Master Thesis: MSc Strategy Economics

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Drivers and Barriers of Corporate Sustainability Practices

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Executive Summary

This research studies the internal and external drivers and barriers of corporate sustainability practices from a stakeholder theory perspective. Based on cross-sectional data from the Flash Eurobarometer study 486, multilevel (ordered) logistic regression models for engagement in sustainable processing and commitment to sustainable product development were estimated. The research findings indicate that companies with high access to external knowledge sources are likelier to engage in sustainability-enhancing activities than other companies. Furthermore, a positive relationship between firm internationalization and corporate sustainability practices was revealed. The findings also show that more stringent intellectual property rights motivate firms to create sustainable products. However, the estimated effect for the IPR variable significantly differs among product types. Besides, this research presents that stricter environmental regulations pressure corporations to implement additional sustainable processing measures. Moreover, a positive relationship between firm size and enterprises' engagement in corporate sustainability practices is found. Lastly, this research demonstrates that a lack of managerial awareness and willingness to overcome sustainability-related problems negatively affects companies' commitment to sustainable business practices.

Key Words: Corporate sustainability practices; Sustainable product development; Sustainable processing

Table of Contents

1. Introduction

Globalization, economic growth, and the continuous increase in the world population have led to the pollution and depletion of existing natural resources, such as water, air, and rare minerals (Dean & McMullen, 2007; United Nations, 2022). At the same time, rising wealth inequality (Piketty, 2017) and increasing demand for social justice (United Nations, 2020) have been observed. Over the last decade, individuals, governments, and other organizations have become increasingly aware of these sustainability-related issues (Artiach et al., 2010). As a result, worldwide authorities have implemented policy measures to promote sustainable behavior. (United Nations, 2022)

Since companies directly affect the environment and society through their strategic decisions, many studies have examined different stakeholders' effects on sustainable innovations (Ayuso et al., 2011; Ketata et al., 2015). In addition, excessive research on the factors affecting corporate social responsibility has been conducted (Dartey-Baah & Amoako, 2021; Laudal, 2011). However, in contrast to these two prominent research streams, this thesis focuses on companies' engagement in corporate sustainability practices, a topic that has obtained limited attention in past research (Gupta et al., 2015; Rahimifard et al., 2009; Vimalnath et al., 2022). More specifically, two sustainable business practices are considered: sustainable product development and sustainable processing. Hence, this thesis aims to answer the following research question: *What are the internal and external drivers of corporate sustainability practices?*

In line with previous academic articles, this research employs stakeholder theory to formulate reasonable hypotheses about the effect different stakeholders have on companies' engagement in corporate sustainability practices (Ayuso et al., 2011; Hoogendoorn et al., 2015). Besides, to test these hypotheses, this research estimates multilevel (ordered) logistic regression models based on data from the Flash Eurobarometer survey 486 of the European Commission (2020b).

From an academic perspective, this research helps fill the lack in corporate sustainability practices literature. Furthermore, this study simultaneously investigates the effect of firm-level and country-level variables on firms' engagement in sustainability activities by developing multilevel regression models, an approach only a few papers have previously followed (Hoogendoorn et al., 2015). This research considers the following five firm-level: access to external knowledge sources, customer demand for sustainability, firm internationalization, firm size, and managerial

willingness to solve sustainability-related issues. In addition, two country-level variables, namely the stringency of a country's environmental regulations and the strictness of its intellectual property rights, are incorporated in the model. From a societal point of view, the results of this research will enable governments to make more profound policy choices. Additionally, the findings can provide valuable insights for developing future sustainability support programs that encourage businesses to commit to sustainable business practices.

To adequately answer the proposed research question, Section 2, the literature review, provides an overview of the critical concepts linked to corporate sustainability practices. Furthermore, it outlines the fundamental principles of stakeholder theory and describes how different actors influence firms' engagement in sustainability activities. Based on this knowledge, the hypotheses are developed. Next, Section 3 reveals crucial information about the data set, and Section 4 explains the meaning of each distinct variable. After that, Section 5 shows how the multilevel (ordered) logistic regression models have been derived. Besides, Section 6 presents the estimated models, followed by robustness checks in Sections 7 and 8. Lastly, a detailed discussion of the research findings is delivered in Section 9, while Section 10 highlights potential limitations.

2. Literature Review

2.1. Framing the Research Field

2.1.1. Sustainable Development

Worldwide, the idea that a drastic transformation is required to decrease harmful environmental and societal effects resulting from unsustainable business practices has become widespread (Hall et al., 2010). Hence, during the past 20 years, extensive research in sustainability has been conducted to understand the drivers and barriers to sustainable development (Komiyama & Takeuchi, 2006; Purvis et al., 2018). However, even though the number of sustainability-related publications tremendously increased over time, no consensus on the meaning of sustainable development emerged (Holden et al., 2014). Nevertheless, many academics rely on the definition of the World Commission on Environment and Development (WCED) (Howarth, 1997). According to the WCED (1987), sustainable development can be described as progress that "meets the needs of current generations without compromising on the ability of future generations to meet their own needs" (p.37). To accomplish sustainable development, managers, investors, and

consultants increasingly direct their efforts toward the Triple Bottom Line (TBL) concept, a valuable measure of sustainability (Norman & MacDonald, 2004). Generally, the TBL framework emphasizes that companies must consider economic, environmental, and social problems during their decision-making process. Hence, while the traditional perspective proposes that a firm's financial performance defines its success, the TBL model states that a corporation's long-run performance will be determined by its ability to simultaneously commit to social justice, economic growth, and environmental quality. (Elkington, 1999; Gimenez et al., 2012; Norman & MacDonald, 2004) Instead of the TBL concept, previous literature often also refers to the Triple P-model, which measures sustainable development in terms of people, planet, and profit (Kleindorfer et al., 2009; Larivière & Smit, 2022). However, even though the names of the two concepts differ, they essentially communicate the same idea (Kleindorfer et al., 2009).

2.1.2. Corporate Social Responsibility and Corporate Sustainability

Even though the terms corporate social responsibility (CSR) and corporate sustainability (CS) are often interchangeably employed throughout the academic literature, a clear distinction between these two concepts exists and should be maintained to avoid confusion among researchers (Bansal & Song, 2017; Montiel, 2008). Over the years, many researchers have attempted to define CSR (Montiel, 2008). In essence, CSR can be described as actions taken by a firm that exceed legal and technical requirements to promote a social cause (McWilliams & Siegel, 2001). Hence, these activities are associated with a proactive approach (Hoogendoorn et al., 2015). In contrast, CS also comprises a firm's activities that are merely performed to ensure compliance with regulations, also called a reactive approach (Bansal, 2005; Buysse & Verbeke, 2003; Hoogendoorn et al., 2015; Leisinger, 2007). Thus, CSR, meaning voluntary steps taken to support sustainable development, is an essential component of CS.

2.1.3. Sustainable Innovations and Corporate Sustainability Practices

It is also crucial to distinguish between sustainable innovations and corporate sustainability practices (CSP). According to the existing academic literature, sustainable entrepreneurs develop innovations to substitute unsustainable business actions with processes and products that do not cause damage to society or the environment (Lüdeke-Freund, 2019; Young & Tilley, 2006). In this way, sustainable innovations help overcome market imperfections, such as resource inefficiencies,

negative externalities, and imperfect information, which are the key reason for environmental degradation and adverse societal effects (Cohen & Winn, 2007; Dean & McMullen, 2007). In contrast to sustainable entrepreneurship, corporate sustainability practices, also called sustainable business practices, describe *all* firm actions that intend to decrease a company's operational impact on the environment and society (Dunphy et al., 2003; Linnenluecke et al., 2009). Hence, based on the logic of Hoogendoorn, Guerra, and van der Zwan (2015), this definition comprises creating *new* products but also designing *existing* articles more sustainable. Besides, common process-related examples of corporate sustainability practices are minimizing pollution, water consumption, and waste, as well as improving working conditions, and developing new technologies (Dunphy et al., 2003; Linnenluecke et al.,2009; Russell et al., 2006). While some of these sustainability measures are voluntarily implemented by firms, other corporate sustainability actions might be legally forced (Hoogendoorn et al., 2015; Leisinger, 2007; Russell et al., 2006).

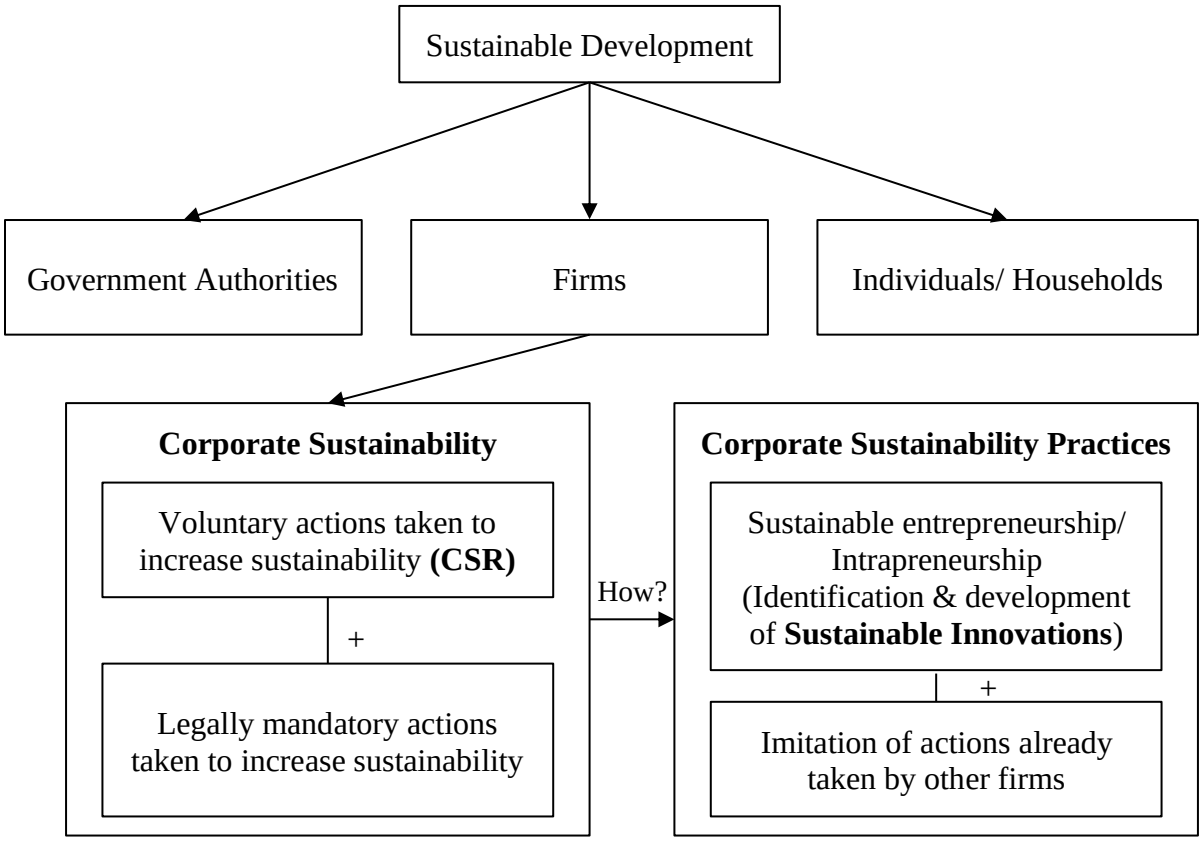

Figure 1: Theoretical Framework

Note: The author of this thesis created this figure based on information obtained from the articles mentioned in Section 2.1. The figure illustrates the interconnection between the different terminologies.

To conclude, this research focuses on corporate sustainability practices. Accordingly, this incorporates all actions a business undertakes to improve sustainability, regardless of whether they are legally compulsory or voluntary, and whether they comprise new innovative measures or the adoption of existing steps. The primary motivation for investigating corporate sustainability practices instead of CSR is that legal sustainability requirements differ across countries, suggesting that an analysis of cross-country CSR activities is not advisable (Hoogendoorn et al., 2015). The following section will analyze corporate sustainability practices from the stakeholder theory perspective.

2.2. Stakeholder Theory

Many economic theories solely focus on the relationship between companies and their customers, meaning the endeavor of businesses to create customer value in exchange for economic rewards (Freudenreich et al., 2020). Conversely, stakeholder theory also examines a firm's relationships with other stakeholders. In other words, stakeholder theory assumes that a company is characterized by relationships with different individuals and parties, which influence or are influenced by the corporation's achievements. (Freeman, 1984; Freeman, 2010; Freudenreich et al., 2020) These stakeholders can be categorized in two ways. First, one can distinguish between internal and external stakeholders (Freudenreich et al., 2020; Marques et al., 2019). Commonly, the groups that are not directly part of a company but are impacted by its actions are, by definition, external stakeholders. For example, customers, suppliers, creditors, competitors, society, and the government can be classified as external stakeholders. On the other hand, internal stakeholders represent people actively engaged in a corporation's work or who own a portion of its shares. Thus, employees, managers, and investors belong to this stakeholder group. (Marques et al., 2019). Instead of differentiating between internal and external stakeholders, one can also classify parties based on whether they are primary or secondary stakeholders (Buysse & Verbeke, 2003; Clarkson, 1995; Goodman et al., 2017; Hoogendoorn et al., 2015). Generally, primary stakeholders, such as employees and customers, are individuals and organizations whose ongoing engagement with the firm is crucial for the corporation's survival and long-term growth (Clarkson, 1995). The opposite applies to secondary stakeholder groups, which do not influence a business's survival but can tremendously damage the firm. Examples of secondary stakeholders are non-governmental

organizations (NGOs), the media, and academic institutions (Clarkson, 1995; Goodman et al., 2017). Figure 2 illustrates the stakeholder groups to which particular players belong in detail.

Over the past years, stakeholder theory has been frequently employed to explain why companies participate in sustainable business practices (Clarkson, 1995; Montiel & Delgado-Caballos, 2014; Schaltegger et al., 2019; Sharma & Henriques, 2005). According to stakeholder theory, a company participates in a mutual value exchange with each of its stakeholders. (Freeman, 2010; Freudenreich et al., 2020) Consequently, the firm's key objective is to maximize the overall value created for its stakeholders (Freeman, 2010). It is crucial to note that value, an outcome satisfying a stakeholder's needs, can comprise different things for the various actors (Freudenreich et al., 2020). Since the different players interacting with a company have competing interests, a business must strategically evaluate the consequences of its actions (Clarkson, 1995; Freudenreich et al., 2020). If the value created by a firm is not mutually advantageous for all stakeholders, it risks to loos its operational legitimacy (Freudenreich et al., 2020; Freeman, 2010). Hence, based on stakeholder theory, companies must incorporate stakeholders' attitudes toward environmentally friendly and socially-acceptable outcomes in their value-creation process, potentially driving them to engage in sustainable activities (Clarkson, 1995; Freudenreich et al., 2020; Hoogendoorn et al., 2015; Schaltegger et al., 2019).

Categorization	Internal	External
Primary	• Managers • Employees • Shareholders	• Customers • Suppliers • Creditors/ Financial institutions • Government
Secondary		• Competitors • Research institutions/ Academic institutions • Business support groups • Advanced producer services • Media • NGOs • Society

Figure 2: Stakeholder overview

Note: The author of this thesis created this figure based on information obtained from Buysse and Verbeke (2003), Clarkson (1995), Goodman et al. (2017), and Hoogendoorn et al. (2015). This research primarily focuses on the underlined stakeholders.

Under the insights of stakeholder theory, the following section discusses how the different stakeholder pressures and resources impact whether a company commits to sustainable business practices.

2.3. Access to External Knowledge

Due to increased global competition, rapid technological progress, and fast-changing consumer preferences, companies are under constant pressure to increase the efficiency of their business operations and create new innovative products. In order to explore unique opportunities and gain insights that exceed the firm's research and development (R&D) capacities, corporations often rely on external knowledge sourcing. (Foss et al., 2013) By definition, external organizational knowledge transfers represent the process through which companies trade or receive information and knowledge from other firms and institutions. (Van Wijk et al., 2008)

Generally, existing economic theories distinguish between two knowledge classes, namely tacit and explicit knowledge (Johnson, 2007). Explicit knowledge refers to information a person can easily communicate through verbal statements or written documents, such as academic papers, manuals, or patents. (Johnson, 2007; Smith, 2001). The second type of knowledge, tacit knowledge, centers around an idea initially developed by Michael Polanyi (Gascoigne & Thornton, 2014), which emphasized that "we know more than we can tell" (Polanyi & Sen, 2009, p.4), implying that this type of knowledge cannot be expressed in the form of words and symbols (Johnson, 2007). Hence, tacit knowledge, also known as implicit knowledge, can be defined as procedural knowledge gained through pattern recognition over time (Johnson, 2007; Watson, 2006). Consequently, passing on tacit knowledge is rather challenging and, thus, requires direct personal interactions between the knowledge provider and the recipient (Goffin & Koners, 2011). Through conscious observation of the movements and actions taken by an expert, the knowledge receiver can learn about the procedural steps. Additionally, by mimicking the knowledge provider's behavior, the recipient can consolidate the newly gained knowledge. (Goffin & Koners, 2011; Johnson, 2007) Examples of tacit knowledge are understanding how to ride a bike or operating a complex technology (Gascoigne & Thornton, 2014).

In practice, companies can receive explicit and tacit knowledge from various actors, such as academic institutions, suppliers, customers, public agencies, and support organizations (Foss et al., 2013). Instead of analyzing the impact of each distinct external knowledge source on corporate

sustainability practices, this research focuses on the effectiveness of different knowledge transfer channels, such as industry clusters and formal collaborations.

