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# Sustainability as a driver of green innovation investment and exploitation

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ABSTRACT

This paper examines what drives green innovation investment and exploitation with regard to sustainability. The specific focus of this paper is on company valuations of different dimensions of sustainability and their relationships to green innovation. Empirical data were gathered from a cross-section of horse industry companies located in Finland. The scientific value of the paper lies in showing that certain dimensions of sustainability lead to the exploitation of and investment in green innovation, while other dimensions do not. The results of this study's regression analyses show that the more a company values economic, institutional, and social sustainability, the more likely it is to invest in green innovation. Further, a high valuation of institutional and economic sustainability increases the willingness to exploit green innovation. The valuation of environmental sustainability was not found to affect the willingness to invest in or exploit green innovation. Our results suggest that green innovation is driven by economic and institutional pressures, and that such innovation can create value in terms of social sustainability.


## 1. Introduction

Sustainable development has been receiving growing attention from academics, industry representatives, and policy-makers. One of the key areas tackled by the sustainable development discourse is the role of sustainability in enhancing innovation (cf., Qi et al., 2010; Albort-Morant et al., 2016). Boons and Lüdeke-Freund (2013) argue that for a sustainable value proposition, business–society dialogs must identify trade-offs between optimal products and service performance (e.g., convenience, low costs) and improved social and environmental effects (e.g., dematerialization, better working conditions). This situation is even more critical in natural-resources-intensive sectors, such as the horse industry, which has a significant environmental impact. Thus, enhancing green innovation should be a top priority for the industry companies. In comparison with traditional innovation, the study of green innovation is relatively new in the academic field, even though researchers' interest in green innovation has grown in recent years (e.g., Chen, 2008; Cuerva et al., 2014; Albort-Morant et al., 2016). Whereas traditional innovation relates to the development of new products, materials, processes, services, and organizational forms in order to gain competitive advantage (Baregheh et al., 2009), green innovation refers to the generation of new ideas, goods, services, processes, or management systems that can be used to deal with environmental problems (Rennings, 2000; Li et al., 2017). Green innovation refers to innovations related to, for example, technologies for energy saving, pollution prevention, waste recycling, green product design, and corporate environmental management (Chen et al., 2006). According to Kemp and Pearson (2007), green innovation can effectively reduce environmental pollution and the negative impacts of resource (and energy) use processes, thus leading to sustainable development.

The establishment of a new role for companies requires a broad understanding of the drivers of green innovation. Hence, firms must generate a variety of sustainability dimensions as drivers that reflect the benefits of adopting green innovation. Previous research has identified that drivers such as environmental commitment (Chang and Chen, 2013; Chang, 2016), managerial concern (Qi et al., 2010; Huang et al., 2016), customer pressure (Horbach et al., 2012; Huang et al., 2016), environmental regulations (Cai and Zhou, 2014; Zailani et al., 2015; Hojnik and Ruzzier, 2016), and cost savings (Horbach et al., 2012, 2013; Del Río et al., 2015; Hojnik and Ruzzier, 2016) facilitate green innovation initiatives. All in all, little empirical research addresses the question of what drives green innovation (Albort-Morant et al., 2016), especially in terms of

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sustainability. In this study, the drivers for sustainability and sustainable development are examined in terms of the environmental, social, institutional, and economic dimensions of sustainability (Brundtland, 1987; Vos, 2007; Choi and Ng, 2011).

The empirical part of this study was executed in the Finnish horse industry, which plays a significant role within society even though the roles of horses have shifted from the warhorse and agriculture to leisure activities, horse races, and ways of living (Raento, 2016). As in other European countries, in Finland, the location of horse industry companies has moved from the countryside to urban areas over the past few decades, causing more sustainability and environmental challenges (Liljenstolpe, 2009), such as manure handling and hygiene. These challenges lead to the continuous generation of new types of innovations seeking to utilize the business potential of horse companies. Green innovation can thus be an appropriate approach to overcome the highlighted challenges.

Reflecting the call being made by society for further investments and initiatives from organizations, educational institutions, and governments to adopt innovative multidisciplinary approaches to resolve current sustainability challenges (Lozano et al., 2013; Almeida et al., 2013), this study attempts to narrow the above-mentioned research gap by examining the link between sustainability and green innovation. The focus of this paper is the companies' valuation of the dimensions of sustainability (identified by several authors, e.g., Mamede and Gomes, 2014; Khan et al., 2016) and on its relationship to the investment in and exploitation of green innovation. Thus, the aim of this paper is to examine what drives green innovation investment and exploitation in terms of sustainability.

This study contributes to existing knowledge on the dimensions of sustainability that drive green innovation investment and exploitation by showing that certain dimensions lead to the exploitation of and investment in green innovation, whereas others do not. First, we contribute to the sustainability literature by showing the differing roles of sustainability when investing in and exploiting green innovation. Second, we contribute to the innovation management literature by providing a full model of the different sustainability dimensions that drive green innovation. The structure of the paper is organized as follows: Section 1 presents the introduction, including the study's identified research gap and aim of the paper. Section 2 offers a literature review that covers concepts of green innovation, dimensions of sustainability, and the development of the study's hypothesis. In Section 3, the study's methodology is presented, including empirical setting, the sample and data collection, and measures. In Section 4, the descriptive statistical analysis and the results of regression analysis are discussed. In Section 5, the results of the study are discussed and compared with those of the prior literature. Section 6 concludes by discussing the contributions of the study to the literature and recommendations for future research.

## 2. Literature review

### 2.1. Green innovation

Research that combines the terms innovation and sustainability has increased significantly during the last two decades (e.g., Franceschini et al., 2016). For this reason, the four main terms of eco-innovation, environmental innovation, green innovation, and sustainable innovation have been promoted (Schiederig et al., 2012). It is important to understand how these terms differ from each other, because terms and forms of language may play a powerful role because they can be used to shape meanings and identify areas of interest to the different communities involved (Nicolini, 2012; Franceschini et al., 2016).

Some prior studies suggest that eco-innovation, ecological innovation, green innovation, and environmental innovation are interchangeable (Halila and Rundquist, 2011; Schiederig et al., 2012; Hojnik and Ruzzier, 2016); for example, Schiederig et al. (2012) suggest that the terms can be used interchangeably, even though sustainable innovation includes a social dimension as well as an ecological dimension. However, the commendable bibliometric study of Franceschini et al. (2016) provides new insights into the definitions of the terminology of sustainability-related innovation. They found overlaps between the terms eco-innovation and environmental innovation by identifying them as referring explicitly to innovations aiming at reducing environmental impacts, in the attempt of operationalizing the sustainable development premises (e.g., Carraro and Siniscalco, 1992; Johansson and Magnusson, 1998; Lanjouw and Mody, 1996; Pickman, 1998). However, the studies of Charter and Clark (2007) and Franceschini et al. (2016) made a distinction between eco-innovation and sustainable innovation, showing that eco-innovation only addresses environmental and economic dimensions while sustainable innovation embraces these as well as the broader social and ethical dimensions. While the sustainable innovation approach carries a strong sociological component, green innovation is strongly related to objectives of management and competition (Franceschini et al., 2016).

Although being a relatively new concept in the sustainable development discourse, the amount of research on this topic is rising (e.g., Chen, 2008; Cuerva et al., 2014; Albort-Morant et al., 2016). Chen et al. (2006) suggest that green innovation can refer both to green products and green processes. These can concern, for example, technologies for energy saving, pollution prevention, waste recycling, green product designing, and corporate environmental management (Chen et al., 2006). Similarly, green innovations have been seen to refer to those innovations in products, processes, and management that can lead organizations to achieve sustainable competitive advantages in an eco-effective way (Porter and Van der Linde, 1995; Schiederig et al., 2012; Huang et al., 2016). In the view of Chang and Chen (2013), green innovation is essential for a firm's business management and efficient management can create value, leverage a competitive advantage, and increase the firm's performance. According to Albort-Morant et al. (2016), green technologies provide two main benefits for organizations: the commercial rewards from creating environmentally sustainable products, and financial benefits that can increase competitiveness. They assert that green innovation is a strategic need for firms, which offers a great chance for meeting customers' demands without harming the ecosystem. Relating to the firm performance, green innovation performance can be defined as achievements in the environmental, market, financial, and knowledge fields at all stages of the implementation of green innovations (Pereira-Moliner et al., 2012; Cai and Zhou, 2014; Li, 2014; Huang et al., 2016).

