if you consider them a very important, somewhat important, not important or not at all important driver in case of your company?
[ROTATE - READ OUT- ONE ANSWER PER LINE]

- Very important 4
- Somewhat important 3
- Not important 2
- Not at all important 1
- [Not applicable] 8
- [DK/NA] 9

a. Technological and management capabilities within the enterprise 1 2 9
b. Secure or increase existing market share 1 2 9
c. Current high material prices (as an incentive to innovate, to use less material and decrease the cost) 1 2 9
d. Limited access to materials 1 2 9
e. Expected future material scarcity (as an incentive to develop innovative, less material-intensive substitutes) 1 2 9
f. Collaboration with research institutes, agencies and universities 1 2 9
g. Good access to external information and knowledge, including technology support services 1 2 9
h. Good business partners 1 2 9
i. Current high energy prices (as an incentive to innovative, to use less energy and decrease the cost) 1 2 9
j. Expected future increases in energy prices 1 2 9
l. Existing regulations, including standards 1 2 9
m. Expected future regulations imposing new standards 1 2 9
n. Access to existing subsidies and fiscal incentives 1 2 9
o. Increasing market demand for green products 1 2 9

Source: (European Commission 2011)

Appendix 7 – Question Q7 of Flash Eurobarometer Survey 315

[ASK ALL]

Q7. I will list you some barriers that could represent an obstacle to accelerated eco-innovation uptake and development for a company. Please tell me for each of them if you consider them a very serious, somewhat serious, not serious or not at all serious barrier in case of your company?

[ROTATE - READ OUT- ONE ANSWER PER LINE]

- Very serious 4
- Somewhat serious 3
- Not serious 2
- Not at all serious 1
- [Not applicable].....8
- [DK/NA] 9

a. Lack of funds within enterprise	1	2	9
b. Lack of external financing	1	2	9
c. Uncertain return on investment or too long payback period for eco-innovation	1	2	9
d. Lack of qualified personnel and technological capabilities within the enterprise	1	2	9
e. Limited access to external information and knowledge, including lack of well-developed technology support services	1	2	9
f. Lack of suitable business partners	1	2	9
g. Lack of collaboration with research institutes and universities	1	2	9
h. Uncertain demand from the market	1	2	9
i. Reducing material use is not an innovation priority	1	2	9
j. Reducing energy use is not an innovation priority	1	2	9
k. Technical and technological lock-ins in economy (e.g. old technical infrastructures)	1	2	9
l. Market dominated by established enterprises	1	2	9
m. Existing regulations and structures not providing incentives to eco-innovate	1	2	9
n. Insufficient access to existing subsidies and fiscal incentives	1	2	9

Source: (European Commission 2011)

Appendix 8 – Descriptive Statistics of Flash Eurobarometer Survey 315

	Frequency (ranking)						Mean						Pearson's χ2					
	Eco-Innovator	All_Eco-Innovator	Product	Process	Method	No _Eco-Innovator	Eco-Innovator	All_Eco-Innovator	Product	Process	Method	No_Eco-Innovator	Eco-Innovator	All_Eco-Innovator	Product	Process	Method	No_Eco-Innovator
tech_man_cap	1766 (6)	371 (4)	955 (6)	1171 (7)	930 (6)	1997 (6)	81,2%	88,1%	82,8%	81,6%	83,9%	71,6%	60.790***	37.325***	39.103***	36.541***	49.937***	60.790***
market_share	1845 (3)	375 (3)	1007 (3)	1211 (3)	956 (3)	2073 (4)	84,8%	89,1%	87,3%	84,4%	86,2%	74,3%	80.375***	27.806***	62.130***	35.747***	44.888***	80.375***
material_price	1779 (5)	368 (5)	963 (5)	1197 (4)	934 (5)	2031 (5)	81,8%	87,4%	83,4%	83,4%	84,2%	72,8%	54.620***	28.638***	37.297***	49.685***	44.091***	54.620***
material_scarcity	1355 (13)	314 (12)	741 (13)	908 (13)	752 (13)	1549 (13)	62,3%	74,6%	64,2%	63,3%	67,8%	55,5%	22.719***	48.292***	19.889***	18.674***	50.466***	22.719***
future_mat_scarcity	1457 (12)	322 (11)	808 (12)	974 (12)	792 (12)	1638 (12)	67,0%	76,5%	70,0%	67,9%	71,4%	58,7%	35.146***	38.501***	37.239***	25.924***	49.512***	35.146***
coll_institutes	1282 (14)	291 (13)	707 (14)	877 (14)	688 (14)	1275 (14)	58,9%	69,1%	61,3%	61,1%	62,0%	45,7%	85.070***	56.348***	56.767***	74.002***	62.817***	85.070***
ext_info_support	1743 (7)	365 (6)	924 (8)	1172 (6)	926 (7)	1975 (8)	80,1%	86,7%	80,1%	81,7%	83,5%	70,8%	56.014***	33.382***	21.020***	48.750***	55.583***	56.014***
business_partner	1797 (4)	364 (7)	974 (4)	1182 (5)	940 (4)	2147 (3)	82,6%	86,5%	84,4%	82,4%	84,8%	77,0%	23.463***	13.376***	22.173***	10.273***	24.237***	23.463***
energy_price	1886 (2)	379 (1)	1009 (2)	1261 (2)	977 (2)	2179 (2)	86,7%	90,0%	87,4%	87,9%	88,1%	78,1%	60.142***	19.928***	30.691***	48.187***	36.570***	60.142***
future_energy	1912 (1)	378 (2)	1027 (1)	1264 (1)	979 (1)	2240 (1)	87,9%	89,8%	89,0%	88,1%	88,3%	80,3%	50.934***	12.206***	30.976***	28.647***	21.993***	50.934***
existing_regulations	1669 (11)	342 (10)	916 (9)	1094 (11)	890 (8)	1883 (10)	76,7%	81,2%	79,4%	76,2%	80,3%	67,5%	50.590***	20.661***	44.684***	21.415***	52.523***	50.590***
future_regulations	1676 (10)	349 (8)	911 (10)	1111 (9)	882 (10)	1978 (7)	77,1%	82,9%	78,9%	77,4%	79,5%	70,9%	23.370***	19.909***	21.655***	14.822***	25.382***	23.370***
subsidy_access	1686 (8)	344 (9)	907 (11)	1129 (8)	884 (9)	1973 (9)	77,5%	81,7%	78,6%	78,7%	79,7%	70,7%	28.598***	14.743***	18.192***	25.321***	26.139***	28.598***
green_demand	1678 (9)	349 (8)	941 (7)	1109 (10)	873 (11)	1738 (11)	77,1%	82,9%	81,5%	77,3%	78,7%	62,3%	124.600***	41.797***	112.710***	66.874***	64.682***	124.600***
lack_int_funds	1379 (5)	271 (7)	758 (4)	890 (5)	718 (5)	1703 (3)	63,4%	64,4%	65,7%	62,0%	64,7%	61,1%	2.746*	0.915	8.0689***	0.001	4.135**	2.746*
lack_ext_finance	1270 (6)	273 (6)	710 (6)	821 (7)	695 (6)	1497 (6)	58,4%	64,8%	61,5%	57,2%	62,7%	53,7%	10.825***	15.055***	20.083***	1.688	27.420***	10.825***
inv_uncertainty	1532 (1)	297 (3)	825 (1)	996 (1)	784 (1)	1725 (2)	70,4%	70,5%	71,5%	69,4%	70,7%	61,9%	39.554***	4.727**	22.686***	12.651***	16.057***	39.554***
lack_labor_tech_cap	1147 (10)	245 (9)	601 (10)	777 (9)	606 (9)	1375 (8)	52,7%	58,2%	52,1%	54,1%	54,6%	49,3%	5.631**	9.728***	0.910	8.825***	8.219***	5.631**
no_ext_info_support	968 (12)	215 (12)	535 (12)	657 (12)	512 (13)	1133 (13)	44,5%	51,1%	46,4%	45,8%	46,2%	40,6%	7.385***	14.020***	9.817***	9.696***	8.438***	7.385***
lack_partners	954 (13)	208 (13)	530 (13)	631 (13)	517 (12)	1145 (12)	43,9%	49,4%	45,9%	44,0%	46,6%	41,1%	3.833*	9.244***	7.981***	2.259	10.764***	3.833*
lack_coll	825 (14)	201 (14)	467 (14)	547 (14)	469 (14)	862 (14)	37,9%	47,7%	40,5%	38,1%	42,3%	30,9%	26.560***	38.148***	27.794***	15.116***	43.434***	26.560***
uncertain_demand	1518 (2)	299 (2)	822 (2)	988 (2)	783 (2)	1767 (1)	69,8%	71,0%	71,2%	68,9%	70,6%	63,4%	22.335***	4.590**	16.865***	6.279**	12.254***	22.335***
no_material_prio	1050 (11)	219 (11)	571 (11)	691 (11)	557 (11)	1153 (11)	48,3%	52,0%	49,5%	48,2%	50,2%	41,3%	23.529***	10.541***	15.578***	11.432***	19.467***	23.529***
no_energy_prio	1259 (7)	278 (5)	694 (7)	858 (6)	666 (7)	1402 (7)	57,9%	66,0%	60,1%	59,8%	60,1%	50,3%	28.196***	28.023***	25.459***	30.699***	23.542***	28.196***
tech_lockin	1236 (8)	247 (8)	656 (8)	818 (8)	656 (8)	1369 (9)	56,8%	58,7%	56,8%	57,0%	59,2%	49,1%	29.060***	6.803***	11.275***	16.323***	25.167***	29.060***
incumbent_domination	1183 (9)	229 (10)	647 (9)	769 (10)	598 (10)	1356 (10)	54,4%	54,4%	56,1%	53,6%	53,9%	48,6%	16.059***	1.800	14.296***	4.675**	4.256**	16.059***
no_regulation_incentive	1383 (4)	285 (4)	756 (5)	916 (4)	721 (4)	1533 (5)	63,6%	67,7%	65,5%	63,8%	65,0%	55,0%	37.113***	14.813***	28.057***	21.282***	22.837***	37.113***
limit_subsidy_access	1425 (3)	300 (1)	799 (3)	934 (3)	744 (3)	1560 (4)	65,5%	71,3%	69,2%	65,1%	67,1%	55,9%	46.415***	23.249***	51.494***	20.376***	28.438***	46.415***

Note: Multiple answers per interviewee are possible. The frequency sums the dummy variable (1=TRUE) per category.