Industry clusters represent geographic concentrations of sector-linked companies and organizations with comparable knowledge, skills, and technologies (Easterby-Smith et al., 2008; Enright & Roberts, 2001). As suggested by Easterby-Smith, Lyles, and Tsang (2008), industry clusters encourage the formation of social networks among employees from different businesses, which fosters the exchange of company-specific information. In line with the previously mentioned findings, research performed by Dahl and Pedersen (2004) reveals that engineers from different cooperations exchange valuable knowledge via informal contacts. Consequently, industry clusters help firms familiarise themselves with industry-specific standards and increase their understanding of competitors' products and manufacturing processes (Foss et al., 2013). This knowledge instantly simplifies identifying and exploiting new opportunities, which improves the company's market position in the long run (Dahl & Pedersen, 2004; Foss et al., 2013).

Next to industry clusters, knowledge is also shared via *external collaborations* with companies not necessarily located in geographic proximity. For instance, Foss, Lyngsie, and Zahra (2013) demonstrate that cooperating with technical service providers, consulting companies, and other institutions can be beneficial for overcoming bottlenecks, identifying strategic advantages, and conducting forecasts. Additionally, knowledge can be obtained from universities in the form of publications, recruitment of students, collaborative research, informal gatherings, and conferences (Agrawal, 2001; D'Este & Patel, 2007; Geuna & Muscio, 2009).

While external knowledge sourcing is, in general, essential for developing new processing techniques and products, it is especially critical for implementing corporate sustainability practices. Dangelico, Pontrandolfo, and Pujari (2013) argue that businesses do not have sufficient internal knowledge and capabilities to deal with complex environmental issues independently. This theory is supported by their empirical findings, which indicate that external knowledge positively affects firms' green manufacturing activities. Moreover, the authors reveal that formal cooperation with supply chain actors positively influences the development of environmental-friendly products. Besides, research by Seuring and Müller (2008) illustrates that collaborations along the supply chain secure the supply of green input materials. Furthermore, the study of Cainelli, De Marchi, and Grandinetti (2015) verifies that developing environmental innovations requires more external relationships than creating other innovations. Lastly, prior research has also

shown that external knowledge, such as legal advice, is fundamental to ensuring compliance with ethical standards and cultural norms, such as human rights (Guadamillas-Gómez & Donate-Manzanares, 2011). Hence, given the previous research results, the following hypotheses will be analyzed:

Hypothesis 1a: Access to external knowledge is positively related to companies' engagement in sustainable product development.

Hypothesis 1b: Access to external knowledge is positively related to companies' engagement in sustainable processing.

2.4. Demand

2.4.1. Customer Preferences

Firms' primary objective is to understand and satisfy the needs of their customers. However, in practice, it can be quite challenging for businesses to keep up with customers' rapidly changing preferences, creating uncertainty regarding a product's success (Chong & Chen, 2010). Due to the growing awareness of environmental deterioration's gravity, consumers have shown an increased interest in sustainable products and processes over the past years (Dagher & Itani, 2014; Pullman & Sauter, 2012; Sharma, 2021). Today, customers not only require transparency regarding firms' environmental impact but also in terms of product safety, ethical standards, and employee well-being. (Pullman & Sauter, 2012).

Previous research shows that customer requirements are the main driver for firms to incorporate recycled materials in their manufacturing processes and acquire sustainability certifications (González-Benito & González-Benito, 2006). Besides, several papers report that companies design sustainable supply chains out of fear that unsustainable business practices could be disclosed to the public, potentially resulting in a boycott of the firms' products (Seuring & Müller, 2008; Rebs et al., 2018). In addition, research performed by Shafiq, Ahmed, and Mahmoodi (2020) reveals a positive relationship between customer pressure for ethical conduct and a company's transparency concerning its supply chain operations. The authors also find a positive, statistically significant relationship between consumer pressure for ethical behavior and

engagement in employee-focused social practices. Thus, based on these research findings, the following hypotheses were formulated:

Hypothesis 2a: Consumer demand for sustainable firm behavior is positively related to companies' engagement in sustainable product development.

Hypothesis 2b: Consumer demand for sustainable firm behavior is positively related to companies' engagement in sustainable processing.

2.4.2. Firm Internationalization

Firm internationalization describes a company's "expansion beyond its domestic market into other regions or countries" (Kang, 2013, p.101). Hojnik, Ruzzier, and Manolova (2018) established that internationalization can considerably affect a firm's performance. For instance, the researchers emphasize that international companies generate higher revenues and benefit from improved operational efficiency. Moreover, past research has indicated that internationalization is positively correlated to firm size with regard to the number of markets a corporation entered (Svetličič et al., 2007). Consequently, this research considers a firm's degree of internationalization as a proxy for market size.

There are several reasons why firm internationalization impacts corporate sustainability practices. Compared to multinational enterprises (MNE), domestic businesses operate in smaller markets and, therefore, experience lower demand. Consequently, substantial financial investments to create sustainable products and processes cannot be justified. In contrast, MNEs experience higher demand and, thus, can profit from economies of scale. Hence, international corporations can afford significant investments in corporate sustainability practices. (Attig et al., 2016; Kang, 2013) In addition to economies of scale advantages, international firms are more likely to commit to corporate sustainability practices due to their greater visibility through the global media, pressuring MNEs to protect their brand image (Attig et al., 2016). Besides, previous academic articles indicate that MNEs must demonstrate organizational legitimacy when entering a foreign market. In other words, international companies must prove to their foreign target audience that their actions are desirable and do not contradict cultural beliefs and norms prevailing in the country. Accordingly, the researchers reveal that compared to local firms, MNEs invest more

heavily in corporate sustainability practices to prevent legitimacy challenges. (Attig et al., 2016; Balasubramanian et al., 2021; Park, 2018). Based on the provided arguments, this research aims to test the subsequent hypotheses:

Hypothesis 3a: Firm internationalization (market size) is positively related to companies' engagement in sustainable product development.

Hypothesis 3b: Firm internationalization (market size) is positively related to companies' engagement in sustainable processing.

2.5. Intellectual Property Rights

Intellectual property can be classified as intangible assets (Voss et al., 2017). Past research has demonstrated that IP is crucial for guaranteeing a company's long-term success (Nolan, 2011). Hence, instead of simply looking at the value of a firm's physical capital, investors usually prefer information regarding a company's market capitalization value, which captures the worth of a business's intangible assets (Hall, 1993).

In order to protect corporations' IP and prevent its unauthorized usage, government institutions established intellectual property rights (IPRs). Many forms of IPRs exist, such as patents, trademarks, copyrights, and trade secrets. (Voss et al., 2017) Nevertheless, from a company innovation perspective, patents matter the most. The primary reason for developing intellectual property rights is that the innovation level in competitive markets is not sufficiently high, given that innovation activities necessitate significant upfront financial investments, which cannot be fully recovered in a competitive market environment. By providing IPRs, authorities grant firms monopoly power for a specific period, shielding them from competitors' imitation efforts. Notably, these rights expire after some time to offset the social welfare loss resulting from the monopoly formation. (Menell, 2000; Menell & Scotchmer, 2007)

In line with this theory, Sweet and Maggio (2015) identify that stronger IPRs promote innovation activities in developed countries. Other academic articles come to similar conclusions (Candelin-Palmqvist et al., 2012). While research on the relationship between IPR and innovation is extensive, studies on the connection between IPR and sustainable business practices are rare and ambiguous (Vimalnath et al., 2022). Krystofik, Wagner, and Gaustad (2015) find that

strengthening IPRs stimulates firms to develop products with remanufacturing features, implying that stricter IPRs encourage firms to engage in sustainable waste management planning. The authors also demonstrate that the environmental benefits from additional remanufacturing outweigh the social welfare reduction from stricter IPRs. Likewise, another study shows that IPRs are crucial for fostering sustainable behavior by pointing out that economic incentives are also required for fostering sustainable behavior (Vimalnath et al., 2022).

Taking into account that most of these arguments relate to product development and given that processes are more rooted in a company's culture and organizational structure, indicating that it is more challenging to reverse-engineer processes (Schnaars, 1994), the effect of the stringency of IPR will only be assessed from the product standpoint.

Hypothesis 4a: The stringency of IPRs is positively related to companies' engagement in sustainable product development.

Since intangible service offerings are more organization-specific than tangible product and service offerings, one can argue that IPRs are of greater importance for developing tangible, sustainable products and services than intangible, sustainable services. This moderating effect will be tested through the following hypothesis:

Hypothesis 4b: The effect of the stringency of IPRs on sustainable product development is larger for manufacturers of tangible products and services than for producers of intangible services.

2.6. Environmental Regulations

Over the past decades, a sharp increase in environmental regulations has been observed worldwide to limit environmental degradation and foster sustainable business practices (Hoogendoorn et al., 2015; Rugman & Verbeke, 1998). However, the effect of such regulations on firms and their corporate sustainability strategy remains controversial (Buysse & Verbeke, 2003; Hoogendoorn et al., 2015; Li et al., 2020). Generally, environmental regulations can be described as a set of laws and policies governments implement to ensure companies behave in an environmentally-conscious manner (Li et al., 2020). One can distinguish between mandatory and

voluntary rules. As the name suggests, mandatory environmental regulations (MERs) force firms to remain below a specified pollution emission threshold and fulfill other environmental requirements by employing advanced technologies. The government strictly inspects firms' compliance with MERs and imposes penalties in case of infringements. (Camisón, 2010; Li et al., 2020) Two types of environmental policies classify as MERs: Firstly, command-and-control regulations and second, market-based regulations. Commonly, command-and-control regulations comprise emission limits, the installation of control equipment, and the disclosure of required information regarding a firm's environmental undertaking. In contrast, market-based regulations refer to policy tools that rely on competitive market mechanisms to reduce environmental degradation, like emission trading or pollution taxes. (Camisón, 2010; Xie et al., 2017) Unlike MERs, voluntary environmental programs (VEPs) or informal regulations represent measures taken by companies that are not controlled by government authorities. Examples of voluntary actions are formulating additional company-internal environmental benchmarks or providing more information on a corporation's environmental impact than legally mandated. (Li et al., 2020; Xie et al., 2017) Overall, if a company solely invests in environmentally-friendly technologies to comply with the established regulations, it follows a reactive approach. In contrast, a firm that actively aims to reduce its environmental impact beyond the legal requirements is considered a proactive player. (Buysse & Verbeke, 2003 ; Hoogendoorn et al., 2015)

While, at first, it might seem intuitive to analyze the effectiveness of specific policy instruments, this research will follow the example of Hoogendoorn, Guerra, and van der Zwan (2015), which focused on the stringency of countries' environmental regulations. As suggested by the authors, the efforts required to satisfy ERs can drastically differ among countries, which could bias the results when analyzing the effectiveness of explicit policies. Hence, using the overall stringency of environmental laws as an explanatory variable is more appropriate (Hoogendoorn et al., 2015). Besides, given that most existing regulations are concerned with the manufacturing process and not with the sustainability degree of a firm's products, the effect of the stringency of a country's environmental legislation will only be analyzed from the process perspective (Hoogendoorn et al., 2015; Noci & Verganti, 1999).

Previous academic research by Xie, Yuan, and Huang (2017) indicates that coercive institutional pressure will drive companies to use more environmentally-friendly input materials and invest in new end-of-pipe techniques. Based on a sample of 8000 small and medium-sized

enterprises located in 36 different countries, Hoogendoorn, Guerra, and van der Zwan (2015) also found that stringent environmental regulations promote corporate environmental practices. Furthermore, Li and Ramanathan (2018) found that the corporation's desire to defend its operational legitimacy is the primary motivation for complying with the ERs. Thus, in line with the prior research results, the following hypothesis will be tested:

Hypothesis 5: The stringency of environmental regulations is positively related to companies' engagement in sustainable processing.

2.7. Firm Size

Previous academic articles often use the number of employees as a proxy for a company's size (Hoogendoorn et al., 2015; Zhang et al., 2020). Most research findings indicate that firm size positively relates to implementing sustainable business practices, implying that smaller firms engage less in sustainable actions than large corporations (D'Amato & Falivena, 2020; Hoogendoorn et al., 2015; Murphy et al., 1992; Uhlaner, 2012). One of the key arguments underlying this finding is that small and medium-sized enterprises (SMEs) lack crucial financial, physical, and human resources required to increase the sustainability of their business operations (Bianchi & Noci, 1998; Zhou et al., 2021). For instance, researchers argue that large firms have a higher absorptive capacity than SMEs due to their extensive knowledge base, allowing them to acquire more external information than SMEs, which is crucial for developing sustainability measures (Cohen & Levinthal, 1990; Zhang et al., 2020). Besides their resource disadvantage, SMEs face more anonymity than large firms since the press reports less frequently about them. Consequently, smaller companies are free of public pressure to introduce corporate sustainability measures.(Bianchi & Noci, 1998; Hoogendoorn et al., 2015)

Given these arguments, prior research discovers that firm size positively affects a company's engagement in environmentally-friendly processing methods (Hoogendoorn et al., 2015) and ethical operational behavior (Murphy et al., 1992). However, the relationship between firm size and the development of sustainable products is not as clear. On the one hand, smaller firms can change their business strategy more quickly and flexibly, giving them an advantage over larger enterprises. On the other hand, smaller firms possess fewer resources, putting them in a disadvantaged position (Hockerts & Wüstenhagen, 2010; Hoogendoorn et al., 2015). Since both

small and large companies seem to encounter difficulties in creating sustainable products, this research expects that the relationship between firm size and sustainable product development is insignificant. As a result, this research only examines the following hypothesis:

Hypothesis 6: Firm size is positively related to companies' engagement in sustainable processing.

2.8. Managerial Willingness

Top management strongly impacts whether a company participates in corporate sustainability practices (Ageron et al., 2012; González-Benito & González-Benito, 2006; Meixell & Luoma, 2015). If managers are extremely conscious of the advantages, drawbacks, and tools related to environmental management, they will place greater importance on this subject within their business. For instance, highly aware managers will promote the formation of a department devoted to eco-friendly behavior (Del Brío González et al., 2001). Other research demonstrates that managers might be encouraged to implement sustainability measures along a firm's supply chain to safeguard the corporate reputation and image (Ageron et al., 2012). Del Brío González, Fernández, and Junquera (2007) investigated the consequences of top managers' environmental dedication. Their research reveals a positive, statistically significant relationship between a manager's engagement in environmental protection and a company's ability to gain an environmental action-driven competitive advantage. Moreover, it has been communicated that the integration level of eco-logical problems within a business also affects a corporation's capability to accomplish an environmental measures-based competitive advantage, meaning the integration at a lower management rank is not as effective as the inclusion of environmental issues at a higher management position (Brío González et al., 2007). This finding can be attributed to the fact that resources become more easily accessible when the management team is highly dedicated, directly affecting a firm's capability to execute its environmental strategy. Besides, if top-level management highly supports environmental conservation, collaboration across departments will be initiated, which is necessary to identify environmental solutions successfully. (González-Benito & González-Benito, 2006).

Besides the environmental aspect, academic articles also indicate that top managers' attention to ethical conduct influences corporate performance. By being highly committed to fairness and ethics, top-level managers communicate a particular standard of ethical behavior they

expect from supply chain actors. Hence, a manager's moral attention positively affects a firm's socially responsible performance, which enhances its operational legitimacy. (Weaver et al., 1999). This result coincides with the research findings of Jones (1995), which highlights that ethical firm behavior will provide a business with a competitive advantage. Given these reasons, the subsequent hypotheses were developed:

Hypothesis 7a: A lack of managerial willingness to solve sustainability-related issues is negatively related to companies' engagement in sustainable product development.

Hypothesis 7b: A lack of managerial willingness to solve sustainability-related issues is negatively related to companies' engagement in sustainable processing.

2.9. Summary

Overall, this literature review has discussed how various stakeholders influence a company's decision to engage in corporate sustainability activities. Proposed external drivers of sustainable business practices on the firm level were adequate access to external knowledge sources, strong customer demand for sustainability, and a high degree of firm internationalization. Moreover, on the country level, stringent IPRs and environmental regulations were suggested to foster firms' participation in sustainability practices. Besides, this literature review has indicated that this research captures internal stakeholder pressures through firm size and managerial willingness to solve sustainability-related issues. It is crucial to emphasize that these seven explanatory variables capture the pressure executed by a few but not all stakeholders interacting with a company. For instance, due to an information gap, the model does not account for the effect of important stakeholders, such as local communities and NGOs, potentially creating omitted variable bias. In the following sections, the developed hypotheses will be tested.

3. Data

3.1. Description of the Data Set

This research primarily relies on data from the Flash Eurobarometer survey 486, called "SMEs, start-ups, scale-ups, and entrepreneurship," to study firms' engagement in corporate sustainability practices. The survey was performed on behalf of the European Commission between February 19 and May 5, 2020. In total, 16365 firm decision-makers were questioned via telephone interviews. Hence, the data set entails information about companies of different sizes, industries, and countries. More specifically, the observed survey sample comprises firms from 27 European Union (EU) member states and 12 non-EU countries, namely Bosnia and Herzegovina, Brazil, Canada, Iceland, Japan, North Macedonia, Norway, Serbia, Turkey, the UK, the US, and Kosovo. (European Commission, 2020a; European Commission, 2020b)

As previously mentioned, the study was conducted in Spring 2020. It is crucial to note that, except in five countries, the interview periods were finished before government authorities announced the first Covid-19 policy measures, like lockdowns (European Commission, 2020a). Moreover, the pandemic was only declared during the study interval (WHO, 2020). Given these reasons, it is reasonable to assume that the answers provided during the interview and, thus, the survey data reflect companies' pre-Covid opinions and views (European Commission, 2020a).