In summary, it can be stated that whereas traditional innovations relate to the development of new products, materials, processes, services, and organizational forms in order to gain competitive advantage (Baregheh et al., 2009), green innovation aims to generate new ideas, goods, services, processes, or management systems that can be used to deal with environmental problems (Rennings, 2000; Li et al., 2017). Lai et al. (2003) suggest that meeting stakeholders' environmental requirements can lead to green innovation and increased environmental performance. Li et al. (2017) argue that green innovation is not only an important means for enterprises to gain competitive advantage in the future, but a basic requirement to hold legitimacy.

### 2.2. Dimensions of sustainability

According to Brown et al. (1987), sustainability is increasingly viewed as a desired development and environmental management goal. The term "sustainability," they argue, changes in meaning within the different disciplines and contexts in which it is used, be they social, economic, or ecological in focus. Over the past several decades, many definitions of the terms sustainability and sustainable development have been put forward. These terms have been considered to be complex, controversial, and, in many cases, mutually exclusive (Hussey et al., 2001; Baker, 2006; Lozano, 2008). From the definition of the concept of sustainable development by Brundtland (1987), the concept of sustainability has evolved to include several dimensions, and organizations have been pressured to change the way they do and report business, focusing on more than just the economic performance and dimensions (Delai and Takahashi, 2011; Choi and Ng, 2011). As a so-called triple bottom line, environmental, economic, and social dimensions traditionally have been seen as relevant dimensions for sustainability and sustainable development (for example, Vos, 2007; Choi and Ng, 2011), and these constitute one of the main concerns of analysts and policy-makers involved in the development of any region (Galdeano-Gómez et al., 2013). In addition to the environmental, economic, and social dimensions of sustainability, Brundtland (1987) suggested the institutional aspects as being an important dimension for sustainable development. These four dimensions of sustainability were selected for this study to examine the link between sustainability and investment in and exploitation of green innovation. While not entirely separate from the other dimensions, institutional sustainability was deemed its own dimension due to its relevance in supporting sustainable development (Pfahl, 2005).

From the environmental viewpoint of sustainable development, major changes have been observed in technologies and services aiming to reduce negative environmental impacts, such as waste management and harnessing ecological processes, for example, nutrient recycling and a general commitment to the environmental cause (Pretty et al., 2011; Delai and Takahashi, 2011; Galdeano-Gómez et al., 2013). Environmental sustainability has become increasingly important to societies and organizations, with an attention to environmental issues that has been on the increase since the 1980s. Accordingly, organizations need to pay attention to investment, exploitation, and the use of green technologies and innovations aiming toward the efficient use of resources while improving ecological activities and productivity (Galdeano-Gómez et al., 2013; Khan et al., 2016).

The social dimension of sustainability is concerned with the wellbeing of communities, organizations, and people. Challenges related to the social dimension of sustainability include that of finding a balance between societal and individual human "needs" and nature's capacity and economic welfare (Choi and Ng, 2011; Delai and Takahashi, 2011; Khan et al., 2016). The social dimension of sustainability is related to organizations' economic productivity—competitiveness, respect for the environment, and socio-economic processes while paying attention to human capital development, job creation, and development of health and safety issues (Galdeano-Gómez et al., 2013; Khan et al., 2016).

The institutional dimensions of sustainability can be seen as related to the governmental aspects of sustainable development, for example, political and regulatory issues. In this context of the conceptual and analytical discussion of operationalizing sustainable development, institutional sustainability has so far been less studied (Pfahl, 2005). Institutional sustainability includes elements of pertinent legislation, policies enacted at the community level, and political support for development (Hacatoglu et al., 2013; Mamede and Gomes, 2014; Lozano, 2015). Organizations that operate according to a conceptual foundation of business tend to integrate social and environmental sustainability concepts gradually in response to institutional sustainability aspects, for example, legislation and new business models and indirect jobs.

Economic sustainability can be recognized as the effort of societies and organizations to manage their own and the business network's impact on life on Earth and its ecosystems (Wagner and Svensson, 2014; Svensson and Wagner, 2015). Sheth et al. (2011) have demonstrated the economic dimension of sustainability by identifying two different aspects: one relating to conventional financial performance (e.g., cost reductions), and the other relating to the interests of external stakeholders of the organizations (e.g., improvements in economic well-being and standard of living). Even though, out of these four dimensions, economic sustainability is the most widely studied, the recent economic depression has brought attention to the concept of economic sustainability among societies and organizations all around the world. Thus, with the enduring global economic recession, societies and organizations are deeply concerned with economic sustainability due to the fear of bankruptcy of organizations, job losses, and other financial risks to governments and organizations (Choi and Ng, 2011).

In summary, sustainability can be understood as development that includes environmental, social, institutional, and economic dimensions. The valuation of sustainability and its individual dimensions are seen as important drivers of green innovation (Kemp and Pearson, 2007).

### 2.3. Hypothesis development

#### 2.3.1. Environmental sustainability and green innovation

Firms may have different motivations for adopting green innovation. Cuerva et al. (2014) have studied product differentiation strategies as a driver of environmental innovation. They found a relationship between the strategy of product differentiation and environmental innovation with an inclusion of the customer's awareness as a relevant consideration because the increase of market demand for green products incentivizes environmental product innovations. Similarly, Albino et al. (2009) suggest that companies that have adopted different environmental strategies are more likely to generate green products. Chang (2016) and Chang and Chen (2013) suggest that an environmental commitment of the firm actuates green innovation performance. An environmental commitment can assist firms in their attempt to meet their environmental goals (Chang and Chen, 2013), and this relationship is also supported by the capability to comply with uncertain environmental regulations and environmentalism (Chang, 2016). Dangelico and Pujari (2010) describe ecological responsibility as one of the most important motivators for companies to create green products. They suggest that such responsibility originates either from the internal environmental orientation of a company or the personal commitments of management. Hojnik and Ruzzier (2016) have found that product eco-innovation, process eco-innovation, organizational eco-innovation, and environmental R&D investments can all be enhanced by environmental management systems. Similarly, Cuerva et al. (2014) have found that a firm with a quality management system is more likely to adopt green innovation. According to Sáez-Martínez et al. (2014), in the current business environment, companies have a greater awareness of the impact of their activities on the environment and are increasingly motivated by environmental concerns in their pursuit of innovation. Thus, the first hypothesis is as follows:

**H1**. *Environmental sustainability is positively related to the investment and exploitation of green innovation.*

#### 2.3.2. Social sustainability and green innovation

The internal development initiatives and capabilities of firms have been found to play a crucial role in green innovation (cf., Zailani et al., 2015; Huang et al., 2016). According to Albort-Morant et al. (2016), dynamic capabilities function as tools that enable the reconfiguration of existing operational capabilities. As Chang (2016) observed, one operational capability, which is the capability to comply with uncertain environmental regulations and environmentalism, can assist in effectively applying the firm's human capital to green product innovation. Human capital development through training can assist in motivating employees and adjusting their behavior to more environmentally sustainable action (Huang et al., 2016). In addition to the development of human capital, Del Río et al. (2015) suggest that a firm's internal knowledge flows stimulate the process of eco-innovations. Environment related practices are found to affect for example productivity and wellbeing of the employees (Delmas and Pekovic, 2013; Lanfranchi and Pekovic, 2014). This relationship is somewhat assisted by peer support (cf., Paillé and Raineri, 2015; Delmas and Pekovic, 2016; Paillé et al., 2016). Also, Chen (2008) has found that the collective learning and capabilities about green innovation and environmental management in a firm enhance their green product innovation performance and green process innovation performance. In this sense, managerial commitment to both human capital development and support of the information flow can be considered as an important driver for green innovation (Huang et al., 2016). For example, Qi et al. (2010) identified managerial concern as the most important driver for the adoption of green practices. Another aspect that has been found to be significant in attaining green innovation is social recognition (e.g., Doran and Ryan, 2012; Cai and Zhou, 2014). Doran and Ryan (2012) suggest that firms are willing to pay to brand themselves as eco-friendly. As Horbach et al. point out (2012), customers require firms to produce, for example, products with improved environmental performance and process innovations that increase material efficiency and reduce energy consumption, waste, and the use of dangerous substances. However, Cai and Zhou (2014) conclude that external drivers, including customers' green demands, affect eco-innovation partially through internal drivers such as firm capabilities. Thus, the following, second hypothesis is formulated:

**H2**. *Social sustainability is positively related to the investment and exploitation of green innovation.*

#### 2.3.3. Institutional sustainability and green innovation

Kesidou and Demirel (2012) have found differences among the drivers of firms that undertake eco-innovations and investments in eco-innovations. They argue that the motivation to undertake eco-innovations comes from satisfying the minimum customer and societal requirements. However, increased investments in eco-innovations are driven by, for example, cost savings and stricter regulations. Regulations, both existing and expected, are one of the most discussed drivers of green innovation (cf., Dangelico and Pujari, 2010; Doran and Ryan, 2012; Horbach et al., 2013; Cai and Zhou, 2014; Bar, 2015; Zailani et al., 2015; Hojnik and Ruzzier, 2016), which suggests that the motivation for green innovation is highly connected to the compliance with standards (Bossle et al., 2016). Hojnik and Ruzzier (2016) found that regulations are a driving force in both stages of eco-innovation, development, and diffusion. In addition to pressure through regulations, Del Río et al. (2015) suggest that involvement in external knowledge flows and cooperation are important incentives for eco-innovation. Li et al. (2017) suggest pressure with regard to legitimacy to be an important influence on green innovation, which requires companies to more carefully consider the environmental requirements of their stakeholders. All in all, a variety of external cooperatives are found to play a crucial role in green innovation. Actually, Horbach et al. (2013) suggest that these types of innovation activities require more external sources of knowledge and information. Facilitation for eco-innovation from different types of public and private actors is one essential driver for green innovations (Klewitz et al., 2012). A stronger relationship between different actors, for example, producers and customers, may increase the actors' understanding of green innovation (Bar, 2015) and thus facilitate its adoption. However, according to the study of Del Río et al. (2015), external knowledge flows from knowledge institutions are relevant only for product eco-innovations. Other drivers are government incentives in the form of grants, while voluntary industrial agreements enhance eco-innovation in firms, as presented in the study of Doran and Ryan (2012). Also, R&D investments serve as a key factor for improving the technological capabilities required for green innovations (Huang et al., 2016), which can assist in creating new business. Based on the above, the third hypothesis is as follows:

**H3**. *Institutional sustainability is positively related to the investment and exploitation of green innovation.*

#### 2.3.4. Economic sustainability and green innovation

Cost savings are one the most frequently proposed drivers of green innovation (e.g., Horbach et al., 2012, 2013; Del Río et al., 2015; Hojnik and Ruzzier, 2016). Specifically, Hojnik and Ruzzier (2016) assert that product eco-innovation, process eco-innovation, organizational eco-innovation, and environmental R&D investments all seem to be driven by cost savings. The results of Del Río et al. (2015) show that energy and material cost reductions are drivers for both product and process eco-innovation. Horbach et al. (2012) suggest that cost savings are an important motivation for reducing energy and materials use, pointing to the role of energy and raw materials prices as well as taxation as drivers for eco-innovation. Triguero et al. (2013) identify these as supply-side factors and find them to be equally important as drivers for environmental processes and organizational innovations. However, the relationship is not that clear when it comes to environmental product innovations. This type of mixed result was also found by Li et al. (2017), who found that company profitability is significantly positively related to green product innovation, though not significantly related to green process innovation. Further, Horbach et al. (2012) state that the motivational factor for reducing energy consumption is formed through customer requirements. For example, easing materials handling and reducing energy consumption can be top priorities of customer demand. Thus, the evidence from previous research support the construction of the following, fourth hypothesis:

**H4**. *Economic sustainability is positively related to the investment and exploitation of green innovation.*

As a summary of previous sections, prior research on the relationship between sustainability and green innovation is presented below in Table 1.

### 2.4. The research model

All in all, little empirical research addresses the question of what drives green innovation investment and exploitation, especially in terms of sustainability. And as society has called for further investments and initiatives from organizations, educational institutions and governments are impelled to adopt innovative multidisciplinary approaches to resolve current sustainability challenges (Lozano et al., 2013; Almeida et al., 2013), this study

**Table 1**
Studies indicating a relationship between sustainability and green innovation.

| | Dimensions of sustainability | Activities related to sustainability | Measure of green innovation |
|---|---|---|---|
| Chen, 2008 | Social | Collective learning and green innovation and environmental management capabilities | Green product innovation performance, green process innovation performance |
| Dangelico and Pujari, 2010 | Environmental, Social, Institutional | Environmental regulations, ecological responsibility, social obligations and values | Green products |
| Qi et al., 2010 | Social, Institutional | Managerial concern, government regulations, stakeholder pressure | Green innovation practices |
| Doran and Ryan, 2012 | Social, Institutional | Customer perception (brand), existing and expected regulations, government incentives, voluntary industrial agreements | Eco-innovation |
| Horbach et al., 2012 | Economic, Institutional | Cost savings, regulation, customer requirements | Eco-innovation |
| Kesidou and Demirel, 2012 | Institutional, Economic | Customer and societal requirements, cost savings, organizational capabilities, stricter regulations | Eco-innovation (undertake, investment) |
| Klewitz et al., 2012 | Institutional | Facilitation of local authorities and different public and private actors | Eco-innovation |
| Chang and Chen, 2013 | Environmental, Social | Green organizational identity, environmental commitment, environmental organizational legitimacy | Green innovation performance |
| Horbach et al., 2013 | Institutional, Economic | Regulation, cost savings, external sources of knowledge and information | Eco-innovation |
| Triguero et al., 2013 | Economic, Institutional | Environmental policy influences, demand-side factors, supply-side factors | Eco-process innovation, Eco-product innovation, Eco-organizational innovation |
| Cai and Zhou, 2014 | Social, Institutional | Internal drivers (e.g., organizational capabilities, technological capabilities, and corporate social responsibility), external drivers (e.g., customers' green demands, competition pressures, and environmental regulations) | Eco-innovation performance |
| Sáez-Martínez et al., 2014 | Environmental, Institutional | University collaboration, technology push, demand-side factors, regulations | Eco-innovation |
| Cuerva et al., 2014 | Environmental, Social | Technological capabilities (e.g., R&D and human capital), quality management systems, strategic product differentiation | Green innovation |
| Bar, 2015 | Institutional | Relationship between different actors (e.g., producers and customers), environmental requirements of governmental agencies | Green innovation |
| Del Río et al., 2015 | Social, Institutional, Economic | Environmental regulation, internal knowledge flows, involvement in external knowledge flows and cooperation, energy and material cost reductions | Product eco-innovations, Process eco-innovations |
| Zailani et al., 2015 | Institutional, Social | Environmental regulations, market demand, firm internal initiatives | Green innovation initiatives |
| Bossle et al., 2016 | Institutional, Economic | Regulation, normative pressures, and the need for efficiency (e.g., cost reduction) | Eco-innovation |
| Chang, 2016 | Environmental, Social, Institutional | Environmental commitment, green human capital, ability to comply with uncertain environmental regulations, and environmentalism | Green product innovation performance |
| Hojnik and Ruzzier, 2016 | Environmental, Institutional, Economic, Social | Environmental management systems, regulations, cost savings, competitive pressure, customer demand, managerial environmental concerns, command-and-control, economic incentives | Product eco-innovation, Process eco-innovation, Organizational eco-innovation, Environmental R&D investments |
| Huang et al., 2016 | Social, Institutional, Environmental | Regulatory and customer pressure, Top management support, training, R&D investments, collaboration networks, environmental management systems | Green innovation performance |
| Li et al., 2017 | Institutional, Economic | Legitimacy pressure from stakeholders, internal profitability | Green product innovation, Green process innovation |

