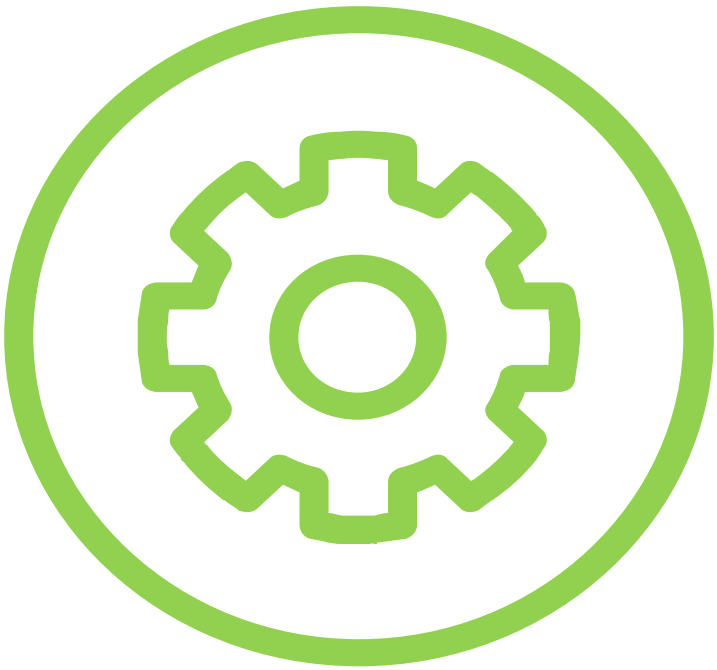
The adoption of eco-innovation

Internal and external factors that influence the adoption of eco-innovation in the pulp- and paper industry and brewing industry



Author: Ing. (Maurice) M.V.D. van den Oever (5672430)
Email: M.v.d.vandenoever@students.uu.nl

Supervisor: Dr. (Maryse) M.M.H. Chappin
Second reader: Dr. (Simona) S.O. Negro

Organisation: Deloitte
Supervisor: Drs. (Han) J.S. Hindriks

Wordcount: 19.852
Wordcount (without annexes and figures): 14.651
Characters (without spaces): 109.142

Master Thesis
Sustainable Business and Innovation
Faculty of Geosciences
UTRECHT UNIVERSITY

Abstract

Nowadays, there is a lot of literature available regarding the factors that influence the adoption of eco-innovation. Out these many different types of factors were twelve factors selected which were used for this research in specific, consisting of six internal factors and six external factors. This research about the influence of these twelve factors on the adoption of eco-innovation was used in order to close the research gap, namely providing a systematic overview of the influence of the different factors and how the influence of these factors change over time. Most of the literature focuses on the adoption of one type of eco-innovation, whereas this research focuses on the adoption of eighty eco-innovations, which yielded richer insights about the adoption of eco-innovations. Also the literature focuses mainly on the adoption of eco-innovations in one specific year, whereas this research focused on the time period 2005 to 2017. This timeframe made it possible to analyse how the influence of the different factors change over time. This information is needed in order to develop specific strategies and policies with the intention of stimulating the adoption of eco-innovations. This research closes the research gap that currently exist by providing a clear systematic overview of the different factors, by analysing the factors which influenced the adoption of eco-innovations in the pulp- and paper industry and the brewing industry. Using a multiple and embedded case study, in both industries ten organisations were analysed about the factors which influenced the adoption of eco-innovations. The organisations were analysed by the use of four eco-innovations which were adopted in the organisation during the period 2005 to 2017. In total twenty organisations and eighty eco-innovations were analysed in this research.

Overall, we can conclude that all the twelve factors have an influence on the adoption of eco-innovations in the pulp- and paper industry and the brewing industry. However, there are some differences in the level of influence of the different factors. The findings show that internal factors were more important, in comparison with the external factors. In the pulp- and paper industry the (F2) financial advantage was the most important factor, as the industry has to deal with small margins and small investment budgets. Whereas the brewing industry focuses on a broader set of factors that had an important influence on the adoption of eco-innovations, namely (F2) financial advantage, (F3) ethical responsibility, (F4) management promotes, and (F6) clear objectives and plans. In addition, the research provides some barriers and stimulatory measures which can be used by organisations, the government, non-governmental organisations, and consultancy firms in order to develop and implement new strategies and policies in order to stimulate the adoption of eco-innovations.

Keywords: Adoption – Eco-innovation – Internal and external factors – CO_2 reductions – Energy efficiency

Table of Contents

Table of figures

1. Introduction

Anthropogenic emissions of carbon dioxide (CO_2) and other greenhouse gases at or above current rates cause significant changes in the global climate system (IPCC, 2007; McKinnon, 2007). These changes lead to economic, social and environmental problems (IPCC, 2007; Lozano, 2012; McKinnon, 2007). Companies are considered to be key contributors to these anthropogenic emissions due to their large-scale use of fossil fuels and depletion of resources (Dunphy et al., 2003; Kupers, 2011; Lozano, 2013). Due to their negative environmental and social impacts companies are pressured by stakeholders (e.g. shareholders and customers) to decrease these detrimental practices (Kolk, 2003; Jeswani et al., 2008). These pressures can create risks and opportunities for companies and their investors (Collins et al., 1994). This has also lead to the launch of different kind of protocols and agreements, e.g. the Kyoto Protocol and Paris Climate Agreement (Boiral, 2006; Cogan, 2006). With the launch of the Kyoto Protocol in 2005, CO_2 reductions are becoming important for doing business on a global scale (Boiral, 2006; Cogan, 2006). Nevertheless, recent events show that organisations need to take their responsibility in order to reduce the global CO_2 emissions as governments are lacking behind, for example the announcement of Donald Trump (President of the USA) to withdraw from the Paris Climate Agreement (CNN, 2017).

Currently, financial markets have already started rewarding businesses that are reducing their CO_2 emissions (Boiral, 2006; Cogan, 2006). Delivering goods and services more efficiently is a core component of today's attempts to reduce global carbon emissions, e.g. energy efficiency (Cullen et al., 2010). According to the International Energy Agency (IEA, 2008) is energy efficiency the least costly strategy for realising reductions in carbon emissions. Therefore, organisational change and energy efficient eco-innovations are needed to reduce the overall CO_2 emissions of businesses (Carrillo-Hermosilla, 2009; Ragsdell, 2000). Eco-innovation stimulates the progress towards the goal of sustainable development, through reducing impacts on the environment (CO_2 emissions) or achieving a more efficient and responsible use of natural resources (Carrillo-Hermosilla, 2009). Innovation does not always require in-house investments in creative activities such as R&D, because innovation can also be adopted from other organisations that have developed the innovation (Kemp et al., 2007). The adoption of innovation can be the result of managerial choice (internal factors) or can be imposed by external conditions (external factors) that influence the organisation towards the adoption of innovation (Damanpour et al., 2006).

In the literature, internal and external factors that influence the adoption of eco-innovation are discussed, e.g. Cogan (2006) and Epstein et al. (2001a) focus on the internal factors that influence the adoption of eco-innovation, and Jamali et al. (2008) and Bansal (2005) focus on the external factors. Whereas, Chappin et al. (2009) and Bossle et al. (2016) focus on the influence of both the internal and external factors on the adoption of eco-innovation. As a result, there is a lot of literature available regarding the factors that influence the adoption of eco-innovation. Out those many different types of factors were twelve factors selected which were used for this research in specific, consisting of six internal factors and six external factors. The internal factors are directly coming from the inside of the organisation, whereas the external factors are pressures from the business environment, e.g. the government, competitors and critical stakeholders (Azapagic et al., 2005; Cogan, 2006; Cannon, 1994; Bansal, 2005; Moon, 2004; Weymes, 2004). As a result, the current literature discuss a broad set of the different types of factors that influence the adoption of eco-innovation. However, a clear systematic overview of the factors that influence the adoption of eco-innovation and how the influence of the factors change over time is still missing. Also how the influence of the different factors change among large and small organisations, industries, and type of innovations (process- and product) is still missing. This research gap needs to be analysed in order to develop specific strategies and policies in order to stimulate the adoption of eco-innovations.

In this research the different factors were analysed about their influence on the adoption of eco-innovation in order to close the research gap. Two industries that were responsible for a large quantity of CO_2 emissions were analysed during this research, namely the pulp- and paper industry and the brewing industry (RVO, 2015a; RVO, 2015b). The pulp- and paper industry focusses on the production of packaging for gifts or products, but also notebooks and toilet paper (VNP, 2016). Whereas the brewing industry focusses on the production of beer and cider (Nederlandse Brouwers, 2016). In 2015, the energy consumption of the pulp- and paper industry was 22.556 TJ and the energy consumption of the brewing industry was 3.266,1 TJ. In comparison with the year 2014, the industries reduced their energy consumption in 2015 by 4,6% in pulp- and paper industry (RVO, 2015a) and the brewing industry reduced their energy consumption by 0,8% (RVO, 2015b). The energy reductions were the

result of the adoption of eco-innovation (RVO, 2015a; RVO, 2015b). However, some of these reductions were also the result of a decrease in production volume (RVO, 2015a; RVO, 2015b). Therefore, these industries were interesting to analyse in order to get more insight in the factors that influence the adoption of eco-innovation. A random selection of organisations in the pulp- and paper industry and brewing industry were analysed about the influence of the internal and external factors on the adoption of eco-innovation. The organisations were analysed by the use of four eco-innovations which were adopted in the organisation during the period 2005 to 2017. In total twenty organisations and eighty eco-innovations were analysed in order the close the research gap. For that reason, the following research question is formulated:

What is the influence of internal and external factors on the adoption of eco-innovation in the pulp- and paper industry and the brewing industry?

The research is relevant from both a scientific and practical perspective. From a scientific perspective the study closes the research gap that currently exists, namely the absence of a systematic overview of the level of influence of the different eco-innovations and how the influence of the factors change over time. The results encourage other scientists to elaborate on this when researching similar topics, by using the results as a starting point for more in depth research. From a more practical perspective, this analysis is useful for Deloitte (principal for the research). Deloitte provides industry-leading audit, consulting, tax, and advisory services to many of the world's most admired brands. The research results are used for their advisory department, which aims to gain more insight in the internal and external factors on the adoption of eco-innovation. Also organisations, governments and stakeholders can use the research results as a starting point for the formulation of policies and strategies in order to stimulate the adoption of eco-innovation. This research report continues with the theoretical framework and the research methods, followed by the research results. Finally, the results are discussed and a conclusion is formulated.

2. Theoretical Framework

In this chapter the theoretical framework is described in order to elaborate on the dependent variable specifically, the adoption of eco-innovation. As well the conceptualisation of the internal and external factors will be provided. Furthermore, the internal and external factors will be explained in more detail. In this research, the focus will be on six internal and six external factors. These factors will be used for the reminder of the study.

2.1 Adoption of eco-innovation

The adoption of innovation refers to the decision of an organisation to make use of a specific innovation (Rogers, 1995). This includes the process through which an individual or other decision-making unit passes from (1) first knowledge of an innovation, (2) to forming an attitude toward the innovation, (3) to a decision to adopt or reject, (4) to implementation of the new idea, and (5) to confirmation of this decision (Rogers, 1995). This research focused on the factors which had an influence on the (3) decision to adopt the different eco-innovations. Nowadays, organisations adopt eco-innovations in order to reduce their CO_2 emissions, to be exact, 'realising direct and measurable reductions in carbon emissions' (Office of Sustainability, 2017). These eco-innovations were defined as any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment (reducing CO_2 emissions) or achieving a more efficient and responsible use of natural resources, e.g. energy efficiency (Carrillo-Hermosilla, 2009). In order to make the results as specific as possible, the research focused on energy efficient eco-innovations.

2.2 Conceptualisation of the internal and external factors

In the literature different factors were mentioned which had an influence on the adoption of eco-innovations. A selection of those factors were used in order to develop a framework, which was used for this research in specific. The framework consisted of twelve factors, six internal and six external factors. These factors were selected by the following criteria: (1) only the factors that have influenced the adoption of eco-innovation were selected, (2) the factors were mentioned in articles about sustainability, and (3) the factors were mentioned by more than four different kinds of authors as important for the adoption of eco-innovation (Bansal, 2005; Bossle et al., 2016; Chappin et al., 2009; Cogan, 2006; Epstein et al., 2001a; Hoffman, 2007; McKinnon, 2007; Smith et al., 2006). The factors that were the same but had different names in different articles were clustered. The framework (figure 1) provides a clear overview of the internal and external factors, and the authors that mentioned the different factors as important.

Code		Factor	Literature
		Internal factors	
F1		Awareness of the high CO_2 emissions by constantly reporting	Bansal, 2005; Calabrese, 2016; Cogan, 2006; Gladwin et al., 1995; Guthrie et al., 2008; Lozano et al., 2011; Siew, 2016; Siew, 2016; Stubs et al., 2006
F2		Financial advantage (high resources and production costs)	Abernethy et al., 1990; Azapagic, 2003; Burchell et al., 1980; Chappin et al., 2009; Cogan, 2006; Daily et al., 2001; Demirel et al., 2011; DeSimone et al., 2000; Dunphy et al., 2003; Green et al., 1994; Hoffman, 2007; Horbach, 2008; Horbach et al., 2012; Lozano et al., 2011; O'Connor, 2010; Quazi, 2001; Robbert et al., 2002
F3		Ethical (social) responsibility	Carroll, 1991; Crane et al., 2007; Kaptein, 2008; Paine, 1997; Sinclair, 1993; Solomon, 2004; Riivari et al., 2012 ; Treviño et al., 2003
F4		Top management promotes CO_2 reductions initiatives	Cogan, 2006; Crews, 2010; Doppelt, 2009; Epstein et al., 2001a; Gill, 2003; Hoffman, 2007; Lueneburger et al., 2010; Reid et al., 2008; Stubs et al., 2006
F5		Corporate culture encourages initiatives from employees	Chandy, 2008; Chui et al., 2016; Griffiths et al., 2001; Hoffman, 2007; Lorenzi et al., 2000; Lozano, 2012; Walker et al., 2009
F6		Clear objectives and plans in terms of CO_2 reductions	Cogan, 2006; Epstein et al., 2001a; Epstein et al., 2001b; Lozano, 2012; Stubs et al., 2006

Figure 1A | Overview of the internal factors

Code		Factor	Literature
		External factors	
F7		Regulatory pressure on CO_2 emissions	Benn et al., 2006; Cannon, 1994; Cleff et al., 1999; Dewick, 2010; Frondel et al., 2008; Green et al., 1994; Jaffe et al., 2016; Moon, 2004; Reid et al., 2008; Smith et al., 2006
F8		Threat of new regulation on CO_2 emissions	Chappin, 2009; Green et al., 1994; Horbach et al., 2010; Jaffe et al., 1997; Jamali et al., 2008; Triguero, 2013
F9		Subsidies on CO_2 reductions	Clausen, 2009; Del Rio et al., 2010; Moon, 2004; Jelsma, 2003; Reid et al., 2008; Vollenbroek, 2002
F10		Stakeholder's expectations	Azapagic et al., 2005; Doh et al., 2010; Dunphy et al., 2003; Dyllick et al., 2002; Freeman, 1984; Garvare et al., 2010; Lozano, 2011; Quazi, 2001; Vermeulen et al., 2016
F11		Opportunities to enter new markets	Bansal, 2005; Davidsson et al., 2006; Green et al., 1994; Grubb et al., 2002; Kesidou, 2012; Suchman, 1995; Stern, 2006
F12		Competitive advantage	Carrillo-Hermosilla, 2009; Cogan, 2006; European Commision, 2008; Ghemawat, 1986; Hart et al., 1994; Lieberman et al., 1988; Quazi, 2001; Romm, 1993; Roper Organization, 1992; Vinnova, 2001

Figure 1B | Overview of the external factors

2.3 Evaluating the internal factors

2.3.1 Awareness of the high CO_2 emissions by constantly reporting

Reporting or public disclosure describes a situation in which an organisation makes information available by publishing an annual or sustainability report (Cogan, 2006; Lozano et al., 2011). A sustainability report can be described as a report published by a company or organisation about the economic, environmental and social impacts (non-financial) caused by its everyday activities (Global Reporting Initiative, 2017; Hayatun et al., 2012). The report helps the organisation to measure, understand, and communicate their performance and makes it possible to set goals and manage change more effectively (Global Reporting Initiative, 2017). Widespread sustainability reporting practices can help to create transparency and help markets to function more efficiently (Global Reporting Initiative, 2014). Therefore, by constantly reporting are organisations aware of their high CO_2 emissions, which will result in the adoption of eco-innovations in order to reduce the CO_2 emissions of the organisation. The literature predicts that organisations decide to adopt eco-innovations for the reason that they are aware of their (too) high CO_2 emissions.