In addition to the Flash Eurobarometer survey data, this research uses gross domestic product (GDP) data from the World Bank (2021) and real GDP growth data from the International Monetary Fund (2018). Besides, information on the stringency of a country's IPR is gathered from the Intellectual Property Rights Index (IPRI) (Levy-Carciente & De Soto, 2020) and data on the strictness of environmental regulations was obtained from the World Economic Forum (2017).

3.2. Data Preparation

After merging the various data sources into one data frame, observations with missing variable values were eliminated from the data set. Due to insufficient country-level information for Kosovo and Bosnia and Herzegovina, observations from these two countries were not used for estimating the models. In the second step, new variables were constructed based on information from existing columns. After data preparation, the final sample comprised 10,901 companies from 37 countries.

4. Variables & Descriptive Statistics

4.1. Dependent Variables

The two dependent variables of interest were assembled based on the answers companies' provided to the following question: 'In terms of environmental and social sustainability, which of the following actions, if any, is your enterprise actively taking?' (European Commission, 2020b, Q24). The answer option 'developing sustainable products or services' was used to construct the binary variable, *sust_products*, which amounts to one if a firm communicated to engage in sustainable product development and zero otherwise. The descriptive statistics table shows that 35.54% of all sample companies participate in sustainable product development.

Some of the remaining answer options referred to green processing measures, such as 'recycling or reusing materials,' 'reducing consumption of or impact on natural resources (e.g., saving water or switching to sustainable resources),' and 'saving energy or switching to sustainable energy sources' (European Commission, 2020b, Q24). Moreover, three answer options were related to ethical and socially-responsible company behavior: 'improving working conditions of [the] employees,' 'promoting and improving diversity and equality in the workplace,' and 'evaluating the impact of [the] enterprise on society' (European Commission, 2020b, Q24). Hence, these six response choices were used to produce a categorical variable, which indicates the degree to which a company engages in sustainable processing. Accordingly, this research classifies a firm's processing methods as 'unsustainable' if the company has not implemented any of these environmentally-friendly and socially-beneficial activities. In contrast, if a corporation incorporates one or two of the mentioned activities in its business operations, its processing strategy is deemed 'fairly unsustainable.' Furthermore, enterprises engaging in three to four sustainable processing actions are considered 'fairly sustainable,' while businesses implementing at least five measures are regarded as 'very sustainable.' As the frequency table (Table 2) indicates, 8.6% of all firm observations can be classified as 'very unsustainable,' 27.58% as 'fairly unsustainable,' 28.77% as 'fairly sustainable,' and 35.05% as 'very sustainable,' suggesting sufficient sample coverage for each category.

Table 1: Summary statistics

	N	Mean	SD	Variance	Min	Max
sust products	10901	.3554	0.4787	.2291	0	1
degree sust process	10901	1.9028	0.9802	.9608	0	3
ind cluster	10901	.1677	0.3736	.1396	0	1
collaborations	10901	2.9537	0.7072	.5001	1	4
sust support	10901	2.5968	0.8164	.6665	1	4
lack demand	10901	.3147	0.4644	.2157	0	1
foreign markets	10901	.4684	0.7624	.5813	0	3
lack willingness	10901	.0864	0.2810	.079	0	1
employees	10901	1.7336	0.9083	.825	1	4
env regulations	10901	4.957	0.7890	.6225	3	6.2
IPR	10901	7.0276	1.2562	1.578	3.732	8.924
financial res	10901	.7654	0.4237	.1796	0	1
age	10901	24.9134	21.4194	458.7927	0	170
growth	10901	2.4071	0.7416	.55	1	3
single owner	10901	.3793	0.4852	.2355	0	1
GDP growth	10901	2.6321	1.3478	1.8166	-.2	5.9
ln GDP	10901	26.9677	1.5256	2.3275	23.7451	30.6518
tangible	10901	.7131	0.4523	.2046	0	1

Table 2: Frequency table for sustainable processing (*degree_sust_process*)

	Freq.	Percent	Cum.
very unsustainable	937	8.60	8.60
fairly unsustainable	3007	27.58	36.18
fairly sustainable	3136	28.77	64.95
very sustainable	3821	35.05	100.00
Total	10901	100.00	

4.2. Firm-level Independent Variables

4.2.1. Access to External Knowledge

The developed model includes three variables as indicators for a company's access to external knowledge resources. The first variable is a binary variable that takes on a value of one for companies that are part of an industry cluster or a business support organization (*ind_cluster*) (European Commission, 2020b, Q9). Thereby, industry clusters stand for geographic concentrations of sector-interconnected businesses. Moreover, business support organizations represent regional associations that provide advice and recommendations to businesses of diverse types to support their growth. (European Commission, 2020a) The second variable (*collaborations*) is a categorical variable which was constructed based on businesses' ranking of their 'access to and collaboration with business partners, [such as] other enterprises, [the] public sector, educational institutions, [and] research organizations' (European Commission, 2020b,

Q16). Thus, this variable comprises four categories, corresponding to the answers' very poor,' 'fairly poor,' 'fairly good,' and 'very good.' The third external knowledge-related variable (*sust_support*) was constructed in a similar manner as the second variable. However, this categorical variable captures a representative's opinion concerning a company's access to sustainability support services (European Commission, 2020b, Q16).

The descriptive statistics table reveals that 16.77% of all sample observations belong to an industry cluster or support organization. Moreover, the frequency tables (Table 3 and 4) show that most companies have 'fairly good' access to collaboration networks and external sustainability assistance services.

Table 3: Frequency table for access to collaborations (*collaborations*)

Collaboration rating	Freq.	Percent	Cum.
very poor	433	3.97	3.97
fairly poor	1691	15.51	19.48
fairly good	6725	61.69	81.18
very good	2052	18.82	100.00
Total	10901	100.00	

Table 4: Frequency table for access to sustainability support services (*sust_support*)

Sustainability support rating	Freq.	Percent	Cum.
very poor	1143	10.49	10.49
fairly poor	3287	30.15	40.64
fairly good	5293	48.56	89.19
very good	1178	10.81	100.00
Total	10901	100.00	

4.2.2. Demand

Customer's preference for corporate sustainability practices is measured through a binary variable (*lack_demand*) that builds upon the question, 'Which of the following [points], if any, are currently preventing your enterprise from becoming sustainable,[...]?' (European Commission, 2020b, Q26). If an interviewee stated lack of sustainability demand as one of the critical reasons stopping the company from becoming more sustainable, the binary variable equals one and zero otherwise. The descriptive statistics table demonstrates that 31.47 % of all sample observations encounter a lack of sustainability demand.

The Flash Eurobarometer survey also instructed the interviewees to reveal whether their company sells goods in the following international markets: the EU, European countries outside

the EU, North America, Latin America and the Caribbean, China, or the rest of Asia and the Pacific (European Commission, 2020b, Q11). After computing the total number of foreign regions in which a corporation operates, a categorical variable with four categories was constructed (*foreign_markets*). This variable is a measure of firm internationalization and, thus, provides information regarding a company's market size. Grouping firms with similar degrees of internationalization into lesser categories was necessary since only a few observations indicated that they conducted business in more than five foreign markets, implying that the number of observations belonging to these categories was not sufficiently high. Table 5 reveals that 7170 sample observations classify as domestic businesses. In contrast, 2792 companies export to one to two foreign regions. Finally, only 503 corporations export to three to four foreign markets, and 436 companies operate in minimum of five markets.

Table 5: Frequency table for firm internationalization (*foreign_markets*)

Number of foreign markets entered	Freq.	Percent	Cum.
none	7170	65.77	65.77
1 to 2 foreign markets	2792	25.61	91.39
3 to 4 foreign markets	503	4.61	96.00
more than 4 foreign markets	436	4.00	100.00
Total	10901	100.00	

4.2.3. Firm Size

In this research, firm size (*employees*) is defined as a categorical variable, which classifies companies with less than nine employees as 'micro firms,' companies with 10 to 49 employees as 'small firms,' businesses with 50 to 249 workers as 'medium firms,' and corporations with minimum 250 workers as 'large firms' (European Commission, 2020b, Q2B). Table 6 shows that most sample companies classify as 'micro firms', making up 52.62% of all observations. On the other hand, only 5.49% of the sample firms are considered 'large' corporations.

Table 6: Frequency table for firm size (*employees*)

	Freq.	Percent	Cum.
micro firm	5736	52.62	52.62
small firm	2932	26.90	79.52
medium firm	1634	14.99	94.51
large firm	599	5.49	100.00
Total	10901	100.00	

4.2.4. Managerial Willingness

A manager's attitude toward sustainable business behavior is represented through a binary variable (*lack_willingness*). If the interviewee indicated that one of the key barriers 'preventing [an] enterprise from becoming sustainable' (European Commission, 2020b, Q26) is a lack of willingness among the management team, the variable value is one. Otherwise, the variable equals zero. Table 1 shows that only 8.64% of the considered company managers lack sustainability awareness and are unmotivated to implement corporate sustainability activities.

4.3. Country-level Independent Variables

4.3.1. Stringency of Intellectual Property Rights

As an indicator of a country's IPR stringency, this research relies on data from the Intellectual Property Rights Index. Generally, the IPRI evaluates a country's IPR stringency by assessing an expert's opinion on the country's IPR protection, details concerning the strictness of its patent laws, and information about its copyright piracy level. (Levy-Carciente & De Soto, 2020). Generally, the IPR stringency is measured on a scale of zero to ten, with a score of ten representing a country with an extremely strict IPR system. The maximum IPR stringency value reported for a country equals 8.924 points (Table 1). Moreover, the lowest reported IPRI value amounts to 3.732 points. The mean IPRI score of the sample countries is 7.027 points.

4.3.2. Stringency of Environmental Regulations

Data concerning a country's stringency of environmental regulations (*env_regulations*) was obtained from the World Economic Forum's Executive Opinion Survey (2017), which required specialists to rate the strictness of a country's environmental legislation on a scale from one to seven, whereby one denotes a very lax legal system and seven a very stringent environmental judicial regime. The exact wording of the survey question was, 'How would you assess the stringency of your country's environmental regulations?' (World Economic Forum, 2017, p.357). The lowest environmental stringency score assigned to a sample country is 3 points, and the highest score 6.2 points. The average environmental stringency score of the sample countries amounts to approximately 5 points.

4.4. Firm-level Control Variables

This research integrated several control variables into the developed model to eliminate potential bias sources.

4.4.1. Access to External Financial Resources

A company's access to external financial means will likely affect its engagement in corporate sustainability practices. In other words, a company needs extensive financial resources to be capable of investing in sustainability-enhancing activities (Bianchi & Noci, 1998). SMEs often find it more challenging to obtain funds from financial institutions (Chittenden et al., 1996). Based on the argument that access to external financial means is positively related to the dependent variables and firm size, the variable's exclusion from the model would result in an upward bias of the estimated firm size coefficient. Hence, this variable will be included in the model as a dummy variable (*financial_res*) which takes on value one if company representatives assumed their business could receive external financing (European Commission, 2020b, Q10). Table 1 shows that 76.54% of all sample companies have access to external financial resources.

4.4.2. Firm Age

The developed model also accounts for firm age (*age*) to reduce bias and increase the model's precision. The continuous variable indicates a company's age in 2020, the year the interviews were performed and was constructed based on Question 1 of the Flash Eurobarometer survey (European Commission, 2020b). As illustrated in the descriptive statistics table, the mean age of the sampled companies is roughly 25 years.

4.4.3. Turnover Growth

Firm growth (*growth*) is a crucial indicator of a company's past performance and future growth opportunities. Thus, it directly impacts a firm's capabilities to react to stakeholder claims, explaining why this variable is also part of the model. In the context of this research, firm growth is a categorical variable with the following three categories: 'negative growth,' 'zero growth,' and 'positive growth.' The variable was constructed based on the answers provided to Question 5 of the survey (European Commission, 2020b). The frequency table (Appendix A) shows that 56.14% of all company observations experienced positive growth over the past three years.

4.4.4. Ownership Status

Based on the idea that ownership status affects a company's access to resources and its internal innovation and product-design decisions (Kaya & Patton, 2011), controlling for this variable is necessary to avoid bias. Therefore, a binary variable (*single_owner*) was constructed, which equals one if the interviewee answered 'yes' to the question, 'In terms of the ownership, is your enterprise solely owned by one person?' (European Commission, 2020b, Q14). Table 1 indicates that 37.93% of the sample businesses are owned by a single owner.

4.5. Country-level Control Variables

A country's economic condition highly affects businesses' behavior (Gottfries, 2013). As a result, this research accounts for two indicators of a country's market environment.

4.5.1. Annual Real GDP Growth

The first country-level control variable is the real gross domestic product (GDP) growth rate in 2019 (*GDP_growth*). Data for this variable was collected from the International Monetary Fund (2018). Even though the interviews were conducted in early spring 2020, gathering data for 2019 was favored over data from 2020 since the real GDP growth rate in 2020 did not accurately represent a country's market environment during pre-covid times. In other words, since taking sustainable actions is not a decision that businesses spontaneously make and given that the pandemic was only announced during the interview period (WHO, 2020), looking at the pre-Covid real GDP growth rate appeared more appropriate. The average real GDP growth rate in 2019 across the sampled countries was 2.63%.

4.5.2. PPP-adjusted GDP

The second variable used to incorporate information about a country's economic state is purchasing power parity (PPP) adjusted GDP measured in constant 2017 international dollars (*ln_GDP*). Data for this variable was retrieved from the World Bank (2021). In contrast to nominal GDP, this GDP estimate accounts for inflation and living cost differences across countries, suggesting it reflects a country's actual economic power more accurately (Gottfries, 2013).

When examining the distribution of PPP-adjusted GDP, one can recognize that it is skewed to the right due to some extreme outliers Therefore, a logarithmic transformation of the variable was performed to obtain a more symmetrical distribution curve (Appendix A).

4.6. Moderator

Based on the example of Hoogendoorn, Guerra, and van der Zwan (2015), this research classifies the following sectors as providers of tangible products and services: mining and quarrying (NACE code B), manufacturing (C), electricity, gas, steam, and air conditioning (D), water supply, sewerage, and waste management (E), construction (F), wholesale and retail trade (G), transportation and storage (H), and lastly, accommodation and food services (I). In contrast, information and communication services (J), financial and insurance activities (K), real estate activities (L), professional, scientific, and technical work (M), administrative and supportive services (N), education (P), human health and social work activities (Q), and arts, entertainment and recreation work (R) belong to the intangible service sectors. This sector classification was the basis for constructing the tangibility dummy variable, which equals one for companies that sell tangible products and services and zero for intangible service providers. Table 1 shows that 71.3% of the sample businesses trade tangible products and services.

4.7. Correlation & VIF Test

A correlation table was generated to identify potential multicollinearity issues (Appendix B). One can see that the correlation between the independent and control variables is less than 0.3 in all cases, suggesting that multicollinearity is not an issue for this research (Wooldridge, 2019). Besides, the correlation table can also provide first insights into the relationship between the explanatory and dependent variables. The sign of the correlation values matches most formulated hypotheses.

In addition to the correlation table, the Variance Inflation Factor (VIF) scores provide valuable information about the degree of multicollinearity prevalent in a regression model. Tables 3 and 4 of Appendix B show that for none of the observed variables, the VIF scores exceed the threshold value of 10.0, providing evidence for no multicollinearity issues. (Uhlaner et al., 2012)

5. Methodology

This research employs a multilevel logistic regression model to investigate the drivers and barriers of companies' engagement in sustainable product development. Moreover, a multilevel ordered logistic regression model is used to study the impact of different stakeholder claims on firms' commitment to sustainable processing. Analyzing the data structure clarifies why these two model specifications suit the research context.

Suppose sustainable product development is modeled through a linear regression function. In that case, the predicted outcome value is unbounded, meaning it can be equivalent to a numeric value between negative and positive infinity. Consequently, the obtained output value can take on a value below zero and above one, which is unrealistic based on the variable definition of sustainable product development. (Sommet & Morselli, 2017; Wooldridge, 2019) Therefore, a logistic response function is more fitting when dealing with a binary variable, such as *sust_products*, since it limits the prediction interval to values between zero and one (Maalouf, 2011; Sommet & Morselli, 2017).

The second dependent variable classifies as an ordered categorical variable. Even though the variable's categories are arranged in a particular order, it is crucial to note that non-constant distances separate the different categories. Hence, it is problematic to model sustainable processing via a linear regression model, which assumes that each unit increase in the independent variable has the same effect size on the outcome probability. Besides, as in the binary variable case, a linear regression model puts no restriction on the interval of the outcome probability. (Winship & Mare, 1984)

Lastly, the hierarchical data set structure implies that 10,901 companies (level-1 units) are nested in 37 countries (level-2 units). Thus, a standard (ordered) logistic regression model does not fit the data structure since this would violate the residual independence assumption. In other words, company observations within a particular country cluster are likely to be more similar to each other than to observations included in other clusters, leading to a correlation between the residuals. Besides, using a standard one-level (ordered) logistic regression model and omitting relevant country-level variables would lead to biased coefficient estimates and deflated standard errors. Hence, the probability of a type I error, meaning the rejection of a true hypothesis, rises. (Sommet & Morselli, 2017) For these reasons, a multilevel logistic regression model and a

multilevel ordered logistic model were constructed based on the instructions provided by Sommet and Morselli (2017).