attempts to narrow the above-mentioned research gaps by examining the link between sustainability and green innovation investment and exploitation. The focus of this paper is the companies' valuation of the dimensions of sustainability (identified by several authors, e.g., Mamede and Gomes, 2014; Khan et al., 2016) and on its relationship to the green innovation. The conceptual model of the study is presented in Fig. 1.

## 3. Methodology

In order to examine the drivers of green innovation investment and exploitation with regard to sustainability, systematic data collection procedures and statistical analyses were conducted. The analysis process of this study included the following phases: 1) data collection, including the selection of variables and measurements and the conducting of the survey, 2) checking the validity and reliability of the collected data, and 3) statistical analyses to test the study's hypotheses.

### 3.1. Empirical setting

The empirical part of this study was executed in the Finnish horse industry, which plays a significant role within society, even though the role of horses has shifted from the war horse and

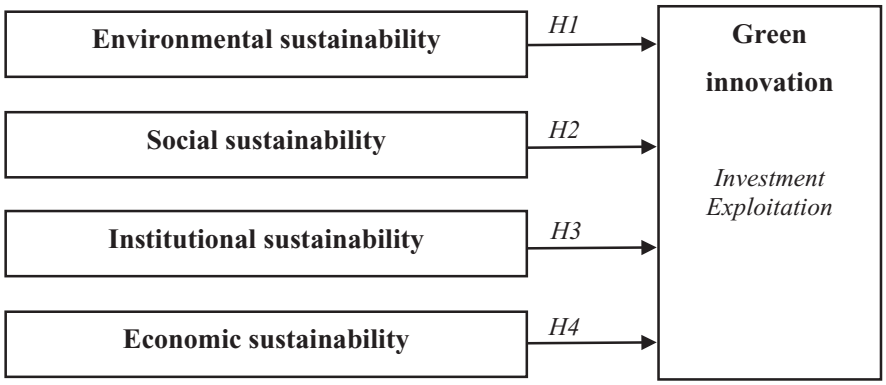


**Fig. 1.** The conceptual model.

agriculture to leisure activity, horse races, and way of living (Raento, 2016). The number of horses in Finland is currently around 75,000 and the horse industry in Finland is of economic importance, for example, employing thousands of people directly and indirectly. The current number of stables in Finland is around 15,000. There are approximately 16,500 cow sheds, 2500 pig houses, 1000 hen houses and poultry farms, and 2400 fur farms in Finland (Häggblom et al., 2008). Within the horse industry, there are currently 15,000 full- or part-time employees (Laitinen, 2016), of which approximately 10, 000 are full-time workers in the sector (Paula et al., 2013). From an economic viewpoint, the estimated annual turnover of the Finnish horse industry sector is around 830 million Euros (Laitinen, 2016). The most common form of business in the current horse industry is breeding (Paula et al., 2013), with riding classes the second most common (Pussinen and Thuneberg, 2010). As in other European countries, also in Finland over the past few decades, the location of stables and other horse industry companies has moved from the countryside to urban areas causing more sustainability and environmental challenges (Liljenstolpe, 2009).

Even though the horse industry in Finland today provides new opportunities and possibilities for new businesses and green innovations, for example, by supporting alternative land use or improving nutrient recycling, and producing energy from manure, it also faces some sustainability challenges. For the main part, the horse industry companies and individual stables in Finland are rather small in scale, and most of their businesses are run on a part-time basis. These companies are continually struggling with problems of profitability. Currently, one of the biggest challenges of the horse industry companies in Finland is related to the handling and utilization of horse manure. For most of the companies, this is seen as a growing problem causing higher costs and environmental problems harming their other daily activities, not a potential for a new business model and innovations. Due to current challenges to and possibilities of the horse industry companies, new types of green innovations to support the activities of the companies and, for example, the utilization of horse manure are being generated for the market.

### 3.2. Sample and data collection

The study was conducted by collecting survey data from a cross-section of horse industry companies located in Finland. The initial sample was 631 companies, of which 580 were reached. Fifty-one surveys were returned to the researchers with return to sender messages, indicating that the addresses were no longer valid. Two rounds of reminders were sent, each of them a week after the previous round. After the responses were received, the data were screened. Responses were excluded if they met some of the following criteria: first, if most of the items included missing values; second, if it was clear that the responses were deliberately incorrect throughout the survey (i.e., the best possible response was selected in all of the survey items); third, if there were inconsistencies in the responses. Finally, 139 responses were declared to be valid, which equals a response rate of 24 percent.

An analysis of the variance test was used to check the non-response bias. The respondents were divided into three groups: the first respondents, the first follow-ups, and the second follow-ups. The results of the analysis of the variance test revealed that there was no significant difference (at the 5 percent significance level) between the four groups regarding study variables (green innovation investment, green innovation exploitation, and sustainability dimensions). Therefore, it is confirmed that the responses reflect the whole sample well.

Table 2 presents the background information of the respondents. Forty-eight point nine percent of the responses came from small companies with fewer than 20 horses. Forty-four point six percent of the responses represent medium-sized companies and 2.9 percent large companies. A majority of the responses represent horse-riding companies, whereas 18.7 percent of the responses represent horse race companies.

### 3.3. Measures

The unit of analysis in the study is the individual respondent's perceptions of the sustainability dimensions and investment and exploitation of green innovation at their company. The respondents were managers, as managers were expected to have adequate knowledge to answer the items concerning their company's operations. The respondents provided their personal evaluations of the value of sustainability dimensions in their company. The independent variables of the study were environmental sustainability,

**Table 2**
Background information of the respondents.

| | | No | % |
|---|---|---|---|
| Size | Fewer than 20 horses | 68 | 48.9 |
| | 20–50 horses | 62 | 44.6 |
| | Over 50 horses | 4 | 2.9 |
| | No answer | 5 | 3.6 |
| Type of operation | Horserace | 26 | 18.7 |
| | Horse-riding | 98 | 70.5 |
| | Other | 13 | 9.4 |
| | No answer | 2 | 1.4 |

social sustainability, institutional sustainability, and economic sustainability. Each of the variables was measured using 3–5 items. The items were constructed based on the previously utilized scales of Delai and Takahashi (2011), Mamede and Gomes (2014), Svensson and Wagner (2015), and Khan et al. (2016). The important factors of each sustainability dimension stated in the above-mentioned studies were operationalized into survey items. The respondents were asked to "evaluate the following statements concerning the handling of sustainability problems." For each of the items, the respondents were asked to indicate their opinion on a scale ranging from 1 to 7 (1 = not at all significant, 7 = extremely significant). The items and their references are presented in Table 3.

The dependent variables, meaning green innovation investment and green innovation exploitation, were measured by two items each. The respondents were asked to indicate "How willing are you to invest in and exploit the following solutions at your operations?". Here exploitation refers to the use of green innovation already existing. These solutions were identified from the literature and modified according to items chosen by the authors. The items were asked on a scale of 1–7 (1 = not at all willing, 7 = extremely willing). Size and type of operation were entered in the survey as control variables.