2.3.2 Financial advantage (high resources and production costs)

Research shows that energy efficiency and therefore CO_2 reductions enhance the operating and financial performance of firms with high emissions levels (Hart et al., 1996). Organisations are seeking opportunities to reduce costs, in order to increase the profitability of the organisation (Cogan, 2006). The demand for electricity seems almost insatiable for organisations, therefore a promising solution is greater efficiency. These savings can be beneficial for both consumers and suppliers. The decision to spend money in order to reduce energy expenditures depends on the expected savings, in this case decision makers must weigh the expected savings with serval other issues (Kissock et al., 2008). In an increasingly competitive environment, energy efficiency can provide means to reduce costs without negatively affecting the yield or the quality of the product (Galitsky, 2008). As a result, cost savings caused by eco-innovations were found to be an important motivation for the adoption of these eco-innovations (Chappin et al., 2009; Demirel et al., 2011; Green et al., 1994; Horbach, 2008; Horbach et al., 2012). For example, energy savings have become an invaluable tool for exploring ways to reduce costs, manage risks and create new products (Azapagic, 2003). For that reason, organisations are likely to decide to adopt eco-innovations in order to reduce their high production costs, which will result in a financial advantage.

2.3.3 Ethical (social) responsibility

Ethical responsibility encourage organisations to operate in a sustainable way or deter it from doing so, which means that organisations are doing right, admirable and have fair values and practices (Kaptein, 2008; Paine, 1997; Sinclair, 1993; Treviño et al., 2003). Nowadays, organisations recognise that ethics, along with the demand for innovativeness, are crucial for their sustainability performance (Carroll, 1991; Crane et al., 2007; Paine, 1997; Solomon, 2004). Research on ethics focus mainly on two constructs, namely ethical climate and ethical culture (Kaptein, 2008; Treviño et al., 2003). Ethical climate focuses on the perceptions and aspects that determine what constitutes ethical conduct, whereas ethical culture is defined as those aspects that stimulate ethical conduct (Kaptein, 2008; Treviño et al., 2003). Organisations with such ethical (social) responsibility are aware of their risks and opportunities which will result in a sustainable business. The organisations which can constructively deal with risk are the most innovative in the long run (Riivari et al., 2012). Organisations that have an urgency of ethical responsibility are likely to decide to adopt eco-innovations in order to do 'right'.

2.3.4 Top management promotes CO_2 reductions initiatives

Boards are entrusted to oversee and ensure that the organisation remains true to its mission, namely functions within the confines of state and federal laws, and operates in a financially responsible manner (Preston et al., 2004). Boards can change the course and strategy of the organisation, and therefore the board can stimulate the organisation towards a more sustainable business (Cogan, 2006; Doppelt, 2003; Weymes, 2004). High costs of innovation activity, the lack of an appropriate source of finance, and perceived excessive economic risks are seen as barriers for eco-innovation (Reid et al., 2008). This lack of an appropriate source of finance can be resolved when the board shows their vision towards energy savings and makes money and time available in order to adopt eco-innovation. Therefore the board needs to articulate clearly the company's view on energy savings and greenhouse gas (GHG) control measures in order to stimulate the adoption of eco-innovation (Cogan, 2006; Crews, 2010; Doppelt, 2009; Epstein et al., 2001a; Gill, 2003; Hoffman, 2007; Lueneburger et al., 2010; Stubs et al., 2006). As a result, the literature predicts that top management can influence the adoption of eco-innovation by promoting CO_2 reductions and energy savings initiatives.

2.3.5 Organisational culture encourages initiatives from employees

The adoption of eco-innovation requires an organisational culture that is open for change and aware of the impact of CO_2 emissions. Chandy (2008) and Walker et al. (2009) describe the organisational culture as an important factor that stimulate the adoption of eco-innovation. Research shows that organisational support or management support for idea development and tolerance for risk taking are found exert positive effects on the innovative performance of the organisation (Alpkan et al., 2010). Top management (upper-level) can promote initiatives for the adoption of eco-innovation, on the other hand the adoption of eco-innovation can also be influenced from the lower-level of the organisation. Employees can influence the adoption of eco-innovation when they discover new type of eco-innovations in the market and promote them internally. Nevertheless, this inquires an organisational culture which encourages initiatives from employees. As a result, an organisational culture which encourages initiatives from employees is needed in order to stimulate the adoption of eco-innovations from a bottom-up perspective.

2.3.6 Clear objectives and plans in terms of CO_2 reductions

Senior managers recognise the importance of formulating a strategy on corporate sustainability, e.g. CO_2 reductions strategies (Epstein et al., 2001a). However managers often struggle with how to translate the strategy into action (Epstein et al., 2001a; Epstein et al., 2001b; Stubs et al., 2006). For this reason, organisations need to develop and implement goals and action plans to manage climate risks and seize market opportunities (Cogan, 2006). Research shows that CO_2 reductions are likely to improve when sustainability goals and targets are explicitly identified (Epstein et al., 2001a). For this reason, the board needs to formulate a corporate CO_2 reduction strategy that includes the company's values, commitment, and goals in order to reduce the CO_2 emissions (or energy consumption) of the organisation (Epstein et al., 2001a). The research predicts that the formulation of clear objectives and plans will have an influence on the decision to adopt eco-innovations.

2.4 Evaluating the external factors

2.4.1 Regulatory pressure on CO_2 emissions

Nowadays, national and supra-national law (EU legislation, international treaties) have risen to great heights (Gestel et al., 2006). State, national, and international regulators are putting increasing pressure on companies with emissions from operations or products to invest in emissions controls, purchase carbon credits, or face clean-up costs (Reid et al., 2008). The literature shows that organisations will adopt sustainability practices when regulation requires these practices (Dewick, 2010; Jaffe et al., 2016; Reid et al., 2008; Smith et al., 2006) and empirical firm-level studies suggest that stricter environmental regulations can boost eco-innovations (Cleff et al., 1999; Frondel et al., 2008; Green et al., 1994). As a results, regulatory pressures have an influence on the decision to adopt eco-innovations.

2.4.2 Threat of new regulation on CO_2 emissions

Green et al. (1994) suggest that organisations implement eco-innovations in order to comply with anticipated regulation, also Horbach et al. (2010) suggest that expected future regulation influence the adoption of eco-innovation. New and more stringent environmental regulations (e.g. regulation on CO_2 emissions) can provide an incentive for firms to develop new and less costly ways of reducing pollutions or, potentially, entirely new methods of production that eliminate particular types of emissions (Jaffe et al., 1997). The threat of the implementation of new regulation on CO_2 emissions can stimulate organisations to adopt eco-innovations (Chappin et al., 2009; Jaffe et al., 1997; Jamali et al., 2008; Triguero, 2013).

2.4.3 Subsidies on CO_2 reductions

Higher price (and not lower quality or less reliability) of environmental products seems to be a major barrier for market penetration (Reid et al., 2008), therefore investment subsidies might be granted if up-front investment costs represent a major barrier to the adoption of eco-innovation (Del Rio et al., 2010). In many countries subsidies are used as a positive impulse for businesses to adopt corporate sustainability practices, which includes the adoption of eco-innovations (Clausen, 2009; Jelsma, 2003; Moon, 2004; Vollenbroek, 2002). Therefore, subsidies on CO_2 reductions can influence the decision to adopt eco-innovations.

2.4.4 Stakeholder's expectations

Stakeholders are groups or individuals that can affect or are affected by the actions that a company undertakes to achieve their objectives (Freeman, 1984). It is important for a company to manage their stakeholders carefully because they can provide essential means of support required by the organisation. Moreover, stakeholders could withdraw their support if their needs or expectations are not met, thereby causing the company to fail, or inflicting unacceptable levels of damage (Garvare et al., 2010). The literature predicts that organisations adopt specific behaviours (e.g. CO_2 reductions) to obtain the support by critical stakeholders (Doh et al., 2010). For this reason, it is expected that stakeholders have an influence on the decision to adopt eco-innovations.

2.4.5 Opportunities to enter new markets

Organisations are responding strategically to normative pressures and to changes in their social environment to gain or maintain legitimacy, because they recognize that conforming will result in improved access to resources (Bansal, 2005; Suchman, 1995). Organisations want to enter new markets in order to get access to resources and new customers segments (Bansal, 2005; Suchman, 1995). Organisations that are more sustainable than others are likely to gain more access to new markets and resources (Green et al., 1994; Grubb et al., 2002; Kesidou, 2012; Stern, 2006). As a result, organisations are likely to adopt eco-innovations in order to become more sustainable, which will result in the access towards several new markets.

2.4.6 Competitive advantage

Through pollution prevention companies can realize significant savings resulting in a cost advantage relative to competitors (Hart et al., 1994; Romm, 1993). Competitive advantage might best be secured initially through competitive pre-emption; setting a position early on that competitors will find it difficult to quickly imitate in the future (Ghemawat, 1986; Lieberman et al., 1988). The literature predicts that organisations are reducing their CO_2 emissions in order to obtain and sustain their competitors' advantage by adopting different types of eco-innovations. Therefore, the competitive advantages that can be achieved by the organisation can have an influence on the decision to adopt of eco-innovation.

3. Research Methods

In this chapter the research methods used to answer the research question is elaborated upon. The research design will be explained in more detail. Also the case selection and data collection will be demonstrated. Furthermore, the operationalisation of the research will be elaborated. Followed by the data analysis and data quality of the research.

3.1 Design

The research consisted of a multiple and embedded case study design; a case study can be defined as 'the in-depth study of instances of a phenomenon in its natural context and form the perspective of the participants involved in the phenomenon' (Gall et al., 1996). Whereas a multiple and embedded case study contains more than one sub-unit (different kind of organisations and eco-innovations) of analysis, which made it possible to analyse each sub-unit (organisation) separately and to explore patterns of similarity or difference between (the selected organisations) sub-units (Yin, 2003). This research design made it possible to analyse the influence of the different types of factors on the adoption of eighty eco innovations, which were adopted by twenty organisations. Therefore, each organisation was analysed by the use of four eco-innovations which were adopted in the organisation. The multiple and embedded case study provided more in-depth knowledge about the influence of the factors on the adoption process (decision) of eco-innovations, which was needed in order to answer the research question. The research consisted of three steps: (1) the selection of the eco-innovations with the highest reduced CO_2 emissions, (2) the analysis of the factors that influenced the adoption of the eco-innovations, and (3) the comparison between the different organisations.

3.2 Case selection

During this research ten organisations in the pulp- and paper industry and ten organisations in the brewing industry were analysed. These ten organisations cover almost the whole industry, as the industry does not consist of many large players. All the selected organisations in the pulp- and paper industry were willing to participate in this research. Whereas, two organisations in the brewing industry were not willing to participate, therefore twelve organisations were contacted in this industry. The organisations in both industries were selected by the following criteria's: the organisations were in the same industry, the organisations were known by one of the industry associations (Koninklijke VNP or Nederlandse Brouwers), and the focus was on organisations that have a production plant in The Netherlands. The organisations that participated in this research were anonymous and therefore research codes were used. The selected organisations were analysed about their four eco-innovations which they adopted during the period 2005 to 2017. The eco-innovations with the highest quantity of reduced CO_2 emissions were selected.

3.3 Data collection

The collection of data was needed in order to analyse the influence of the internal and external factors on the adoption of eco-innovations. Data collection was done by analysing annual and sustainability reports (desk research), and by the use of semi-structured interviews.

3.3.1 Annual and sustainability reports

Annual and sustainability reports and websites of the selected organisations in the pulp- and paper industry and brewing industry (see 3.2 Case selection) were analysed. This analysis focused on the activities that were described in the reports that have influenced the adoption of the eco-innovations. It took some time to analyse all the reports and websites of the twenty organisations. Where possible, four important eco-innovations were selected. These four eco-innovations were used as input for the semi-structured interviews. It was difficult to analyse the different internal and external factors which had influenced the adoption of eco-innovations, since this information was limited available on the website. Therefore semi-structured interviews were crucial in order to get the accurate data with the intention to answer the research question.

3.3.2 Semi-structured interviews

Interviews were conducted with the decision-makers that were responsible for the adoption of the eco-innovations, in order to assess their opinion on which of the factors influenced the adoption of the eco-innovations. The interviews were conducted on location and most of the time the interviews were closed with a factory tour. The interviews started with questions about the four eco-innovations which resulted in high CO_2

reductions. Subsequently, the internal and external factors that influenced the adoption of these eco-innovations were selected. Finally, the interviewees were asked to rank the selected internal and external factors from high influence (1) to low influence (12). The interview questions were formulated (see Annex A) before the interviews were conducted and were the same for all the interviewees, therefore it is possible to compare the results.

3.4 Operationalisation

The operationalisation of the internal and external factors will be provided in this chapter. The analysis focuses on the influence of internal and external factors on the adoption of eco-innovations. In order to make these factors measurable and comparable it is important to translate the factors into measurable descriptions. The figure below shows the codes, icons, factors, definitions and the descriptions, which were used during the entire study.

Code	Icon	Factor	Definition	Description of the influence
F1		Awareness of the high CO_2 emissions by constantly reporting	The organisation was aware of their high energy consumption and CO_2 emissions by constantly measuring and reporting.	The organisation adopted eco-innovations in order to reduce their high energy consumption and CO_2 emissions.
F2		Financial advantage (high resources and production costs)	The organisation had high resources and production costs, and was looking for opportunities to obtain a financial advantage.	The organisation adopted eco-innovations in order to reduce their high resources and production costs, which resulted in a financial advantage.
F3		Ethical (social) responsibility	The organisation had an urgency of ethical responsibility which was integrated in the vision of the organisation.	The organisation adopted eco-innovations in order to do 'right' and responsible.
F4		Top management promotes CO_2 reductions initiatives	The board articulated clearly the company's view on energy savings and greenhouse gas (GHG) control measures.	The organisation adopted eco-innovations because the top management promoted energy savings and CO_2 reduction initiatives.
F5		Corporate culture encourages initiatives from employees	The organisation encouraged employees to think about ways to reduce energy consumption and CO_2 emissions (bottom-up approach).	Employees discovered a new type of eco-innovation in the market and promoted it internally, which resulted in the adoption of eco-innovations.
F6		Clear objectives and plans in terms of CO_2 reductions	The organisation had formulated a corporate CO_2 (or energy) reduction strategy that included the company's values, commitment and goals.	The organisation adopted eco-innovations in order to achieve their clear objectives and plans.
F7		Regulatory pressure on CO_2 emissions	The organisation was pressured by state, national, and international regulators to invest in measures in order to reduce the CO_2 emissions of the organisation.	The organisation adopted eco-innovations in order to meet strict regulation (in terms of CO_2 reductions).
F8		Threat of new regulation on CO_2 emissions	The organisation was aware of the threat of new and more stringent environmental regulations (e.g. CO_2 reductions or energy reductions).	The organisation adopted eco-innovations in order to respond to the threat of potential pressure from new regulation in the area of CO_2 emissions (or energy consumption).
F9		Subsidies on CO_2 reductions	The organisation has to deal with high up-front investment costs, which made it less interesting to invest in innovation and therefore were looking for subsidies.	The available subsidies on CO_2 reduction initiatives motivated or made it possible for the organisation to adopt eco-innovations.
F10		Stakeholder's expectations	The organisation managed their stakeholders carefully in order to sustain their support or to prevent the counteractivity of their stakeholders.	The organisation adopted eco-innovations in order to meet stakeholder's expectations in terms of reducing the total amount of CO_2 emissions of the organisation.
F11		Opportunities to enter new markets	The organisation was looking for opportunities to enter new markets in order to get access to resources and new customers segments.	The organisation adopted eco-innovations in order to get access to opportunities in new markets (e.g. in the field of reducing CO_2 emissions or energy consumption).
F12		Competitive advantage	The organisation was looking for setting a position early on that competitors will find it difficult to imitate in the future in order to get or sustain their competitive advantage.	The organisation adopted eco-innovations in order to get or sustain their competitive advantage.