5.1. Step 1: Mean Centering the Variables

The first step is concerned with the data preparation. Sommet and Morselli (2017) argue that mean-centering the firm-level and country-level explanatory variables can improve the interpretation of the estimated regression coefficients. In general, two different mean-centering approaches exist. First, grand-mean centering can be performed on level-1 and level-2 variables and involves the subtraction of a variable's overall sample mean from the variable values. In contrast, cluster-mean centering involves the subtraction of the cluster-specific mean from the variable values, implying that this mean-centering approach can only be applied to firm-level variables. (Echambadi & Hess , 2007; Sommet & Morselli, 2017) However, since previous academic papers have indicated that mean-centering does not improve a model's explanatory power over a model constructed on uncentered variables, this step was skipped in this research setting (Echambadi & Hess, 2007; Kromrey & Foster-Johnson, 1998; Sommet & Morselli, 2017).

5.2. Step 2: Empty Model

The second step involves the estimation of the empty multilevel (ordered) logistic regression models, also called null models. These models do not incorporate any explanatory variables and, thus, help determine whether there is significant variation in the outcome variable between clusters, meaning countries. Formula 1 and 2 present the null model equations for the respective dependent variables. Index i denotes a particular firm, and index j signifies a specific country. (Sommet & Morselli, 2017)

$$sust\_products_{ij} = \gamma_{00} + u_{oj} \quad ,\forall\, i \in N, j \in K \tag{1}$$

$$degree\_sust\_processing_{ij} = \gamma_{00} + u_{oj} \quad ,\forall\, i \in N, j \in K \tag{2}$$

Note: N refers to the total number of countries and K to the number of companies

Based on the estimated regression models, the intraclass correlation coefficients (ICCs) (Formula 3) can be computed (Sommet & Morselli, 2017). The ICC reveals the proportion of a dependent variable's total variance attributed to country differences. If the ICC takes on a value of

one, the residuals are highly correlated, suggesting that companies' engagement in corporate sustainability practices highly differs among countries. Using a multilevel (ordered) logistic regression model is inevitable in such a case. In contrast, if a model's ICC equals zero, the residuals are entirely uncorrelated, and no country variation exists, which suggests the use of a standard one-level (ordered) logistic regression model. (Sommet & Morselli, 2017; Wu et al., 2012).

$$ICC = \frac{var(u_{oj})}{var(u_{oj}) + (\frac{\pi^2}{3})} \quad (3)$$

The empty model estimates and the ICCs of the two model specifications are included in Appendix C. One can recognize that the ICC for the sustainable product development model equals 13.98%. Hence, it can be concluded that cross-country differences explain 13.98% of the variance in the outcome variable. The remaining 86.02% can be attributed to firm-level variations, meaning within-country differences. For the sustainable processing model, the ICC amounts to 25,10%, indicating that 25.10% of the variation in firms' sustainable processing degrees can be assigned to country-level variations and 74,90% to within-county variations (firm differences). (Sommet & Morselli, 2017) Considering these findings and given that the ICCs exceed the critical threshold value of 0.05 (Heck et al., 2013), including country-level variables in the models is crucial to capture the heterogeneity in companies' corporate sustainability engagement. Accordingly, the intercept of the multilevel (ordered) logistic regression model will vary across country clusters, which sets it apart from the standard (ordered) logistic regression model. (Sommet & Morselli, 2017)

5.3. Step 3: CIM versus AIM

Besides the fixed slope parameters, it must be determined whether random slope variances for the level-1 explanatory variables should be included in the models. Therefore, the constrained intermediate model (CIM) must be compared to the augmented intermediate model (AIM) for each dependent variable. In contrast to the AIM, the CIM only comprises fixed slope coefficients, implying that this model specification does not account for country-level differences regarding the effect of firm-level variables on the dependent variables. To put it differently, the CIM proposes that the relationship between level-1 explanatory variables and the dependent variables is the same across all observed regions. (Sommet & Morselli, 2017) Formula 4 and 5 denote the CIM models

for the two dependent variables of interest. Note that the CIM comprises all level-1 and level-2 explanatory variables but not the cross-level interaction term required to test hypothesis 4b (Appendix C).

$$sust\_products = ß_{00} + ß_{10}ind\_cluster_{ij} + ß_{20}collaboration_{ij} + ß_{30}sust\_support_{ij} + ß_{40}lack\_demand_{ij} + ß_{50}foreign\_market_{ij} + ß_{60}lack\_willingness_{ij} + ß_{01}IPR_j + ß_{70}X_{ij} + ß_{02}Z_j + u_{0j}. \quad (4)$$

$$degree\_sust\_process = ß_{00} + ß_{10}ind\_cluster_{ij} + ß_{20}collaboration_{ij} + ß_{30}sust\_support_{ij} + ß_{40}lack\_demand_{ij} + ß_{50}foreign\_market_{ij} + ß_{60}employees_{ij} + ß_{70}lack\_willingness_{ij} + ß_{01}env\_regulations_j + ß_{80}X_{ij} + ß_{02}Z_j + u_{0j} \quad (5)$$

Note: X_{ij} – Firm-level control variables. Z_j – Country-level control variables.

As previously mentioned, the AIM contains the fixed slope parameter and the random slope variance for the level-1 explanatory variables. Essentially, this means that the model tests for random variations in the firm-level variables to check whether the effect of these variables depends to a certain extent on countries' attributes. As suggested by Sommet and Morselli (2017), this research constructed a separate AIM model for each firm-level independent variable, to be able to perform adequate likelihood ratio tests. Hence, Formula 6 only shows an example AIM equation for the explanatory variable *lack_demand*. Based on the AIM presented in Appendix C, one can see that the variance in the effect of insufficient sustainability demand equals 0.052 ($p<0.1$). This finding shows that 5.20% of the variation in the impact of inadequate sustainability demand on the output variable can be attributed to country-level differences. (Sommet & Morselli, 2017)

$$sust\_products = ß_{00} + ß_{10}ind\_cluster_{ij} + ß_{20}collaboration_{ij} + ß_{30}sust\_support_{ij} + (ß_{40} + u_{1j})\times lack\_demand_{ij} + ß_{50}foreign\_market_{ij} + ß_{60}lack\_willingness_{ij} + ß_{01}IPR_j + ß_{70}X_{ij} + ß_{02}Z_j + u_{0j.} \quad (6)$$

After estimating the CIMs and AIMs, likelihood ratio tests must be conducted to derive the model that explains the most variation in the outcome variable (Formula 8). The likelihood ratio test for the sustainable product development model displays a lower deviance value for the AIM than for the CIM in the case of the explanatory variable *lack_demand* (Prob > chi2 = 0.0125*)*. Thus, the final model specification will include a random slope parameter for this firm-level variable. The likelihood ratio tests performed for the sustainable processing variable indicate

that the random slope is needed for *ind_cluster* (Prob > chi2 = 0.0248) and *lack_demand* (Prob > chi2 = 0.005)

In conclusion, an augmented intermediate model is used for both dependent variables. The final sustainable product development model also incorporates a cross-level interaction term to test H4b. Formula 7 represents the final regression equation for this model, while Formula 8 describes the final sustainable processing model. The following section will discuss the research findings in more depth.

$$\begin{aligned} sust\_products = {} & ß_{00} + ß_{10}{\times}ind\_cluster_{ij} + ß_{20}collaboration_{ij} + ß_{30}sust\_support_{ij} + \\ & (ß_{40} + u_{1j}){\times}lack\_demand_{ij} + ß_{50}foreign\_market_{ij} + \\ & ß_{60}lack\_willingness_{ij} + ß_{01}IPR_j + ß_{70}tangible_{ij} + ß_{71}IPR_j{*}\ tangible_{ij} + ß_{80}X_{ij} + ß_{02}Z_j + u_{0j} \end{aligned} \quad (7)$$

$$\begin{aligned} degree\_sust\_process = {} & ß_{00} + (ß_{10} + u_{1j})ind\_cluster_{ij} + ß_{20}collaboration_{ij} + ß_{30}sust\_support_{ij} + \\ & (ß_{40} + u_{2j}){\times}lack\_demand_{ij} + ß_{50}foreign\_market_{ij} + ß_{60}employees_{ij} + ß_{70}lack\_willingness_{ij} + \\ & ß_{01}env\_regulation_j + ß_{70}X_{ij} + ß_{02}Z_j + u_{0j.} \end{aligned} \quad (8)$$

6. Results

Table 7 displays the estimated regression coefficients for the sustainable product development model with and without the interaction term (Columns 1 and 2). Besides, the last column of Table 7 presents the obtained results for the multilevel ordered logistic regression model with the dependent variable *degree_sust_process*. Since only the sign and significance of the regression coefficients shown in Table 6 can be interpreted (Sommet & Morselli, 2017), the estimated coefficients were transformed into odds ratios (Table 8), enabling the magnitude interpretation of the computed effects. Before evaluating the results, it is also crucial to note that, in multilevel (ordered) logistic regression models, the sign, significance, and magnitude of cross-level interaction terms might be slightly biased since no adequate software exists to correctly identify their effect (Kolasinski & Siegelm, 2010; Sommet & Morselli, 2017). Nevertheless, Sommet and Morselli (2017) indicate that it is still appropriate to interpret the interaction term coefficients based on the significance-of-the-product-term technique. Accordingly, this research will follow this recommendation.

Table 7 shows that being part of an industry cluster or a business support group increases a company's likelihood of engaging in sustainable product development and sustainable processing. For both dependent variables, the estimated coefficient is positive and statistically

significant at the 1% level (β=0.385, p<0.01; β=0.628, p<0.01). In the case of the sustainable product model, no statistically significant relationship between the dependent variable of interest and the variable *collaborations* (p>0.1) was revealed. However, Column 3 indicates that companies with 'very good' access to collaborations implement more process-related sustainability measures than companies with 'very poor' access to partnerships (reference category) (β=0.310, p<0.01). Regarding the variable *sust_support*, the product model shows positive, statistically significant coefficient estimates for the categories' fairly good' (β=0.167, p<0.05) and 'very good' (β=0.440, p<0.01). Likewise, the processing model shows a statistically significant coefficient for the 'very good' class. Thus, it can be concluded that companies that rank access to sustainability support services as good are more likely to participate in corporate sustainability practices than corporations that indicate 'very poor' access to such services (reference category). Given these three variables, H1a and H1b are only partly supported.

Next, this study surprisingly discovered a positive relationship between the absence of sustainability demand from customers and companies' adoption of sustainable manufacturing procedures (β=0.161, p<0.01), resulting in a rejection of H2b. Contrarily, the variable's coefficient for the product development model is insignificant at the 10% significance level (β=0.019, p>0.1), suggesting a rejection of H2a. Thus, on average, consumer demand for sustainability does not affect businesses' commitment to sustainable product development. However, one can also recognize that between countries, there are significant variations in the effect of customer pressures on corporate sustainability activities (β=0.716, p<0.01).

In addition to these findings, Table 7 hints toward a positive, statistically significant relationship between firm internationalization and companies' involvement in sustainable processing and product development (p<0.01), supporting H3a and H3b. Furthermore, this research finds a positive, statistically significant relationship between countries' IPR stringency and firms' sustainable product development efforts (β=0.308, p<0.01), which provides evidence for H4a. Next, Column 2 reveals a negative, statistically significant regression coefficient for the *tangible* variable *(*β=-0.641, p<0.05) and a positive, statistically significant coefficient for the interaction term (β=0.113, p<0.01). These findings emphasize that producers of tangible products and services are less likely to devote resources to sustainable product development than intangible service providers. Moreover, the effect of an increase in IPR stringency on sustainable product

development is larger for manufacturers of tangible products and services than for suppliers of intangible services. This finding upholds H4b.

Regarding the stringency of environmental legislation, the analysis uncovers a positive regression coefficient which is statistically significant at the 1% significance level ($\beta=0.513$, $p<0.01$), backing up H5. Further, this research reveals a positive relationship between firm size and sustainable processing ($p<0.01$), which validates H6. Lastly, this research finds a negative, statistically significant coefficient for variable *lack_of_willingess* ($\beta=-0.387$, $p<0.01$; $\beta=-0.212$, $p<0.01$). This result demonstrates that companies lacking managerial willingness to solve sustainability issues are less likely to get involved in sustainable product design and processing methods. Hence, H7a and H7b are also supported.

When looking at the control variables, one can realize that companies that experienced 'positive' growth over the past three years are more likely to engage in sustainable product creation ($\beta=0.150$, $p<0.05$) and sustainable manufacturing ($\beta=0.275$, $p<0.01$) than businesses that encountered negative growth (reference category). Likewise, companies with access to external financial resources participate more in corporate sustainability activities ($\beta=0.131$, $p<0.05$; $\beta=0.218$, $p<0.01$). All the other control variable coefficients are insignificant at the 10% significance level ($p>0.1$).

Table 7: Multilevel (ordered) logistic regression estimates for both dependent variables

	(1)	(2)	(3)
VARIABLES	sust_products	sust_products	degree_sust_process
ind_cluster	0.385***	0.375***	0.628***
	[0.0592]	[0.059]	[0.075]
collaborations_fairly_poor	0.086	0.093	0.150
	[0.1312]	[0.131]	[0.105]
collaborations_fairly_good	0.051	0.064	0.158
	[0.1253]	[0.126]	[0.099]
collaborations_very_good	0.087	0.114	0.310***
	[0.1336]	[0.134]	[0.108]
sust_support_fairly_poor	0.023	0.027	-0.022
	[0.0849]	[0.085]	[0.068]
sust_support_fairly_good	0.167**	0.171**	0.046
	[0.0841]	[0.084]	[0.068]
sust_support_very_good	0.440***	0.447***	0.364***
	[0.1048]	[0.105]	[0.089]
lack_demand	-0.019	-0.024	0.161***
	[0.0624]	[0.063]	[0.056]
foreign_markets_ 1_to_2	0.426***	0.412***	0.050
	[0.0523]	[0.053]	[0.044]
foreign_markets_3_to_4	0.875***	0.858***	0.294***
	[0.1021]	[0.102]	[0.092]
foreign_markets_more_than_4	0.917***	0.888***	0.632***
	[0.1111]	[0.112]	[0.107]
lack_willingness	-0.387***	-0.390***	-0.212***
	[0.0787]	[0.079]	[0.066]
employees_small	0.134**	0.135**	0.304***
	[0.0527]	[0.053]	[0.045]
employees_medium	0.205***	0.215***	0.591***
	[0.0666]	[0.067]	[0.059]
employees_large	0.481***	0.509***	0.773***
	[0.1004]	[0.101]	[0.092]
tangible		-0.641**	
		[0.313]	
IPR	0.308***	0.233**	
	[0.0889]	[0.094]	
tangible#IPR		0.113***	
		[0.042]	
env_regulations			0.513***
			[0.197]
financial_res	0.131**	0.127**	0.218***
	[0.0550]	[0.059]	[0.045]
age	-0.001	-0.001	0.003***
	[0.0011]	[0.001]	[0.001]
growth_zero	-0.018	-0.012	0.048
	[0.0710]	[0.071]	[0.058]
growth_positive	0.150**	0.155**	0.275***
	[0.0652]	[0.065]	[0.054]
single_owner	-0.046	-0.058	-0.038
	[0.0481]	[0.048]	[0.041]
GDP_growth	-0.084	-0.083	-0.014
	[0.0863]	[0.087]	[0.136]
ln_GDP	-0.026	-0.018	0.115
	[0.0763]	[0.077]	[0.107]
var(1.lack_demand[country])	0.052*	0.054*	0.052*
	[0.0308]	[0.031]	[0.027]
var(_cons[country])	0.316***	0.311***	0.716***
	[0.0796]	[0.080]	[0.172]
var(1.financial_res[country])		0.012	
		[0.022]	
var(1.ind_cluster[country])		0.066	
		[0.043]	
Constant	-2.609	-2.373	
	[2.1074]	[2.150]	
Observations	10,901	10,901	10,901
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

As previously stated, Table 8 depicts the estimated effects via odds ratios. Generally, the odds ratio related to a one-unit increase of an explanatory variable is defined as the exponential function of the estimated regression coefficient. If the odds ratio exceeds one, the corresponding estimated effect is positive, whereas a ratio value below one relates to a negative regression coefficient. (Szumilas, 2010)

The following part will examine the odds ratios of the model with the dependent variable *sust_products*. First, one can recognize that the odds of participating in sustainable product development are 47% higher for companies included in an industry cluster or a business group than for those not included in such networks, ceteris paribus ($p<0.01$). Besides, compared to businesses with 'very poor' sustainability support access, the odds of engaging in sustainable product development are 18.2% higher for companies with 'fairly good' access to sustainability support services ($p<0.05$) and 55.2% higher for firms with 'very good' access to such help ($p<0.01$), when holding the other factors fixed. As previously told, the effect of the variable *lack_of_demand* is statistically insignificant at the 10% significance level ($p>0.1$). However, statistically significant odds ratios are revealed for the categories of the *foreign_markets* variable ($p<0.01$). One can note that compared to local companies, the odds of sustainable product development are 1.53 times higher for companies exporting to one to two foreign markets, 2.4 times higher for corporations operating in three to four foreign regions, and 2.5 times higher for businesses operating in minimum five non-domestic territories, keeping the other variables fixed.

Furthermore, Table 8 demonstrates that the odds of creating sustainable products are 32.1% lower for firms with less motivated managers than for those with sustainability-encouraging managers (1-0.679, $p<0.01$), holding the other explanatory variables fixed. Even though no hypothesis regarding the effect of firm size on sustainable product development was formulated, one can detect that compared to micro businesses, the odds of sustainable product development are 1.143 times higher for small firms, 1.228 times higher for medium-sized firms, and 1.617 times higher for large companies when controlling for the other factors ($p<0.01$). In addition, the findings show that a one-unit increase in a country's IPR stringency leads to a 36.1% increase in the odds that a business creates sustainable products ($p<0.01$), ceteris paribus. Besides, the cross-level interaction term indicates that for a one-unit increase in IPR legislation strictness, being a supplier

of tangible products and services increases the odds of sustainable product development by 11.9% ($p < 0.01$).