## 4. Results

Factor analysis was used to classify the sustainability factors into groups. To analyze the sample adequacy for the variables, a Kaiser-Meyer-Olkin (KMO) test was performed, which helps to reveal whether or not factor analysis will be possible. The overall KMO value of the sustainability dimensions was 0.894, which is above the acceptable value proposed for this type of analysis, and thus indicated a sufficient sample size relative to the number of items in our scale.

The validity and reliability of the variables was examined prior to hypothesis testing. There are three main kinds of validity: construct validity, internal validity, and external validity. *Construct validity* of scales is established by assessing content validity, criterion validity, and discriminant validity (Hair et al., 2010). First, factor loadings of 0.4 or greater and communalities above 0.6 were accepted. Content validity was ensured in the survey design phase by utilizing existing measurements that had been empirically tested in previous studies. In addition, all measurements included in the final survey were evaluated for content validity by a four-member panel of researchers. Criterion validity was assessed through correlation analyses (presented in Table 5), which showed that the constructs behaved in a credible manner. Discriminant validity was assessed through exploratory factor analyses, which supported the uni-dimensionality of the scales. Furthermore, a lack of significant cross-loadings supported discriminant validity. Cronbach's Alphas were computed to measure the reliability of the constructs. Reliability was supported, as the values were bigger than 0.60 (Table 3). *Internal validity* was ensured by performing statistical analyses to check for non-response bias. In addition, the effect of control variables that might have an effect on the results was checked. In this type of research, *external validity* typically means defining the domains to which the results of the study may be generalized (Easterby-Smith et al., 2002). The sample was selected in way that well represents the target group and therefore enables the generalizability of the results.

Table 4 presents the correlations for the green innovation investment and exploitation, and sustainability dimensions. The table shows significant correlations throughout between the variables. These findings indicate a connection between sustainability dimensions and the investment and exploitation of green innovation.

Linear regression analysis was used to test the hypotheses. In order to assess the extent of multicollinearity, the variance inflation factor (VIF) was computed. Multicollinearity refers to situations in which explanatory variables are highly correlated with each other (Knecht, 2013). The VIFs were significantly below the cut-off value of 10, and therefore it is suggested that multicollinearity does not cause problems. Based on the notion that a minimum $R^2$ should be found to be statistically significant (Hair et al., 2010), the analyses presented in Tables 6 and 7 show that three of the four hypotheses were supported by the data.

Table 6 presents the regression results regarding green innovation investment. Model 1 presents the analyses regarding the relationship between environmental sustainability and the investments in green innovation. The model is significant, but the included variables explained only 7.4 percent of the investment in green innovation. Model 2 presents the analyses regarding the relationship between social sustainability and the investments in green innovation. The model shows that the more a company values social sustainability, the more likely it is to invest in green innovation. The included variables explained 10.7 percent of the investment in green innovation. Model 3 presents the analyses regarding the relationship between institutional sustainability and the investments in green innovation. It was confirmed that the more a company values institutional sustainability, the more likely it is to invest in green innovation. The included variables explained 16.7 percent of the investment in green innovation. Model 4 presents the analyses regarding the relationship between economic sustainability and the investment in green innovation. It was confirmed that the more a company values economic sustainability, the more likely it is to invest in green innovation. The included variables explained 19.2 percent of the investments in green innovation.

Table 7 presents the regression results regarding green innovation exploitation. Model 5 presents the analyses regarding the relationship between environmental sustainability and the exploitation of green innovation. The model was not significant, meaning that the valuation of environmental sustainability did not have an influence on the exploitation of green innovation. Model 6 presents the analyses regarding the relationship between social sustainability and the exploitation of green innovation. The model is significant, but the included variables explained only 8.8 percent of the exploitation of green innovation. Model 7 presents the analyses regarding the relationship between institutional sustainability and the exploitation of green innovation. It was confirmed

**Table 3**
Items.

| | | Items | References |
|---|---|---|---|
| Sustainability | Environmental | Nutrient cycling, Commitment to environmental cause, Waste management, Hygienic factors, Land occupied | Delai and Takahashi, 2011; Khan et al., 2016 |
| | Social | Social recognition, Human capital development, Job creation, Health and safety | Delai and Takahashi, 2011; Khan et al., 2016 |
| | Institutional | Incomes, Indirect jobs, New business | Delai and Takahashi, 2011; Mamede and Gomes, 2014 |
| | Economic | Ease of material handling, Energy consumption, Cost reduction | Delai and Takahashi, 2011; Svensson and Wagner, 2015 |

**Table 4**
Variables.

| Dimension | No of items | Communalities | Loadings | Alpha |
|---|---|---|---|---|
| Environmental sustainability | 5 | 0.746–0.897 | 0.619–0.905 | 0.924 |
| Social sustainability | 4 | 0.758–0.854 | 0.653–0.772 | 0.894 |
| Institutional sustainability | 3 | 0.816–0.863 | 0.743–0.827 | 0.851 |
| Economic sustainability | 3 | 0.641–0.780 | 0.492–0.847 | 0.768 |
| Green innovation investment | 2 | | | 0.733 |
| Green innovation exploitation | 2 | | | 0.675 |

**Table 5**
Correlations of the study variables.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 Environmental sustainability | 1.000 | | | | | |
| 2 Social sustainability | 0.759*** | 1.000 | | | | |
| 3 Institutional sustainability | 0.511*** | 0.664*** | 1.000 | | | |
| 4 Economic sustainability | 0.624*** | 0.604*** | 0.599*** | 1.000 | | |
| 5 Green innovation investment | 0.229** | 0.325*** | 0.442*** | 0.455*** | 1.000 | |
| 6 Green innovation exploitation | 0.189* | 0.342*** | 0.372*** | 0.438*** | 0.632*** | 1.000 |

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05.

**Table 6**
Regressions analyses of green innovation investment.

| Models | β | SE | St. β | St. β | R | $R^2$ | Adj. $R^2$ | SE | F |
|---|---|---|---|---|---|---|---|---|---|
| **1. (Constant)** | 2.300 | 0.938 | | 2.451* | 0.272 | 0.074 | 0.051 | 1.80172 | 3.179* |
| Size | −0.091 | 0.297 | −0.028 | −0.305 | | | | | |
| Type of operation | −0.046 | 0.307 | −0.013 | −0.149 | | | | | |
| Environmental sustainability | 0.372 | 0.121 | 0.273 | 3.080** | | | | | |
| **2. (Constant)** | 1.452 | 0.989 | | 1.469 | 0.327 | 0.107 | 0.084 | 1.77324 | 4.668** |
| Size | −0.020 | 0.292 | −0.006 | −0.069 | | | | | |
| Type of operation | 0.049 | 0.310 | 0.014 | 0.158 | | | | | |
| Social sustainability | 0.459 | 0.123 | 0.327 | 3.741*** | | | | | |
| **3. (Constant)** | 0.520 | 1.007 | | 0.517 | 0.409 | 0.167 | 0.146 | 1.70886 | 7.962*** |
| Size | −0.008 | 0.281 | −0.002 | −0.029 | | | | | |
| Type of operation | 0.043 | 0.292 | 0.013 | 0.149 | | | | | |
| Institutional sustainability | 0.620 | 0.127 | 0.410 | 4.881*** | | | | | |
| **4. (Constant)** | −1.306 | 1.222 | | −1.068 | 0.439 | 0.192 | 0.172 | 1.68772 | 9.286*** |
| Size | 0.132 | 0.280 | 0.040 | 0.472 | | | | | |
| Type of operation | −0.082 | 0.292 | −0.024 | −0.280 | | | | | |
| Economic sustainability | 0.866 | 0.164 | 0.441 | 5.278*** | | | | | |

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05.