Note: Significance (*: p<0.1, **: p<0.05, ***: p<0.01)

Source: Flash Eurobarometer #315

Appendix 9 – Correlation Table of Independent Obstacle Variables

Obstacle Correlation	limit_subsidy_access	lack_coll	lack_partners	tech_lockin	no_energy_prio	no_ext_info_support	inv_uncertainty	lack_ext_finance	uncertain_demand	no_regulation_incentive
inv_uncertainty	0,32	-	-	0,30	-	-	-	-	0,31	0,32
no_ext_info_support	0,33	0,36	0,34	0,33	-	-	-	-	-	-
lack_int_funds	0,36	-	-	-	-	-	0,30	0,49	-	-
lack_labor_tech_cap	-	-	0,31	-	-	0,31	-	-	-	-
lack_ext_finance	0,38	-	-	-	-	-	-	-	-	-
lack_partners	-	0,30	-	-	-	-	-	-	-	-
lack_coll	0,30	-	-	-	-	-	-	-	-	-
no_material_prio	-	-	-	-	0,36	-	-	-	-	-
no_regulation_incentive	0,37	-	-	-	-	-	-	-	-	-

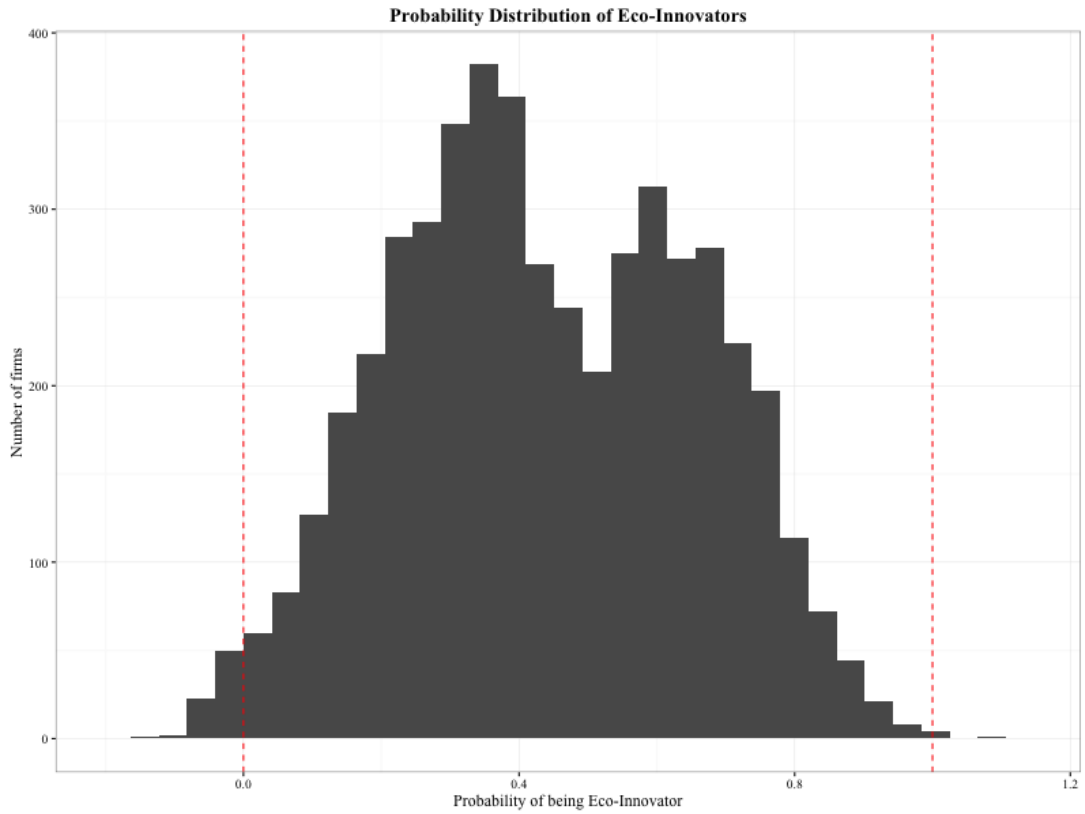
Note: Table displays correlation values >=0,3
Source: Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 10 – Mean Table for Obstacle Ensembles

Ensemble	Eco-Innovator	All_Eco-Innovator	Product	Process	Method	No_Eco-Innovator
lack_int_funds & lack_ext_finance	47,59	52,02	50,69	46,20	50,41	45,29
no_ext_info_support & lack_coll	24,87	33,49	27,21	26,27	27,50	**21,26**
no_ext_info_support & lack_partners	27,03	35,87	29,64	28,78	29,22	**25,42**
inv_uncertainty & tech_lockin	44,78	47,27	45,58	44,53	46,35	**39,15**
lack_labor_tech_cap & lack_partners	30,30	**39,19**	32,06	31,57	32,73	28,15
no_material_prio & no_energy_prio	36,23	**44,42**	38,39	37,49	39,22	29,83

Note: values in % *Source:* Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 11 – Probability Distribution of Eco-Innovator



Source: Authors' own graph (derived from Flash Eurobarometer survey 315 - Graphs – R Studio)

Appendix 12 – Average Marginal Effects of Eco-Innovation Modes

Average Marginal Effects (Probit Regression Model)

	Dependent variable:								
	Product_Eco-Innovator			Process_Eco-Innovator			Method_Eco-Innovator		
	Total	Drivers	Obstacles	Total	Drivers	Obstacles	Total	Drivers	Obstacles
tech_man_cap	0,013	0,012		0,011	0,014		0,018	0,021	
market_share	0,052***	0,054***		0,003	0,005		0,023	0,022	
material_price	0,017	0,020		0,045**	0,045**		0,019	0,023	
material_scarcity	-0,018	-0,016		-0,012	-0,011		0,024*	0,024*	
future_mat_scarcity	0,013	0,013		-0,010	-0,010		0,011	0,011	
coll_institutes	0,029**	0,034**		0,041***	0,040***		0,016	0,027**	
ext_info_support	-0,025	-0,026		0,040**	0,039**		0,032**	0,029*	
business_partner	0,005	0,003		-0,020	-0,025		0,005	0,001	
energy_price	0,008	0,012		0,048**	0,051**		0,020	0,023	
future_energy	0,006	0,011		-0,015	-0,011		-0,028	-0,025	
existing_regulations	0,042***	0,043***		0,014	0,015		0,042***	0,043***	
future_regulations	-0,025	-0,024		-0,031*	-0,030*		-0,020	-0,019	
subsidy_access	-0,036**	-0,014		0,000	-0,002		-0,019	-0,010	
green_demand	0,077***	0,080***		0,041***	0,040**		0,028**	0,030**	
lack_int_funds	-0,002		-0,004	-0,035**		-0,035**	-0,024		-0,024
lack_ext_finance	0,008		0,012	-0,025		-0,017	0,030**		0,034**
inv_uncertainty	0,015		0,018	0,005		0,007	0,005		0,004
lack_labor_tech_cap	-0,025*		-0,024*	0,021		0,023	0,000		0,004
no_ext_info_support	-0,020		-0,019	-0,014		-0,007	-0,037***		-0,028**
lack_partners	-0,003		0,002	-0,010		-0,009	-0,001		0,005
lack_coll	0,010		0,026*	-0,007		0,013	0,034**		0,047***
uncertain_demand	0,007		0,017	0,004		0,006	0,006		0,012
no_material_prio	-0,003		0,002	-0,008		-0,003	0,004		0,011
no_energy_prio	0,020		0,025*	0,040***		0,046***	0,013		0,020
tech_lockin	-0,002		0,000	0,017		0,022	0,019		0,025*
incumbent_domination	0,001		0,008	-0,009		-0,003	-0,024*		-0,016
no_regulation_incentive	0,007		0,012	0,014		0,020	0,006		0,011
limit_subsidy_access	0,058***		0,055***	0,020		0,026	0,017		0,021
Country	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Main_Activity	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Firm_Size	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Turnover_Trend	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost_Trend (past)	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost_Trend (future)	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Eco_Investment	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Observations	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964
McFadden R^2	0,11607	0,10998	0,10143	0,14033	0,13647	0,13202	0,0945	0,08931	0,085
Log Likelihood	-2,379.271	-2,395.670	-2,418.699	-2,566.078	-2,577.608	-2,590.884	-2,387.622	-2,401.317	-2,416.321
Akaike Inf. Crit.	4,860.543	4,865.340	4,911.398	5,234.156	5,229.216	5,255.768	4,877.244	4,876.635	4,906.642

Note: Table shows average marginal effects for better interpretation (Significance = * : p<0.1, ** : p<0.05, *** : p<0.01)
Source: Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 13 – Average Marginal Effects of Additional Dependent Variables

Average Marginal Effects (Probit Regression Model)