Column 3 of Table 8 displays the odds ratios for the sustainable processing model. It becomes clear that the odds of being in a higher sustainable processing category are 87.5% higher for businesses integrated into an industry cluster or involved in a business support group, holding the other variables fixed ($p<0.01$). Besides, the results indicate that the odds of having a higher sustainable processing degree are 36.4% higher for companies with 'very good' access to collaboration networks than for enterprises with 'very poor' access to cooperation, keeping the other factors fixed ($p<0.01$). It can also be observed that the odds of implementing more sustainable processing measures are 43.9% higher for businesses with 'very good' access to sustainability support services than for firms with 'poor access' to such assistance services, ceteris paribus ($p<0.01$). Regarding H2b, the odds of being in a higher sustainable processing category are 17.5% higher for enterprises not facing any sustainability-related customer demands than for firms that feel pressured by their consumer base, holding the other factors fixed ($p<0.01$).

The coefficients associated with firm internationalization indicate that compared to domestic firms, the odds of engaging in more sustainable processing activities are 43.9% higher for businesses exporting to three to four foreign regions and 88.2% higher for corporations operating in a minimum of five foreign areas, ceteris paribus ($p<0.01$). Since the odds ratio of the management-related variable is below one, it can be said that compared to businesses with highly aware managers, the odds of having a higher sustainable processing extent are 9.1% lower for corporations with managers not considerate of sustainability issues ($p<0.01$), keeping the other explanatory variables fixed.

Regarding the effect of firm size, one can say that compared to 'micro' firms, the odds of being in a higher sustainable processing category are 1.355 times higher for small businesses, 1.806 times higher for medium-sized companies, and 2.167 times higher for large corporations when controlling for the other factors ($p < 0.01$). Lastly, the odds of achieving a more advanced degree in sustainable processing are 67.1% higher for countries with stricter environmental legislation than for countries with very lax environmental regulations ($p<0.01$), ceteris paribus.

Table 8: Multilevel (ordered) logistic regression estimates in odds ratio format

VARIABLES	(1) sust_products	(2) sust_products	(3) degree_sust_process
ind_cluster	1.470***	1.456***	1.875***
	[0.087]	[0.086]	[0.140]
collaborations_fairly_poor	1.089	1.098	1.162
	[0.143]	[0.144]	[0.122]
collaborations_fairly_good	1.053	1.067	1.171
	[0.132]	[0.134]	[0.116]
collaborations_very_good	1.091	1.122	1.364***
	[0.146]	[0.150]	[0.147]
sust_support_fairly_poor	1.023	1.027	0.979
	[0.087]	[0.087]	[0.066]
sust_support_fairly_good	1.182**	1.188**	1.047
	[0.099]	[0.100]	[0.071]
sust_support_very_good	1.552***	1.563***	1.439***
	[0.163]	[0.164]	[0.128]
lack_demand	0.981	0.976	1.175***
	[0.061]	[0.061]	[0.066]
foreign_markets_ 1_to_2	1.532***	1.511***	1.052
	[0.080]	[0.079]	[0.046]
foreign_markets_3_to_4	2.400***	2.360***	1.342***
	[0.245]	[0.242]	[0.123]
foreign_markets_more_than_4	2.501***	2.430***	1.882***
	[0.278]	[0.271]	[0.201]
lack_willingness	0.679***	0.677***	0.809***
	[0.053]	[0.053]	[0.053]
employees_small	1.143**	1.144**	1.355***
	[0.060]	[0.060]	[0.060]
employees_medium	1.228***	1.240***	1.806***
	[0.082]	[0.083]	[0.106]
employees_large	1.617***	1.662***	2.167***
	[0.162]	[0.167]	[0.200]
IPR	1.361***	1.263**	
	[0.121]	[0.119]	
tangible		0.527**	
		[0.165]	
tangible#c.IPR		1.119***	
		[0.047]	
env_regulations			1.671***
			[0.329]
financial_res	1.140**	1.137**	1.243***
	[0.063]	[0.063]	[0.056]
age	0.999	0.999	1.003***
	[0.001]	[0.001]	[0.001]
growth_zero	0.982	0.988	1.049
	[0.070]	[0.070]	[0.061]
growth_positive	1.162**	1.167**	1.317***
	[0.076]	[0.076]	[0.071]
single_owner	0.955	0.944	0.963
	[0.046]	[0.045]	[0.039]
GDP_growth	0.920	0.919	0.986
	[0.079]	[0.079]	[0.134]
ln_GDP	0.975	0.975	1.122
	[0.074]	[0.074]	[0.120]
var(1.lack_demand[country])	[0.032]	[0.033]	[0.029]
	1.372***	1.370***	2.045***
var(_cons[country])	[0.109]	[0.109]	[0.351]
var(ind_cluster[country])			1.068
			[0.046]
Constant	0.074	0.114	
	[0.155]	[0.241]	
Observations	10,901	10,901	10,901
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

7. Robustness Analysis I

A first robustness check is performed to examine whether the estimated regression coefficients differ in their sign, magnitude, and significance when accounting for product type differences. Hence, the total sample is divided into three subsamples. While the first subsample only comprises tangible product suppliers, the second includes tangible service providers. Moreover, intangible service producers are incorporated in the third subsample. The assignment of companies into these three categories was done by splitting providers of tangible products and services (*tangible*=1) into two groups based on the example of Hoogendoorn, Guerra, and van der Zwan (2015) (More information about the classification can be found in Appendix A). Generally, 32.65% of sample companies are regarded as tangible product producers (Appendix A). Besides, 38.67% of all observations qualify as tangible service providers. The remaining 28.69% classify as intangible service producers. Since the subsamples are relatively similar in size, this will increase the validity of the robustness results. To be able to judge the robustness of the research findings, Table 9 provides an overview of the previously supported hypotheses.

Table 9: Overview of the supported hypotheses

Hypothesis	Dependent variable	Support for the hypothesis?
1a: External knowledge access	Sustainable product development	Partly
1b: External knowledge access	Sustainable processing degree	Partly
2a: Customer demand	Sustainable product development	No
2b: Customer demand	Sustainable processing degree	Yes
3a: Firm internationalization	Sustainable product development	Yes
3b: Firm internationalization	Sustainable processing degree	Yes
4a: Stringency of IPR	Sustainable product development	Yes
4b: Moderating effect of tangibility on IPR	Sustainable product development	Yes
5: Stringency of environmental regulations	Sustainable processing degree	Yes
6: Firm size	Sustainable processing degree	Yes
7a: Managerial willingness	Sustainable product development	Yes
7b: Managerial willingness	Sustainable processing degree	Yes

The robustness results for the multilevel logistic regression model with the dependent variable sustainable product development are presented in Table 10. In line with the previous research findings, the odds ratios for the variable *ind_cluster* are positive and statistically significant at the 1% significance level. Nonetheless, the effect of 'very good ' access to collaboration networks on the odds of engaging in sustainable product development is only statistically significant for the tangible product model (β =1.716, $p<0.05$). Besides, the 'fairly poor' and 'fairly good' sustainability support service categories' odds ratios are also only statistically significant for the tangible product model (β=1.415, $p<.05$; β=1.453, $p<0.05$). Thus, external access to knowledge and information is most important for the manufacturers of tangible products.

In addition, Table 10 also indicates that H2a is not supported for any of the three product categories ($p>0.1$), supporting the previous findings. Besides, firm internationalization has a positive, statistically significant impact on companies' engagement in sustainable product development ($p<0.01$) for all three product types, which also aligns with the prior findings. The results show that the magnitude of the estimated odds ratios is similar among the three models, revealing no product type differences. When examining the odds ratios for variable IPR, one can only find a statistically significant effect for the tangible product and tangible service models ($p<0.01$). However, among these two product categories, the impact of an increase in IPR stringency on the odds of participating in sustainable product development is similar (β= 1.397, β=1.457). Lastly, H7a is supported by all three product type models ($p<0.01$ / $p<0.05$), which coincides with the previous findings.

In conclusion, the robustness check for the sustainable product development model verified the earlier results to a large extent. Except for the effect of IPR (support for H4b) and external knowledge access, the impact of the other explanatory variables on the dependent variable did not differ among product classes.

Table 10: Subsample analysis - Multilevel logistic regression estimates for dependent variable sustainable product development in odds ratio format

VARIABLES	(1) tangible_products	(3) tangible_services	(5) intangible_services
ind_cluster	1.398***	1.538***	1.528***
	[0.144]	[0.150]	[0.170]
collaborations_fairly_poor	1.284	1.029	1.238
	[0.317]	[0.194]	[0.352]
collaborations_fairly_good	1.431	0.901	1.193
	[0.339]	[0.161]	[0.325]
collaborations_very_good	1.716**	0.974	1.046
	[0.432]	[0.191]	[0.296]
sust_support_fairly_poor	1.415**	0.863	0.980
	[0.225]	[0.111]	[0.164]
sust_support_fairly_good	1.453**	1.131	1.133
	[0.230]	[0.143]	[0.187]
sust_support_very_good	1.863***	1.522***	1.585**
	[0.373]	[0.245]	[0.312]
lack_demand	0.908	0.989	1.040
	[0.076]	[0.095]	[0.094]
foreign_markets_ 1_to_2	1.555***	1.461***	1.471***
	[0.141]	[0.125]	[0.152]
foreign_markets_3_to_4	2.286***	2.073***	2.851***
	[0.358]	[0.399]	[0.584]
foreign_markets_more_than_4	2.534***	1.946***	2.972***
	[0.439]	[0.413]	[0.656]
lack_willingness	0.705***	0.653***	0.686**
	[0.095]	[0.085]	[0.104]
employees_small	1.212**	1.026	1.275**
	[0.114]	[0.087]	[0.127]
employees_medium	1.227*	1.166	1.339**
	[0.137]	[0.140]	[0.168]
employees_large	2.039***	1.972***	1.204
	[0.359]	[0.367]	[0.211]
IPR	1.397***	1.459***	1.161
	[0.139]	[0.135]	[0.107]
financial_res	1.062	1.075	1.235**
	[0.107]	[0.093]	[0.128]
age	0.998	0.997*	1.002
	[0.002]	[0.002]	[0.002]
growth_zero	0.957	0.982	0.966
	[0.117]	[0.111]	[0.138]
growth_positive	1.056	1.240**	1.155
	[0.119]	[0.127]	[0.153]
single_owner	0.936	0.889	0.997
	[0.080]	[0.068]	[0.092]
GDP_growth	0.897	0.971	0.866*
	[0.086]	[0.087]	[0.075]
ln_GDP	0.973	0.993	0.977
	[0.081]	[0.079]	[0.074]
var(_cons[country])	1.406***	1.353***	1.300***
	[0.134]	[0.116]	[0.107]
var(1.lack_demand[country])		1.109	
		[0.075]	
Constant	0.051	0.034	0.180
	[0.118]	[0.076]	[0.379]
Observations	3,559	4,215	3,127
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

The robustness results for the multilevel ordered logistic regression model with the dependent variable sustainable processing are depicted in Table 11. One can recognize the effect of being in an industry cluster on businesses' sustainable processing engagement is positive and statistically significant at the 1% level for all three product category models. However, the odds ratios for the collaboration categories 'fairly good' and 'very good' are only significant for the tangible product model (β=1.556, $p<0.05$; β=1.936, $p<0.01$). A similar finding can be made for the 'fairly good' support service category (β =1.231, $p<0.1$). Based on these findings, one can say that external knowledge is more critical for the sustainable processing of tangible products.

Moreover, Table 11 only shows a positive, significant odds ratio for the variable *lack_demand* in the case of the tangible product model and intangible service models ($p<0.01$). One can also realize that firm internationalization has a larger impact on tangible product suppliers' and service providers' sustainable processing commitment than on the sustainability engagement of intangible service producers. Furthermore, Table 11 shows managers' willingness to solve sustainability-related issues does not affect the sustainability degree of the manufacturing process of tangible products (β=0.903, $p>0.1$). Nevertheless, this variable significantly affects service providers' sustainable processing engagement ($p<0.1$), supporting H7b. Lastly, H5 and H6 are supported for all three models with no sign of magnitude differences for product types.

Overall, the robustness check for the sustainable processing model confirmed most of the previous results. However, significant product type differences in the effects of most variables were observed. Consequently, future research should consider product type differences from the start.

Table 11: Subsample analysis - Multilevel ordered logistic regression estimates for dependent variable sustainable processing – in odds ratio format

VARIABLES	(1) tangible_products	(3) intangible_products	(5) intangible_services
ind_cluster	1.815***	2.080***	1.759***
	[0.176]	[0.193]	[0.178]
collaborations_fairly_poor	1.315	1.137	1.089
	[0.254]	[0.174]	[0.238]
collaborations_fairly_good	1.556**	1.051	1.076
	[0.287]	[0.152]	[0.223]
collaborations_very_good	1.936***	1.162	1.296
	[0.388]	[0.186]	[0.282]
sust_support_fairly_poor	1.106	0.899	1.014
	[0.137]	[0.092]	[0.136]
sust_support_fairly_good	1.231*	0.931	1.111
	[0.153]	[0.096]	[0.148]
sust_support_very_good	1.842***	1.345**	1.414**
	[0.310]	[0.186]	[0.235]
lack_demand	1.276***	1.093	1.248***
	[0.094]	[0.070]	[0.096]
foreign_markets_ 1_to_2	1.025	1.072	0.990
	[0.079]	[0.077]	[0.086]
foreign_markets_3_to_4	1.387**	1.336*	1.267
	[0.193]	[0.235]	[0.231]
foreign_markets_more_than_4	1.926***	1.924***	1.814***
	[0.318]	[0.393]	[0.384]
lack_willingness	0.903	0.825*	0.737**
	[0.138]	[0.089]	[0.091]
employees_small	1.292***	1.350***	1.509***
	[0.104]	[0.097]	[0.127]
employees_medium	1.861***	1.744***	1.822***
	[0.183]	[0.187]	[0.199]
employees_large	2.601***	2.043***	2.130***
	[0.422]	[0.357]	[0.328]
env_regulations	1.724***	1.702***	1.380*
	[0.344]	[0.331]	[0.269]
financial_res	1.267***	1.178**	1.266***
	[0.107]	[0.083]	[0.106]
age	1.002	1.001	1.004**
	[0.002]	[0.002]	[0.002]
growth_zero	0.968	1.152	1.001
	[0.099]	[0.104]	[0.118]
growth_positive	1.190*	1.450***	1.279**
	[0.114]	[0.121]	[0.141]
single_owner	0.989	0.947	0.912
	[0.073]	[0.061]	[0.070]
GDP_growth	0.958	1.002	0.922
	[0.133]	[0.135]	[0.123]
ln_GDP	1.073	1.179	1.098
	[0.116]	[0.126]	[0.115]
var(1.lack_willingness[country])	1.340*		
	[0.212]		
var(_cons[country])	2.013***	1.979***	1.915***
	[0.356]	[0.336]	[0.325]
Observations	3,559	4,215	3,127
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

8. Robustness Analysis II

In addition to the first robustness analysis, another robustness test was performed to determine whether the empirical findings still hold if sustainable processing is not defined as a categorical variable but as a binary variable. Consequently, the variable *sust_processing* was created, which equals one if a business implemented at least one environmental-related activity and one socially-beneficial measure. Table 12 presents the estimated regression coefficients for the model with the binary dependent variable *sust_processing*. As previously, the coefficient of the variable *industry_cluster* is positive and statistically significant at the 1% significance level ($\beta=0.848$, $p<0.01$). Yet conversely to the findings in Section 6, all coefficients for the collaboration categories are positive and statistically significant ($p<0.05$, $p<0.01$), providing additional support for H1b. Moreover, the generated regression coefficients for the sustainability support variable contradict previous discoveries since the coefficients are statistically insignificant at the 10% significance level.

Nevertheless, the findings connected to a lack of sustainability demand and firm internationalization conform with the prior observations, suggesting H2b and H3b are still supported. Additionally, a positive, statistically significant relationship between countries' stringency of environmental regulations and firms' engagement in sustainable processing is revealed ($\beta=0.502$, $p<0.01$), which supports H5 and matches the earlier findings. Furthermore, the previous conclusions regarding the effect of firm size are supported by this robustness analysis ($p<0.01$). However, in contrast to the results presented in Section 6, a lack of managerial willingness to solve sustainability-related issues has an insignificant effect on a firm's sustainable processing commitment ($\beta=-0.137$, $p>0.1$).

In conclusion, the previous findings regarding sustainable processing and the results of this robustness analysis both support H1b (partially), H2b, H3b, H5, and H6. However, a significant effect of managerial willingness and, thus, support for H7 is only identified when measuring engagement in sustainable processing via a categorical variable. Hence, the empirical findings are considerably robust.