Figure 2 | Operationalisation of the internal and external factors

3.5 Data analysis

The influence of the internal and external factors on the adoption of eighty eco-innovations were analysed in order to answer the research question. The analysis focused on forty eco-innovations in the pulp- and paper industry, and forty eco-innovations in the brewing industry (see 3.3 - Data collection). Therefore, each organisation was analysed by the use of four eco-innovations which were adopted in the organisation. This analysis resulted in four sets of factors that influenced the adoption of the selected eco-innovations in each organisation. The level of influence of the different types of factors were measured by the use of a ranking scale (1 up to 12); the factor that had the most influence on the adoption of eco-innovations got the number '1', whereas the factor with the least influence got the highest number, e.g. the number '12'. Internal and external factors that had no influence on the adoption of the eco-innovations were not scored.

The results were visualised in an overview table (see Annex B). All the organisations got a unique code that was used during the entire research, for example 'B1' was the code of the first organisation in the brewing industry. Two overview tables were visualised, namely an overview of the factors which had an influence on the forty eco-innovations in the pulp- and paper industry, and an overview of the factors which had an influence on the forty eco-innovations in the brewing industry. These overview tables were used in order to make different comparisons. First of all, a comparison was made about the number of times the different types of factors were mentioned, this shows how often a specific factor has influenced the adoption of eco-innovations. Next to this, a comparison is made between the level of influence of the different types of factors. The respondents have ranked the factors from most influence (score 1) to least influence (score 12). The number of times a factor was ranked with the score 1, 2 or 3 were compared with each other, therefore this comparison focused only on the factors which have the most important influence on the adoption of eco innovation. The analysis continues with comparing the differences or similarities between the type of innovations (process or product innovations), time periods (changes over the years), small and large organisations, and the amount of reduced CO_2 emissions. Finally, the overview tables were used in order to compare the two industries, namely the pulp- and paper industry, and the brewing industry. This analysis resulted in an systematic overview of which factors were more important than others in their influence on the adoption of eco-innovation.

3.6 Quality indicators

The principles of reliability and validity were important in order to guarantee the quality of the research. The principle of reliability was concerned with whether the results were more than a one-off finding and be inherently repeatable. It is important that other researchers were able to perform exactly the same experiment, under the same conditions and generate the same results. This condition was met by the detailed description of the data collection and data analysis methods, as well as by using the same interview questions for all the respondents. The focus was on eco-innovations with the highest quantity of reduced CO_2 emissions, which were adopted during the period 2005 to 2017. These criteria's made it possible for other researchers to select the same eco-innovations when they repeat the research. The influence of the factors on the adoption of these eco-innovations in the different types of organisations have already occurred; therefore the researched influence of the factors on the adoption of these eco-innovations cannot change. Nevertheless, the factors change overtime, and so it is possible that these factors were different when other time periods (e.g. 1990 to 2000) were analysed.

According to Yin (2008) validity, and with that data quality, is improved through data triangulation, i.e. diminishing the probability that results were based on coincidence by searching converging findings from multiple data sources. Using the two different sources desk research and semi-structured interviews ensures that this condition is met. The operationalisation (chapter 3.4) ensures that the results from the interview questions and the analysed factors were answering the research question when the research was completed. The clear description of the different factors (construct validity) made it possible to measure which factors had an influence on the adoption of eco-innovations in the different types of organisations. Next to this, the interview template (see annex A) with the different research questions made it possible to get the needed results and made the research more clear for the interviewees. The structure of the semi-structured interview was tested before the actual interviews started. The semi-structured interview was tested by an intern (Deloitte), a consultant (Deloitte), a scientist (Utrecht University) and a small organisation (brewing industry). The results from the test interviews were used in order to improve the structure of the semi-structured interviews. Finally, the research results were combined in an overview table (Annex B), which made it possible to analyse all the organisations in the same way (external validity). Also, the research focused on two industries in specific, which made it possible to generalise the research results.

4. Results

In this chapter, the results from the twenty conducted interviews will be discussed. First of all, the results from the brewing industry will be discussed. Followed by the factors which influenced the adoption of eco-innovations in the pulp- and paper industry. Finally, a comparison is made between the two industries.

4.1 Brewing industry

The brewing industry adopted eco-innovations which reduced the quantity of CO_2 emissions in the production process and the chain, however this research focused only on the CO_2 reductions realised in the production process. The analysed eco-innovations were adopted in the period between 2005 up to 2017. The number of adopted eco-innovations peaks in the years 2006, 2010, and 2013. Most of the eco-innovations were adopted between 2012 and 2017. In these years a diverse range of eco-innovations were adopted, e.g. heat recovery and efficient machinery. All of the eco-innovations were process innovations, none of them were product innovations.

The figure below gives a clear overview of the production process and the places where the eco-innovations were adopted. The eight eco-innovations above the production process consist of eco-innovations which made the brewery (building) more energy-efficient, e.g. led-lighting (see figure 3). Phase 1, barley to hops, consist of sixteen eco-innovations which were most of the time innovations like new machinery, pipes isolation, and frequency controllers. Whereas, phase 2 (the yeast process) consist mainly of heat recovery innovations. Phase 3, oxygen to transportation, consists of four eco-innovations which optimised the cooling process. Finally, the last phase (transportation) consists of lean and green projects. The factors that influenced the adoption of the eco-innovations will be discussed in the next paragraphs.

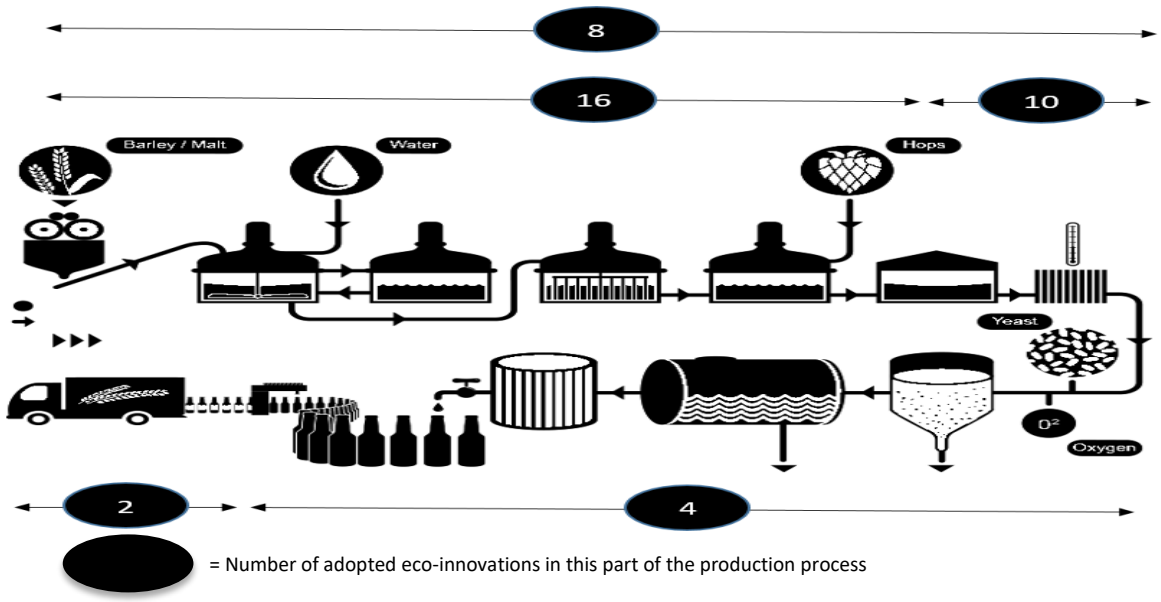


Figure 3 | Overview of the number of adopted eco-innovations in each phase of the production process (Devilsgullet, 2017)

4.1.1 Number of times a factor is mentioned

Figure 4 visualises the number of times a factor was mentioned by the respondents. All the respondents discussed four eco-innovations which they have adopted in the organisation. Therefore, forty eco-innovations were analysed and so the maximum number of times a factor can be mentioned is forty. The colours in the figure show the different ranges, namely 0 to 9 is orange, 10 to 19 is blue, and 20 to 29 is green. The factors which were mentioned the most were (F4) management promotes [29], (F2) financial advantage [26], and (F3) ethical responsibility [23]. One of the respondents also specifically highlighted the factors management promotes and financial advantage; *'Our CEO is a strong promoter for the adoption of energy-efficient innovations and has also set clear goals for our management. The focus is on energy savings, however a sustainable business case is needed' (Organisation B5).* Also one of the respondents mentioned the ethical responsibility of the organisation

as a factor that influenced the adoption of eco-innovations; '*The factors which influenced the adoption of the eco-innovation were ethical responsibility, reducing water and energy, and top management. These three were important.' (Organisation B8).*

The factors that were mentioned between the 10 and 20 times were (F7) regulatory pressure [15], (F6) clear objectives and plans [14], (F10) stakeholders [14], (F1) awareness [14], (F5) corporate culture [13], and (F12) competitive advantage [11]. The factors which were mentioned by only a few respondents, below the 10 times, were only external factors, namely (F8) threat of new regulation [10], (F11) business opportunities [8], and (F9) subsidies [3]. Some of the respondents mentioned the current subsidy procedures as too difficult and therefore not interesting to consider. Also the threat of new regulation was not present, as one of the respondents mentioned: *'As far as potential legislation was concerned, it is very difficult because you are not aware of what is coming. However, the minister set a goal to become gas free in 2050. We try to keep that goal in mind, but it is still far away' (Organisation B1).* This shows that the respondents were sceptic about the influence of new regulation, on the other hand they were aware of the ambition of the minister for economic affairs in the Netherlands to implement individual savings agreements.

Finally, the figure shows that none of the factors were mentioned by all of the respondents (40 times mentioned). Overall the internal factors were mentioned more by the respondents as having an influence on the adoption of eco-innovations in comparison with the external factors, especially internal management, finance, and responsibility had an influence on the adoption of many eco-innovations.

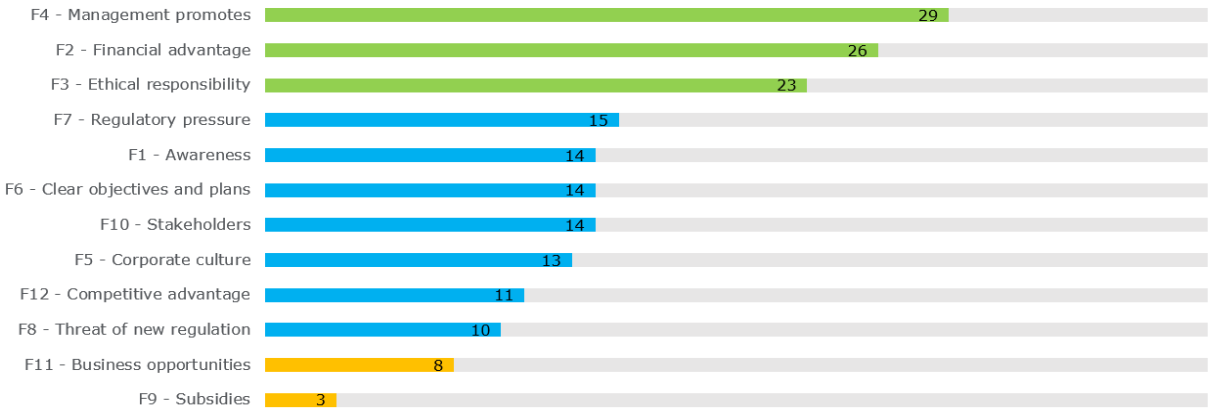


Figure 4 | Number of times a factor was mentioned. *The different colours visualize the different ranges, namely 0-9 (orange), 10-19 (blue), and 20-29 (green). The factors F1 up to F6 were internal factors and the factors F7 up to F12 were the external factors.*

4.1.2 High scoring factors

The respondents were asked to rank the factors, which they mentioned, from most important to least important. The factors which were ranked with the 'score 1' were the most important ones and the factors which were ranked with the highest score (score 12) were the least important ones. Figure 5 provides an overview of the factors that were mentioned as factors which had an important influence on the adoption of eco-innovations. The figure visualize only the number of times a factor got the score 1, 2, or 3 (not the score 4 up to 12). The factors which were scored most of the time with the 'score 1' were (F2) financial advantage, (F4) management promotes, (F3) ethical responsibility, and (F6) clear objectives and plans. These factors were often also scored with the 'score 2' or 'score 3'. Therefore, these factors were important for the adoption of different eco-innovations. One of the respondents highlighted the factors financial advantage and management promotes; *'Reducing production costs and top management promotes initiatives were important factors that influenced the adoption of eco-innovations, but these were not directly linked to CO_2 reductions, but rather to energy savings. We have a top-down culture, our management says we will reduce so much in a specific year.'* (Organisation B1).

The factors which were not scored or less with the 'score 1' but were scored many times with the 'score 2' or 'score 3' were (F1) awareness, (F5) corporate culture, (F7) regulatory pressure, (F9) subsidy, and (F10) stakeholders. One of the respondents also elaborated on the factor corporate culture: *'Corporate culture was also an important one. I implemented a bonus scheme and employees have different kind of KPI's. I have been doing this since the beginning in order to stimulate initiatives from the employees.' (Organisation B8).* The factors

that are not shown in figure 5 were not scored as factors which had an important influence (not scored with 1, 2, or 3) on the decision to adopt the eco-innovations, therefore the factors (F8) threat of new regulation, (F11) business opportunities, and (F12) competitive advantage were the factors which were not much influencing the adoption of eco-innovations. Overall the internal factors were more important than the external factors, especially the financial and management factors were important. Whereas the external factors were significantly less important, in specific the threat of new regulation, business opportunities and the competitive advantage of the organisation were not ranked as factors which had an important influence on the adoption of eco-innovations.

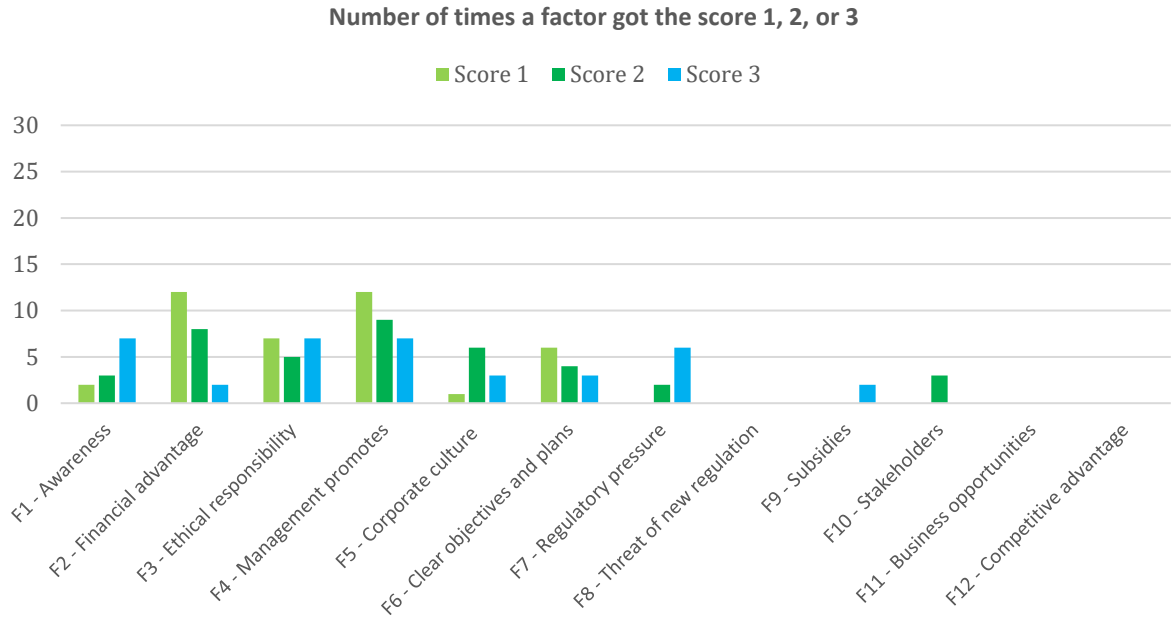


Figure 5 | Number of times a factor got the score 1, 2, or 3

4.1.3 Process- and product innovation

The results consisted only of process innovations because the quality of the beer is the highest priority of the brewers, as a consequence product innovations in the context of energy efficient innovations were not considered. Product innovations in the form of changing the design of the beer bottles were discussed. Nevertheless, concessions in the design of the beer bottles have an impact on the times a bottle can be reused by the breweries, which makes it less sustainable to change the design of the beer bottles. As a result, it is not possible to compare the differences between process- and product innovations, however it does show that process innovations were only considered in the brewing industry.