**Table 7**
Regressions analyses of green innovation exploitation.

| Models | β | SE | St. β | t | R | $R^2$ | Adj. $R^2$ | SE | F |
|---|---|---|---|---|---|---|---|---|---|
| **5. (Constant)** | 4.136 | 0.974 | | 4.245*** | 0.191 | 0.036 | 0.012 | 1.88999 | 1.519 |
| Size | −0.019 | 0.310 | −0.006 | −0.061 | | | | | |
| Type of operation | −0.243 | 0.322 | −0.069 | −0.755 | | | | | |
| Environmental sustainability | 0.245 | 0.124 | 0.177 | 1.980* | | | | | |
| **6. (Constant)** | 2.763 | 1.014 | | 2.724** | 0.296 | 0.088 | 0.065 | 1.82646 | 3.819* |
| Size | 0.030 | 0.299 | 0.009 | 0.101 | | | | | |
| Type of operation | −0.109 | 0.319 | −0.030 | −0.342 | | | | | |
| Social sustainability | 0.421 | 0.126 | 0.294 | 3.356*** | | | | | |
| **7. (Constant)** | 1.963 | 1.042 | | 1.883 | 0.376 | 0.141 | 0.120 | 1.78393 | 6.643*** |
| Size | 0.014 | 0.291 | 0.004 | 0.049 | | | | | |
| Type of operation | −0.155 | 0.305 | −0.044 | −0.509 | | | | | |
| Institutional sustainability | 0.576 | 0.131 | 0.370 | 4.384*** | | | | | |
| **8. (Constant)** | −0.070 | 1.163 | | −0.060 | 0.454 | 0.206 | 0.186 | 1.70482 | 10.323*** |
| Size | 0.209 | 0.282 | 0.062 | 0.742 | | | | | |
| Type of operation | −0.232 | 0.295 | −0.066 | −0.788 | | | | | |
| Economic sustainability | 0.839 | 0.151 | 0.455 | 5.540*** | | | | | |

Sign. *** ≤ 0.001, ** 0.001 < p ≤ 0.01, * 0.01 < p ≤ 0.05.

that the more a company values institutional sustainability, the more likely it is to exploit green innovation. The included variables explained 14.1 percent of the exploitation of green innovation. Model 8 presents the analyses regarding the relationship between economic sustainability and the exploitation of green innovation. The model shows that the more a company values economic sustainability, the more likely it is to exploit green innovation. The included variables explained 20.6 percent of the exploitation of green innovation.

## 5. Discussion

This study has shown that certain dimensions of sustainability lead to the exploitation of and investment in green innovation. First, concerning the drivers for green innovation investments, the findings indicate that economic sustainability and institutional sustainability were the most significant drivers for investments. Also, social sustainability explained the willingness for green innovation investment. In comparison to the exploitation of green innovation, the investment in green innovation seems to be more related to social sustainability. It seems that through the investment the companies are responding to customer pressure (Horbach et al., 2012; Huang et al., 2016), and green innovation investment has also been seen as a strategic need for firms that offers a great chance for meeting customers' demands without harming the ecosystem (Albort-Morant et al., 2016). Further, the findings are in line with the results of Galdeano-Gómez et al. (2013) and Khan et al. (2016), suggesting that in green innovation investment, the social dimension of sustainability may be highlighted through organizations' economic productivity–competitiveness, respect for the environment, and socioeconomic process while paying attention to human capital development, job creation, and development of health and safety issues. It seems that social sustainability puts an emphasis on the green innovation investments compared to the exploitation of green innovation that is provided by the external service provider.

Second, concerning the drivers for green innovation exploitation, the findings indicate that economic and institutional sustainability were the most significant drivers for exploitation of green technologies and services. For example, although Boons and Lüdeke-Freund (2013) argue that for a sustainable value proposition, business–society dialogs must identify improved social and environmental effects, it does not seem to be the case concerning the green innovation exploitation. When exploiting green innovation instead of investing in such, the issues around the environmental and social sustainability seem to be "outsourced" to the service or product provider. The motivation for green innovation exploitation seems to be connected to the financial benefits (Albort-Morant et al., 2016), such as cost savings (e.g., Horbach et al., 2012; Del Río et al., 2015; Hojnik and Ruzzier, 2016), as well as to the institutional aspects of sustainability. The findings regarding the exploitation of green innovation thus support that the elements of institutional sustainability such as pertaining legislation, enacted policies in the community, and political support for development (Hacatoglu et al., 2013; Mamede and Gomes, 2014; Lozano, 2015), together with the connection to the compliance with standards (Bossle et al., 2016) are the drivers for the exploitation of green innovation.

Environmental sustainability was not recognized as a significant driver for green innovation exploitation or investment. Although Sáez-Martínez et al. (2014) asserted that companies have a greater awareness of the impact of their activities on the environment, which motivates them toward green innovations, it seems that a need still exists to facilitate the environmental knowledge. This can be realized by utilizing the environmental management systems, as suggested by Hojnik and Ruzzier (2016) or quality management systems, as suggested by Cuerva et al. (2014). Both of these systems were considered to enhance and facilitate the adoption of green innovation. All in all, it appears that economic sustainability is the most significant of the dimensions of sustainability both in terms of investment in and exploitation of green innovation, which may indicate that there is still room for stricter environmental requirements among stakeholders (cf. Lai et al., 2003). It also seems that aspects of institutional sustainability, such as legislation and regulations, as well as political support for sustainable development, are the best ways to control investment in and exploitation of green innovation for environmental sustainability (cf. Hacatoglu et al., 2013; Mamede and Gomes, 2014; Lozano, 2015).

The study also has significant implications for policymakers, officials, and civil servants in terms of the current drivers of green innovation investment and exploitation. According to a report by Paula et al. (2013), officials' and decision-makers' knowledge of the horse industry was the most significant problem in the dialogue between the industry and society, with officials failing to take the needs and growth potential of horse companies into sufficient account in their planning and decision-making. The results of this study support the notion that different organizations can inform decision-makers, officials, and citizens as to certain possibilities within the horse industry. The results of the study can be used to better connect the horse industry sector with society at large by examining the drivers of investment in and exploitation of green innovations related, for example, to energy consumption and land use.

Finally, it is important to discuss the reasons why environmental sustainability was not recognized as a significant driver for green innovation exploitation or investment. One reason can be poor profitability of the companies in the horse industry (Liljenstolpe, 2009), and thus the only option is to appreciate economic sustainability. Thus it is worth to examine whether the companies with good profitability consider environmental sustainability as a driver for green innovation. From institutional perspective, strict regulations or subventions can be imposed in a way that all green innovation investments are ultimately also profitable. This is happening in the automotive industry. This gives space for eco-friendly thinking and may allow environmental sustainability to be a driver for green innovations. It is also clear that environmental awareness needs to be increased both for employees and customers. This motivates employees' behavior (Huang et al., 2016) and customers' requirement (Horbach et al., 2012) to be more focused on environmental sustainability. Thus it is worth to consider whether the employees and customers with higher level of environmental awareness consider environmental sustainability as a driver for green innovation exploitation and investment.

## 6. Conclusions

The aim of this paper was to examine what drives green innovation investment and exploitation in terms of sustainability. The focus of this paper is the companies' valuation of the dimensions of sustainability and on its relationship to the investment and exploitation of green innovation. As a theoretical contribution, the study has increased the understanding of how green innovation is driven by sustainability. The study has three main conclusions. First, it was confirmed that the more a company values economic, institutional, and social sustainability, the more likely it is to invest in green innovation. Second, a high valuation of institutional and

economic sustainability increases the willingness to exploit green innovation. Third, the valuation of environmental sustainability was not found to affect the willingness to invest in or exploit green innovation. In sum, the results of the study suggest that investment in green innovation is aligned with the valuation of a wide range of sustainability dimensions. When it comes to the exploitation of green innovation, economic and institutional sustainability are the most valued dimensions of sustainability.