Table 12: Multilevel ordered logistic regression estimates for the alternative dependent variable

VARIABLES	(1) sust_processing	(2) sust_processing
ind_cluster	0.848***	2.335***
	[0.083]	[0.193]
collaborations_fairly_poor	0.287**	1.332**
	[0.127]	[0.169]
collaborations_fairly_good	0.261**	1.298**
	[0.120]	[0.156]
collaborations_very_good	0.406***	1.501***
	[0.131]	[0.197]
sust_support_fairly_poor	-0.039	0.962
	[0.082]	[0.079]
sust_support_fairly_good	-0.004	0.996
	[0.082]	[0.082]
sust_support_very_good	0.107	1.113
	[0.111]	[0.123]
lack_demand	0.421***	1.524***
	[0.053]	[0.081]
foreign_markets_ 1_to_2	0.070	1.072
	[0.055]	[0.059]
foreign_markets_3_to_4	0.500***	1.649***
	[0.131]	[0.216]
foreign_markets_more_than_4	0.560***	1.750***
	[0.155]	[0.271]
lack_willingness	-0.137	0.872
	[0.086]	[0.075]
employees_small	0.306***	1.358***
	[0.056]	[0.076]
employees_medium	0.631***	1.879***
	[0.077]	[0.144]
employees_large	0.867***	2.380***
	[0.128]	[0.305]
env_regulations	0.502***	1.652***
	[0.181]	[0.299]
financial_res	0.266***	1.304***
	[0.056]	[0.072]
age	0.003**	1.003**
	[0.001]	[0.001]
growth_zero	0.113	1.119
	[0.072]	[0.080]
growth_positive	0.321***	1.379***
	[0.067]	[0.093]
single_owner	-0.094*	0.910*
	[0.050]	[0.046]
GDP_growth	-0.013	0.987
	[0.126]	[0.124]
ln_GDP	0.061	1.063
	[0.099]	[0.105]
var(_cons[country])	0.596***	1.815***
	[0.147]	[0.267]
Constant	-4.466	0.011
	[3.068]	[0.035]
Observations	10,901	10,901
Number of groups	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level.
Column 2 depicts the results in odds ratio format.

9. Discussion of the Results

This research has examined the effect of different stakeholder pressures on companies' engagement in corporate sustainability practices. The research findings indicate that businesses, part of an industry cluster or support group, are more likely to participate in corporate sustainability practices irrespective of the product type they supply. This finding can be attributed to the idea that companies located close to each other are part of a social network, which stimulates the knowledge exchange among workers from different firms and, thus, enables more effortless opportunity exploration (Dahl & Pedersen, 2004; Easterby-Smith et al., 2008; Foss et al., 2013). Besides, the robustness test revealed a positive, statistically significant relationship between collaboration access and tangible product suppliers' corporate sustainability efforts. This discovery reveals that collaborations are critical for developing physical, sustainable products since businesses lack the internal knowledge and capabilities to design such products independently (Dangelico et al., 2013; Guadamillas-Gómez & Donate-Manzanares, 2011). Thus, without help from external collaboration partners, tangible product manufacturers might be reluctant to invest in sustainable product development due to the high risk of unsuccessful efforts. This risk might be especially alarming for tangible product providers since the financial losses associated with failed development attempts are likely higher than those experienced by intangible service suppliers. This argumentation also explains why a larger effect of sustainability support services on engagement in sustainable product development was found for tangible product producers. Overall, this research supports H1a and H1b to a large extent, suggesting that access to external knowledge positively impacts firms' sustainability-related activities. The identified effect is found to be stronger for tangible product manufacturers.

Besides, the results did not support H2a and provided no evidence for a negative relationship between consumers' lack of sustainability demand and firms' sustainable processing efforts. Indeed, a positive relationship between those two variables was found. This result can potentially be explained by the fact that some firms invest in sustainability to set themselves apart from their competitors, even though they face no pressure from the market. Alternatively, businesses not facing sustainability-related consumer pressure might still be tempted to invest in sustainable processing to prevent future legitimacy issues. Future research should investigate these ideas further by interviewing enterprises without consumer pressure for sustainability about the drivers that encourage these companies to engage in sustainable processing.

This research has also shown that firm internationalization has a positive, statistically significant effect on companies' participation in corporate sustainability practices, supporting H3a and H3b. However, it was observed that the effect of this explanatory variable on sustainable processing was slightly larger for the tangible product and service providers. This result can be ascribed to the idea that due to the economies of scale resulting from increased firm internationalization, providers of tangible products and services face considerable cost reductions, which likely is not an issue for intangible service providers in the first place (Hill, 1999; Kang, 2013). Moreover, this finding can be explained by the fact that tangible product and service suppliers are more visible to the public, given that their actions can be directly seen. Hence, firm internationalization puts more pressure on those companies than on intangible service providers.

In addition, this research fully supports H4a and H4b, suggesting IPR stringency positively relates to companies' engagement in sustainable product development, which coincides with the results of Krystofik, Wagner, and Gaustad (2015). Providing monopoly power to companies allows them to reap returns from their development and innovation efforts (Menell & Scotchmer, 2007). The previously conducted analysis has also revealed a positive, statistically significant effect of environmental legislation stringency on sustainable processing commitment. This finding supports H5 and matches the results presented in other academic articles (Hoogendoorn et al., 2015; Li & Ramanathan, 2018; Xie et al., 2017).

Lastly, regarding the internal drivers and barriers of corporate sustainability practices, it has been shown that firm size has a positive, statistically significant effect on companies' engagement in sustainable processing activities. Since large corporations own more resources and face higher pressure from the media, they engage more frequently in sustainable processing than SMEs (Bianchi & Noci, 1998; Zhou et al., 2021). Even though no hypothesis was formulated regarding the effect of firm size on sustainable product development, this research has shown a positive, statistically significant relationship between these two variables.

Lastly, H7a and H7b are also upheld by this research, implying that a lack of managerial awareness and willingness to support sustainable business behavior negatively impacts participation in corporate sustainability practices. This finding shows that managers are a key internal force for implementing sustainability practices (Brío González et al., 2007).

To conclude, this research has shown that many internal and external stakeholders affect a corporation's engagement in sustainable business practices. Furthermore, it has been demonstrated

that the estimated effects of specific variables vary across product type classes. Thus, controlling for product type differences is crucial to get unbiased results.

10.Limitations

This research has a few shortcomings related to the data set, the variable definitions, and the model specification. This section provides a detailed description of the limitations and presents potential solutions.

10.1. Data and Sample-related Limitations

The data set mainly comprises developed countries (European Commission, 2020b). Consequently, the obtained findings might not apply to less developed nations. Hence, if the study is repeated, the European Commission (2020b) should also consider questioning representatives of businesses operating in less-developed regions. In this way, the generalizability of the results can be improved.

Moreover, the data set mainly contains information about firms with less than 49 employees. Thus, approximately 80% of the observed sample companies classify as micro and small businesses (Table 6). Due to the systematic undersampling of large corporations, this research may overestimate the effect of drivers that are especially critical for small firms' corporate sustainability behavior. On the other hand, the impact of drivers that encourage large companies to engage in sustainability practices might be neglected. As a result, the generated findings are likely not representative of the entire population of companies. Accordingly, the European Commission should guarantee that identical proportions of enterprises of all sizes are incorporated in future studies.

A more sample-related limitation also needs to be pointed out. As the data preparation section explained, firm observations with missing values were excluded from the original data set. Besides, company observations from Kosovo and Bosnia and Herzegovina were also not incorporated in the final sample due to missing GDP information. Given the unanswered questionnaire questions and the unavailable data, the sample might exhibit selection bias, underlying the previous statement that the company sample is not representative of the entire population of businesses, which restricts the generalizability of the findings. For instance, it could

be the case that firms that did not respond to specific questionnaire questions engage in extremely unsustainable behavior. The research findings will be biased towards more sustainability-interested corporations in such a case.

Next, the dataset was constructed based on the answers company key decision-makers provided during phone interviews (European Commission, 2020b). Therefore, the given information reflects, to a certain extent, the interviewees' opinions and perceptions, potentially biasing the results. For example, the collaboration and sustainability support rating highly depend on the representatives' personal impressions. In addition, the information on managerial attitude communicated by the top-level company leaders might be unreliable. Based on the social desirability bias definition provided by Nederhof (1985), the interviewed business executives are more likely to give socially acceptable replies, suggesting they report a positive managerial attitude towards sustainability despite their actual willingness to solve environmental and social issues being low. Consequently, the estimated coefficient for the *lack_willingness* variable is presumably overestimated. However, by interviewing more than one person per company, future studies could overcome these problems.

10.2. Variable-related Limitations

This research relies on a binary variable to identify companies that engage in sustainable product development. However, this variable does not capture the extent to which companies design and manufacture sustainable products. For instance, this variable could take on a value of one for a company that has only created one sustainable product but also for a firm whose entire product range (e.g., ten articles) comprises sustainable products. Given that the degree of sustainable product development is not captured through the constructed variable, alternative ways of measuring sustainable product development must be established. For example, one could calculate the percentage of sustainable products from a business's entire assortment. Alternatively, the portion of sustainable product sales from the total sales volume could be computed. Nevertheless, additional data would be needed to build such continuous variables. A similar argument applies to the second dependent variable, which only measures the number of sustainable processing activities implemented by a company but not the extent to which these activities are actually incorporated into the firm's operations.

10.3. Model-related Limitations

It could be the case that the model suffers from omitted variable bias (Wooldridge, 2019). For example, society's cultural values will likely affect a company's engagement in corporate sustainability practices and managers' willingness to solve sustainability issues. Compared to firms from short-term-oriented nations, businesses in countries with a long-term-oriented culture are more concerned with working toward a more meaningful future goal, suggesting they are more likely to commit to sustainable firm behavior. (Lee & Herold, 2016) On the other hand, one can assume that managers from forward-looking cultures are less likely to lack the motivation to solve sustainability-related issues. Consequently, the estimated coefficient for the variable *lack_willingness* might be downward biased since it captures part of the '*long-term cultural orientation*' variable effect. Accordingly, including information on Hofstede's cultural dimensions in the model might be valuable to resolve this problem (Lee & Herold, 2016). Alternatively, an instrumental variable approach could be applied to overcome this concern. Generally, the instrumental variable (IV) must satisfy two criteria. First, the IV must be strongly correlated to the endogenous variable, *lack_willigness*. Second, the IV should not be directly related to the dependent variables or any other explanatory factors, implying it is exogenous. (Semadeni et al., 2014) Hence, to overcome the described issue, one could use managers' bonuses connected to achieving sustainability goals as an IV (Figure 3).

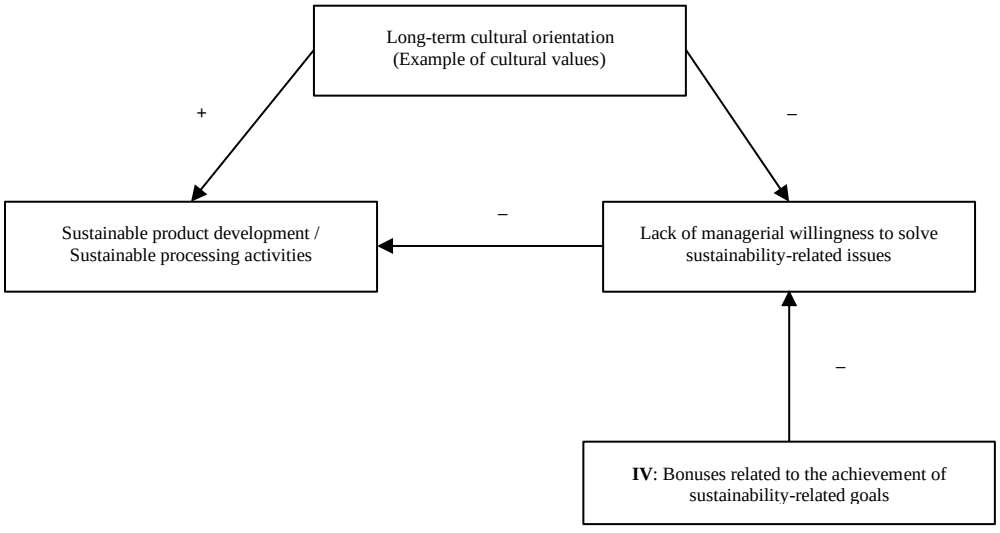

Figure 3: Isolation of the exogenous variation in lack of managerial willingness based on the IV.
Note: The author of this thesis created this figure based on theoretical knowledge from Semadeni et al. (2014).

In addition to omitted variable bias, reverse causality might also be an issue (Wooldridge, 2019). As proposed in the literature review, firm internationalization encourages businesses to commit to corporate sustainability practices. However, companies' participation in corporate sustainability practices might also motivate them to expand to foreign countries, based on the idea that they can easily reach operational legitimacy due to their environmentally-friendly and socially-responsible behavior. Future research should further explore this concern.

The third model-related issue concerns the number of level-2 units in the data set. In total, information on firms from 37 different countries is included in the cleaned data set. However, previous research has indicated that at least 50 level-2 units are required to obtain correct standard errors and prevent causal inference-related issues (Maas & Hox, 2005; Sommet & Morselli, 2017). Consequently, the estimated coefficients for this research are less precise. Nonetheless, this problem can be overcome by increasing the number of countries considered for future Flash Eurobarometer surveys (European Commission, 2020b).

Lastly, it would have been beneficial to construct a three-level hierarchical model to account for industry differences (i.e., product type differences). However, in the case at hand, there were insufficient company observations at the end of each node of the three-level hierarchical tree (Sommet & Morselli, 2017). Due to not accounting for industry-level differences in corporate sustainability practices, the generated regression coefficients are likely biased. Hence, more observations should be collected for future studies.

11. Conclusion

Based on data from the Flash Eurobarometer study 486 (European Commission, 2020b) and stakeholder theory insights, this research has investigated internal and external drivers and barriers of corporate sustainability practices. The estimated multilevel (ordered) logistic regression models reveal that industry clusters and sustainability support services positively affect companies' commitment to sustainable business practices. Moreover, tangible product manufacturers with reasonable access to collaborations are more likely to design sustainable products and have a higher sustainable processing degree than other tangible product suppliers. Besides, no relationship exists between a lack of customer pressure for sustainability and an enterprise's engagement in sustainable product development. However, surprisingly, a lack of consumer demand for

sustainability positively affects a company's engagement in environmentally and socially friendly processing techniques. Regarding the impact of internal stakeholders, a positive relationship exists between the number of employees (firm size) and companies' engagement in corporate sustainability practices. Additionally, a lack of managerial awareness and willingness to solve sustainability-related issues negatively impacts a business's participation in sustainable activities. Lastly, it is crucial to note that the effects of variables, such as IPR and collaborations, significantly vary across product types.

The presented findings have several societal implications. In the first instance, the research emphasizes that various stakeholder groups influence companies' engagement in corporate sustainability activities, supporting the theoretical implications of stakeholder theory (Freeman, 1984; Freeman, 2010; Freudenreich et al., 2020). Moreover, the findings suggest that government interventions in the market economy via IPRs and environmental regulations can be valuable for encouraging firms to participate in sustainable business practices. Additionally, the empirical results indicate that governments should foster the formation of industry clusters and encourage the construction of knowledge-exchange platforms. Lastly, the government could enforce programs that educate managers on sustainability-related issues to increase firms' sustainability in the long run. The generated findings also have positive implications for suppliers of sustainability support services. Generally, companies offering such services must raise awareness of the benefits they provide to businesses that aim to become more sustainable.

Apart from the importance of the presented results for society, this research also has academic implications. Since past research has mainly focused on the drivers and barriers to sustainable innovations and corporate social responsibility (Ayuso et al., 2011; Dartey-Baah & Amoako, 2021; Ketata et al., 2015; Laudal, 2011), this research helps fill the literature gap regarding corporate sustainability practices. Moreover, it increases researchers' understanding of the factors driving and hindering companies from engaging in sustainability activities. In addition, this research can be regarded as one of few papers that relies on multilevel regression models to study the effect of firm- and country-level variables jointly (Hoogendoorn et al., 2015).

Concerning future research, evaluating the effect of other stakeholder groups, such as NGOs and financial institutions, seems crucial. Moreover, upcoming investigations should aim to identify the impact of each *distinct* stakeholder group on corporate sustainability practices since the exact importance of each stakeholder group cannot be quantified based on the presented

research findings (Hoogendoorn et al., 2015). For example, the positive effect of firm internationalization on sustainable firm behavior could be due to an increased customer base or higher media coverage. Future investigations can handle this problem by more precisely designing and targeting questionnaire questions to specific stakeholder groups. Finally, as proposed in the discussion section, future research should further examine why a lack of customer demand for sustainability positively relates to companies' engagement in environmentally and socially friendly processing activities.

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Appendix A: Summary Statistics

Table A1: Frequency table for firm growth (*growth*)

	Freq.	Percent	Cum.
negative growth	1682	15.43	15.43
zero growth	3099	28.43	43.86
positive growth	6120	56.14	100.00
Total	10901	100.00	

Table A2: Frequency table for product type

	Freq.	Percent	Cum.
(tangible) product sector	3559	32.65	32.65
intangible service sector	3127	28.69	61.33
tangible service sector	4215	38.67	100.00
Total	10901	100.00	

Robustness test information

Based on the example of Hoogendoorn, Guerra, and van der Zwan (2015), this research classifies companies via their NACE code into three categories: Tangible product manufacturers, tangible service producers, and intangible service suppliers. It is essential to distinguish between tangible and intangible services, given that some suppliers use tremendous amounts of natural resources and pollute the environment, while others do not.