	Dependent variable:								
	Eco-Innovator			All_Eco-Innovator			No_Eco-Innovator		
	Total	Drivers	Obstacles	Total	Drivers	Obstacles	Total	Drivers	Obstacles
tech_man_cap	0,024	0,026		0,016*	0,016*		-0,024	-0,026	
market_share	0,055***	0,060***		0,011	0,011		-0,055***	-0,060***	
material_price	0,027	0,030		0,010	0,011		-0,027	-0,030	
material_scarcity	-0,027	-0,028		0,020***	0,021***		0,027	0,028	
future_mat_scarcity	-0,014	-0,012		0,009	0,008		0,014	0,012	
coll_institutes	0,041**	0,043**		0,017**	0,023***		-0,041**	-0,043**	
ext_info_support	0,029	0,023		0,010	0,011		-0,029	-0,023	
business_partner	-0,016	-0,024		0,000	-0,003		0,016	0,024	
energy_price	0,033	0,039		0,011	0,011		-0,033	-0,039	
future_energy	0,013	0,019		-0,017	-0,015		-0,013	-0,019	
existing_regulations	0,049**	0,051***		0,002	0,003		-0,049**	-0,051***	
future_regulations	-0,052**	-0,049**		0,000	-0,001		0,052**	0,049**	
subsidy_access	-0,039*	-0,021		-0,013	-0,009		0,039*	0,021	
green_demand	0,082***	0,084***		0,014*	0,015*		-0,082***	-0,084***	
lack_int_funds	-0,028		-0,029	-0,018**		-0,019**	0,028		0,029
lack_ext_finance	-0,012		-0,006	0,010		0,013	0,012		0,006
inv_uncertainty	0,036**		0,038**	-0,005		-0,005	-0,036**		-0,038**
lack_labor_tech_cap	-0,001		0,002	0,005		0,008	0,001		-0,002
no_ext_info_support	-0,049***		-0,043**	-0,006		-0,001	0,049***		0,043**
lack_partners	-0,023		-0,021	0,014		0,005	0,023		0,021
lack_coll	0,000		0,023	0,018**		0,028***	0,000		-0,023
uncertain_demand	0,020		0,030*	-0,002		0,000	-0,020		-0,030*
no_material_prio	0,007		0,013	-0,005		-0,002	-0,007		-0,013
no_energy_prio	0,018		0,027	0,019***		0,023***	-0,018		-0,027
tech_lockin	0,028		0,032*	-0,005		-0,001	-0,028		-0,032*
incumbent_domination	0,003		0,013	-0,014**		-0,011	-0,003		-0,013
no_regulation_incentive	0,016		0,022	0,002		0,005	-0,016		-0,022
limit_subsidy_access	0,055***		0,054***	0,013*		0,016**	-0,055***		-0,054***
Country	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Main_Activity	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Firm_Size	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Turnover_Trend	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost_Trend (past)	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Material_Cost_Trend (future)	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Eco_Investment	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Observations	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964
McFadden R^2	0,1523	0,1475	0,1415	0,1258	0,1171	0,1079	0,1523	0,1475	0,1415
Log Likelihood	-2,884.344	-2,900.759	-2,921.347	-1,259.993	-1,272.618	-1,285.826	-2,884.344	-2,900.759	-2,921.347
Akaike Inf. Crit.	5,870.687	5,875.519	5,916.693	2,621.987	2,619.236	2,645.653	5,870.687	5,875.519	5,916.693

Note: Table shows average marginal effects for better interpretation (Significance = * : p<0.1, ** : p<0.05, *** : p<0.01)
Source: Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 14 – Probit Regression for Product, Process and Method

Probit Regression Model

	Dependent variable:								
	Product_Eco-Innovator			Process_Eco-Innovator			Method_Eco-Innovator		
	Total	Drivers	Obstacles	Total	Drivers	Obstacles	Total	Drivers	Obstacles
tech_man_cap	0.046	0.044		0.034	0.043		0.067	0.078	
	(0.060)	(0.059)		(0.057)	(0.057)		(0.060)	(0.060)	
market_share	0.193***	0.200***		0.010	0.017		0.084	0.082	
	(0.063)	(0.063)		(0.059)	(0.059)		(0.062)	(0.062)	
material_price	0.060	0.071		0.142**	0.142**		0.068	0.083	
	(0.061)	(0.061)		(0.059)	(0.059)		(0.062)	(0.061)	
material_scarcity	-0.063	-0.057		-0.037	-0.035		0.087*	0.085*	
	(0.051)	(0.050)		(0.049)	(0.048)		(0.051)	(0.050)	
future_mat_scarcity	0.046	0.047		-0.032	-0.031		0.040	0.040	
	(0.053)	(0.052)		(0.051)	(0.050)		(0.053)	(0.052)	
coll_institutes	0.102**	0.119**		0.127***	0.125***		0.057	0.097**	
	(0.050)	(0.047)		(0.048)	(0.046)		(0.050)	(0.047)	
ext_info_support	-0.087	-0.091		0.127**	0.123**		0.117*	0.106*	
	(0.060)	(0.059)		(0.058)	(0.058)		(0.061)	(0.060)	
business_partner	0.020	0.010		-0.062	-0.076		0.017	0.002	
	(0.063)	(0.061)		(0.060)	(0.058)		(0.063)	(0.061)	
energy_price	0.028	0.041		0.154**	0.162**		0.073	0.084	
	(0.072)	(0.071)		(0.069)	(0.069)		(0.072)	(0.072)	
future_energy	0.023	0.040		-0.046	-0.034		-0.098	-0.087	
	(0.073)	(0.073)		(0.070)	(0.069)		(0.073)	(0.072)	
existing_regulations	0.154***	0.157***		0.043	0.047		0.155***	0.158***	
	(0.056)	(0.056)		(0.053)	(0.053)		(0.056)	(0.056)	
future_regulations	-0.087	-0.082		-0.095*	-0.092*		-0.072	-0.068	
	(0.057)	(0.056)		(0.054)	(0.054)		(0.056)	(0.056)	
subsidy_access	-0.126**	-0.049		-0.001	-0.005		-0.068	-0.037	
	(0.059)	(0.056)		(0.057)	(0.054)		(0.059)	(0.056)	
green_demand	0.289***	0.297***		0.131***	0.126**		0.103**	0.110**	
	(0.054)	(0.053)		(0.051)	(0.050)		(0.053)	(0.052)	
lack_int_funds	-0.008		-0.014	-0.106**		-0.106**	-0.087*		-0.083
	(0.053)		(0.052)	(0.051)		(0.050)	(0.053)		(0.052)
lack_ext_finance	0.030		0.043	-0.078		-0.054	0.108**		0.123**
	(0.051)		(0.051)	(0.050)		(0.049)	(0.051)		(0.051)
inv_uncertainty	0.054		0.062	0.017		0.022	0.018		0.015
	(0.051)		(0.051)	(0.049)		(0.049)	(0.051)		(0.051)
lack_labor_tech_cap	-0.089*		-0.084*	0.065		0.072	-0,0005		0.016
	(0.046)		(0.046)	(0.045)		(0.044)	(0.046)		(0.046)
no_ext_info_support	-0.073		-0.065	-0.043		-0.022	-0.135***		-0.099**
	(0.050)		(0.049)	(0.049)		(0.048)	(0.050)		(0.049)
lack_partners	-0.010		0.007	-0.030		-0.029	-0.003		0.018
	(0.049)		(0.048)	(0.048)		(0.047)	(0.049)		(0.048)
lack_coll	0.034		0.091*	-0.021		0.039	0.119**		0.165***
	(0.052)		(0.049)	(0.050)		(0.048)	(0.051)		(0.049)
uncertain_demand	0.026		0.061	0.012		0.018	0.022		0.042
	(0.050)		(0.050)	(0.048)		(0.048)	(0.050)		(0.050)
no_material_prio	-0.011		0.008	-0.024		-0.009	0.014		0.039
	(0.047)		(0.046)	(0.046)		(0.045)	(0.047)		(0.046)
no_energy_prio	0.070		0.086*	0.126***		0.143***	0.048		0.073
	(0.047)		(0.046)	(0.045)		(0.045)	(0.047)		(0.046)
tech_lockin	-0.009		0.001	0.053		0.068	0.068		0.089*
	(0.048)		(0.048)	(0.047)		(0.046)	(0.048)		(0.048)
incumbent_domination	0.002		0.029	-0.027		-0.010	-0.087*		-0.058
	(0.046)		(0.046)	(0.045)		(0.045)	(0.046)		(0.046)
no_regulation_incentive	0.024		0.044	0.044		0.061	0.022		0.037
	(0.049)		(0.049)	(0.048)		(0.047)	(0.049)		(0.049)
limit_subsidy_access	0.209***		0.198***	0.061		0.079	0.061		0.074
	(0.053)		(0.051)	(0.051)		(0.049)	(0.052)		(0.051)
agriculture_fishing	-0.366***	-0.352***	-0.343***	0.239**	0.238**	0.256**	-0.010	-0.003	-0.019
	(0.111)	(0.110)	(0.109)	(0.105)	(0.104)	(0.104)	(0.107)	(0.106)	(0.105)
construction	-0.006	0.001	-0.009	-0.014	-0.013	-0.023	-0.019	-0.011	-0.032
	(0.088)	(0.088)	(0.087)	(0.089)	(0.089)	(0.088)	(0.089)	(0.088)	(0.088)
water_supply	0.066	0.067	0.036	0.068	0.068	0.074	-0.210	-0.210	-0.242*
	(0.136)	(0.135)	(0.134)	(0.135)	(0.135)	(0.134)	(0.142)	(0.141)	(0.140)