4.1.4 Time dimension

Figure 6 provides an overview of the number of times internal and external factors were mentioned over time and the number of adopted eco-innovations in a specific year. As shown in figure 6, the internal factors were mentioned more by the respondents in comparison with the external factors, especially in the years 2010 and 2015. Only in the year 2007 no external factors were present. The figure also shows that the number of external factors was increasing since the year 2013, with exception of the year 2015. The increase in the number of external factors was also mentioned by the respondents, especially the increase in regulation, however the influence of regulation was still limited. Some of the respondents highlighted the influence of regulation; *'Legislation certainly, we need to do something in order to reduce our excessive NOx emissions and therefore gas savings must be carried out. Also potential legislation shows pressure on gas usage'* (Organisation B2) and another respondent mentioned; *'Pressure from legislation always works, we need to reduce our energy use with 2% and subsidies do not matter much.'* (Organisation B1). The number of adopted eco-innovations was increasing over the years, however this could also be the result of the fact that the respondents only mentioned the most recent adopted eco-innovations. Overall the external factors were increasing over time, however the internal factors were still more represented. The results show fluctuations in the total amount of times a factor is mentioned, these fluctuations were the result of the fluctuations in the number of adopted eco-innovations.

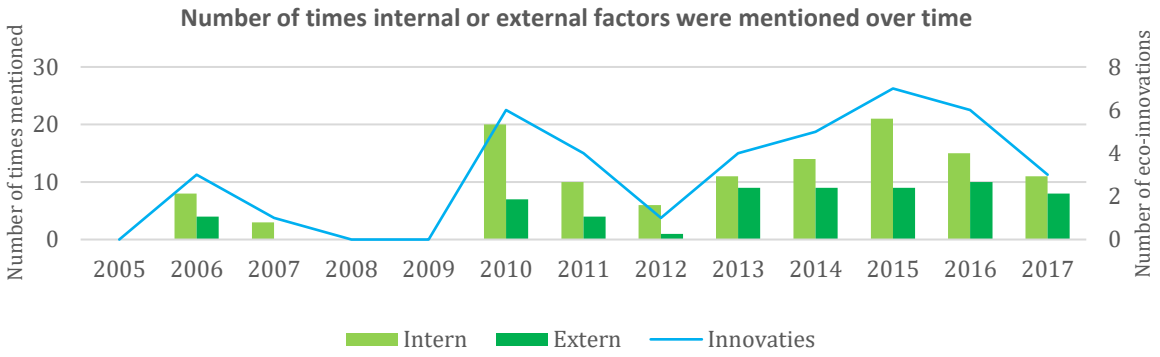


Figure 6 | Number of times internal and external factors were mentioned (in each year)

4.1.5 Type of organisation

The respondents consisted of large and small breweries, which were divided in five large breweries (>80 employers) and five small breweries (<80 employers). Figure 7 provides a clear overview of the number of times a factor is mentioned by the large breweries and by the small breweries. The results show that the factors (F4) management promotes, (F6) clear objectives and plans, and (F11) business opportunities were increasingly influencing the adoption of eco-innovations by the large breweries in comparison with the small breweries. Whereas, the factors (F1) awareness, (F2) financial advantage, (F3) ethical responsibility, (F8) threat of new regulation, and (F10) stakeholders were more important for the small breweries. Overall the internal factors were more present than the external ones, this applies for both large and small breweries. Clear objectives, internal management, and business opportunities were more important for the large breweries, whereas the awareness and responsibility of the small breweries is significantly higher in comparison with the large breweries.

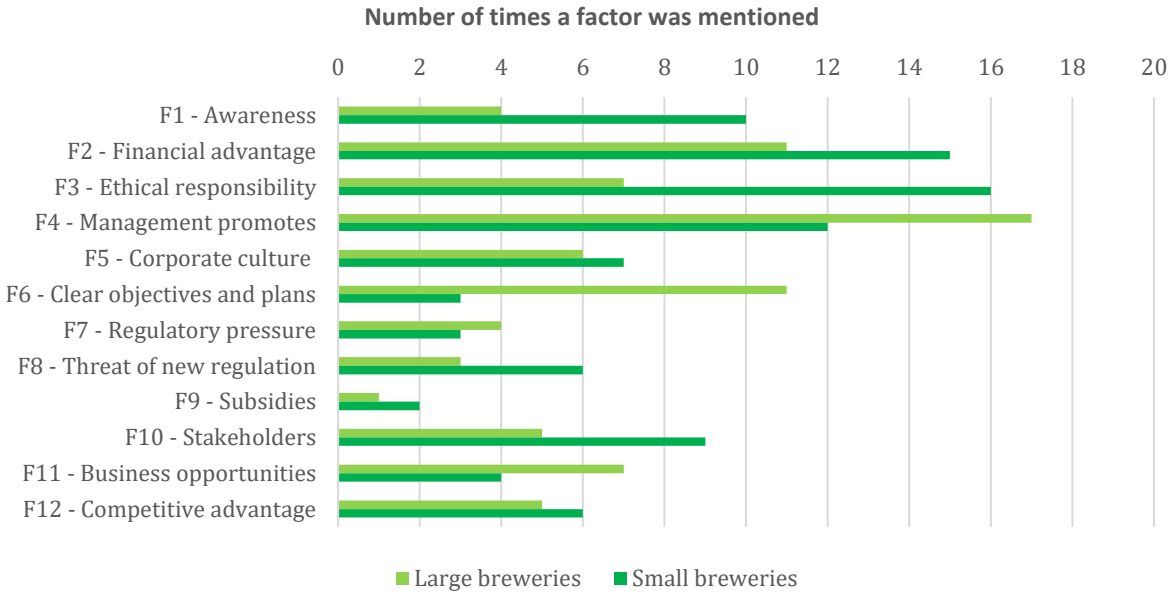


Figure 7 | Number of times a factor was mentioned by small and large breweries

4.1.6 Quantity of reduced CO_2 emissions

The information about the quantity of reduced CO_2 emissions, as a result of the adoption of the eco-innovations, was not available for all the eco-innovations. Only a few respondents provided the needed information about the quantity of reduced CO_2 emissions for each eco-innovation. The number of respondents was too small to make any reliable conclusions. Moreover, some of the respondents have access to the needed information but they were reserved in sharing the information. One of the respondents confirmed this; *'I am a little hesitant for giving the reduced energy for each eco-innovation, because it can go on the market. We must not be too open, we must pay attention to that'* (Organisation B5). Therefore, the results show that the respondents were still sceptical about sharing their information about the reduced CO_2 emissions for each eco-innovation.

4.1.7 Barriers which influence the adoption of eco-innovation

Next to the factors which influenced the adoption of eco-innovations in a positive way, there were also barriers that block the adoption of eco-innovations in the organisation. The respondents mentioned eleven types of barriers, which consist of internal and external barriers. The barriers 'high investments' and 'payback period' were mentioned by almost all the respondents. The energy prices for the industry were low in comparison with the energy prices for households, namely one of the respondents mentioned *'We pay 6,2 cents here. That is almost nothing. As a household, I already pay 10 a 12 cents more for energy.'* (Organisation P4). These low energy prices have a direct effect on the payback period of the eco-innovations. One of the respondents also mentioned *'We have industrial rates for energy and therefore it is quite difficult to make a financial interesting business case. The energy price is just too low'* (Organisation B2).

Next to these factors, the respondents also mentioned the following barriers, namely obstructing legislation (environmental law against the construction of windmills), fast changing business environment, current scale of the brewery, needed infrastructure, uncertainty about the reliability of the innovation, uncertainty about the effect on the product quality, corporate culture (internal KPI's), limited internal knowledge, and technical feasibility (see Annex D). The barriers were most of the time external, however some of the respondents also mentioned internal barriers, e.g. the company culture. The barriers 'high investments' and 'payback period' were important when analysing the factors that influence the adoption of eco-innovations. Especially, financial advantage was an important factor that influenced the adoption of eco-innovation, however this was also an important barrier for organisations because of the long pay-back-period. Overall some of the barriers were related to the factors that influenced the adoption of eco-innovations, therefore were these factors more important than others, e.g. financial advantage and regulation.

4.2 Pulp- and paper industry

The analysed eco-innovations were adopted during the period of 2005 to 2017. The number of adopted eco-innovations peaks in the years 2010, 2012, and 2013. Most of the eco-innovations were adopted between 2011 and 2016. In these years a diverse range of eco-innovations were adopted, e.g. condensers, frequency controllers, and heat recovery installations. Most of the eco-innovations were process innovations, namely 34 out of 40 eco-innovations (85%). The adopted product innovations were for example, new types of paper, new types of fill fabric, and lower weight of the paper. The CO_2 reductions resulted from the product innovations were most of the time realised in the chain, however only CO_2 reductions realised in the production process were included in this research.

The figure below gives a clear overview of the production process and the places where the eco-innovations were adopted. The four eco-innovations, above the different phases, consist of measures which made the building more sustainable, e.g. isolation and led-lighting. The first phase, forming section, consists of eco-innovations like a new type of filler and optimisations in the pulperline. Phase 2, the press section, consist of eco-innovations which optimize the press. Phase 3, drying section (most of the eco-innovations were implemented in this phase), consist of eco-innovations like new ovens and condensors. Finally, calendaring section, the elimination of the pulp from the production line is included. The factors that influenced the adoption of the eco-innovations will be discussed in the next paragraphs.

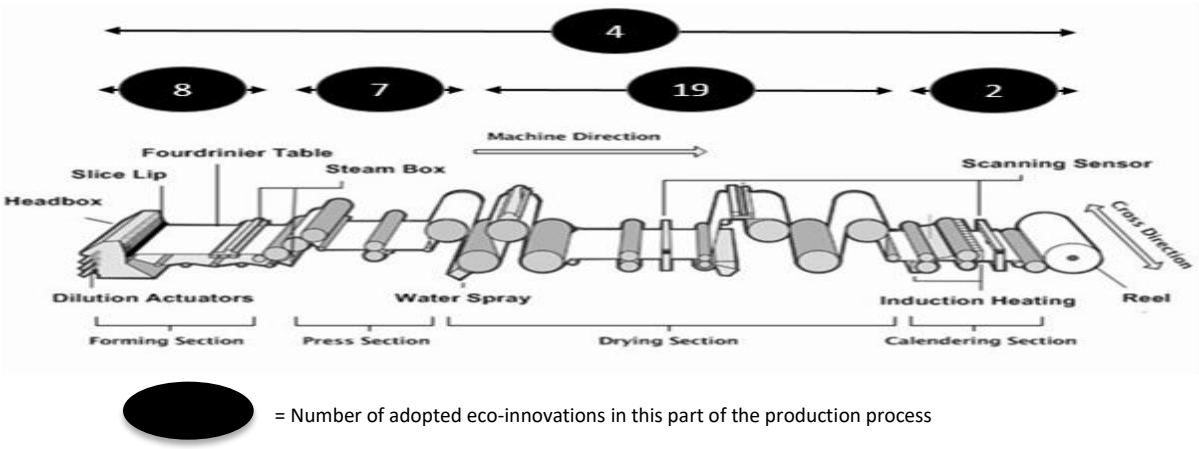


Figure 8 | Overview of the number of adopted eco-innovations in each phase of the production process (Intechopen, 2017)

4.2.1 Number of times a factor is mentioned

Figure 9 shows the number of times a factor was mentioned as a factor that had an influence on the adoption of eco-innovations. The factors that were mentioned the most, more than 30 times, were (F2) financial advantage [35] and (F4) management promotes [31]. One of the respondents mentioned *'I think the most important factor was the financial incentive. When talking about energy, it is one of the highest costs for a pulp- and paper factory. About 10% of our costs, when you can reduce the energy consumption with 2% it will have a big impact on the total costs.' (Organisation P8).*

The factors which were mentioned between the 10 and 30 times were the factors (F6) clear objectives and plans [27], (F3) ethical responsibility [16], (F7) regulatory pressure [16], (F5) corporate culture [14], (F12) competitive advantage [13], and (F1) awareness [10]. The factors which were mentioned by only a few respondents, below the 10 times, were most of all external factors, namely (F9) subsidies [8], (F11) business opportunities [5], (F10) stakeholders [5], and (F8) threat of new regulation [3]. Overall the internal factors were mentioned more in comparison with the external factors. Especially, the financial advantage, the attitude of the management, and clear objectives and plans had an influence on the adoption of eco-innovations. Whereas the threat of new regulation, stakeholders and opportunities in the business environment have almost no influence.

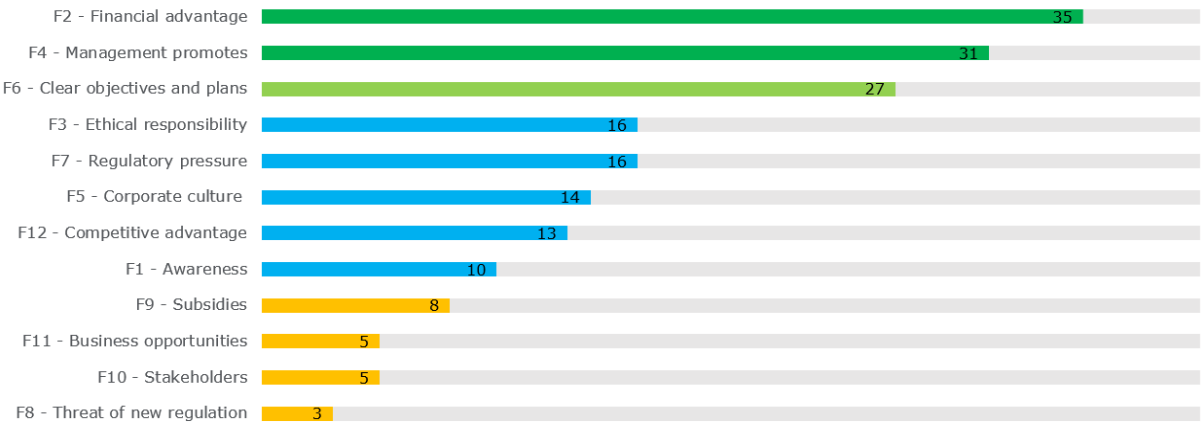


Figure 9 | Number of times a factor was mentioned. *The different colours visualize the different ranges, namely 0-9 (orange), 10-19 (blue), 20-29 (green), and 30-40 (dark green). The factors F1 up to F6 were internal factors and the factors F7 up to F12 were the external factors.*

4.2.2 High scoring factors

Figure 10 shows the high scoring factors that had an important influence on the adoption of the eco-innovations in the pulp- and paper industry. As shown in figure 10, is the factor (F2) financial advantage scored most of the time with the 'score 1'. Therefore the factor (F2) financial advantage had an important influence on the adoption of many eco-innovations. To be precise, 68% of the adopted eco-innovations in the pulp- and paper industry were strongly influenced by the factor (F2) financial advantage. For that reason, the factor (F2) financial advantage was the most important factor that influenced the adoption of eco-innovations in the pulp- and paper industry. One of the respondents highlighted the importance of the factor (F2) financial advantage; *'There was of course a financial benefit. If there is no financial benefit and it is not a strategic project, it will simply not be adopted'* (Organisation P10). Next to the (F2) financial advantage the factors (F11) business opportunities, (F6) clear objectives and plans, (F7) regulatory pressure, (F5) corporate culture, (F4) management promotes, and (F10) stakeholders were also mentioned as high scoring factors. Nevertheless, these factors were significantly scored less with the 'score 1' in comparison with the factor (F2) financial advantage.