Tangible product sectors:

- Mining and quarrying (NACE B)
- Manufacturing (NACE C)
- Electricity, gas, steam and air conditioning (NACE D)
- Water supply, sewerage and waste management (NACE E)
- Construction (NACE F)

Tangible service sectors:

- Wholesale and retail (NACE G)
- Transportation and storage (NACE H)
- Accommodation and food service (NACE I)

Intangible service sectors:

- Information and communication services (NACE J)
- Financial and insurance activities (NACE K)
- Real estate activities (NACE L)
- Professional, scientific, and technical activities (NACE M)
- Administrative and supportive services (NACE N)
- Education (NACE P)
- Human health and social work activities (NACE Q)
- Arts, entertainment, and recreation work (NACE R)

Table A3: Country frequency table

COUNTRY/SAMPLE ID (SERIES STANDARD)	Freq.	Percent	Cum.
FR - France	365	3.35	3.35
BE - Belgium	367	3.37	6.71
NL - The Netherlands	362	3.32	10.04
DE - Germany	320	2.94	12.97
IT - Italy	301	2.76	15.73
LU - Luxembourg	150	1.38	17.11
DK - Denmark	244	2.24	19.35
IE - Ireland	342	3.14	22.48
GB - United Kingdom	264	2.42	24.91
GR - Greece	373	3.42	28.33
ES -Spain	379	3.48	31.80
PT - Portugal	355	3.26	35.06
FI - Finland	400	3.67	38.73
SE - Sweden	351	3.22	41.95
AT - Austria	334	3.06	45.01
CY - Cyprus (Republic)	117	1.07	46.09
CZ - Czech Republic	314	2.88	48.97
EE - Estonia	184	1.69	50.66
HU - Hungary	329	3.02	53.67
LV - Latvia	359	3.29	56.97
LT - Lithuania	301	2.76	59.73
MT - Malta	119	1.09	60.82
PL - Poland	395	3.62	64.44
SK - Slovakia	295	2.71	67.15
SI - Slovenia	395	3.62	70.77
BG - Bulgaria	357	3.27	74.05
RO - Romania	372	3.41	77.46
TR - Turkey	259	2.38	79.84
HR - Croatia	375	3.44	83.28
MK - Makedonia/FYROM	178	1.63	84.91
RS - Serbia	153	1.40	86.31
NO - Norway	208	1.91	88.22
IS - Iceland	77	0.71	88.93
JP - Japan	177	1.62	90.55
US - USA	359	3.29	93.84
BR - Brazil	325	2.98	96.83
CA - Canada	346	3.17	100.00
Total	10901	100.00	

Table A4: Industry frequency table

D1 SECTOR OF ACTIVITY (NACE) - SECTIONS	Freq.	Percent	Cum.
B - Mining and quarrying	68	0.62	0.62
C - Manufacturing	2242	20.57	21.19
D - Electricity, gas, steam and air conditioningsupply	69	0.63	21.82
E - Water supply,sewerage,waste management/remediation activ	118	1.08	22.91
F - Construction	1062	9.74	32.65
G - Wholesale and retail trade, repair of motor vehicles and	2994	27.47	60.11
H - Transportation and storage	625	5.73	65.85
I - Accommodation and food service activities	596	5.47	71.31
J - Information and communication	383	3.51	74.83
K - Financial and insurance activities	231	2.12	76.95
L - Real estate activities	247	2.27	79.21
M - Professional, scientific and technical activities	1026	9.41	88.62
N - Administrative and support service activities	472	4.33	92.95
P - Education	189	1.73	94.69
Q - Human health and social work activities	392	3.60	98.28
Arts, entertainment and recreation	187	1.72	100.00
Total	10901	100.00	

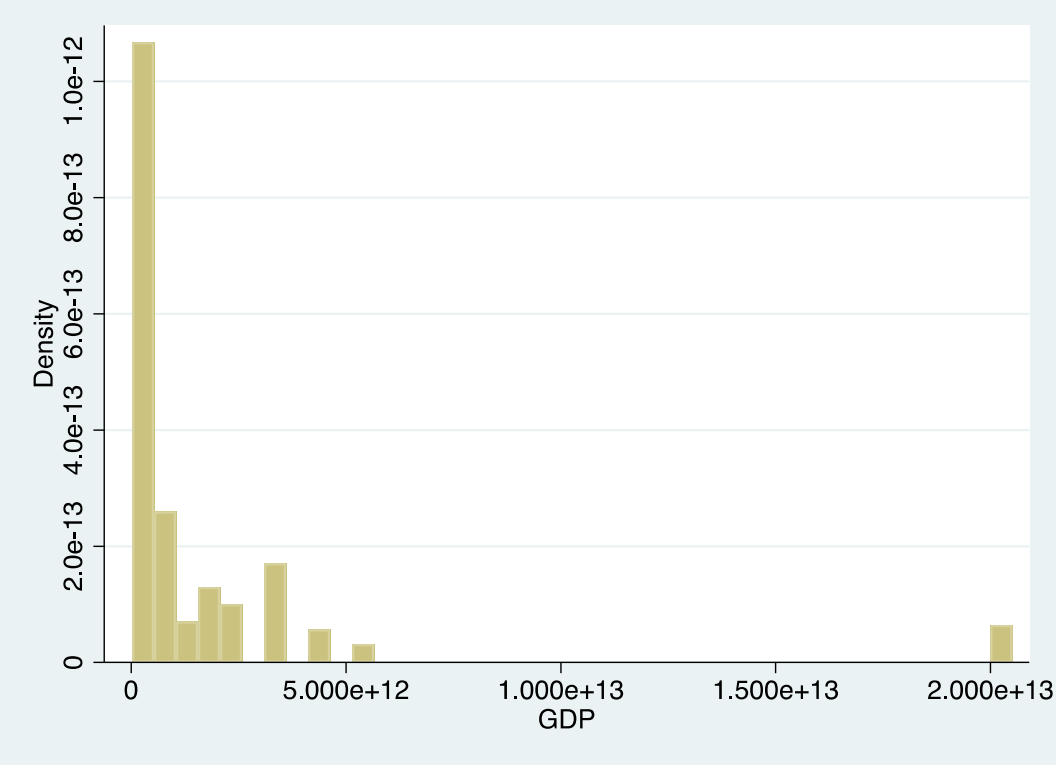

Figure A1: Distribution of PPP-adjusted GDP (2017 international dollars)

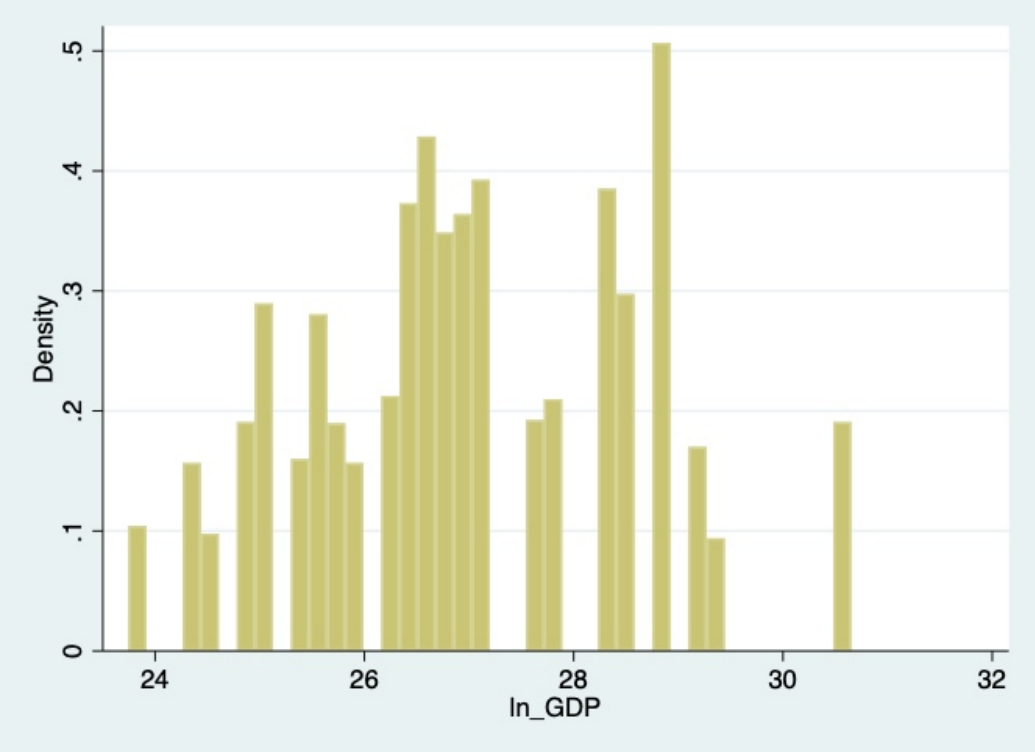

Figure A2: Distribution of log GDP

Appendix B: Correlation & VIF

Table B1: VIF for multilevel logistic regression model with the dependent variable sustainable product development

	VIF	1/VIF
1.ind cluster	1.07	.93
2.collaborations	4.33	.23
3.collaborations	6.99	.14
4.collaborations	5.25	.19
2.sust support	2.93	.34
3.sust support	3.39	.3
4.sust support	2.15	.46
1.lack demand	1.04	.96
1.foreign markets	1.11	.9
2.foreign markets	1.06	.94
3.foreign markets	1.09	.92
1.lack willingness	1.03	.97
2.employees	1.18	.85
3.employees	1.26	.79
4.employees	1.21	.83
IPR	1.55	.64
1.financial res	1.08	.92
age	1.17	.85
2.growth	2.09	.48
3.growth	2.17	.46
1.single owner	1.1	.91
GDP growth	1.54	.65
ln GDP	1.63	.61
1.tangible	1.04	.96
Mean VIF	2.02	.

Table B2: VIF for multilevel ordered logistic regression model with the dependent variable sustainable processing

	VIF	1/VIF
1.ind cluster	1.06	.94
2.collaborations	4.33	.23
3.collaborations	7	.14
4.collaborations	5.26	.19
2.sust support	2.93	.34
3.sust support	3.39	.3
4.sust support	2.15	.46
1.lack demand	1.04	.96
1.foreign markets	1.1	.91
2.foreign markets	1.06	.94
3.foreign markets	1.09	.92
1.lack willingness	1.03	.97
2.employees	1.18	.85
3.employees	1.26	.8
4.employees	1.2	.83
env regulations	1.38	.72
1.financial res	1.08	.93
age	1.17	.86
2.growth	2.08	.48
3.growth	2.17	.46
1.single owner	1.09	.91
GDP growth	1.77	.56
ln GDP	1.48	.67
1.tangible	1.04	.96
Mean VIF	2.01	.

Table B3: Part I – Correlation table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) sust_products	1.0000																	
(2) sustainable0	-0.17***	1.0000																
(3) sustainable1	-0.31***	-0.19***	1.0000															
(4) sustainable2	-0.03***	-0.19***	-0.39***	1.0000														
(5) sustainable3	0.41***	-0.23***	-0.45***	-0.47***	1.0000													
(6) ind_cluster	0.15***	-0.10***	-0.16***	0.02**	0.20***	1.0000												
(7) collabs1	-0.04***	0.04***	0.03***	-0.0100	-0.04***	-0.03***	1.0000											
(8) collabs2	-0.02*	0.0000	0.03***	-0.0100	-0.02**	-0.02*	-0.09***	1.0000										
(9) collabs3	0.0000	0.0100	0.0100	0.0000	-0.0100	0.0000	-0.26***	-0.54***	1.0000									
(10) collabs4	0.04***	-0.04***	-0.05***	0.0100	0.06***	0.03***	-0.10***	-0.21***	-0.61***	1.0000								
(11) sust_serv1	-0.06***	0.06***	0.06***	-0.02**	-0.07***	-0.06***	0.28***	0.12***	-0.13***	-0.08***	1.0000							
(12) sust_serv2	-0.05***	0.02**	0.03***	0.02**	-0.07***	-0.03***	-0.03***	0.18***	0.0000	-0.15***	-0.22***	1.0000						
(13) sust_serv3	0.05***	-0.03***	-0.03***	0.0100	0.04***	0.04***	-0.13***	-0.17***	0.19***	-0.02**	-0.33***	-0.64***	1.0000					
(14) sust_serv4	0.07***	-0.03***	-0.06***	-0.03***	0.10***	0.05***	-0.03***	-0.11***	-0.18***	0.33***	-0.12***	-0.23***	-0.34***	1.0000				
(15) lack_demand	0.03***	-0.07***	-0.09***	0.07***	0.06***	0.06***	0.02*	0.05***	-0.0100	-0.04***	0.02**	0.03***	-0.02**	-0.03***	1.0000			
(16) foreignmarkets0	-0.11***	0.05***	0.0100	-0.0100	-0.03***	-0.05***	0.02**	0.02**	-0.02**	-0.0100	0.0100	-0.03***	0.0100	0.02**	0.0100	1.0000		
(17) foreignmarkets1	0.03***	-0.0100	0.05***	0.0100	-0.04***	0.0000	-0.0100	-0.0100	0.0100	-0.0100	0.02*	0.04***	-0.03***	-0.03***	-0.0100	-0.81***	1.0000	
(18) foreignmarkets2	0.09***	-0.04***	-0.05***	0.03***	0.05***	0.05***	-0.0100	-0.0100	0.0000	0.0100	-0.03***	0.0000	0.02*	0.0100	0.02*	-0.30***	-0.13***	1.0000
(19) foreignmarkets3	0.10***	-0.04***	-0.07***	-0.02**	0.11***	0.07***	-0.03***	-0.03***	0.02*	0.02**	-0.04***	-0.02*	0.03***	0.02*	-0.0100	-0.28***	-0.12***	-0.04***
(20) lack_willingn~s	-0.02**	-0.02**	-0.03***	0.04***	0.0100	0.03***	0.0000	0.03***	-0.0100	-0.0100	-0.02**	0.0100	0.0000	-0.0100	0.13***	0.03***	-0.03***	0.0000
(21) micro_firm	-0.09***	0.11***	0.07***	-0.0100	-0.12***	-0.07***	0.06***	0.05***	-0.03***	-0.04***	0.10***	0.04***	-0.07***	-0.04***	0.02**	0.18***	-0.09***	-0.10***
(22) small_firm	0.0200	-0.05***	-0.0100	0.02*	0.02**	0.0100	-0.02*	0.0000	0.0100	0.0000	-0.02**	-0.0100	0.02**	0.0000	0.0000	-0.03***	0.04***	0.0000
(23) medium_firm	0.06***	-0.06***	-0.05***	-0.0100	0.09***	0.06***	-0.04***	-0.05***	0.04***	0.03***	-0.08***	-0.02**	0.05***	0.02**	-0.02**	-0.14***	0.07***	0.10***
(24) large_firm	0.08***	-0.05***	-0.05***	-0.0100	0.09***	0.04***	-0.03***	-0.04***	0.0000	0.05***	-0.06***	-0.03***	0.03***	0.04***	-0.02**	-0.12***	0.03***	0.07***
(25) env_regulations	0.16***	-0.14***	-0.18***	0.09***	0.17***	0.11***	-0.06***	-0.06***	0.0100	0.07***	-0.09***	-0.06***	0.08***	0.04***	0.08***	0.02**	-0.06***	0.03***
(26) IPR	0.17***	-0.16***	-0.23***	0.09***	0.23***	0.19***	-0.04***	-0.02*	-0.0100	0.05***	-0.10***	-0.06***	0.07***	0.07***	0.09***	0.07***	-0.12***	0.03***
(27) financial_res	0.07***	-0.08***	-0.07***	0.04***	0.08***	0.08***	-0.07***	-0.05***	0.0100	0.07***	-0.13***	-0.04***	0.09***	0.05***	-0.02**	-0.11***	0.06***	0.05***
(28) age	0.05***	-0.07***	-0.08***	0.0100	0.10***	0.11***	-0.02**	-0.04***	0.0000	0.04***	-0.08***	-0.02**	0.05***	0.03***	0.03***	-0.04***	-0.03***	0.05***
(29) negative_growth	-0.04***	0.05***	0.04***	-0.0100	-0.06***	-0.0100	0.06***	0.07***	-0.04***	-0.05***	0.10***	0.05***	-0.08***	-0.05***	0.07***	0.04***	-0.02**	-0.0200
(30) zero_growth	-0.05***	0.04***	0.03***	0.0000	-0.05***	-0.05***	0.0100	-0.0100	0.02**	-0.02**	-0.03***	-0.0100	0.02**	0.0000	-0.0100	0.07***	-0.05***	-0.04***
(31) positiv_growth	0.08***	-0.08***	-0.05***	0.0100	0.08***	0.05***	-0.05***	-0.05***	0.0100	0.05***	-0.05***	-0.03***	0.03***	0.04***	-0.04***	-0.10***	0.06***	0.05***
(32) single_owner	-0.08***	0.08***	0.07***	-0.03***	-0.09***	-0.08***	0.04***	0.03***	-0.02**	-0.02**	0.07***	0.0000	-0.03***	-0.02*	0.0000	0.11***	-0.05***	-0.06***
(33) GDP_growth	-0.13***	0.09***	0.16***	-0.05***	-0.16***	-0.17***	0.0000	-0.03***	0.02**	0.0000	0.07***	0.03***	-0.06***	-0.03***	-0.09***	-0.06***	0.11***	-0.02**
(34) ln_GDP	0.10***	-0.08***	-0.15***	0.02**	0.17***	0.15***	0.02**	0.07***	-0.06***	0.0000	-0.08***	-0.04***	0.03***	0.09***	0.08***	0.11***	-0.15***	0.0000
(35) tangible	0.02***	0.0000	0.03***	-0.04***	0.0000	0.0100	0.03***	0.03***	0.02*	-0.07***	0.03***	0.02*	-0.0100	-0.03***	0.02**	-0.09***	0.08***	0.02**