manufacture	-0.071	-0.065	-0.072	0.168**	0.168**	0.158*	-0.066	-0.054	-0.078
	(0.085)	(0.084)	(0.084)	(0.085)	(0.084)	(0.084)	(0.085)	(0.085)	(0.084)
food_service									
"10-49"	-0.124**	-0.115**	-0.147***	-0.256***	-0.264***	-0.278***	-0.163***	-0.161***	-0.185***
	(0.051)	(0.050)	(0.050)	(0.049)	(0.048)	(0.048)	(0.050)	(0.050)	(0.050)
"50-249"									
turnover_inc	-0.037	-0.049	-0.057	-0.120	-0.125	-0.124	-0.057	-0.059	-0.070
	(0.160)	(0.159)	(0.158)	(0.152)	(0.151)	(0.151)	(0.158)	(0.157)	(0.156)
turnover_dec	-0.177	-0.166	-0.215	-0.316**	-0.335**	-0.333**	-0.279*	-0.275*	-0.309**
	(0.160)	(0.158)	(0.158)	(0.151)	(0.150)	(0.150)	(0.158)	(0.157)	(0.156)
turnover_remain	-0.161	-0.161	-0.208	-0.363**	-0.372**	-0.383**	-0.271*	-0.270*	-0.301*
	(0.161)	(0.160)	(0.159)	(0.153)	(0.152)	(0.152)	(0.159)	(0.159)	(0.158)
"turnover_DK/NA"									
mat_cost_minimum	-0.101	-0.103	-0.085	-0.065	-0.071	-0.061	-0.004	-0.007	0.004
	(0.085)	(0.084)	(0.084)	(0.082)	(0.082)	(0.082)	(0.085)	(0.085)	(0.084)
mat_cost_high	-0.094	-0.084	-0.068	-0.061	-0.066	-0.050	-0.060	-0.058	-0.046
	(0.081)	(0.081)	(0.080)	(0.079)	(0.079)	(0.078)	(0.082)	(0.081)	(0.081)
mat_cost_other									
mat_trend_highinc	-0.064	-0.050	-0.048	-0.090	-0.088	-0.051	0.080	0.094	0.093
	(0.143)	(0.142)	(0.140)	(0.137)	(0.136)	(0.135)	(0.144)	(0.144)	(0.141)
mat_trend_inc	-0.110	-0.106	-0.089	-0.169	-0.172	-0.126	-0.037	-0.029	-0.015
	(0.140)	(0.139)	(0.137)	(0.134)	(0.133)	(0.132)	(0.141)	(0.141)	(0.139)
mat_trend_remain	-0.156	-0.157	-0.133	-0.256*	-0.255*	-0.221	-0.090	-0.079	-0.074
	(0.146)	(0.145)	(0.144)	(0.140)	(0.139)	(0.138)	(0.147)	(0.147)	(0.145)
mat_trend_dec	-0.149	-0.137	-0.119	-0.178	-0.177	-0.125	0.042	0.059	0.063
	(0.152)	(0.151)	(0.149)	(0.145)	(0.144)	(0.143)	(0.152)	(0.152)	(0.150)
mat_trend_other									
mat_future_inc	0.323**	0.306**	0.343***	-0.028	-0.028	-0.004	0.070	0.076	0.089
	(0.126)	(0.126)	(0.125)	(0.110)	(0.110)	(0.109)	(0.118)	(0.118)	(0.117)
mat_future_remain	0.294**	0.277*	0.293**	-0.153	-0.158	-0.139	-0.014	-0.011	-0.021
	(0.146)	(0.146)	(0.145)	(0.132)	(0.132)	(0.131)	(0.140)	(0.140)	(0.139)
mat_future_dec	0.714***	0.693***	0.757***	0.012	0.018	0.032	0.424**	0.439**	0.451**
	(0.212)	(0.210)	(0.209)	(0.209)	(0.208)	(0.207)	(0.206)	(0.205)	(0.205)
"mat_future_DK/NA"									
eco_investment_high	0.897***	0.899***	0.928***	1.167***	1.170***	1.197***	0.707***	0.703***	0.729***
	(0.108)	(0.107)	(0.107)	(0.108)	(0.107)	(0.107)	(0.110)	(0.109)	(0.109)
eco_investment_modhigh	0.775***	0.774***	0.793***	0.935***	0.942***	0.969***	0.603***	0.594***	0.642***
	(0.102)	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)	(0.104)	(0.104)	(0.103)
eco_investment_moderate	0.425***	0.436***	0.442***	0.743***	0.748***	0.775***	0.540***	0.541***	0.567***
	(0.092)	(0.091)	(0.091)	(0.091)	(0.090)	(0.090)	(0.093)	(0.093)	(0.092)
eco_investment_low	0.044	0.046	0.033	0.164*	0.175**	0.174*	0.092	0.091	0.095
	(0.091)	(0.090)	(0.090)	(0.090)	(0.089)	(0.089)	(0.093)	(0.092)	(0.092)
eco_investment_none	-0.452***	-0.457***	-0.487***	-0.392***	-0.388***	-0.392***	-0.329***	-0.330***	-0.343***
	(0.109)	(0.108)	(0.107)	(0.106)	(0.105)	(0.105)	(0.108)	(0.108)	(0.107)
eco_investment_other									
Constant	-1.430***	-1.381***	-1.101***	-0.777***	-0.733***	-0.575***	-1.226***	-1.230***	-0.919***
	(0.229)	(0.227)	(0.217)	(0.211)	(0.210)	(0.203)	(0.225)	(0.223)	(0.214)
Observations	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964
McFadden R^2	0,11607	0,10998	0,10143	0,14033	0,13647	0,13202	0,0945	0,08931	0,085
Log Likelihood	-2,379.271	-2,395.670	-2,418.699	-2,566.078	-2,577.608	-2,590.884	-2,387.622	-2,401.317	-2,416.321
Akaike Inf. Crit.	4,860.543	4,865.340	4,911.398	5,234.156	5,229.216	5,255.768	4,877.244	4,876.635	4,906.642

Note: Significance = * : p<0.1, ** : p<0.05, *** : p<0.01 *Source:* Authors' own table (derived fom Flash Eurobarometer survey 315)

Appendix 15 – Probit Regression for All-, No-, and Eco-Innovator

Probit Regression Model

	Dependent variable:								
	Eco-Innovator			All_Eco-Innovator			No_Eco-Innovator		
	Total	Drivers	Obstacles	Total	Drivers	Obstacles	Total	Drivers	Obstacles
tech_man_cap	0.061	0.066		0.143*	0.147*		-0.061	-0.066	
	(0.054)	(0.053)		(0.086)	(0.085)		(0.054)	(0.053)	
market_share	0.141**	0.156***		0.102	0.093		-0.141**	-0.156***	
	(0.055)	(0.055)		(0.089)	(0.087)		(0.055)	(0.055)	
material_price	0.069	0.077		0.094	0.099		-0.069	-0.077	
	(0.055)	(0.055)		(0.087)	(0.086)		(0.055)	(0.055)	
material_scarcity	-0.069	-0.071		0.180***	0.181***		0.069	0.071	
	(0.046)	(0.046)		(0.069)	(0.068)		(0.046)	(0.046)	
future_mat_scarcity	-0.036	-0.031		0.078	0.070		0.036	0.031	
	(0.048)	(0.048)		(0.073)	(0.071)		(0.048)	(0.048)	
coll_institutes	0.104**	0.110**		0.148**	0.198***		-0.104**	-0.110**	
	(0.046)	(0.043)		(0.067)	(0.063)		(0.046)	(0.043)	
ext_info_support	0.073	0.058		0.085	0.092		-0.073	-0.058	
	(0.054)	(0.054)		(0.086)	(0.084)		(0.054)	(0.054)	
business_partner	-0.042	-0.060		-0,0003	-0.021		0.042	0.060	
	(0.056)	(0.055)		(0.086)	(0.083)		(0.056)	(0.055)	
energy_price	0.084	0.100		0.096	0.102		-0.084	-0.100	
	(0.064)	(0.064)		(0.101)	(0.101)		(0.064)	(0.064)	
future_energy	0.033	0.048		-0.136	-0.117		-0.033	-0.048	
	(0.065)	(0.065)		(0.100)	(0.099)		(0.065)	(0.065)	
existing_regulations	0.126**	0.131***		0.015	0.023		-0.126**	-0.131***	
	(0.050)	(0.050)		(0.076)	(0.076)		(0.050)	(0.050)	
future_regulations	-0.131**	-0.122**		-0.004	-0.010		0.131**	0.122**	
	(0.051)	(0.051)		(0.078)	(0.077)		(0.051)	(0.051)	
subsidy_access	-0.098*	-0.054		-0.104	-0.077		0.098*	0.054	
	(0.053)	(0.051)		(0.080)	(0.076)		(0.053)	(0.051)	
green_demand	0.213***	0.216***		0.127*	0.133*		-0.213***	-0.216***	
	(0.047)	(0.047)		(0.074)	(0.073)		(0.047)	(0.047)	
lack_int_funds	-0.072		-0.075	-0.149**		-0.147**	0.072		0.075
	(0.048)		(0.048)	(0.070)		(0.069)	(0.048)		(0.048)
lack_ext_finance	-0.030		-0.014	0.085		0.108	0.030		0.014
	(0.047)		(0.047)	(0.069)		(0.068)	(0.047)		(0.047)
inv_uncertainty	0.093**		0.097**	-0.040		-0.041	-0.093**		-0.097**
	(0.047)		(0.046)	(0.068)		(0.067)	(0.047)		(0.046)
lack_labor_tech_cap	-0.004		0.006	0.041		0.061	0.004		-0.006
	(0.043)		(0.042)	(0.062)		(0.060)	(0.043)		(0.042)
no_ext_info_support	-0.125***		-0.109**	-0.052		-0.010	0.125***		0.109**
	(0.046)		(0.045)	(0.066)		(0.064)	(0.046)		(0.045)
lack_partners	-0.059		-0.053	0.012		0.039	0.059		0.053
	(0.045)		(0.045)	(0.065)		(0.063)	(0.045)		(0.045)
lack_coll	0,0004		0.059	0.152**		0.219***	-0,0004		-0.059
	(0.048)		(0.046)	(0.067)		(0.063)	(0.048)		(0.046)
uncertain_demand	0.052		0.076*	-0.015		0.002	-0.052		-0.076*
	(0.046)		(0.045)	(0.067)		(0.066)	(0.046)		(0.045)
no_material_prio	0.017		0.032	-0.047		-0.015	-0.017		-0.032
	(0.043)		(0.043)	(0.062)		(0.061)	(0.043)		(0.043)
no_energy_prio	0.047		0.068	0.163***		0.190***	-0.047		-0.068
	(0.043)		(0.043)	(0.063)		(0.062)	(0.043)		(0.043)
tech_lockin	0.072		0.082*	-0.041		-0.010	-0.072		-0.082*
	(0.044)		(0.044)	(0.064)		(0.063)	(0.044)		(0.044)
incumbent_domination	0.008		0.032	-0.121**		-0.089	-0.008		-0.032
	(0.043)		(0.042)	(0.061)		(0.060)	(0.043)		(0.042)
no_regulation_incentive	0.040		0.055	0.017		0.037	-0.040		-0.055
	(0.045)		(0.045)	(0.066)		(0.065)	(0.045)		(0.045)
limit_subsidy_access	0.140***		0.139***	0.119*		0.132*	-0.140***		-0.139***
	(0.048)		(0.046)	(0.071)		(0.068)	(0.048)		(0.046)
agriculture_fishing	0.053	0.071	0.065	-0.192	-0.201	-0.198	-0.053	-0.071	-0.065
	(0.100)	(0.100)	(0.099)	(0.139)	(0.138)	(0.136)	(0.100)	(0.100)	(0.099)
construction	0.023	0.030	0.010	-0.104	-0.096	-0.113	-0.023	-0.030	-0.010
	(0.082)	(0.082)	(0.082)	(0.113)	(0.112)	(0.111)	(0.082)	(0.082)	(0.082)
water_supply	0.064	0.067	0.051	-0.181	-0.180	-0.218	-0.064	-0.067	-0.051
	(0.129)	(0.129)	(0.128)	(0.179)	(0.177)	(0.176)	(0.129)	(0.129)	(0.128)