Other factors like (F1) awareness, (F3) ethical responsibility, and (F12) competitive advantage were mentioned only with the 'score 2' or 'score 3'. Next to these factors replacement investments were mentioned as an important driver, namely one of the respondents mentioned *'Most innovations were originated from the sense of urgency, namely old or broken systems needed to be replaced by new ones. The margins in the pulp- and paper industry are quite small, therefore we do not have the financial resources to facilitate the high upfront investment costs which are required for the adoption of eco-innovations.'* (Organisation P2). Overall the internal factors played an important role in influencing the adoption of eco-innovations. Especially, the factor (F2) financial advantage was clearly the most important factor in this industry.

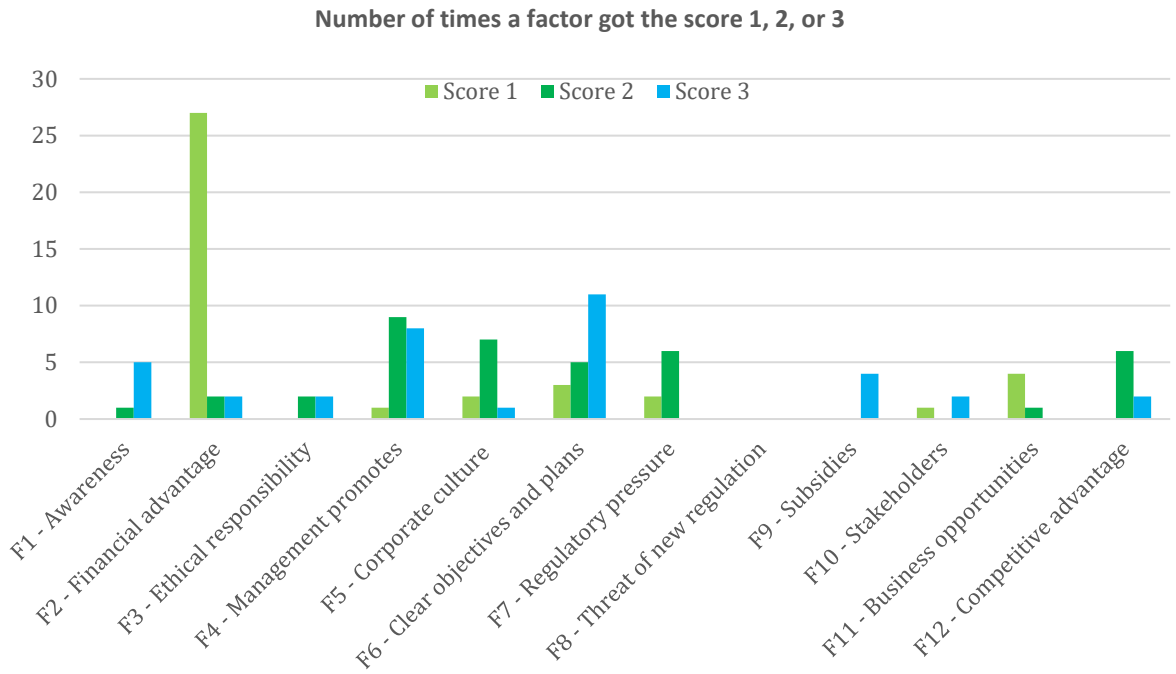


Figure 10 | Number of times a factor got the score 1, 2, or 3

4.2.3 Process- and product innovation

Most of the eco-innovations were process innovations, namely 34 out of 40 eco-innovations (85%). For that reason, it is difficult to make a comparison between process- and product innovations. The differences in the influence of the factors on the adoption of eco-innovations between process- and product innovations were small. Nevertheless, the factor (F11) business opportunities influenced five times the adoption of eco-innovations and thereof four times the factor (F11) influenced the adoption of product innovations. At the time the factor (F11) business opportunities was mentioned it had an important influence on the adoption of eco-innovations, since it was mentioned four times with the 'score 1' and ones with the 'score 2'. As a result, the factor (F11) had an important influence on the adoption of product innovations and therefore most of the product innovations were adopted in order to get access to different kinds of business opportunities.

4.2.4 Time dimension

As shown in figure 11, most of the studied eco-innovations were adopted in the years 2012 and 2013. Also the figure shows the number of times internal and external factors were mentioned over time. In the years 2005, 2008, and 2016 only internal factors influenced the adoption of eco-innovations. Over the years the internal factors were mentioned more in comparison with the external factors, with exception of the year 2009. The internal factors were regularly mentioned twice as much as the external factors. The fluctuations in the number of times internal and external factors were mentioned can sometimes be linked to the fluctuations in the number of adopted eco-innovations, but in some years the number of mentioned factors was significantly lower than in other years, e.g. the year 2015. Overall the internal factors were more present than the external factors and in some years the total amount of mentioned factors was less than other years.

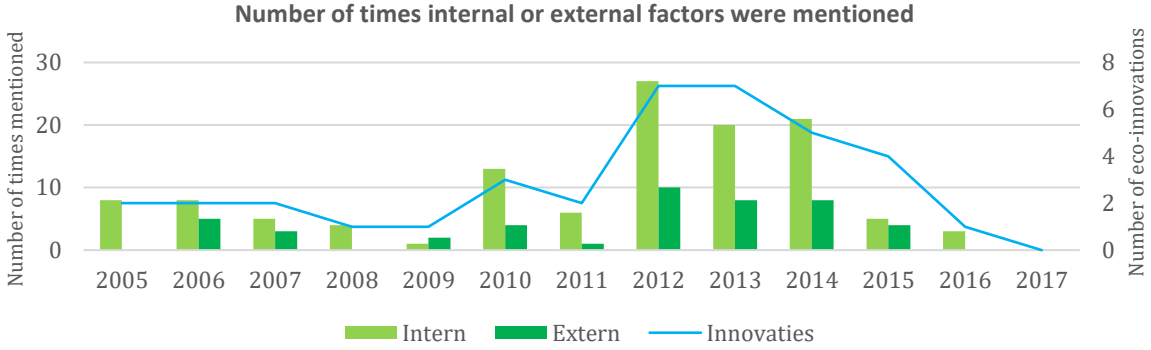


Figure 11 | Number of times internal and external factors were mentioned (in each year)

4.2.5 Type of organisation

The respondents consisted of large and small factories, which were divided into five large factories (>200 employees) and five small factories (<200 employees). Figure 12 provides a clear overview of the number of times a factor was mentioned by the large factories and by the small factories. The results show that the factors (F4) management promotes and (F6) clear objectives and plans were significantly more influential to the adoption of eco-innovation by large factories, whereas the factors (F1) awareness, (F12) competitive advantage, (F11) business opportunities, (F10) stakeholders, and (F9) subsidies were more important for the adoption of eco-innovations in the small factories in comparison with the large factories. For that reason, clear objectives and internal management were more important factors that influenced the adoption of eco-innovations in the large factories. Whereas awareness, competition and money available (subsidies) play a more important role for the adoption of eco-innovations by small factories. Overall the internal factors were more important for both large and small factories, nevertheless the external factors were more influencing the adoption of eco-innovations in the small factories in comparison with the large factories. As a result, the small factories were more external focused in comparison with the large factories.

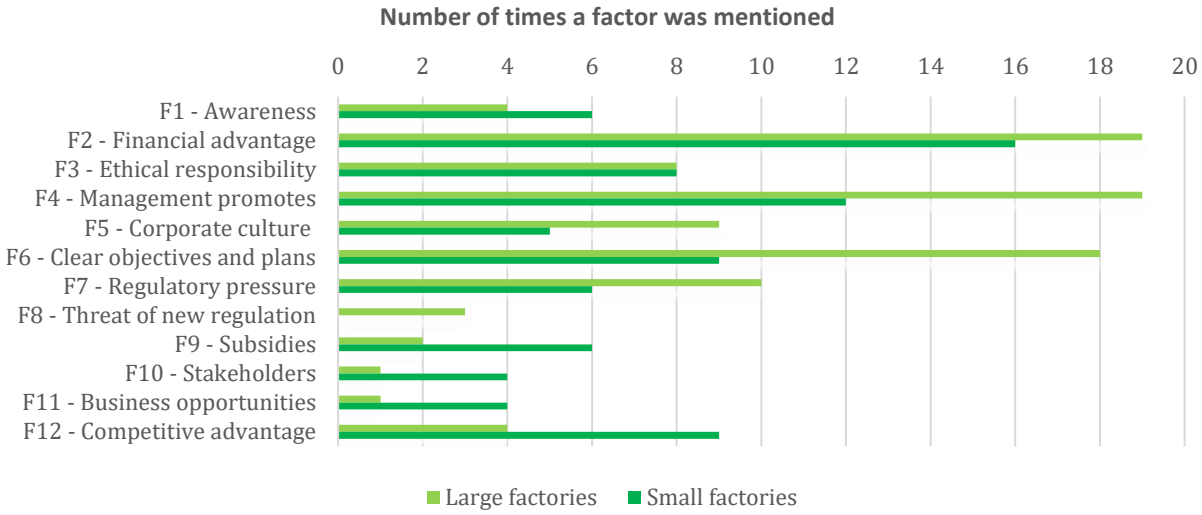


Figure 12 | Number of times a factor was mentioned by small and large factories

4.2.6 Quantity of reduced CO_2 emissions

The analysed eco-innovations diverse in the quantity of reduced CO_2 emissions, namely from 2,4 tonnes of CO_2 till 116266,0 tonnes of CO_2. Most of the respondents provided the necessary information about the reduced CO_2 emissions for each eco-innovation (the information is available for 80% of the eco-innovations). The eco-innovations were divided into three ranges, below 100 tonnes of CO_2 (44%), above 100 tonnes of CO_2 (22%), and above 1000 tonnes of CO_2 (34%). The set of factors which influenced the adoption of eco-innovations were the same for all the three ranges, so there was no clear difference between the quantity of reduced CO_2 emissions and the factors which influenced the adoption of eco-innovation.

4.2.7 Barriers which influence the adoption of eco-innovation

Next to the factors that influenced the adoption of eco-innovations in a positive way, there were also barriers that block the adoption of eco-innovations in the organisation. The respondents mentioned nine types of barriers, which consisted of internal and external barriers. The high investments, the payback period, and the inconsistent policy of the government were mentioned the most by the respondents as barriers that influenced the adoption of eco-innovation. Most of the organisations in the pulp- and paper industry have to deal with short term financial focus; *'The payback periods goes beyond the financial short terms. Honestly, the pulp- and paper industry have a short term focus, we have to survive tomorrow' (Organisation P3 – 2017).*

Furthermore, 20% of the respondents mentioned the obstructing legislation of the government and the current corporate culture as important barriers. Next to these most important barriers the respondents also mentioned lack of radical innovations, reliability of the innovations, and technical feasibility (see Annex D) as barriers. One of the respondents mentioned *'We are waiting for a breakthrough innovation for the pulp- and paper industry'* (Organisation P7 – 2017). Overall the barriers were financially oriented due to small margins in the industry.

4.3 Differences between the two industries

In this chapter the two industries are compared with each other in order to come to a conclusion about the differences between the two industries. Government and non-governmental organisations can use those conclusions in order to develop their strategies. The analysed eco-innovations were adopted in the years 2005 up to 2017. Almost all of the eco-innovations were process innovations, namely 92,5% of the analysed eco-innovations. The product innovations (7,5%) were only adopted by the organisations in the pulp- and paper industry. The supply chain and type of customers of the two industries were completely different, the pulp- and paper industry focused on business-to-business, whereas the brewing industry was focusing more on the end-consumer. The differences between the two industries in the factors that have influenced the adoption of the eco-innovations will be discussed in the following paragraphs.

4.3.1 Number of times a factor is mentioned

As shown in figure 13, all twelve factors were mentioned by the respondents, however some of the factors were mentioned more than others. If we compare the results from the two industries it shows that the (F2) financial advantage, (F6) clear objectives and plans, and (F9) subsidies were mentioned more by respondents in the pulp- and paper industry, whereas the factors (F1) awareness, (F3) ethical responsibility, (F8) threat of new regulation, and (F10) stakeholders were mentioned more by respondents in the brewing industry. The number of times a factor was mentioned was in most cases the same for both industries, however there was a clear difference between the two industries in the number of times the factors (F2) financial advantage, (F6) clear objectives and plans, and (F10) stakeholders were mentioned. Overall the brewing industry was more aware of their internal and external responsibilities, whereas the pulp- and paper industry focused on more financial benefits. In both industries, the respondents mentioned the internal factors more in comparison with the external factors.

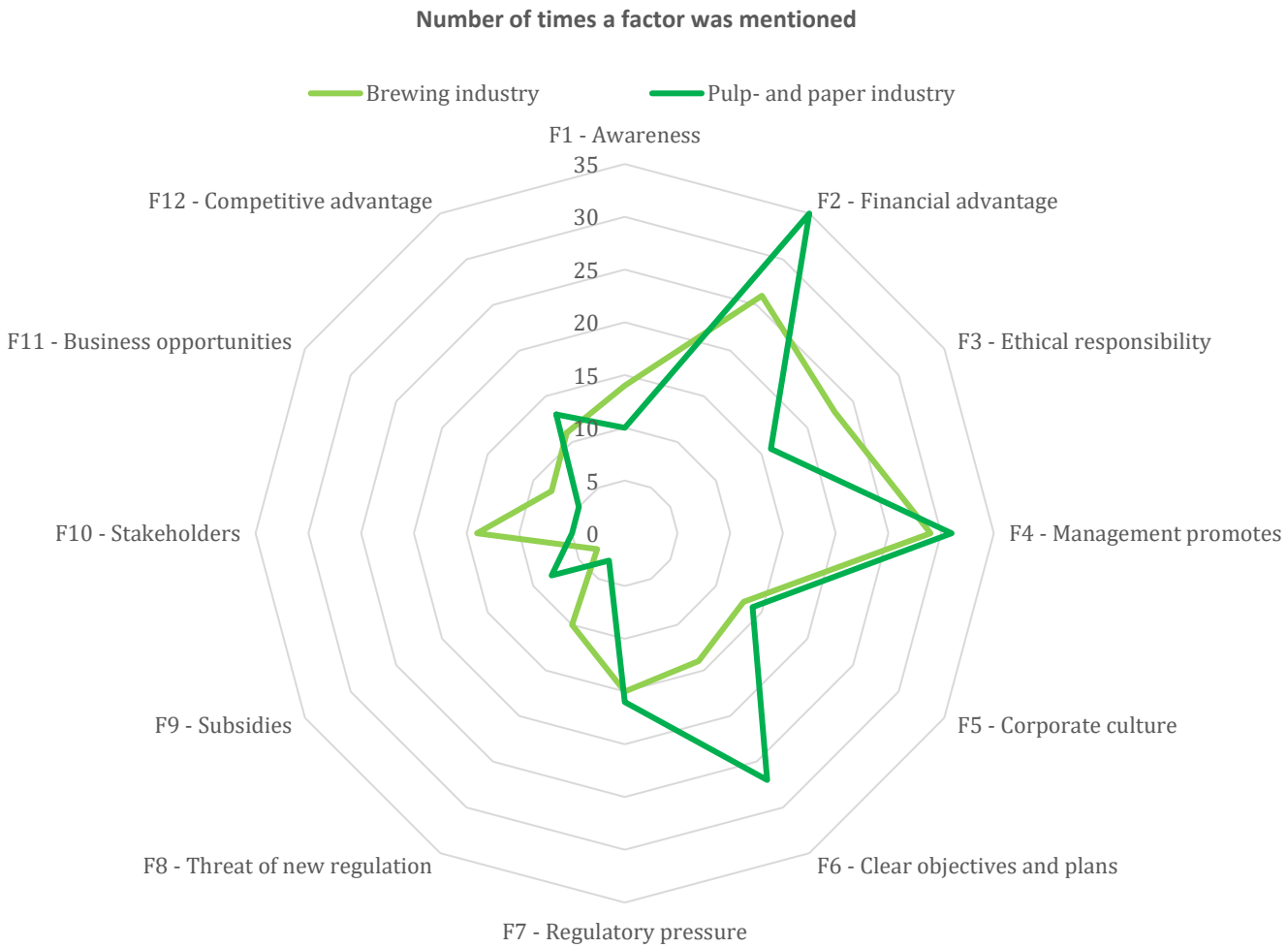


Figure 13 | Differences in the number of times a factor was mentioned

4.3.2 High scoring factors

Figure 14 shows the top four high scoring factors (score 1) which had the most important influence on the adoption of eco-innovations. The total number of times the factors were mentioned with the 'score 1' in both industries were added up (e.g. (F2) 12 times mentioned [brewing] + (F2) 27 times mentioned [pulp- and paper] = (F2) 39 times mentioned [total]). The top four factors which were mentioned the most with the 'score 1' are visualised in figure 14, namely (F2) financial advantage, (F3) ethical responsibility, (F4) management promotes and (F6) clear objectives and plans.