Table B4: Part II – Correlation table

Variables	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)
(1) sust_products																	
(2) sustainable0																	
(3) sustainable1																	
(4) sustainable2																	
(5) sustainable3																	
(6) ind_cluster																	
(7) collabs1																	
(8) collabs2																	
(9) collabs3																	
(10) collabs4																	
(11) sust_serv1																	
(12) sust_serv2																	
(13) sust_serv3																	
(14) sust_serv4																	
(15) lack_demand																	
(16) foreignmarkets0																	
(17) foreignmarkets1																	
(18) foreignmarkets2																	
(19) foreignmarkets3	1.0000																
(20) lack_willingn~s	0.0000	1.00															
(21) micro_firm	-0.13***	-0.01	1.00														
(22) small_firm	-0.0100	0.01	-0.64***	1.00													
(23) medium_firm	0.08***	0.00	-0.44***	-0.25***	1.00												
(24) large_firm	0.17***	0.00	-0.25***	-0.15***	-0.10***	1.00											
(25) env_regulations	0.05***	0.05***	0.01	-0.03***	0.01	0.01	1.00										
(26) IPR	0.08***	0.08***	-0.01	-0.01	0.01	0.02**	0.83***	1.00									
(27) financial_res	0.06***	0.02**	-0.12***	0.05***	0.08***	0.05***	0.12***	0.15***	1.00								
(28) age	0.12***	0.01	-0.22***	0.02**	0.15***	0.21***	0.15***	0.19***	0.07***	1.00							
(29) negative_growth	-0.03***	0.01	0.10***	-0.04***	-0.05***	-0.05***	-0.07***	-0.07***	-0.11***	0.03***	1.00						
(30) zero_growth	-0.02**	0.01	0.09***	-0.03***	-0.07***	-0.04***	0.00	0.00	-0.04***	0.05***	-0.27***	1.00					
(31) positiv_growth	0.04***	-0.02**	-0.16***	0.06***	0.10***	0.07***	0.05***	0.05***	0.12***	-0.07***	-0.48***	-0.71***	1.00				
(32) single_owner	-0.09***	0.00	0.23***	-0.08***	-0.15***	-0.12***	-0.04***	-0.11***	-0.11***	-0.14***	0.05***	0.04***	-0.07***	1.00			
(33) GDP_growth	-0.07***	-0.04***	-0.01	0.00	0.00	0.01	-0.48***	-0.46***	-0.07***	-0.14***	-0.01	-0.01	0.02*	0.03***	1.00		
(34) ln_GDP	0.05***	0.07***	-0.03***	0.02**	0.01	0.00	0.24***	0.49***	0.09***	0.11***	0.01	0.00	0.00	-0.07***	-0.54***	1.00	
(35) tangible	0.02**	0.00	-0.02*	0.02**	0.01	-0.03***	-0.10***	-0.12***	-0.01	0.03***	0.06***	-0.02**	-0.03***	0.05***	0.02**	-0.03***	1.00

Appendix C: Additional Regression Results

Table C1: Empty multilevel logistic regression model for the dependent variable sustainable product development

VARIABLES	(1) sust_products	(2) /
var(_cons[country])		0.535*** [0.1310]
Constant	-0.701*** [0.1226]	
Observations	10,901	10,901
Number of groups	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

Table C2: ICC for multilevel logistic regression model

Intraclass correlation ICC	Std.	err.	[95%	conf.	interval]
0.1398		0.0295		0.0914	0.2081

Table C3: CIMs and AIMs for the dependent variable sustainable product development

VARIABLES	CIM sust_products	AIM sust_products	AIM sust_products	AIM sust_products
1.ind_cluster	0.383***	0.388***	0.385***	0.384***
	[0.0590]	[0.0659]	[0.0592]	[0.0591]
2.collaborations	0.093	0.093	0.086	0.097
	[0.1309]	[0.1309]	[0.1312]	[0.1310]
3.collaborations	0.063	0.063	0.051	0.065
	[0.1249]	[0.1250]	[0.1253]	[0.1250]
4.collaborations	0.101	0.101	0.087	0.104
	[0.1332]	[0.1333]	[0.1336]	[0.1333]
2.sust_support	0.020	0.021	0.023	0.019
	[0.0847]	[0.0848]	[0.0849]	[0.0848]
3.sust_support	0.163*	0.163*	0.167**	0.163*
	[0.0840]	[0.0840]	[0.0841]	[0.0840]
4.sust_support	0.438***	0.440***	0.440***	0.440***
	[0.1045]	[0.1046]	[0.1048]	[0.1046]
1.lack_demand	-0.023	-0.023	-0.019	-0.023
	[0.0474]	[0.0474]	[0.0624]	[0.0474]
1.foreign_markets	0.425***	0.425***	0.426***	0.425***
	[0.0522]	[0.0522]	[0.0523]	[0.0522]
2.foreign_markets	0.867***	0.867***	0.875***	0.867***
	[0.1018]	[0.1019]	[0.1021]	[0.1019]
3.foreign_markets	0.909***	0.908***	0.917***	0.909***
	[0.1109]	[0.1109]	[0.1111]	[0.1110]
1.lack_willingness	-0.390***	-0.390***	-0.387***	-0.388***
	[0.0785]	[0.0785]	[0.0787]	[0.0917]
2.employees	0.135**	0.135**	0.134**	0.135**
	[0.0526]	[0.0526]	[0.0527]	[0.0526]
3.employees	0.208***	0.208***	0.205***	0.208***
	[0.0665]	[0.0665]	[0.0666]	[0.0665]
4.employees	0.482***	0.481***	0.481***	0.482***
	[0.1002]	[0.1003]	[0.1004]	[0.1003]
IPR	0.302***	0.304***	0.308***	0.304***
	[0.0874]	[0.0871]	[0.0889]	[0.0873]
1.financial_res	0.126**	0.126**	0.131**	0.126**
	[0.0548]	[0.0548]	[0.0550]	[0.0548]
age	-0.001	-0.001	-0.001	-0.001
	[0.0011]	[0.0011]	[0.0011]	[0.0011]
2.growth	-0.018	-0.018	-0.018	-0.018
	[0.0708]	[0.0709]	[0.0710]	[0.0709]
3.growth	0.149**	0.150**	0.150**	0.150**
	[0.0651]	[0.0651]	[0.0652]	[0.0651]
1.single_owner	-0.045	-0.045	-0.046	-0.045
	[0.0480]	[0.0480]	[0.0481]	[0.0480]
GDP_growth	-0.090	-0.088	-0.084	-0.092
	[0.0849]	[0.0846]	[0.0863]	[0.0848]
ln_GDP	-0.033	-0.032	-0.026	-0.035
	[0.0748]	[0.0746]	[0.0763]	[0.0748]
var(_cons[country])	0.308***	0.305***	0.316***	0.307***
	[0.0769]	[0.0765]	[0.0796]	[0.0768]
var(1.ind_cluster[country])		0.019		
		[0.0276]		
var(1.lack_demand[country])			0.052*	
			[0.0308]	
var(1.lack_willingness[country])				0.058
				[0.0696]
Constant	-2.338	-2.393	-2.609	-2.301
	[2.0675]	[2.0616]	[2.1074]	[2.0663]
Observations	10,901	10,901	10,901	10,901
Number of groups	37	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

Likelihood-ratio tests

Assumption: CIM nested within AIM1
LR chi2(1) = 0.70
Prob > chi2 = 0.4043
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Assumption: CIM nested within AIM2
LR chi2(1) = 6.23
Prob > chi2 = 0.0125
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Assumption: CIM nested within AIM3
LR chi2(1) = 1.03
Prob > chi2 = 0.3101
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Table C4: Empty multilevel ordered logistic regression model for the dependent variable sustainable processing

VARIABLES	(1) degree_sust_process
/cut1	-2.770*** [0.1768]
/cut2	-0.659*** [0.1742]
/cut3	0.818*** [0.1742]
/var(_cons[country])	1.102*** [0.2604]
Observations	10,901
Number of groups	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

Table C5: ICC for multilevel ordered logistic regression model

Residual intraclass correlation ICC	Std.	err.	[95%	conf.	interval]
0.2510		0.0444	0.1742		0.3474

Table C6: CIMs and AIMs for the dependent variable sustainable processing

VARIABLES	CIM degree_sust_process	AIM degree_sust_process	AIM degree_sust_process	AIM degree_sust_process
1.ind_cluster	0.613***	0.624***	0.618***	0.614***
	[0.0554]	[0.0742]	[0.0555]	[0.0554]
2.collaborations	0.144	0.152	0.142	0.148
	[0.1044]	[0.1045]	[0.1046]	[0.1045]
3.collaborations	0.156	0.161	0.153	0.157
	[0.0991]	[0.0992]	[0.0993]	[0.0992]
4.collaborations	0.311***	0.316***	0.306***	0.312***
	[0.1073]	[0.1074]	[0.1075]	[0.1074]
2.sust_support	-0.023	-0.024	-0.021	-0.025
	[0.0675]	[0.0676]	[0.0676]	[0.0676]
3.sust_support	0.045	0.043	0.048	0.045
	[0.0674]	[0.0675]	[0.0675]	[0.0675]
4.sust_support	0.366***	0.366***	0.364***	0.367***
	[0.0888]	[0.0889]	[0.0889]	[0.0889]
1.lack_demand	0.162***	0.164***	0.159***	0.161***
	[0.0406]	[0.0406]	[0.0560]	[0.0406]
1.foreign_markets	0.052	0.050	0.052	0.052
	[0.0440]	[0.0440]	[0.0440]	[0.0440]
2.foreign_markets	0.297***	0.296***	0.295***	0.294***
	[0.0913]	[0.0914]	[0.0914]	[0.0913]
3.foreign_markets	0.633***	0.631***	0.635***	0.636***
	[0.1065]	[0.1066]	[0.1067]	[0.1066]
1.lack_willingness	-0.214***	-0.215***	-0.211***	-0.206**
	[0.0659]	[0.0660]	[0.0661]	[0.0803]
2.employees	0.303***	0.304***	0.303***	0.304***
	[0.0444]	[0.0445]	[0.0445]	[0.0445]
3.employees	0.587***	0.589***	0.589***	0.589***
	[0.0584]	[0.0584]	[0.0585]	[0.0584]
4.employees	0.775***	0.771***	0.777***	0.770***
	[0.0922]	[0.0923]	[0.0924]	[0.0923]
env_regulations	0.488**	0.498**	0.504***	0.492**
	[0.1923]	[0.1935]	[0.1956]	[0.1929]
1.financial_res	0.215***	0.213***	0.219***	0.215***
	[0.0451]	[0.0452]	[0.0452]	[0.0452]
age	0.003***	0.003***	0.003***	0.003***
	[0.0010]	[0.0010]	[0.0010]	[0.0010]
2.growth	0.048	0.048	0.048	0.049
	[0.0579]	[0.0579]	[0.0580]	[0.0579]
3.growth	0.275***	0.276***	0.274***	0.275***
	[0.0540]	[0.0540]	[0.0541]	[0.0540]
1.single_owner	-0.036	-0.037	-0.037	-0.038
	[0.0404]	[0.0405]	[0.0405]	[0.0405]
GDP_growth	-0.023	-0.015	-0.022	-0.029
	[0.1333]	[0.1341]	[0.1356]	[0.1337]
ln_GDP	0.113	0.119	0.110	0.110
	[0.1045]	[0.1051]	[0.1064]	[0.1049]
var(_cons[country])	0.687***	0.694***	0.708***	0.691***
	[0.1642]	[0.1660]	[0.1699]	[0.1651]
var(1.ind_cluster[country])		0.064		
		[0.0421]		
var(1.lack_demand[country])			0.051*	
			[0.0271]	
var(1.lack_willingness[country])				0.061
				[0.0448]
Observations	10,901	10,901	10,901	10,901
Number of groups	37	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

Likelihood-ratio tests

Assumption: CIM nested within AIM1
LR chi2(1) = 5.04
Prob > chi2 = 0.0248
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Assumption: CIM nested within AIM2
LR chi2(1) = 6.23
Prob > chi2 = 0.0050
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Assumption: CIM nested within AIM3
LR chi2(1) = 3.49
Prob > chi2 = 0.0617
Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the parameter space. If this is not true, then the reported test is conservative.

Appendix D: Additional Robustness Test Results

Table D1: Subsample analysis - Multilevel logistic regression estimates for dependent variable sustainable product development in odds format

VARIABLES	(1) tangible_products	(3) tangible_services	(5) intangible_services
ind_cluster	0.335***	0.431***	0.424***
	[0.1028]	[0.0972]	[0.1111]
collaborations_fairly_poor	0.250	0.029	0.213
	[0.2473]	[0.1884]	[0.2841]
collaborations_fairly_good	0.359	-0.105	0.176
	[0.2370]	[0.1785]	[0.2727]
collaborations_very_good	0.540**	-0.027	0.045
	[0.2517]	[0.1959]	[0.2832]
sust_support_fairly_poor	0.347**	-0.147	-0.021
	[0.1587]	[0.1285]	[0.1671]
sust_support_fairly_good	0.374**	0.123	0.125
	[0.1583]	[0.1266]	[0.1649]
sust_support_very_good	0.622***	0.420***	0.460**
	[0.2001]	[0.1609]	[0.1968]
lack_demand	-0.096	-0.011	0.040
	[0.0840]	[0.0958]	[0.0905]
foreign_markets_ 1_to_2	0.442***	0.379***	0.386***
	[0.0908]	[0.0856]	[0.1034]
foreign_markets_3_to_4	0.827***	0.729***	1.048***
	[0.1567]	[0.1927]	[0.2047]
foreign_markets_more_than_4	0.930***	0.666***	1.089***
	[0.1732]	[0.2123]	[0.2208]
lack_willingness	-0.350***	-0.426***	-0.376**
	[0.1344]	[0.1294]	[0.1514]
employees_small	0.192**	0.026	0.243**
	[0.0940]	[0.0852]	[0.0999]
employees_medium	0.205*	0.154	0.292**
	[0.1120]	[0.1200]	[0.1258]
employees_large	0.712***	0.679***	0.186
	[0.1760]	[0.1859]	[0.1749]
IPR	0.334***	0.378***	0.149
	[0.0993]	[0.0928]	[0.0922]
financial_res	0.060	0.073	0.211**
	[0.1004]	[0.0865]	[0.1034]
age	-0.002	-0.003*	0.002
	[0.0020]	[0.0018]	[0.0019]
growth_zero	-0.044	-0.018	-0.034
	[0.1222]	[0.1134]	[0.1425]
growth_positive	0.054	0.215**	0.144
	[0.1131]	[0.1024]	[0.1325]
single_owner	-0.066	-0.118	-0.003
	[0.0854]	[0.0763]	[0.0923]
GDP_growth	-0.109	-0.029	-0.144*
	[0.0956]	[0.0896]	[0.0867]
ln_GDP	-0.028	-0.007	-0.023
	[0.0835]	[0.0800]	[0.0757]
var(_cons[country])	0.341***	0.303***	0.262***
	[0.0952]	[0.0861]	[0.0826]
var(1.lack_demand[country])		0.103	
		[0.0680]	
Constant	-2.979	-3.376	-1.715
	[2.3211]	[2.2169]	[2.1034]
Observations	3,559	4,215	3,127
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level

Table D2 Subsample analysis - Multilevel ordered logistic regression estimates for dependent variable sustainable processing in odds format

VARIABLES	(1) tangible_products	(3) tangible_services	(5) imtangible_services
ind_cluster	0.596***	0.733***	0.565***
	[0.097]	[0.093]	[0.101]
collaborations_fairly_poor	0.274	0.128	0.085
	[0.193]	[0.153]	[0.218]
collaborations_fairly_good	0.442**	0.049	0.073
	[0.184]	[0.144]	[0.207]
collaborations_very_good	0.661***	0.150	0.260
	[0.200]	[0.160]	[0.218]
sust_support_fairly_poor	0.101	-0.107	0.014
	[0.124]	[0.103]	[0.134]
sust_support_fairly_good	0.208*	-0.072	0.105
	[0.124]	[0.103]	[0.133]
sust_support_very_good	0.611***	0.296**	0.347**
	[0.168]	[0.138]	[0.166]
lack_demand	0.244***	0.089	0.221***
	[0.073]	[0.064]	[0.077]
foreign_markets_ 1_to_2	0.025	0.069	-0.010
	[0.077]	[0.072]	[0.087]
foreign_markets_3_to_4	0.327**	0.290*	0.236
	[0.139]	[0.176]	[0.183]
foreign_markets_more_than_4	0.656***	0.654***	0.596***
	[0.165]	[0.204]	[0.212]
lack_willingness	-0.102	-0.193*	-0.306**
	[0.153]	[0.108]	[0.124]
employees_small	0.256***	0.300***	0.411***
	[0.080]	[0.072]	[0.084]
employees_medium	0.621***	0.556***	0.600***
	[0.098]	[0.107]	[0.109]
employees_large	0.956***	0.715***	0.756***
	[0.162]	[0.175]	[0.154]
env_regulations	0.545***	0.532***	0.322*
	[0.199]	[0.195]	[0.195]
financial_res	0.236***	0.164**	0.236***
	[0.084]	[0.070]	[0.084]
age	0.002	0.001	0.004**
	[0.002]	[0.002]	[0.002]
growth_zero	-0.033	0.141	0.001
	[0.102]	[0.091]	[0.117]
growth_positive	0.174*	0.372***	0.246**
	[0.095]	[0.084]	[0.110]
single_owner	-0.011	-0.055	-0.092
	[0.073]	[0.064]	[0.077]
GDP_growth	-0.043	0.002	-0.081
	[0.138]	[0.135]	[0.134]
ln_GDP	0.070	0.164	0.094
var(1.lack_willingness[country])	0.292*		
	[0.158]		
var(_cons[country])	0.699***	0.682***	0.650***
	[0.177]	[0.170]	[0.170]
Observations	3,559	4,215	3,127
Number of groups	37	37	37

Standard errors are in brackets .Note: *** p<0.01, ** p<0.05, * p<0.1 refers to the significance level