manufacture	0.111	0.119	0.099	-0.157	-0.151	-0.163	-0.111	-0.119	-0.099
	(0.079)	(0.079)	(0.078)	(0.108)	(0.107)	(0.106)	(0.079)	(0.079)	(0.078)
food_service									
"10-49"	-0.227***	-0.230***	-0.248***	-0.108*	-0.101	-0.134**	0.227***	0.230***	0.248***
	(0.048)	(0.047)	(0.047)	(0.065)	(0.065)	(0.064)	(0.048)	(0.047)	(0.047)
"50-249"									
turnover_inc	-0.077	-0.087	-0.091	-0.210	-0.209	-0.213	0.077	0.087	0.091
	(0.149)	(0.148)	(0.147)	(0.196)	(0.193)	(0.193)	(0.149)	(0.148)	(0.147)
turnover_dec	-0.330**	-0.334**	-0.359**	-0.323*	-0.329*	-0.356*	0.330**	0.334**	0.359**
	(0.148)	(0.147)	(0.147)	(0.196)	(0.193)	(0.193)	(0.148)	(0.147)	(0.147)
turnover_remain	-0.333**	-0.339**	-0.370**	-0.365*	-0.368*	-0.392**	0.333**	0.339**	0.370**
	(0.149)	(0.148)	(0.148)	(0.198)	(0.196)	(0.196)	(0.149)	(0.148)	(0.148)
"turnover_DK/NA"									
mat_cost_minimum	-0.028	-0.026	-0.015	-0.153	-0.166	-0.143	0.028	0.026	0.015
	(0.078)	(0.078)	(0.077)	(0.109)	(0.108)	(0.108)	(0.078)	(0.078)	(0.077)
mat_cost_high	-0.010	0.003	0.012	-0.167	-0.181*	-0.142	0.010	-0.003	-0.012
	(0.075)	(0.075)	(0.074)	(0.104)	(0.103)	(0.103)	(0.075)	(0.075)	(0.074)
mat_cost_other									
mat_trend_highinc	-0.005	-0.004	0.028	0.187	0.188	0.199	0.005	0.004	-0.028
	(0.133)	(0.133)	(0.131)	(0.189)	(0.188)	(0.185)	(0.133)	(0.133)	(0.131)
mat_trend_inc	-0.072	-0.073	-0.031	0.027	0.017	0.055	0.072	0.073	0.031
	(0.130)	(0.130)	(0.128)	(0.186)	(0.185)	(0.182)	(0.130)	(0.130)	(0.128)
mat_trend_remain	-0.101	-0.101	-0.062	-0.123	-0.127	-0.102	0.101	0.101	0.062
	(0.135)	(0.135)	(0.133)	(0.197)	(0.196)	(0.193)	(0.135)	(0.135)	(0.133)
mat_trend_dec	-0.083	-0.077	-0.034	0.033	0.027	0.068	0.083	0.077	0.034
	(0.140)	(0.140)	(0.138)	(0.202)	(0.201)	(0.197)	(0.140)	(0.140)	(0.138)
mat_trend_other									
mat_future_inc	0.149	0.155	0.165	0.114	0.109	0.130	-0.149	-0.155	-0.165
	(0.106)	(0.105)	(0.105)	(0.164)	(0.164)	(0.161)	(0.106)	(0.105)	(0.105)
mat_future_remain	0.054	0.054	0.055	0.052	0.045	0.042	-0.054	-0.054	-0.055
	(0.126)	(0.125)	(0.125)	(0.194)	(0.193)	(0.191)	(0.126)	(0.125)	(0.125)
mat_future_dec	0.483**	0.482**	0.500**	0.511*	0.518**	0.529**	-0.483**	-0.482**	-0.500**
	(0.198)	(0.197)	(0.196)	(0.264)	(0.262)	(0.259)	(0.198)	(0.197)	(0.196)
"mat_future_DK/NA"									
eco_investment_high	1.186***	1.194***	1.218***	0.847***	0.836***	0.875***	-1.186***	-1.194***	-1.218***
	(0.105)	(0.105)	(0.105)	(0.145)	(0.144)	(0.143)	(0.105)	(0.105)	(0.105)
eco_investment_modhigh	0.975***	0.987***	0.994***	0.728***	0.711***	0.793***	-0.975***	-0.987***	-0.994***
	(0.096)	(0.095)	(0.095)	(0.140)	(0.139)	(0.138)	(0.096)	(0.095)	(0.095)
eco_investment_moderate	0.750***	0.762***	0.767***	0.513***	0.505***	0.552***	-0.750***	-0.762***	-0.767***
	(0.082)	(0.082)	(0.081)	(0.131)	(0.130)	(0.129)	(0.082)	(0.082)	(0.081)
eco_investment_low	0.155*	0.170**	0.146*	0.051	0.040	0.071	-0.155*	-0.170**	-0.146*
	(0.080)	(0.079)	(0.079)	(0.133)	(0.132)	(0.131)	(0.080)	(0.079)	(0.079)
eco_investment_none	-0.472***	-0.466***	-0.493***	-0.357**	-0.376**	-0.357**	0.472***	0.466***	0.493***
	(0.092)	(0.091)	(0.091)	(0.167)	(0.166)	(0.164)	(0.092)	(0.091)	(0.091)
eco_investment_other									
Constant	-0.759***	-0.716***	-0.491**	-1.854***	-1.832***	-1.472***	0.759***	0.716***	0.491**
	(0.204)	(0.202)	(0.196)	(0.302)	(0.298)	(0.279)	(0.204)	(0.202)	(0.196)
Observations	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964	4,964
McFadden R2	0,1523	0,1475	0,1415	0,1258	0,1171	0,1079	0,1523	0,1475	0,1415
Log Likelihood	-2,884.344	-2,900.759	-2,921.347	-1,259.993	-1,272.618	-1,285.826	-2,884.344	-2,900.759	-2,921.347
Akaike Inf. Crit.	5,870.687	5,875.519	5,916.693	2,621.987	2,619.236	2,645.653	5,870.687	5,875.519	5,916.693

Note: Significance = * : p<0.1, ** : p<0.05, *** : *Source:* Authors' own table (derived from Flash Eurobarometer survey 315)

Appendix 16 – All_Eco-Innovator Questionnaire Script

Dear Participant,
thank you for contributing to the international study about "Drivers and Obstacles towards Eco-Innovation in the European Union" on behalf of Católica Lisbon University of Business & Economics, Portugal. This survey consists of several text response questions about drivers and obstacles of eco-innovation. The aim of this study is to clarify why currently observed phenomena occur and to find qualitative reasons for them.

IMPORTANT: This anonymous survey should be filled by individuals that have a leading or strategy-giving position within their organization or should be forwarded to such persons. It can be answered in your native language.

Your answers can be based on personal perceptions and should be honest. Furthermore, this study aims to expand the current scholarly literature about eco-innovations and thus, your help supports the further development of environmental-friendly innovations in the European Union.

Thank you very much!

For questions, information or access to the research results, please contact:

Contact: Mr. Christian Nover
Email: (blank)
Phone: (blank)

Q1) Background information: According to the Flash Eurobarometer Survey 315 (2011) of the European Commission, eco-innovation is defined as:

" ... the introduction of any new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle."

Please indicate if your company introduced the following eco-innovations during the past 24 months: (YES/NO/Don't know) 1)Product 2) Process 3) Method

Introduction to Drivers: The following section aims to investigate reasons for already observed drivers towards eco-innovation. You are kindly asked to briefly state your opinion on these impacting drivers and explain in consideration of your specific company why these drivers are (not) important in your case.
Explanation: Drivers define factors that have a positive/supportive influence on being eco-innovative.

Q2) Our study found out that **Technological and management capabilities within the enterprise** have a significantly driving impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this driver is (not) important in your case?

Q3) Our study found out that **Limited access to materials** has a significantly driving impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this driver is (not) important in your case?

Q4) Our study found out that **Collaboration with research institutes, agencies and universities** has a significantly driving impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this driver is (not) important in your case?

Q5) Our study found out that **Increasing market demand for green products** has a significantly driving impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this driver is (not) important in your case?

Q6) Could you think of any other **driving impacts** that influenced your company in the introduction of eco-innovations? (Multiple answers possible)

Introduction to Obstacles: The following section aims to investigate reasons for already observed obstacles/barriers towards eco-innovation. You are kindly asked to briefly state your opinion on these impacting obstacles and explain in consideration of your specific company why these obstacles are (not)

important in your case.
Explanation: Obstacles define factors that have a negative/hindering influence on being eco-innovative.

Q7) Our study found out that **Lack of collaboration with research institutes and universities** has a significant holdup impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this obstacle is (not) a serious problem in your case?

Q8) Our study found out that **Reducing energy is not an innovation priority** has a significant holdup impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this obstacle is (not) a serious problem in your case?

Q9) Our study found out that **Insufficient access to existing subsidies and fiscal incentives** has a significant holdup impact on being eco-innovative. Considering your company could you elaborate in a few sentences why this obstacle is (not) a serious problem in your case?

Q10) Our study found out that **Lack of funds within the company** has no significant impact on blocking eco-innovations. Considering your company could you elaborate in a few sentences why this obstacle is (not) serious in your case?

Q11) Our study found out that **Market dominated by established enterprises** has no significant impact on blocking eco-innovations. Considering your company could you elaborate in a few sentences why this obstacle is (not) serious in your case?

Q12) Could you think of any other **blocking impacts** that hinder your company in the introduction of eco-innovations? (Multiple answers possible)

Q13) Why did your company not introduce an eco-innovation?

Q14) Please name all obstacles that hindered you to eco-innovate or name drivers that would support you in the introduction of an eco-innovation.