The figure visualises the differences between the two industries by the number of times the factors were mentioned with the 'score 1'. The factor (F2) financial advantage was scored the most with the 'score 1' by respondents in the pulp- and paper industry, whereas the factors (F3) ethical responsibility, (F4) management promotes, and (F6) clear objectives and plans were scored the most with the 'score 1' in the brewing industry. The brewing industry has a broad view on sustainability, including stakeholder's relationship and ethical responsibility, one of the respondents mentioned: *'We are committed towards our stakeholders; as brewery we want to show that we take our stakeholders seriously. Therefore when we see some opportunities in order to reduce our energy consumption, we will take those opportunities.'* (Organisation B7). Whereas, the pulp- and paper industry focuses mainly on the cost savings and financial advantage; *'One of the biggest costs of making paper is energy, so you can lower the cost. And if I say energy savings it is of course also the cost of CO_2 which will be included in the investment calculations.' (Organisation P9).* Nevertheless, this difference is also the result of the difference in customers, the brewing industry focuses directly on the end consumer, whereas, the pulp- and paper industry focuses on business-to-business. Overall the factor (F2) financial advantage was a dominant factor in the pulp- and paper industry. Whereas the brewing industry has a broader focus were clear objectives and plans, management, and responsibility had an important role in the adoption of eco-innovations.

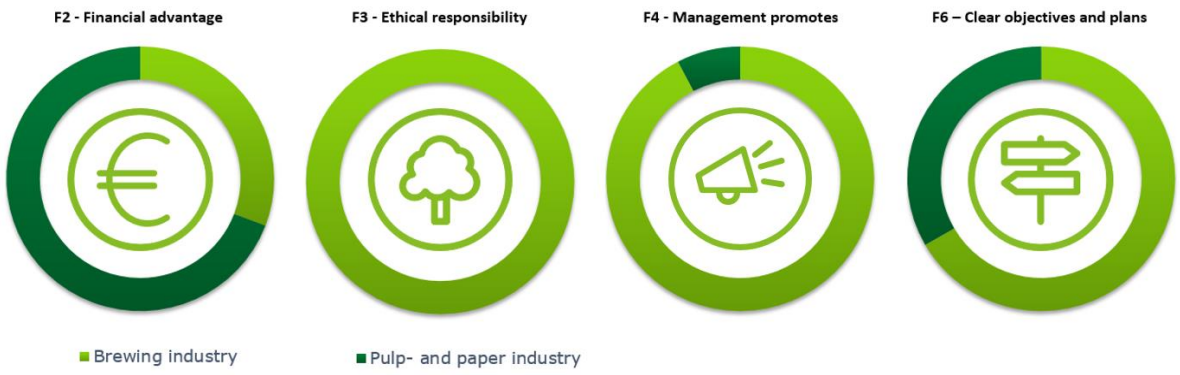


Figure 14 | Differences between the two industries in the number of times a factor got the 'score 1'. *The figure shows the differences between the two industries. This is calculated by dividing the total number of times a factor was mentioned in one industry, by the total number of times it was mentioned by both industries. For example (F2 – Financial advantage), in the pulp- and paper industry the factor was mentioned 27 times with the 'score 1' and the factor is mentioned 39 times overall. So, therefore, 69,2% of the total number of times it was mentioned was from the respondents in the pulp- and paper industry, and 30,8% of the times mentioned was from the brewing industry.*

4.3.3 Overview of the results

Figure 15 gives a clear overview of the differences and similarities between the two industries, especially the number of times a factor was mentioned and the scored average are compared between the two industries. The scored average shows how a particular factor was ranked, for example the factor (F2) financial advantage was twenty six times mentioned and the total ranking score was fifty three (all the rankings added up, e.g. scored with 'score 1', 'score 6', etc.) and so the scored average was two point one (53/26=2.0). How lower the scored average was, the more influence the factor had when it was present during the decision to adoption the eco-innovations (see also Annex B). Whereas, the number of times mentioned shows in how many cases the factor had an influence on the adoption of eco-innovations. In the figure, a ranking is added in order to provide a clear overview of the differences and similarities between the factors and industries. The factor that was mentioned the most is ranked with the number '1' and the factor which comes after this factor is ranked with the number '2'. Therefore the more times a factor is mentioned, the lower the ranking number will be (ranking 1 – (F4) management promotes).

The last four columns show the ranking which visualises the importance of the factors for each industry in specific. If we compare the two industries it shows that the factors (F4) management promotes [ranking 1 – 1], (F2) financial advantage [ranking 2 – 2], (F3) ethical responsibility [ranking 3 – 4] were mentioned the most and had a low average (most important) in the brewing industry (see columns B1 and B2). Whereas the factors (F2) financial advantage [ranking 1 – 2], (F3) management promotes [ranking 2 – 6], (F6) clear objectives and plans [ranking 3 – 4] were mentioned the most in the pulp- and paper industry (see columns P1 and P2). Some of the factors were mentioned less but had a low average (most important), especially in the pulp- and paper industry the factors (F11) business opportunities [ranking 10 – 1] and (F5) corporate culture [ranking 6 – 3] were not always present but when they were present they had an important role in influencing the adoption of eco-innovations. On the other hand, the factor (F11) business opportunities was most of all influencing the adoption of product innovations, instead of the adoption of process innovations.

The two 'differences' columns show the differences between the pulp- and paper industry and the brewing industry. The size of the differences are visualised by minus the numbers of the two industries with each other, for example the factor (F1) awareness was 14 times mentioned in the brewing and 10 times mentioned in the pulp- and paper industry, and so the difference is '4' (14-10=4). The differences in the number of times a factor was mentioned between the two industries was the largest for the factors (F6) clear objectives and plans [difference of -13 times], (F2) financial advantage [difference of -9 times], and (F10) stakeholders [difference of 9 times].

Whereas the differences in the scored averages between the two industries were the largest for the factors (F11) business opportunities [differences of 3,6], (F12) competitive advantage [differences of 1,9], (F3) ethical responsibility [differences of -1,5], and (F4) management promotes [differences of -1,5]. The differences between the two industries show that the brewing industry focuses more on their responsibility and stakeholders, whereas the pulp- and paper industry focuses mainly on their financial advantage and business opportunities. Overall the internal factors played a more important role in comparison with the external factors. Both industries were finance based and the internal management mainly influenced the adoption of eco-innovations, nevertheless the brewing industry has a wider view (responsibility and stakeholders) whereas the pulp- and paper industry focuses mainly on the financial aspects.

		Brewing		Pulp- and paper		Differences		Ranking			
Factors		**B1.**	**B2.**	**P1.**	**P2.**	**Difference**	**Difference**	**B1**	**P1**	**B2**	**P2**
		Times mentioned	**Scored average**	**Times mentioned**	**Scored average**	**(B1-P1)**	**(B2-P2)**	**Times mentioned**		**Scored average**	
F1	Awareness	14	2,6	10	3,7	4	-1,1	5	8	5	8
F2	Financial advantage	26	2,0	35	1,6	-9	0,4	2	1	2	2
F3	Ethical responsibility	23	2,5	16	4,0	7	-1,5	3	4	4	10
F4	Management promotes	29	1,9	31	3,4	-2	-1,5	1	2	1	6
F5	Corporate culture	13	2,8	14	2,8	-1	0	8	6	6	3
F6	Clear objectives and plans	14	2,1	27	3,1	-13	-1,0	5	3	3	4
F7	Regulatory pressure	15	3,7	16	3,3	-1	0,4	4	4	8	5
F8	Threat of new regulation	10	5,3	3	5,3	7	0	10	12	11	12
F9	Subsidies	3	3,3	8	4,6	-5	-1,3	12	9	7	11
F10	Stakeholders	14	4,2	5	3,8	9	0,4	5	10	9	9
F11	Business opportunities	8	4,8	5	1,2	3	3,6	11	10	10	1
F12	Competitive advantage	11	5,4	13	3,5	-2	1,9	9	7	12	7

Figure 15 | Overview of the results. *The scored average shows how a particular factor was ranked, for example the factor (F2) financial advantages was twenty six times mentioned and the total ranking score was fifty three (all the rankings added up, e.g. scored with 'score 1', 'score 6', etc.) and so the scored average was two point one (53/26=2.0). Whereas, the number of times mentioned shows in how many cases the factor had an influence on the adoption of eco-innovations (see Annex B).*

5. Discussion & Conclusion

5.1 Discussion of the findings

The aim of this research was to analyse the influence of internal and external factors on the adoption of eco-innovations in the pulp- and paper industry and the brewing industry. The research focused on twelve factors, consisting of six internal and six external factors. The selected respondents were asked about four eco-innovations which they had adopted in the organisation during the period of 2005 to 2017. In total eighty eco-innovations were analysed during this research. Almost all of the eco-innovations were process innovations, namely 92,5% of the analysed eco-innovations. All twelve factors were mentioned by the respondents in both industries as factors which had an influence on the adoption of eco-innovations. Nevertheless, the internal factors were more present and had a higher influence on the adoption of eco-innovations in comparison with the external factors. This applies both for small and large organisations, however the results show that the small organisations were more externally focused in comparison with the large organisations. The difference between small and large organisations is not clearly described in the literature and for that reason the findings enriched the current literature. Furthermore, the respondents mentioned that the influence of the external factors are becoming more and more important over the years, but still the influence of external factors is low. On the other hand, the respondents mentioned different types of external barriers which can block the adoption of eco-innovations, and so external factors have almost no influence on the adoption of eco-innovations but they can be a barrier to adopt. The findings correspond with the twelve factors that are described in the literature, however there are some clear differences in the level of influence of the different factors and between the two industries.

The findings show that the factor (F2) financial advantage was the most important factor in the pulp- and paper industry. Whereas the factors (F2) financial advantage and (F4) management promotes were the most important factors in the brewing industry. The respondents mentioned the financial benefits and the management as key factors for the adoption of eco-innovations. Especially, in the pulp- and paper industry the (F2) financial advantage was the most important factor, because the industry has to deal with small margins and small investment budgets. The demand for electricity seems almost insatiable for these organisations, and so a promising solution is greater efficiency in order to reduce costs. Moreover, the organisations in the pulp- and paper industry were more costs focused instead of taking full responsibility in reducing their negative environmental and social impacts. This correspondents with the current literature, since Cogan (2006) discussed that organisations are seeking for opportunities to reduce costs in order to increase the profitability of the organisation, however in the literature are also other factors explained which focus more on the broader responsibility of the organisation (Kolk, 2003; Jeswani et al., 2008). Therefore, those findings are in line with the literature that goes beyond the financial benefits of the organisation. Whereas the brewing industry focuses on a broader set of factors that had an important influence on the adoption of eco-innovations, namely (F2) financial advantage, (F3) ethical responsibility, (F4) management promotes, and (F6) clear objectives and plans. The differences between the two industries can be explained by the differences in the supply chain and type of customers. The pulp- and paper industry focuses on business-to-business and has limited association with the end-consumer or other external stakeholders. Whereas the brewing industry focuses more on the end-consumers and therefore is more aware of their broader responsibility. These factors correspond with the current literature about their influence on the adoption of eco-innovations (Chappin et al., 2009; Demirel et al., 2011; Green et al.,1994; Horbach, 2008).

Next to the factors which were mentioned as most important factors, there were also factors which had a moderate influence on the adoption of eco-innovation. The factors (F1) awareness, (F5) corporate culture, (F7) regulatory pressure, (F10) stakeholders, and (F11) business opportunities were mentioned as factors which had a moderate influence, and were not the main driving forces for the adoption of eco-innovation. For example, the factor (F5) corporate culture had an influence on the adoption of many eco-innovations, however this factor (F5) had only an influence when also the most important factor (F2) financial advantage was present. Some of the factors have an influence on the adoption of eco-innovations in some cases only, for example the factor (F11) business opportunities. The factor (F11) business opportunities was mainly influencing the adoption of product innovations, as the product innovations were used in order to enter new business markets. The results show that the literature is accurate about the influence of these factors on the adoption of eco-innovations. However, the level of influence (high or moderate influence) differ among the different factors and the type of eco-innovations (process- or product innovations). The moderate influence of regulation is mainly the result of the current less

strict regulation on CO_2 emissions and energy consumption. Next to this, the instability of regulation due to the changes in the national government makes it greater risk for organisations to invest in specific eco-innovations in order to meet the current regulation. The organisation can lose their competitive advantage when they invest a lot of money into these eco-innovations. Competitors do not invest in eco-innovations, as regulation has changed and it is no longer required to do so. The current literature corresponds with the factors which were mentioned as having a moderate influence on the adoption of eco-innovations, nevertheless the literature considered these factors as having an equal influence on the adoption of eco-innovations. However, the findings show that there is a clear difference between the factors which had an important or moderate influence on the adoption of eco-innovations. Next to the factors, which had an important or moderate influence on the adoption of eco-innovations, there were also factors which had little to no influence on the adoption of eco-innovations.

The factors which had little to no influence on the adoption of eco-innovations, were the factors (F8) threat of new regulation, (F9) subsidies, and (F12) competitive advantage. The threat of new regulation had limited to no influence as it is currently not visible, and the influence of the current regulation was also not high in both industries, therefore the threat of new regulation was not high on the priority list of the organisations. Also, subsidies were not well represented, because most of the time it was difficult to qualify for the available subsidies or they were only used to make the investment more interesting. Finally, the respondents mentioned that the eco-innovations did not directly give a competitive advantage or they were not aware of it, therefore the factor (F12) competitive advantage had almost no influence on the adoption of eco-innovations. In addition, the respondents in the pulp- and paper industry mentioned an additional factor, which is not part of the twelve factors, namely the factor replacement investments. This factor was not part of the theoretical framework but it had an important influence on the adoption of some eco-innovations in the pulp- and paper industry. This factor was not mentioned by more than four authors and therefore this factor was not included in this research. However, Chappin et al. (2009) already described the factor replacement investments as a factor that influence the adoption of eco-innovation. The results show that the respondents were sceptic about the influence of new regulation, however some of the respondents mentioned that it can change in the future. On the other hand, earlier this year the minister for economic affairs in the Netherlands announced that there will be individual savings agreements with the energy-intensive organisations (e.g. pulp- and paper organisations), which will lead to a reduction of 9 PJ of electricity (Rijksoverheid, 2017). Some of the respondents already mentioned these new agreements, however not all of the respondents think this event will stimulate the adoption of eco-innovation.

Overall these findings show that all the factors have an influence on the adoption of eco-innovation, and therefore correspond with the literature which defines the twelve factors. It also shows that there are some differences between the factors regarding their level of influence on the adoption of eco-innovation, namely high, moderate and almost no influence. This is also mentioned in the literature by Chappin et al. (2009), though most of the literature does not discuss the differences in the level of influence (Chandy, 2008; Dewick, 2010; Doh et al., 2010; Global Reporting Initiative, 2014b; Green et al., 1994; Grubb et al., 2002; Hayatun et al., 2012; Jaffe et al., 2016; Kesidou, 2012; Reid et al., 2008; Smith et al., 2006; Stern, 2006; Walker et al., (2009).