As a practical contribution, the study contributes knowledge concerning companies within the horse industry in terms of their motivations toward the investment in and exploitation of green innovations. By increasing the understanding of the main drivers of green innovation investment and exploitation, practitioners can be aware of the factors that increase the adoption of greener innovations. For green innovation developers (e.g., technology and service providers), the results of the study stand as important information for the development of more attractive and valuable solutions. For education and research organizations and consultants, the results of this study can be used to support the development of training and educational possibilities for horse industry operators.

There are some limitations that affect the generalizability of the results. Firstly, the data was gathered from Finland, and the country-specific characteristics should be taken into account. However, the horse industry sector is part of a larger shift towards urbanization. Although the role of horses in many European countries has changed dramatically from work to leisure activities, the horse industry still plays a significant economic role. Its features are similar throughout the western world, and its development is closely tied to lifestyle changes related to possibilities created by the local social, economic, and land use conditions. Even though national differences exist, within the horse industry, there are many similarities, and that national borders have become less important in the horse industry. Thus, the results of this study can be utilized by countries that belong to developed markets. Urbanization is also increased in emerging markets, and the similar development will be apparent in the future. Thus, the results can inform the development of horse industry also in emerging markets. Second, data from only one industry was used and results may differ in different contexts. However, horse industry is a growing branch of the new economy based on the consumption of green goods and services. Even though the horse industry sector is not directly classified as an agricultural industry, the sector is especially important for agriculture, because fodder chains also extend to remote parts of the countryside. Thus, we believe that the results of this study will be relevant to many other agriculturally related industries with regard to energy consumption, biodiversity and land use, and business opportunities. The dominant effect of economic sustainability in green innovation investment and exploitation is likely to be a reality in a variety of sectors, and thus the results are applicable also in variety of industries outside the agricultural industries. This research is cross-sectional in nature, which is a possible limitation of the research method employed. Also, a common method bias can cause problems when the key informant approach is utilized. Future studies would be helpful in tackling these limitations and also in building on the insights from this study. Further studies should investigate a wider scale of the drivers of green innovation. Especially the relationship between environmental sustainability and green innovation requires further investigation. Environmental sustainability could be studied together with other variables while it is possible that moderating or mediating effects would occur. Further research can also examine other effects of sustainability beyond the type of innovation investigated in this study.

## References


Albino, V., Balice, A., Dangelico, R.M., 2009. Environmental strategies and green product development: an overview on sustainability-driven companies. Bus. Strategy Environ. 18 (2), 83–96.

Albort-Morant, G., Leal-Millán, A., Cepeda-Carrión, G., 2016. The antecedents of green innovation performance: a model of learning and capabilities. J. Bus. Res. 69 (11), 4912–4917.

Almeida, C.M.V.B., Bonilla, S.H., Giannetti, B.F., Huisingh, D., 2013. Cleaner Production initiatives and challenges for a sustainable world: an introduction to this special volume. J. Clean. Prod. 47, 1–10.

Baker, S., 2006. Sustainable Development, first ed. Routledge, London, UK.

Bar, E.S., 2015. A case study of obstacles and enablers for green innovation within the fish processing equipment industry. J. Clean. Prod. 90, 234–243.

Boons, F., Lüdeke-Freund, F., 2013. Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. J. Clean. Prod. 45, 9–19.

Bossle, M.B., de Barcellos, M.D., Vieira, L.M., Sauvée, L., 2016. The drivers for adoption of eco-innovation. J. Clean. Prod. 113, 861–872.

Brown, B., Hanson, M., Liverman, D., Merideth, R., 1987. Global sustainability: toward definition. Environ. Manag. 11 (6), 713–719.

Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S., Chidzero, B., Fadika, L., Hauff, V., Lang, I., Shijun, M., de Botero, M., Singh, M., Okita, S., et al., 1987. Our Common Future ('Brundtland report'). Oxford Paperback Reference. Oxford University Press, USA.

Cai, W.G., Zhou, X.L., 2014. On the drivers of eco-innovation: empirical evidence from China. J. Clean. Prod. 79, 239–248.

Carraro, C., Siniscalco, D., 1992. Environmental innovation policy and international competition. Environ. Resour. Econ. 2 (2), 183–200.

Chang, C.H., 2016. The determinants of green product innovation performance. Corp. Soc. Responsib. Environ. Manag. 23, 65–76.

Chang, C.H., Chen, Y.S., 2013. Green organizational identity and green innovation. Manag. Decis. 51 (5), 1056–1070.

Charter, M., Clark, T., 2007. Sustainable Innovation: Key Conclusions from Sustainable Innovation Conferences 2003-2006. The Centre for Sustainable Design. University College for the Creative Arts.

Chen, Y.S., 2008. The driver of green innovation and green image–green core competence. J. Bus. Ethics 81 (3), 531–543.

Chen, Y.S., Lai, S.B., Wen, C.T., 2006. The influence of green innovation performance on corporate advantage in Taiwan. J. Bus. Ethics 67 (4), 331–339.

Choi, S., Ng, A., 2011. Environmental and economic dimensions of sustainability and price effects on consumer responses. J. Bus. Ethics 104 (2), 269–282.

Cuerva, M.C., Triguero-Cano, Á., Córcoles, D., 2014. Drivers of green and non-green innovation: empirical evidence in Low-Tech SMEs. J. Clean. Prod. 68, 104–113.

Dangelico, R.M., Pujari, D., 2010. Mainstreaming green product innovation: why and how companies integrate environmental sustainability. J. Bus. Ethics 95 (3), 471–486.

Delai, I., Takahashi, S., 2011. Sustainability measurement system: a reference model proposal. Soc. Responsib. J. 7 (3), 438–471.

Delmas, M.A., Pekovic, S., 2013. Environmental standards and labor productivity: understanding the mechanisms that sustain sustainability. J. Organ. Behav. 34 (2), 230–252.

Delmas, M.A., Pekovic, S., 2016. Corporate sustainable innovation and employee behavior. J. Bus. Ethics 1–18.

Del Río, P., Romero-Jordán, D., Peñasco, C., 2015. Analysing Firm-specific and Type-specific Determinants of Eco-innovation. Technological and Economic Development of Economy, pp. 1–26.

Doran, J., Ryan, G., 2012. Regulation and firm perception, eco-innovation and firm performance. Eur. J. Innovation Manag. 15 (4), 421–441.

Easterby-Smith, M., Thorpe, R., Lowe, A., 2002. Management Research, second ed. Sage Publications Ltd.

Franceschini, S., Faria, L.G.D., Jurowetzki, R., 2016. Unveiling scientific communities about sustainability and innovation. A bibliometric journey around sustainable terms. J. Clean. Prod. 127, 72–83.

Galdeano-Gómez, E., Aznar-Sánchez, J.A., Pérez-Mesa, J.C., 2013. Sustainability dimensions related to agricultural-based development: the experience of 50 years of intensive farming in Almería (Spain). Int. J. Agric. Sustain. 11 (2), 125–143.

Hacatoglu, K., Rosen, M.A., Dincer, I., 2013. An approach to assessment of sustainability of energy systems. In: Dincer, I., Colpan, C.O., Kadioglu, F. (Eds.), Causes, Impacts and Solutions to Global Warming. Springer, pp. 363–387.

Hair Jr., J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2010. Multivariate Data Analysis: a Global Perspective, seventh ed. Prentice-Hall, Upper Saddle River, NJ.

Halila, F., Rundquist, J., 2011. The development and market success of eco-innovations. Eur. J. Innovation Manag. 14 (3), 278–302.

Hojnik, J., Ruzzier, M., 2016. What drives eco-innovation? A review of an emerging literature. Environ. Innovation Soc. Transitions 19, 31–41.