Q15) Why don't you know if your company introduced an eco-innovation?

Q16) In which country is your company incorporated? (location of headquarter)

Q17) How many employees do you have in your company?

Q18) What is the main activity of your company?

Q19) What is the main activity of your company? (Indicate industry sector)

Q20) Please indicate the following factors for your company:
Did material costs (during the last 5 years) ... (increase(d)/decrease(d)/remain(ed)/Don't know)
Do you expect material prices (in the coming 5-10 years) to ... (increase(d)/decrease(d)/remain(ed)/Don't know)
Has your company's annual turnover ... (increase(d)/decrease(d)/remain(ed)/Don't know)

Q21) What percentage of your company's total cost - i.e. gross production value - is material cost?
Material cost is the cost of all materials used to manufacture a product or perform a service.

Q22) Over the last 5 years, what share of innovation investments in your company were related to eco-innovation?

Q23) Would you like to receive a final version of the research outcomes in January 2017? If yes, please insert your email address.

Source: Authors's own interview script

Appendix 17 – Interview Results

ID	Type	Variable	Alternative	Content	Mode	Country	Main_Activity	Firm_Size	Control Variable Data
1	Phone	uncertain_demand	uncertain_demand	People didn't want to share their own cars	Product	Netherlands	other	50-249	-
1	Phone	lack_partners	business_partner	Introduction of a two-sided quarantee that aimed trust of customers and security for financial risk with Insurance partner	Product	Netherlands	other	50-249	-
1	Phone	tech_man_cap	tech_man_cap	Improvement of technology and communication systems enable the company to easily set up an online platform where they can offer their service	Product	Netherlands	other	50-249	-
1	Phone	subsidy_access	subsidy_access	Won a funding competition which covered start-up costs	Product	Netherlands	other	50-249	-
1	Phone	business_partner	green_demand	Partnership with high reputation companies increase awareness of customers	Product	Netherlands	other	50-249	-
2	Phone	future_regulations	green_demand	Potential demand increase due to legislation worldwide towards energy & waste reduction	Product	Slovenia	other	50-249	-
2	Phone	green_demand	tech_man_cap	High international demand for complex technology solutions	Product	Slovenia	water_supply	50-249	-
2	Phone	lack_int_funds	lack_ext_finance	Development is very costly	Product	Slovenia	water_supply	50-249	-
2	Phone	lack_ext_finance	inv_uncertainty	Due to financial crisis, investors are much harder to find	Product	Slovenia	water_supply	50-249	-
2	Phone	lack_ext_finance	inv_uncertainty	Investments are risky and returns are long-term	Product	Slovenia	water_supply	50-249	-
3	Phone	existing_regulations	existing_regulations	Legislation in Denmark opened market for their product	Product	Denmark	water_supply	50-249	-
3	Phone	future_regulations	green_demand	They expect an expanding market due to future regulation, Denmark to whole Europa and maybe overseas	Product	Denmark	water_supply	50-249	-
3	Phone	subsidy_access	green_demand	There is a good initiative which provides funds for such kind of products and also clients could get financial support if they buy a car wash line	Product	Denmark	water_supply	50-249	-
3	Phone	no_regulation_incentive	no_regulation_incentive	regulations differ between municipalities, thus the product can't be marketed anywhere, only where regulations require low waste water regulations	Product	Denmark	water_supply	50-249	-
3	Phone	uncertain_demand	no_regulation_incentive	High development costs require the selling of huge amounts of washing lines, in municipalities without regulation requirements, customers can use cheaper non-ecofriendly substitutes	Product	Denmark	water_supply	50-249	-
3	Phone	lack_int_funds	lack_ext_finance	Due to high material and development costs much financial resources are needed	Product	Denmark	water_supply	50-249	-
3	Phone	no_regulation_incentive	lack_labor_tech_cap	High bureaucracy	Product	Denmark	water_supply	50-249	-
4	Phone	market_share	tech_man_cap	Creating new market for civil electro aviation, and thus having first mover advantage	Product	Slovenia	manufacture	50-249	-
4	Phone	tech_man_cap	tech_man_cap	In general, aviation sector lacks far behind the automotive sector. Company wants to change this and is first with high learning curve	Product	Slovenia	manufacture	50-249	-
4	Phone	no_regulation_incentive	no_ext_info_support	There is no existing aircraft certification for electric engines	Product	Slovenia	manufacture	50-249	-
4	Phone	uncertain_demand	tech_lockin	Aircraft customers are very conservative, they need to be convinced that new technologies are reliable and safe	Product	Slovenia	manufacture	50-249	-
4	Phone	uncertain_demand	uncertain_demand	Customers have to heavily convinced about the economical and environmental advantages	Product	Slovenia	manufacture	50-249	-
5	Phone	tech_man_cap	tech_man_cap	Recylcing plant is simple technology	Product + Process	Belgium	water_supply	10-49	-
5	Phone	tech_lockin	uncertain_demand	The plant is only usable in areas where it has enough space to be implemented and it only works for small/medium scale utilization	Product + Process	Belgium	water_supply	10-49	-
5	Phone	green_demand	green_demand	The plant is easy to transfer and can be sold overseas easily, bigger market demand	Product + Process	Belgium	water_supply	10-49	-
5	Phone	green_demand	green_demand	high fuel industry demand for the product	Product	Finland	other	10-49	-
5	Phone	material_price	green_demand	They have a really good price-cost level, which makes it a cheap solution and increases the demand	Product	Finland	other	10-49	-
									-

5	Phone	business_partner	green_demand	They established a great network of suppliers and customers, created their own market	Product	Finland	other	10-49	
5	Phone	lack_labor_tech_cap	lack_labor_tech_cap	large orders can't be supplied due to limited capacities. Thus, they have to outsource production for whole in one solutions	Product + Method	Finland	other	10-49	-
6	Phone	green_demand	green_demand	Increasing demand trend for sustainable, organic wine with good taste and quality	Product + Method	Cyprus	manufacture	10-49	-
6	Phone	material_price	material_price	Input costs are much lower compared to traditionally produced wine	Product + Method	Cyprus	manufacture	10-49	-
6	Phone	incumbent_domination	uncertain_demand	The market is dominated by traditionally produced wine, since centuries, thus its very difficult to break the strong bonds between manufacturers and consumers	Product + Method	Cyprus	manufacture	10-49	-
6	Phone	uncertain_demand	incumbent_domination	Especially in the beginning consumers had doubts about organic products	Product + Method	Cyprus	manufacture	10-49	-
7	Phone	green_demand	green_demand	Increasing acceptance regarding recycling	Product + Process	Bulgaria	water_supply	50-249	-
7	Phone	existing_regulations	existing_regulations	It is a huge support that people have to separate their waste	Product + Process	Bulgaria	water_supply	50-249	-
7	Phone	uncertain_demand	uncertain_demand	Still very low customer awareness about the recycling process	Product + Process	Bulgaria	water_supply	50-249	-
8	Phone	existing_regulations	energy_price	National regulations favor high prices of PV generated electricity, higher margin	Product	Slovenia	manufacture	50-249	-
8	Phone	tech_man_cap	tech_man_cap	Very good access to highly skilled engineers and marketing specialists	Product	Slovenia	manufacture	50-249	-
8	Phone	green_demand	green_demand	High international demand for highly reliable and durable Photovoltaik technology	Product	Slovenia	manufacture	50-249	-
8	Phone	lack_int_funds	lack_ext_finance	Very costly research and development of the product	Product	Slovenia	manufacture	50-249	-
8	Phone	lack_ext_finance	lack_int_funds	Extreme need for external investors due to high start-up and development costs	Product	Slovenia	manufacture	50-249	-
8	Phone	lack_labor_tech_cap	no_ext_info_support	Setting up product production was extremely difficult, because there was no knowledge capacity in the beginning and the automated process was a big challenge	Product	Slovenia	manufacture	50-249	-
9	Phone	coll_institutes	ext_info_support	Paris University provides external knowledge and equipment, which is not existing in the company for development	Product	France	manufacture	10-49	-
9	Phone	coll_institutes	ext_info_support	Madrid University makes scientific tests with the clean water project. The results can be used to advertise it.	Product	France	manufacture	10-49	-
9	Phone	market_share	market_share	It's the only product of the company and they have to create the market for it.	Product	France	manufacture	10-49	-
9	Phone	existing_regulations	market_share	There are regulations for water quality in France which requires certain sterilization limits, this opened the market	Product	France	manufacture	10-49	-
9	Phone	no_regulation_incentive	inv_uncertainty	Biocidal Product regulation is a huge challenge because meeting the requirements is very expensive for small companies	Product	France	manufacture	10-49	-
9	Phone	no_regulation_incentive	no_ext_info_support	Biocidal product regulation is very unclear and is developed while innovating the product	Product	France	manufacture	10-49	-
9	Phone	incumbent_domination	no_regulation_incentive	regulations are often only suitable for large companies	Product	France	manufacture	10-49	-
9	Phone	ext_info_support	business_partner	materials are precious metals and they found a good supplier who helps them to save materials	Product	France	manufacture	10-49	-
9	Phone	lack_int_funds	no_regulation_incentive	certification fees and taxes have to be paid, which is costly for small companies	Product	France	manufacture	10-49	-