5.2 Theoretical implications

Nowadays, there is a lot of literature available regarding the factors that influence the adoption of eco-innovation. Out those many different types of factors were twelve factors selected which were used for this research in specific, consisting of six internal factors and six external factors. This research about the influence of these twelve factors on the adoption of eco-innovations was used in order to close the knowledge gap, namely providing a systematic overview of the different factors and how the influence of these factors change over time. Most of the literature focused on the adoption of one type of eco-innovation, whereas this research focused on the adoption of eighty eco-innovations, which yielded richer insights about the adoption of eco-innovations. Also the literature focuses mainly on the adoption of eco-innovations in one specific year, whereas this research focused on the time period 2005 to 2017. This timeframe made it possible to analyse how the influence of the different factors changed over time. The research closes this knowledge gap by providing a clear overview of the different factors that have influenced the adoption of eco-innovations. The findings correspond with the literature regarding the influence of the twelve factors on the adoption of eco-innovations, however an additional factor was mentioned during this research, namely the factor replacement investments. This factor enriches the current list of twelve factors which are described in the current literature that have an influence on the adoption of eco-innovation. The research also provides an overview of which of the twelve factors were the most important factors, as this is not mentioned in the current literature. The results show that the internal

factors were more important in comparison to the external factors, especially the factor (F2) financial advantage was an important factor. Next to this, the research enriches the literature by providing more insights into how the level of influence of the factors changes among different types of innovations (e.g. process and product innovation), organisations (small and large organisations), industries (pulp- and paper industry and brewing industry), environments (internal and external), and time periods (2005 up to 2017). Overall the findings correspond with the literature about the influence of the twelve factors on the adoption of eco-innovations. However, the research also enriches the literature regarding the level of influence of these twelve factors, especially the difference between the influence of internal and external factors. It is important to know what the level of influence is of the different factors in order to stimulate the adoption of eco-innovations. Nowadays, these results are important in order to develop and implement strategies and policies which will stimulate the adoption of eco-innovation. Especially, with the current environmental and geopolitical events (the United States of America withdraws from the Paris Climate Agreement) businesses that operate in a sustainable way are needed.

5.3 Limitations & Recommendations for future research

The study has some limitations. (1) First of all, the findings were based only on two industries, namely the pulp- and paper industry and the brewing industry, causing it to be impossible to make conclusions for other industries. However, the findings show which factors have the most important influence on the adoption of the eco-innovations in both industries. For future research, a questionnaire with a selection of only these important factors can be used, in order to analyse the different industries. (2) The results can be influenced by the use of a broad definition for the adoption of eco-innovations. It is possible that some of the eco-innovations were developed internally with the knowledge adopted from external professionals, especially during the adoption of product innovations. Nevertheless, the factors that influenced the adoption of product innovations were almost the same as the factors which influenced the adoption of process innovations, with exception of the factor (F11) business opportunities. In future research, these findings can be used in order to only focus on product or process innovations. (3) The research focused on twelve factors, however some of the respondents mentioned an additional one (replacement investments), which had an important influence on the adoption of some eco-innovations. This factor needs to be included in future research, for example, during the analysis of the different industries. The number of times the factor was mentioned was limited and for that reason it had no significant influence on the research results. (4) It is possible that some of the respondents found it hard to rank the different factors from most important to least important, causing potential for some of the rankings to be incorrect. In addition the respondents mentioned different types of barriers, however they were not asked to rank the different barriers. For future research it could be interesting to focus on the barriers that influenced the adoption of eco-innovations to a larger extent, the findings of this research can be used as a starting point. (5) The research focused on eighty different eco-innovations and therefore it is possible that the results will be different when the research focused only on one specific eco-innovation. For future research it can be interesting to analyse one specific eco-innovation which was mentioned the most in this research, the findings from this research can be used as starting point for that particular analysis. Finally, some of the organisations in both industries did not want to collaborate in this research. It can be possible that the findings would be different when these organisations also collaborated in this research. On the other hand, in both industries the industry leaders were willing to collaborate in this research and the ratio between large and small organisations was in balance.

5.4 Conclusion

The aim of this research was to explore to what extent internal and external factors influence the adoption of eco-innovations in the pulp- and paper industry and the brewing industry. The research focused on twelve factors, which include six internal and six external factors. The selected respondents were asked about the four eco-innovations which they adopted in the organisation in the years 2005 to 2017. In total eighty eco-innovations were analysed during this research. The research provides a clear overview of the factors that have an influence on the adoption of eco-innovations, this overview consists of twelve factors (and an additional factor) which were mentioned in the literature. All twelve factors have an influence on the adoption of eco-innovation, however the level of influence differs among the different factors. The internal factors have a more important influence on the adoption of eco-innovations in comparison with the external factors. In the pulp- and paper industry the factor (F2) financial advantage have the most important influence on the adoption of eco-innovations. Whereas the brewing industry has a wider focus and therefore, different factors have an important influence on the adoption of eco-innovations, especially the factors (F2) financial advantage, (F3) ethical

responsibility, (F4) management promotes, and (F6) clear objectives and plans have an important influence on the adoption of eco-innovations in the brewing industry. To conclude, the findings answer the research question, by showing that both internal and external factors have an influence on the adoption of eco-innovation in the pulp- and paper industry and brewing industry. Nevertheless, the internal factors were more frequently mentioned and have a higher influence on the adoption of eco-innovations in comparison with the external factors.

6. Recommendations

This chapter will provide more information about which stimulatory measures organisations, the government, non-governmental organisations, and consultancy firms (e.g. Deloitte) can take in order to stimulate the adoption of eco-innovation. This information can be used in order to develop and implement new types of strategies and policies. The stimulatory measures are based on the research results, namely the factors and the barriers which have an influence on the adoption of eco-innovation. In addition, the respondents were asked about which stimulatory measures (see Annex E) need to be introduced in order to stimulate the adoption of eco-innovations. The stimulatory measures, or recommendations, focus on the following aspects: the implementation of internal KPI's (organisational level), reducing the risks (organisational and governmental level), stricter legislation (including CO_2 tax) on the carbon footprint (governmental level), higher energy prices (governmental level), and the development of new eco-innovations (non-governmental organisations). Lastly, the role of the consultancy firms in how to accelerate and implement these different measures will be explained.

First of all, the adoption of eco-innovation can be influenced by the management of the organisation or department. The respondents mentioned that some departments (e.g. packaging department in the brewing industry) do not have internal KPI's on energy reductions and therefore the manager is not focusing on his energy consumption. These managers (without internal KPI's) are not focusing on their energy consumption and so the adoption of eco-innovations is limited. Whereas the managers with internal KPI's are increasingly focusing on ways in which they can reduce their energy consumption. For that reason, organisations need to formulate internal KPI's on energy reduction for each department in order to stimulate the adoption of eco-innovations.

Also, there are some interesting opportunities for organisations and energy suppliers to invest together in sustainable energy in order to divide the high upfront investments. This type of collaboration can only be possible when both partners can agree that the contract will be valid in the long term. However for a listed organisation it is difficult to sign long term contracts, and it also cannot guarantee that the organisation will exist in the long term. For this reason, these partnerships are not made. In order to make those deals possible it is important that partners are stimulated to collaborate with each other, for example the government can reduce the risks of the energy suppliers by giving them the guarantee that the energy will be bought in the long term. The government can for example buy and use the energy when the organisation is not able to do that anymore. Still these deals will only be made with organisations that have long term trust and low risk of discontinuity.

Furthermore (this recommendation focuses on the adoption of eco-innovation in the broader context, instead of only focusing on energy efficient eco-innovations), current regulation focuses mainly on the total consumption of energy (MEE covenant) and therefore the production of sustainable energy is not included and not measured by the government. Most of the respondents mentioned that it will have a positive effect on the adoption of eco-innovations when regulation focuses on the total carbon footprint of the organisation instead of focusing mainly on the total consumption of energy. If the regulation will mainly focus on the total carbon footprint of the organisation it will in turn stimulate organisations to reduce their carbon footprint by adopting eco-innovations like solar panels and other clean energy sources. The government needs to consider implementing stricter legislation on the carbon footprint of the organisation instead of their final energy consumption in order to stimulate the adoption of eco-innovation.

Next to this, the research results display that the financial advantage of the eco-innovations have an important influence on the adoption of eco-innovations. Nowadays many eco-innovations are not adopted because of their long payback period and the needed high upfront investments. The current low energy prices are responsible for the long payback period of these eco-innovations, for that reason the government needs to take measures in order to make the energy prices higher. Though, these high energy prices need to be compensated by reducing other costs in order to balance the overall costs of the organisation. Also, subsidies can help organisations to finance the high investments, but the current requirements and policy makes it hard to qualify for the available subsidies. The government needs to start a dialogue with the different kinds of organisations about how the current subsidy policy can be changed in order to make it easier to qualify.

Fifth, the different organisations are looking for radical innovations which will change the whole production process and will make it more energy-efficient. There are some interesting eco-innovations, however they are

still waiting for the more radical ones. Non-governmental organisation can stimulate the introduction of radical innovations by launching different research projects which focus on energy efficiency.

To conclude, organisations, the government and non-governmental organisations need to introduce some stimulatory measures in order to stimulate the adoption of eco-innovations. The big consultancy firms have the potential to play an important role in accelerating and implementing these different measures. On an organisational level the consultancy firms can advise organisations on how to implement the different energy KPI's and how to report on these KPI's. On a governmental level they can play an important role in how to reduce the risks of long term agreements and the transition towards real energy prices.

7. References

Abernethy, M.A., Brownell, P. (1990). The role of budgets in organizations facing strategic change: an exploratory study.

Alpkan, L., Bulut, C.I., Gunday, G., Ulusoy, G., Kilic, K. (2010). "Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance", *Management Decision.* Volume 48, issue: 5, pp.732-755, doi: 10.1108/00251741011043902.

Azapagic, A. (2003). Systems approach to corporate sustainability. *A general management framework. Chemical and process engineering,* University of Surrey, Guildford, UK.

Bansal, P. (2005). Evolving sustainability: A longitudinal study of corporate sustainable development. *Strategic Management Journal*. Issue 26(3), pp. 197–218.

Benn, S., Dunphy, D., Griffiths, A. (2006). Enabling change for corporate sustainability: An integrated perspective. *Australasian Journal of Environmental Management*. Issue 13(3), pp. 156-165.

Bossle, M.B. (2016). The drivers for adoption of eco-innovation. *Journal of Cleaner Production.* Volume 113, issue 1, pp. 861-872.

Boiral, O. (2006). Global Warming: should companies adopt a proactive strategy? *Long Range Planning. Issue* 39, pp. 315-330.

Burchell, S., Clubb, C., Hopwood, A., Hughes, A. (1980). The roles of accounting in organizations and society. Business, Government and Civil Society. Greenleaf Publishing: Sheffield, UK. *Accounting Organizations and Society*. Issue 5, pp. 5-27.

Calabrese, A., Cost, R., Levialdi, N., Menichini, T. (2016). A fuzzy analytic hierarchy process method to support materiality assessment in sustainability reporting. *Journal of Cleaner Production*. Issue 121(1), pp. 248-264.

Cannon, T. (1994). Corporate Responsibility a Textbook on Business Ethics, Governance, Environment: Roles and Responsibilities.

Carrillo-Hermosilla, J., Rio del Gonzalez, P., Konnola, T. (2009). Eco-Innovation. What is eco-innovation? *When sustainability and competitiveness shake hands*, pp. 6-27.

Carroll, A.B. (1991). "The pyramid of corporate social responsibility: toward the moral management of organizational stakeholders", Business Horizons. Volume 34 (July/August), pp. 39-48.

Chandy, R. (2008). Corporate culture is most important factor in driving innovation. University of Minnesota.

Chappin, M.M.H., Vermeulen, W.J.V., Meeus, M.T.H., Hekkert, M.P. (2009). Enhancing our understanding of the role of environmental policy in environmental innovation: adoption explained by the accumulation of policy instruments and agent-based factors. *Environ. Sci. Policy*. Issue 12 (7), pp. 934–947.

Chui, L., Curtis, M.B. (2016). Intrepreneurs and innovation: Here's a new approach to the adoption of continuous monitoring. *Strategic Finance Report.*

Clausen, T.H. (2009). Do subsidies have positive impacts on R&D and innovation activities at the firm level. *Structural change and economic dynamics*, pp. 239-253.

Cleff, T., Rennings, K. (1999). Determinants of environmental product and process innovation. *European Environment*. Issue 9(5), pp. 191-201.

CNN. (2017). Politics – Trump Paris Agreement. Retrieved on 12-06-2017 from: <http://edition.cnn.com/2017/05/31/politics/trump-paris-accord/index.html>.

Cogan, D.G. (2006). Corporate Governance and Climate Change: making the connection. *A publication of Ceres*.

Collins, J.C., Porras, J.I. (1994). Successful Habits of Visionary Companies (Harper Business Essentials). Harper Collins, New York.

Crane, A., Matten, D. (2007). *Business Ethics*. Managing Corporate Citizenship and Sustainability in the Age of Globalization. Oxford University Press, Oxford.

Crews, D.E. (2010). Strategies for implementing sustainability: five leadership challenges. *Advanced Management Journal.* Issue 75.2, pp. 15-21.

Cullen, J.M., Allwood, J.M. (2010). The efficient use of energy: Tracing the global flow of energy from fuel to service. *Energy Policy.* Volume 38, pp. 75-81.

Daily, B.F., Huang, S.C. (2001). Achieving sustainability through attention to human resource factors in environmental management. *International Journal of Operations & Production Management.* Issue 21(12), pp. 1539–1552.

Damanpour, F., Schneider, M. (2006). Phases of the adoption of innovation in organisations: effects of environment, organisation and top managers. *British Journal of Management*. Volume 17, pp. 215–236.

Davidsson, P., Hunter, E., Klofsten, M. (2006). Institutional forces. The invisible hand that shapes venture ideas. *International Small Business Journal*. Volume 24(2), pp. 115–13.

Del Rio, P., Carrillo-Hermosilla, J., Konnola, T. (2010). Policy strategies to promote eco-innovation. Journal of Industrial Ecolog. Volume 14, issue 4, pp. 541-557.

Demirel, P., Kesidou, E. (2011). Stimulating different types of eco-innovation in the UK: government policies and firm motivations. *Ecol. Econ*. Issue 70, pp. 1546-1557.

DeSimone, L.D., Popoff, F. (2000). Eco-Efficiency. The Business Link to Sustainable Development. MIT Press: Cambridge, MA, USA.

Devilsgullet. (2017). Production process of the brewing industry. Retrieved on 22-05-2017 from <https://devilsgullet.com/the-process/>.

Dewick, P., Miozzo, M. (2002). *Sustainable technologies and the innovation–regulation paradox*. Volume 34, issues 9-10, pp. 823-840.

Doh, J.P., Howton, S.D., Howton, S.W., Siegel, D.S. (2010). Does the market respond to an endorsement of social responsibility? The role of institutions, information, and legitimacy. *Journal of Management*. Issue 36(6), pp. 1461–1485.

Doppelt, B. (2003). Leading Change Toward Sustainability. *A Change-Management Guide for Business, Government and Civil Society*. Greenleaf Publishing: Sheffield, UK.

Doppelt, B. (2009). Leading change toward sustainability. *A change-management guide for business, government and civil society. Globe Scan survey of sustainability experts*.

Dunphy, D., Griffiths, A., Benn, S. (2003). Organizational Change for Corporate Sustainability. London, United Kingdom: Routledge.

Epstein, M.J., Roy, M. (2001a). Sustainability in action: identifying and measuring the key performance drivers. *Long range planning*. Issue 34, pp. 585-604.

Epstein, M.J., Wisner, P.S. (2001b). Using a balanced scorecard to implement sustainability. Joh Wiley & Sons, Inc.

European Commission. (2008). Call for proposals under the Eco-innovation 2008 programme. DG Environment. Retrieved on 03-01-2017 from: <http://ec.europa.eu/environment/etap/ecoinnovation/library_en.htm>.

Freeman, R.E. (1984). Strategic Management. A Stakeholder Approach. Pitman Publishing Inc.: Boston, MA, USA.

Frondel, M., Horbach, J., Rennings, K. (2008). What triggers environmental management and innovation? Empirical evidence for Germany. *Ecological Economics*. Issue 66 (1), pp. 153-160.

Galitsky, C., Worrel, E. (2008). Energy efficiency improvement and cost savings opportunities for the vehicle assembly industry. An energy star guide for energy and plant managers. *Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-50939-Revision.*

Gall, M.D., Borg, W.R., Gall, J.P. (1996). Educational research: An introduction (6th ed.), White Plains, NY: Longman.