Horbach, J., Rammer, C., Rennings, K., 2012. Determinants of eco-innovations by type of environmental impact—the role of regulatory push/pull, technology push and market pull. Ecol. Econ. 78, 112–122.

Horbach, J., Oltra, V., Belin, J., 2013. Determinants and specificities of eco-innovations compared to other innovations—an econometric analysis for the French and German industry based on the community innovation survey. Industry Innovation 20 (6), 523–543.

Huang, X.X., Hu, Z.P., Liu, C.S., Yu, D.J., Yu, L.F., 2016. The relationships between

regulatory and customer pressure, green organizational responses, and green innovation performance. J. Clean. Prod. 112, 3423–3433.
Hussey, D.M., Kirsop, P.L., Meissen, R.E., 2001. Global reporting initiative guidelines: an evaluation of sustainable development metrics for industry. Environ. Qual. Manag. 11 (1), 1–20.
Häggblom, M., Rantamäki-Lathinen, L., Vihinen, H., 2008. Equine Sector Comparison between The Netherlands, Sweden and Finland: LIFE04 ENV/FI/000299. Equine Life, Helsinki, Finland.
Johansson, G., Magnusson, T., 1998. Eco-innovations-a novel phenomenon? J. Sustain. Prod. Des. 7, 7–18.
Kesidou, E., Demirel, P., 2012. On the drivers of eco-innovations: empirical evidence from the UK. Res. Policy 41 (5), 862–870.
Kemp, R., Pearson, P., 2007. Final Report MEI Project about Measuring Eco-innovation. UM Merit, Maastricht, p. 10.
Khan, E.A., Dewan, M.N.A., Chowdhury, M.H., 2016. Reflective or formative measurement model of sustainability factor: a three industry comparison. Corp. Ownersh. Control J. 12 (2), 84–94.
Klewitz, J., Zeyen, A., Hansen, E.G., 2012. Intermediaries driving eco-innovation in SMEs: a qualitative investigation. Eur. J. Innovation Manag. 15 (4), 442–467.
Knecht, M., 2013. Diversification, Industry Dynamism, and Economic Performance: the Impact of Dynamic-related Diversification on the Multi-business Firm. Springer Science & Business Media.
Lai, S.B., Wen, C.T., Chen, Y.S., 2003. The exploration of the relationship between the environmental pressure and the corporate competitive advantage. In: 2003 CSMOT Academic Conference. National Chiao Tung University, Hsin-Chu.
Laitinen, A., 2016. Equine Industry in Finland. The National Equine Competence Association of Finland, Hippolis.
Lanfranchi, J., Pekovic, S., 2014. How green is my firm? Worker well-being and job involvement in environmentally-related certified firms. Ecol. Econ. 100, 16–29.
Lanjouw, J.O., Mody, A., 1996. Innovation and the international diffusion of environmentally responsive technology. Res. Policy 25 (4), 549–571.
Li, Y., 2014. Environmental innovation practices and performance: moderating effect of resource commitment. J. Clean. Prod. 66, 450–458.
Li, D., Zheng, M., Cao, C., Chen, X., Ren, S., Huang, M., 2017. The impact of legitimacy pressure and corporate profitability on green innovation: evidence from China top 100. J. Clean. Prod. 141, 41–49.
Liljenstolpe, C., 2009. Horses in Europe. EU Equus.
Lozano, R., 2008. Envisioning sustainability three-dimensionally. J. Clean. Prod. 16 (17), 1838–1846.
Lozano, R., 2015. A Holistic perspective on corporate sustainability drivers. Corp. Soc. Responsib. Environ. Manag. 22, 32–44.
Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D., Lambrechts, W., 2013. Declarations for sustainability in higher education: becoming better leaders, through addressing the university system. J. Clean. Prod. 48, 10–19.
Mamede, P., Gomes, C.F., 2014. Corporate sustainability measurement in service organizations: a case study from Portugal. Environ. Qual. Manag. 23 (3), 49–73.
Nicolini, D., 2012. Practice Theory, Work, and Organization: an Introduction. Oxford University Press, Oxford.
Paillé, P., Raineri, N., 2015. Linking perceived corporate environmental policies and employees eco-initiatives: the influence of perceived organizational support and psychological contract breach. J. Bus. Res. 68 (11), 2404–2411.
Paillé, P., Mejía-Morelos, J.H., Marché-Paillé, A., Chen, C.C., Chen, Y., 2016. Corporate greening, exchange process among co-workers, and ethics of care: an empirical study on the determinants of pro-environmental behaviors at coworkers-level. J. Bus. Ethics 136 (3), 655–673.
Paula, L., Järvinen, M., Karhu, K., Pyysiäinen, J., Lunner Kolstrup, K., Pizke, S., Löfqvist, L., 2013. Good Practices and Innovations in the Equine Sector: Current Trends and Future Opportunities. Focus group report on situation in Finland, Sweden and Latvia. Central Baltic Interreg IV A programme 2007–2013.
Pereira-Moliner, J., Claver-Cortés, E., Molina-Azorín, J.F., Tarí, J.J., 2012. Quality management, environmental management and firm performance: direct and mediating effects in the hotel industry. J. Clean. Prod. 37, 82–92.
Pfahl, S., 2005. Institutional sustainability. Int. J. Sustain. Dev. 8 (1–2), 80–96.
Pickman, H.A., 1998. The effect of environmental regulation on environmental innovation. Bus. Strategy Environ. 7 (4), 223–233.
Porter, M.E., Van der Linde, C., 1995. Toward a new conception of the environment-competitiveness relationship. J. Econ. Perspect. 9 (4), 97–118.
Pretty, J., Toulmin, C., Williams, S., 2011. Sustainable intensification in African agriculture. Int. J. Agric. Sustain. 9 (1), 5–24.
Pussinen, S., Thuneberg, T., 2010. Katsaus Hevosalan Yritystoimintaan, vol. 16 (In Finnish).
Qi, G.Y., Shen, L.Y., Zeng, S.X., Jorge, O.J., 2010. The drivers for contractors' green innovation: an industry perspective. J. Clean. Prod. 18 (14), 1358–1365.
Raento, P., 2016. A geopolitics of the horse in Finland. Geopolitics 21 (4), 945–968.
Rennings, K., 2000. Redefining innovation – eco-innovation research and the contribution from ecological economics. Ecol. Econ. 32 (2), 319–332.
Sáez-Martínez, F.J., González-Moreno, Á., Hogan, T., 2014. The role of the university in eco-entrepreneurship: evidence from the eurobarometer survey on attitudes of european entrepreneurs towards eco-innovation. Environ. Eng. Manag. J. 13 (10), 2541–2541.
Schiederig, T., Tietze, F., Herstatt, C., 2012. Green innovation in technology and innovation management: an exploratory literature review. R&D Manag. 42 (2), 180–192.
Sheth, J.N., Sethia, N.K., Srinivas, S., 2011. Mindful consumption: a customer-centric approach to sustainability. J. Acad. Mark. Sci. 39 (1), 21–39.
Svensson, G., Wagner, B., 2015. Implementing and managing economic, social and environmental efforts of business sustainability. Manag. Environ. Qual. An Int. J. 26 (2), 195–213.
Triguero, A., Moreno-Mondéjar, L., Davia, M.A., 2013. Drivers of different types of eco-innovation in European SMEs. Ecol. Econ. 92, 25–33.
Vos, R.O., 2007. Defining sustainability: a conceptual orientation. J. Chem. Technol. Biotechnol. 82 (4), 334–339.
Wagner, B., Svensson, G., 2014. A framework to navigate sustainability in business networks: the transformative business sustainability (TBS) model. Eur. Bus. Rev. 26 (4), 340–367.
Zailani, S., Govindan, K., Iranmanesh, M., Shaharudin, M.R., Chong, Y.S., 2015. Green innovation adoption in automotive supply chain: the Malaysian case. J. Clean. Prod. 108, 1115–1122.