10	Questionnaire	lack_ext_finance	lack_int_funds	Because we didn't get funded	No	Italy	manufacture	10-49	Turnover_Trend:remained/Material_Cost: 50% or more/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):increase/ Eco_Investment: Between 10% and 29%
11	Questionnaire	market_share	business_partner	Existing market share is an important factor for market success (it helps to be present already). But sufficiently disruptive technologies may be developed by new players. In these cases partnering with companies having important market share seems to be important.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	coll_institutes	ext_info_support	Yes and no. Many research and academic institutions are not geared towards real scale applications. Some do not have capabilities to do so, some do not feel drive to do so (being an academic is not (necessarily) being an engineer). Our area of interest (algae and algal based remediation technologies) is very open - we have not met a company or an academic organization not willing to share (almost) all information that they have. This may be an attribute of a (not yet) market applicable status or simply a consequence of a small community.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	existing_regulations	no_regulation_incentive	Regulations are of course important. In the biogas are where we are actively searching for customers regulation is essential for even market existence. This regulation (market subsidies) is very far from being EU synchronized - it varies wildly in different countries (and different times). Even the meaning of the word biogas itself is different between UK-Spain-Portugal, Germany-Austria-Italy, France, Sweden (I have defined the four main categories). Differences between EU, Australia, USA and China, India, ... are even more profound.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	green_demand	uncertain_demand	Market drivers and true eco-significant products are frequently different. For example Organic or Eco-certified food is a string market driver but completely irrelevant in the context of true Eco importance (it is non-sustainable, frequently counter productive, etc). Another examples are feed-in tariffs for PV and bio-power - they completely distort the market, but are important as a transition tool. It is important to surf on the market trends for bringing true ecological innovation and improvements to the market. It is hard and you face a lot of stupid competition surfing only on fashion and curretn trends, but it is an important driver and you have to use it.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	subsidy_access	limit_subsidy_access	Not exactly true, but frequently very close to truth. Subsidies (in case of biofuels, feed-in tarrifs and similar, not in case of agricutural subsidies) are a tool for quick turn of the market. They would have to be managed wisely, be transient and directed, but they are mostly not: this has resulted in distorted situations in some markets (a number of idling biofuels plants ot having proper substrate, wild changes in economic drivers in biogas (100 fold decrease in number of installations in a single year in Germany; huge initiatives in biogas in Italy driving all agriculture into energy production, etc). In short it is a powerful tool, has it influence, but it is not always used properly everywhere and all the time.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	material_price	no_energy_prio	Not true for the polymers market and energy rices. They are low and destimulate bioproducts. But of course we are all aware that this will not last forever.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	ext_info_support	ext_info_support	Of course. But as mentioned above "algal community" is (so far) extremely open and cooperative. Also the EU administration (at least DG energy, but it seems also that Eco-iinovation divicion of H2020) is driving the cooperation, doing things right, stimulating openness,etc.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than

									50%
11	Questionnaire	energy_price	no_energy_prio	Where do you see high energy prices?	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	future_regulations	no_regulation_incentive	Not true. At least in environmental regulation compliance to (future) emission limits is an important market driver. It turned out that the expectations in biofuels regulations were broken too many times to be credible anymore (2020 plans from 10 years ago and those from 5 years ago are almost void now). This has lowered the credibility of such expectations in future regulations.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	lack_coll	coll_institutes	We have absolutely no lack of cooperation with research institutes and universities. An opposite may even be true in some cases (mentioned before): research institutes and universities are focused to small lab and pilot scale projects and they are not geared (or interested) in full scale testing.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	no_energy_prio	energy_price	Yes, but reducing cost on the base of reducing energy has a significant impact and we see it as a market driver. Just being low energy is not enough, it has to be economically sound (on moderately long term).	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	limit_subsidy_access	limit_subsidy_access	Already describe in the biogas and bioenergy case before. It is a two way driver/holdup: would have to be much more precise to be truly effective.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	lack_labor_tech_cap	tech_man_cap	Human capital is of extreme importance, but it seems that so far plenty of interested and motivated people are still available. This may change with proliferation of eco-innovative solutions.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
11	Questionnaire	lack_ext_finance	inv_uncertainty	Eco-innovative technologies are much less sexy for (venture or equity) investment compared to IT and high tech bio-tech (basically medical and pharma). It seems that there are different rules, different style and different people that you have to talk to. We suspect that investment in this area is available, but up-to now we have not been successful in finding one.	Product + Process	Slovenia	water_supply	1-9	Turnover_Trend:increase/Material_Cost: Between 30% and 49%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):remained/ Eco_Investment: More than 50%
12	Questionnaire	lack_labor_tech_cap	lack_int_funds	Project was terminated at the mid-point project period. Internal problems with the product.	No	Denmark	other	1-9	Turnover_Trend:remained/Material_Cost: not applicable/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):Don't know/ Eco_Investment: Between 30% and 49%
13	Questionnaire	tech_lockin	tech_lockin	We are a consultancy company. Some of the companies that we work with find it difficult to change their processes for more efficient ones because they have to be requalified with their customers.	No	UK	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Less than 10%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: Between 30% and 49%
14	Questionnaire	lack_labor_tech_cap	tech_man_cap	We have no problems to find interested and qualified personnel.	Product	Germany	water_supply	10-49	Turnover_Trend:remained/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
14	Questionnaire	uncertain_demand	uncertain_demand	Lack of customer demand because potential users might have resentments against the product because it recycled rainwater for drinking. We have to	Product	Germany	water_supply	10-49	Turnover_Trend:remained/Material_Cost:Between 10% and 29%/ Material_Cost_Trend

				educate the consumers and create the market for our product before demand is sufficient.					(past):remained/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
14	Questionnaire	inv_uncertainty	uncertain_demand	Amortization of investment in our product should be lower than 10 years for private users (businesses 5 years).	Product	Germany	water_supply	10-49	Turnover_Trend:remained/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
14	Questionnaire	green_demand	no_regulation_incentive	No mass market product, so our target group are people who are willing to spend more money because they are eco freaks	Product	Germany	water_supply	10-49	Turnover_Trend:remained/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
15	Questionnaire	market_share	market_share	It gives the advantage to companies regarding competitiveness. On the other hand open new markets specially to SMEs.	Product	Spain	-	-	-
15	Questionnaire	coll_institutes	lack_labor_tech_cap	It is important because the research institutes give the know how and the support to the company to include the eco-innovation component in the products, services, etc.	Product	Spain	-	-	-
15	Questionnaire	existing_regulations	existing_regulations	The company has to follow them, so this is a crucial driver.	Product	Spain	-	-	-
15	Questionnaire	green_demand	green_demand	It is very important because our service is aligned with the sustainable issue.	Product	Spain	-	-	-
15	Questionnaire	subsidy_access	limit_subsidy_access	I think it is very important, as it limits the capacity of increasing the innovation in SMEs mainly. Is not the same for big companies, it may be not so important for this profile of companies.	Product	Spain	-	-	-
15	Questionnaire	green_demand	uncertain_demand	Raising awareness of the sector.	Product	Spain	-	-	-
15	Questionnaire	green_demand	green_demand	Marketing and dissemination.	Product	Spain	-	-	-
15	Questionnaire	business_partner	business_partner	Networking.	Product	Spain	-	-	-
16	Questionnaire	market_share	market_share	In our case, being ecoinnovative is what bring us a new market, so is being the way to expand. We started as a star up in 2009, all was focused to ecoinnovate, creating new process and products, so ecoinnovation is all our growth.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	coll_institutes	lack_int_funds	The core ideas for innovation don't come from those centers, in our case. The core work to develop the innovation, was not made by those centers, it was done by us. But they have been a good partner to find the grants, financing, etc.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	existing_regulations	no_regulation_incentive	Our clients are from different sectors. Some of this clients (urban waste treatment, for example) are very pushed by regulations, and more strict regulations push them more to us. In that case, regulations have a positive effect. In other sectors, like fertilizer distribution, regulations have a very small effect for the moment, compared to costs. In general, more estrict environmental regulations, and laws that encourages recycling, is better for our business.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	green_demand	no_regulation_incentive	This driver is extremely important to us, our core activity is based on that. But some sectors are more sensible than others when a new green product gets in the market. Regulation should help that the "non sensible sectors" become "sensible sectors".	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	subsidy_access	subsidy_access	It is very important to estimulate the market growth for a new green product, specially in non sensitive sectors, like fertilizer sector for example. But it should be a temporal incentive. Once that the green new product achieves a big production scale, normally the incentive would not be necesary any more.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	material_price	green_demand	It is also very important. From our point of view, a high material cost means that the new green product will be sold more expensive (for example, we collect and dry milk whey, that produces a powder that has a good price in animal feed market, but if we do the same with blood, price	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%

				of powder is lower), and that makes the production more viable. Then, easier to implant, or to find partners/investors etc.					
16	Questionnaire	ext_info_support	no_ext_info_support	In our case, we develop our own technology, so we don't use external technology support. In the other hand, real market information about prices, possible buyers for the final product ... is more critical and more difficult to find. That knowledge is a very important driver. And sometimes there is no information available at all, because the product we developed can be new. For example, if we develop a new fertilizer that we know is good, but there is no a similar product in the market, how can we show that it will have a market without a previous market record? That paradox happens many times.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	energy_price	energy_price	It is important in some sectors. In animal feed or fertilizer sector it is very important, because the products are produced at a big scale, in that conditions energy is a big % of the cost. In food ingredient sector, productions are smaller and higher added value, then energy is not so critical. But in general, the higher the energy cost, the more competitive we are, then this driver is important to us.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	future_regulations	future_regulations	In general, is not important to us, because the effect happens when the regulations happens.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	green_demand	green_demand	The fact of being a new drying technology (just the innovation, without considering eco aspects), also atracts attention to possible clients	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	lack_coll	coll_institutes	Without colaborating with them everything is more difficult, but in our experience, they have not been technologically helpfull in the end, they helped us more with other issues	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	no_energy_prio	energy_price	Depends on the sector of the client. Some of them priorize the energy saving that our drying system does, others priorize other aspects like product quality or flexibility	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	limit_subsidy_access	lack_ext_finance	That is a serious problem. If we did not have the ecoinnovation grant, that development would not happen. Most of SMEs, have great ideas, but can not develop them because they don't have the capacity with their own resources, and banks/investors don't like innovation in general because it's too risky.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	lack_labor_tech_cap	tech_man_cap	In our case, having the qualified personnel is been a key factor to succeed. We can say that it's been our own only advantage in many moments. The right skills and actitude is been more important than a good management plan or financing, in many moments.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	lack_int_funds	subsidy_access	Without the grants, in our case, it would have been impossible to succeed.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
16	Questionnaire	uncertain_demand	uncertain_demand	The "market barriers" is another key factor. When you develop something that is "better and greener" than other existing products in the market, it does not mean that the market will automatically buy it. We have seen that "the need" does not create allways "the demand", normally because change takes time. That time is also difficult to endure for many ecoinnovative SMEs.	Product + Process	Spain	manufacture	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
17	Questionnaire	market_share		I cannot understant the question	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't

									know/ Eco_Investment: Less than 10%
17	Questionnaire	coll_institutes	coll_institutes	The collaboration is fundamental to understand the technical aspects related to the use of an innovative product with different characteristis from the ones already existing in the market	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	existing_regulations	existing_regulations	Very important. Existing regulations (and bans in our case) could have a good impact for the marketing of our product	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	green_demand	green_demand	Yes, very important. There is a clear movement of the market to go towards eco innovative plasticizers for PVC	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	subsidy_access	limit_subsidy_access	Fiscal incentives (to use eco innovative products) could have a significant impact on our products	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	lack_coll	lack_int_funds	In my experience, and due to the fact that we are a very small company without the possibility to engage internal staff with high educational degree, the collaboration with R&D center is fundamental to innovate our process/products	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	no_energy_prio	energy_price	energy is a very relevant cost in Italy for our type of industries.	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	limit_subsidy_access	subsidy_access	fiscal incentives could help to better market ecoinnovative products	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
17	Questionnaire	lack_labor_tech_cap	ext_info_support	No significant impact I agree. We use open innovation.	Product	Italy	manufacture	1-9	Turnover_Trend:increase/Material_Cost:Between 10% and 29%/ Material_Cost_Trend (past):increase/Material_Cost_Trend (future):Don't know/ Eco_Investment: Less than 10%
18	Questionnaire	coll_institutes	lack_coll	Not important because the process are very slow. Money needed to such collaborations can be invested into "in house" research	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	existing_regulations	uncertain_demand	Regarding B2C business this is not relevant because customers do not understand labels and standards. They think it is bullshit	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	green_demand	uncertain_demand	"Increase market demand" only depend on the willingness of customers. And from now they still do not understand what is a real green product. Indeed automatically, the bigger is the market the more the company grow.	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	material_price	no_material_prio	Not true yet for most of everyday life goods. Still difficult to feel that with b2c business	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	ext_info_support	no_ext_info_support	Yes could improve the comprehension but still a long way	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	energy_price	no_energy_prio	In France for example they are still low.	Process +	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend

					Method				(past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	future_regulations	no_regulation_incentive	I'm the contrary, I think that if the gouvernent would tax for example clothes made in china, it wouldn't have a significant role for us	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	material_scarcity	material_scarcity	Not true yet for us	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
18	Questionnaire	tech_man_cap	tech_man_cap	Team motivation and willingness to change things	Process + Method	Belgium	other	10-49	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
19	Questionnaire	market_share	no_regulation_incentive	Our eco-innovative targeted the construction sector, where the fact of being eco-innovative is interesting, but is a sector basically driven by price, highly competitive.	Product	Spain	other	250 or more	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):remained/Material_Cost_Trend (future):increase/ Eco_Investment: More than 50%
19	Questionnaire	coll_institutes	coll_institutes	In our case the product came from a patent for two universities and represents a clear example of knowledge transfer from research to market.	Product	Spain	other	250 or more	-
19	Questionnaire	existing_regulations	no_regulation_incentive	Some countries (e.g. Italy) are promoting legislations to increase the use of eco-innovative products that might allow to ease market uptake.	Product	Spain	other	250 or more	-
19	Questionnaire	green_demand	green_demand	I believe prescribing and asking for the introduction of green products indeed drives the investment on eco-innovative products.	Product	Spain	other	250 or more	-
19	Questionnaire	green_demand	green_demand	Society demanding green products and more aware of climate change and sustainability.	Product	Spain	other	250 or more	-
19	Questionnaire	lack_coll	coll_institutes	Collaboration with universities and technological centres help the companies to transfer the knowledge and be more competitive.	Product	Spain	other	250 or more	-
19	Questionnaire	lack_labor_tech_cap		I believe it might not be a huge block if the company is open to collaborate with other institutions that indeed have these qualified personnel and technological capabilities. Although the final goal is help these companies to acquire these competences.	Product	Spain	other	250 or more	-
20	Questionnaire	market_share	existing_regulations	It is all depending on the market and you can't generalize it as being one single parameter that drive the process. In our case working with chemicals, we can see that the legislation and the regulatory process is the driving force, not the market per se.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	coll_institutes	lack_coll	It is good for research but hopeless for development. The idea and management of development is not feasible in an academic setting. You have to have professionals to work with that can help you, either CROs or customers.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	existing_regulations	no_regulation_incentive	It is the overall important factor, but not to the better. Dealing with chemicals, the regulatory system in Europe is about to kill all innovation in the area. The market is too small to bear the regulatory burden. It is interesting since we truly need new and better chemicals instead of relying of old less adapted ones.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	green_demand	existing_regulations	As above, the regulatory system is the one driver with major impact.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	subsidy_access	subsidy_access	It certainly is if you are beyond the research state. I have no idea why it shouldn't be important if you want to commercilise your product. If only thinking about research, then it doesn´t matter.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend

									(future):decreased/ Eco_Investment: More than 50%
20	Questionnaire			Better efficacy	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire			Price compability	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	existing_regulations	existing_regulations	Regulatory approval	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	lack_coll	existing_regulations	No - this is not an obstacle for us. Rather on the contrary, we try to avoid collaborating with universities since you don't own the data and they don't have a quality up to the standards that is needed, especially not regulatory demands.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	no_energy_prio	energy_price	It is all about reducing energy in our case. That is a better efficacy and we sell because we will reduce energy consumption among our customers.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	limit_subsidy_access	lack_int_funds	Yes - the time flies without money alternatives and eat up the potential in the innovation.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	lack_labor_tech_cap	tech_man_cap	We are all Ph.Ds and act in a multidisciplinary setting and we are able to adapt and learn. No problem.	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	no_regulation_incentive	no_regulation_incentive	Regulatory system	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	lack_int_funds		Lack of finance	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
20	Questionnaire	lack_ext_finance	inv_uncertainty	Lack of finance	Product	Sweden	other	1-9	Turnover_Trend:increase/Material_Cost:50% or more/ Material_Cost_Trend (past):decreased/Material_Cost_Trend (future):decreased/ Eco_Investment: More than 50%
21	Questionnaire	coll_institutes	lack_coll	This is a driver, however universities and research institutes do not always move at the same pace as commercial organisations. The expertise and facilities are there but not always when it suits for commercially driven	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/

				research.					Eco_Investment: More than 50%
21	Questionnaire	green_demand	green_demand	yes this is hugely important- we are producing ingredients that will be going into the food and cosmetics industries and thankfully those industries are becoming more focused on greening their supply chain.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	material_price	energy_price	yes this is important, but probably more important is increasing costs to dispose of/transport/treat co-products/effluent streams. Eco Innovations that can turn a cost into a value stream (or at least reduce the cost) are thus attractive to companies.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	ext_info_support	ext_info_support	Yes absolutely- we are a consultancy business and our clients couldn't have delivered major environmental savings over the last number of years without our inputs.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	energy_price	material_price	Definitely and I would include water in that also. However the current Energy price is not as high as it has been in the past so probably less focus than previously on this. Sensible companies continuously manage all of their input costs, not just when price spikes.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	future_regulations	green_demand	I think the biggest impact is market driven ones e.g. companies requiring higher environmental standards of their suppliers, and sustainability changes being required in order to access marketing supports. (Origin Green in Ireland is an example of this)	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire			we had being coming up with good ideas for our clients, not all of them being implemented for various reasons. Our particular eco-innovation is something we have worked on in the background for many years.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	no_energy_prio	energy_price	reducing energy is an innovation priority in our experience	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	lack_int_funds	lack_int_funds	This does have an impact on implementing eco-innovations, in particular where we have to put time and money into proving concepts.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	lack_labor_tech_cap	lack_labor_tech_cap	lack of enthusiasm internally in SME to co-fund eco-innovation without seeing results out the other end.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
21	Questionnaire	lack_ext_finance	limit_subsidy_access	Huge Difficulty in getting financial institutions to issue Bond for drawdown of EU funding for eco-innovation.	Process	Ireland	other	10-49	Turnover_Trend:remained/Material_Cost:Not applicable/ Material_Cost_Trend (past):Don't know/Material_Cost_Trend (future):Don't know/ Eco_Investment: More than 50%
22	Questionnaire	market_share	market_share	This is an important driver for our company. Indeed, eco-innovation allows the company to gain market share by proposing solutions that are differentiated on the market.	Product + Process	N.A.	-	-	-
22	Questionnaire	coll_institutes	coll_institutes	Collaboration with research institutes, agencies and universities provides vital resources for developing eco-innovative products and technologies and thereby provides essential resources that our company does not posses internally.	Product + Process	N.A.	-	-	-
22	Questionnaire	existing_regulations	existing_regulations	Eco-innovation allows our company to develop solutions to the market for complying with regulations.	Product + Process	N.A.	-	-	-
22	Questionnaire	green_demand	existing_regulations	Market demand for green products as such is not a sufficient driver for eco-innovation because the product must also meet other needs of the market. Demand for green products is not a sufficient reason achieving commercial success on the market.	Product + Process	N.A.	-	-	-

22	Questionnaire	subsidy_access	subsidy_access	Fiscal incentives and subsidies do impact the eco-innovation of our company, by providing us with extra financial resources needed for this.	Product + Process	N.A.	-	-	-
22	Questionnaire	no_material_prio	green_demand	For our company, reducing consumption of materials and associated costs has not been a driver for our company, because that is not seen as a pressing need in the markets we are targeting.	Product + Process	N.A.	-	-	-
22	Questionnaire	ext_info_support	lack_labor_tech_cap	Access to external information provides vital resources for developing eco-innovative products and technologies and thereby provides essential resources that our company does not posses internally.	Product + Process	N.A.	-	-	-
22	Questionnaire	energy_price	green_demand	For our company, reducing consumption of energy and associated costs has not been a driver for our company, because that is not seen as a pressing need in the markets we are targeting.	Product + Process	N.A.	-	-	-
22	Questionnaire	future_regulations	no_regulation_incentive	Expected future regulations are not a driver for eco-innovation at our company, because the company does not attempt to anticipate future regulations and their potential impact on market demand.	Product + Process	N.A.	-	-	-

Source: Authors's own interview records