Garvare, R., Johansson, P. (2010). Management for sustainability. A stakeholder theory. *Journal of Total quality management & business excellence*. Volume 21, issue 7, pp. 737-744.

Gestel, R.A.J., Hertogh, M.L.M. (2006). What is regulatory pressure? An exploratory study of the international literature. *Study by order of the Scientific Research and Documentation Centre (WODC), Dutch Ministry of Justice.*

Ghemawat, P. (1986). Sustainable advantage. *Harvard business review*. Issue 64(5), pp. 53-58.

Gill, R. (2003). Change management - Or change leadership? *Journal of Change Management. Issue* 3(4), pp. 307–318.

Gladwin, T.N., Kennelly, J.J. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review*. Issue 20(4), pp. 874-907.

Global Reporting Initiative. (2014). The benefits of sustainability reporting. Retrieved on 06-03-2017 from: <https://www.globalreporting.org/resourcelibrary/The-benefits-of-sustainability-reporting.pdf>.

Global Reporting Initiative. (2017). About Sustainability Reporting. Retrieved on 06-03-2017 from: <https://www.globalreporting.org/information/sustainability-reporting/Pages/default.aspx>.

Green, K., Mcmeekin, A., Irwin, A. (1994). Technological trajectories and R&D for environmental innovation in UK Firms. *Futures*. Issue 26 (10), pp. 1047-1059.

Griffiths, A., Petrick, J.A. (2001). Corporate architectures for sustainability. *International Journal of Operations & Production Management*. Volume 21, issue 12, pp. 1573-1585.

Grubb, M., Ulph, D. (2002) Energy, the environment, and innovation. *Oxford Review of Economic Policy.* Issue 18(1), pp. 92-106.

Guthrie, J., Cuganesan, S., Ward, L. (2008). Industry specific social and environmental reporting: The Australian food and beverage industry. *Accounting Forum*. Issue 32(1), pp. 1-15.

Hart, S.L., Ahuja, G. (1996). Does It Pay To Be Green? An Empirical Examination of the Relationship between Emission Reduction And Firm Performance. Business Strategy and the Environment 5(1):30 – 37.

Hayatun, N., Burhan, A., Rahmanti, W. (2012). The impact of sustainability reporting on company performance. Journal of economics, business, & Accountancy. Ventura.

Hoffman, A.J. (2007). Carbon Strategies. How leading companies are reducing their climate change footprint. University of Michigan. The United States of America.

Horbach, J. (2008). Determinants of environmental innovation – new evidence from German panel data sources*. Res. Policy*. Issue 37, pp. 163-173.

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*., Issue 78, pp. 112–122.

IPCC. (2007). IPCC Fourth Assessment Report (AR4). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Core Writing Team, Pachauri, R.K. and Reisinger, A. (Eds.) IPCC, Geneva, Switzerland. pp 104.

Intechopen. (2017). Production process of the pulp- and paper industry. Retrieved on 07-01-2017 from: <https://www.intechopen.com/source/html/16069/media/image1.png>.

Jaffe, A.B., Palmer, K. (1997) Environmental regulation and innovation: A panel data study. *The review of Economics and Statistics*. Volume 97, pp. 610-619.

Jaffe, A.B., Peterson, S.R., Portney, P.R., Stavins, R.N. (2016). Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?

Jamali, D., Safieddine, A.M., Rabbath, M. (2008). Corporate governance and corporate social responsibility synergies and interrelationships. *Coporate governance, an international review.*

Jelsma, J. (2003). Innovating for sustainability: Involving users, politics and technology. *The European Journal of social science research*, pp. 103-116.

Jeswani, H., Wehrmeyer, W., Mulugetta, Y. (2008). How warm is the corporate response to climate change? *Evidence from Pakistan and the UK. Business Strategy and the Environment*. Issue 18, pp. 46-60.

Kaptein, M. (2008). "*Developing and testing a measure for the ethical culture of organizations: the corporate ethics virtue model*". *Journal of Organisational Behaviour*. Volume 29 No. 7, pp. 923-47.

Kemp, R., Foxon, T. (2007). Typology of eco-innovations. Deliverable 2. EU FP6 funded project 044513: 24. Maastricht.

Kesidou, E., Demirel, P. (2012). On the divers of eco innovaties: *Empirical evidence from the UK. Research Policy.* Volume 41, issue 5, pp. 862-870.

Kissock, K.J., Eger, C. (2008). Measuring industrial energy savings. Applied Energy. Volume 85, issue 5, pp. 347-361.

Kolk, A. (2003). Trends in sustainability reporting by the Fortune Global 250. *Business Strategy and the Environment.* Volume 12, issue 5, pp. 279–291.

Kupers, W.M. (2011). Integral responsibilities for a responsive and sustainable practice in organization and management. *Corporate Social Responsibility and Environmental Management*. Issue 18(1), pp. 137–115.

Lieberman, M., Montgomery, D. (1988). First mover advantage. *Strategic management review*. Volume 9, issue S1, pp. 41-58.

Lozano, R., Huisingh, D. (2011). Inter-linking and dimensions in sustainability reporting. *Journal of Cleaner Production*. Issue 19(1), pp. 99–107.

Lozano, R. (2012). Towards better embedding sustainability into companies' systems: An analysis of voluntary corporate initiatives.

Lozano, R. (2013). A Holistic Perspective on Corporate Sustainability Drivers. *Corporate Social Responsibility and Environmental Management.* Issue 20, pp. 275–295.

Lueneburger, C., Goleman, D. (2010). The change leadership sustainability demands. *MIT sloan management review.* Issue 51, pp. 49-55.

McKinnon, A. (2007). CO_2 Emissions from freight transport: an analysis of UK data. Heriot-Watt University, Edinburgh UK.

Moon, J. (2004). Government as a driver of corporate social responsibility: the UK in comparative perspective.

Nederlandse brouwers. (2016). Kerncijfers Nederlandse Brouwers. Publicatie van de branche vereniging van de Nederlandse brouwers.

O'Conner, P.A. (2010). Energy Transitions. Boston University, the Frederick S. Pardee Center for the Study of the Longer-Range Future. *The Pardee Papers*, Number 12.

Office of Sustainability. (2017). CO_2 reduction projects. Tufts University. Retrieved on 06-01-2017 from: <http://sustainability.tufts.edu/co2-reduction-projects>.

Paine, L.S. (1997). *Cases in Leadership, Ethics, and Organizational Integrity*, Irwin, Chicago, IL.

Preston, J.B., Brown W.A. (2004). Commitment and performance of non-profit board members. *Nonprofit Management & Leadership*. Volume 27, issue 1, pp. 1-135.

Quazi, H.A., Khoo, Y., Tan, C., Wong, P. (2001). Motivation for ISO 14000 certification: development of a predictive model. Volume 29. Issue 6, pp. 525-542.

Ragsdell, G. (2000). "Engineering a paradigm shift?: An holistic approach to organisational change management", *Journal of Organizational Change Management*. Volume 13, issue 2, pp. 104–120

Reid, A., Miedzinski, M. (2008). Eco-innovation. Final report for sectoral innovation watch.

Riivari, E., Lämsä, A., Kujala, J., Heiskanen, E. (2012). "The ethical culture of organisations and organisational innovativeness", European Journal of Innovation Management, Volume 15, issue: 3, pp. 310-331, doi: 10.1108/14601061211243657.

Rijksoverheid. (2017). Kamp verheugd over besparingsakkoord energie intensive industrie. Retrieved on 12-06-2017 from: < https://www.rijksoverheid.nl/actueel/nieuws/2017/04/06/kamp-verheugd-over-besparingsakkoord-energie-intensieve-industrie>.

Robert, K.H., Schmidt-Bleek, B., Aloisi de Larderel,

J., Basile, G., Jansen, J.L., Kuehr, R., Wackernagel, M. (2002). Strategic sustainable development - Selection, design and synergies ed.), The Free Press, New York.
RVO. (2015a). MEE-sectorrapport Papier- en kartonindustrie. Rijksdienst van Ondernemend Nederland.
RVO. (2015b). MEE-sectorrapport bierbrouwerijen. Rijksdienst van Ondernemend Nederland.
Siew, R.Y.J. (2016). A review of corporate sustainability reporting tools (SRTs). *Journal of Environmental Management*. Issue 164(1), pp. 180-195.
Sinclair, A. (1993). "*Approaches to organisational culture and ethics*", *Journal of Business Ethics*, Volume 12 No. 1, pp. 63-73.
Smith, M., Crotty, J. (2006). Environmental regulation and innovation driving ecological design in the UK automotive industry. *Journal of Business strategy and the environment*. Volume 25, issue 8, pp. 529-608.
Solomon, R.C. (2004). "*Aristotle, ethics & business organisations*", *Organisation Studies*. Volume 25 No. 6, pp. 1021-43.
Stern, N. (2006). Stern Review: The Economics of Climate Change. Office of Climate Change, UK.
Stubs, W., Cocklin, H. (2006). An ecological modernist interpretation of sustainability: the case of interface inc. *Business strategy and the environment*. Issue 17, pp. 512.
Suchman, M.C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*. Issue 20(3), pp. 571–610.
Treviño, L.K., Weaver, G.R. (2003). *Managing*
of applied tools. *Journal of Cleaner Production.* Issue 10, pp. 197–214.
Rogers, E.M. (1995). Diffusion of innovations (4th *Ethics in Business Organizations: Social Scientific Perspectives*, Stanford University Press, Stanford, CA.
Triguero, A., Moreno-Mondejar, L., Davia, M.A. (2013). Drivers of different types of eco-innovation in European SMEs. *Ecological Economics*. Volume 92, pp. 25-33.
Vermeulen, W.J.V., Witjes, S. (2016). On addressing the dual and embedded nature of business and the route towards corporate sustainability. *Journal of cleaner production*. Volume 112, part 4, pp. 2822-2832.
VINNOVA. (2001). Drivers of environmental innovation. VINNOVA Innovation in focus VF 2001:1. VINNOVA - Swedish Governmental Agency for Innovation Systems, 66. Stockholm.
VNP. (2016). Jaarverslag Koninklijke Vereniging van Nederlandse papier- en karton fabrieken.
Vollenbroek, F.A. (2002). Sustainable development and the challenge of innovation. *Journal of cleaner production*. Volume 10, issue 3, pp. 215-223.
Weymes, E. (2002). Relationships not leadership sustain successful organisations. *Journal of change*. Volume 3. Issue 4.
Yin, R.K. (2003). Case study research, design and methods, 3rd ed. Applied Research Methods Series. Volume 5.
Yin, R.K. (2008). Case Study Research: Design and Methods. Thousand Oaks, United States: SAGE Publications.

Annex A – Interview questions

1. Introductie
Op dit moment ben ik druk bezig met mijn thesis voor de master 'Sustainable Business and Innovation' in samenwerking met Deloitte. Mijn thesis richt zich op de invloed van interne en externe factoren op de adoptie van eco-innovaties door organisaties in de papier- en karton industrie en bier- en dranken industrie. Eco-innovaties worden gedefinieerd als duurzame innovaties die een positief effect hebben op het milieu, bijvoorbeeld gerealiseerde CO_2 reducties. Gedurende dit onderzoek ligt de focus op energiebesparende innovaties die uiteindelijk hebben geresulteerd in CO_2 reducties.

1.1 Welke functie heeft u binnen de organisatie?

2. Eco-innovatie
Voor mijn onderzoek ben ik geïnteresseerd in welke eco-innovaties (energiebesparende innovaties) in de periode tussen 2005 en 2017 zijn geadopteerd in de organisatie. In het bijzonder de eco-innovaties die verantwoordelijk zijn voor belangrijke (grote) CO_2 reducties binnen de organisatie.

2.1 Welke vier eco-innovaties, die verantwoordelijk zijn voor grote CO_2 reducties, zijn er in de periode tussen 2005 en 2017 geadopteerd in de organisatie (product of proces innovaties)?
2.2 Hoeveel CO_2 (totaal/per jaar) heeft elke innovatie gereduceerd?

Voor mijn onderzoek ben ik geïnteresseerd in wanneer de beslissing is genomen om de eco-innovaties te adopteren en wanneer de eco-innovaties uiteindelijk zijn geïmplementeerd.

2.3 Wanneer is de beslissing genomen om de eco-innovatie te adopteren en wanneer is de eco-innovatie uiteindelijk geadopteerd (Annex B)?

3. Interne en externe factoren
De adoptie van de vier eco-innovaties kunnen zijn beïnvloed door interne en externe factoren. Voor mijn onderzoek ben ik geïnteresseerd in de invloed van deze factoren, daarbij kijk ik ook naar welke factoren belangrijker waren dan andere. Daarom ben ik benieuwd welke factoren invloed hebben gehad op de adoptie van deze vier eco-innovaties.

3.1 Welke factoren hebben de adoptie van de eco-innovaties beïnvloed?

Voorafgaand aan dit interview heb ik vanuit de literatuur 12 factoren geformuleerd, waarbij onderscheid is gemaakt tussen interne en externe factoren. De (of enkele) factoren die u benoemd komen ook naar voren in de literatuur, daarom wil ik graag de link leggen naar de 12 factoren die ik heb geformuleerd.

3.2 Als u moet kiezen tussen deze 12 factoren (zie operationalisation), welke van deze factoren hebben de adoptie van de eco-innovaties beïnvloed (beschrijf ze a.u.b voor elke eco-innovatie)?
3.3 Welke factoren waren het belangrijkst? Kan je de factoren ranken van meest belangrijk (score 1) naar minst belangrijk (indien mogelijk t/m 12)?
3.4 Zijn er factoren die op dit moment of in het verleden de adoptie van eco-innovaties hebben belemmerd? Welke barrières zijn er op dit moment?
3.5 Hoe kan de adoptie van eco-innovaties worden gestimuleerd?

4. Samenvatting en afsluiting

4.1 Heeft u nog vragen of opmerkingen?

Annex B – Overview of the results

Code	E	I*	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
B1	1	+		2		1			3			4		
	2	+		2		1			3					
	3	+	4		3	1		7	6			2		5
	4	+		2		1								
B2	1	+			3	1			2			5	4	
	2	+			5	1		2	3	4			6	7
	3	+			5	1		2	3	4			6	7
	4	+		7	2	1		3	4	5			6	8
B3	1	+				1	2							
	2	+		1		2		3						
	3	+				1	2							
	4	+				1	3	2						
B4	1	+		1	3	2							4	
	2	+		1	3	2							4	
	3	+		1	3	2							4	
	4	+		1	3	2							4	
B5	1	+	3	2		1					4			
	2	+	4	1	2	3								
	3	+		3				1	2					
	4	+		1		2			3					4
B6	1	+		1		3	2							
	2	+		4	2	3	1							
	3	+			1						3	2		4
	4	+			1						3	2		4
B7	1	+				3	2	1	4					
	2	+		4	2			1	3			5		
	3	+	3			4	2	1		5		6		
	4	+		3			2	1	4					
B8	1	+	2		1	3								
	2	+		1		2	3							
	3	+	3	1		2				4				
	4	+	2	1		3			4					
B9	1	+	2		3		4	1	5			6		
	2	+		1	2		3					4		
	3	+	1	4	5	2	6	3				7		
	4	+	1		4	3	5	2	6	7				
B10	1	+	3	2	1					6		4		5
	2	+	3	2	1					6		4		5
	3	+	3	2	1					6		4		5
	4	+	3	2	1					6		4		5
Count**			14	26	23	29	13	14	15	10	3	14	8	11
Total amount			37	53	57	55	37	30	55	53	10	59	38	59
Scored average***			2,6	2,0	2,5	1,9	2,8	2,1	3,7	5,3	3,3	4,2	4,8	5,4

Figure B1 | Overview of the results in the brewing industry

* Difference between product (-) and process (+) eco-innovations
** Total number of times a factor is mentioned by the organisations
*** The scored average of all the numbers of a specific factor (total amount/count)

Annex B – Overview of the results

Code	E	I*	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
P1	1	+		1		2								
	2	-		3								1		2
	3	+		1		2								
	4	+		1		2	3							
P2	1	+		1	2	7		4		5	3			6
	2	+		1		4	2	3						
	3	+		1		4	2	3						
	4	-		1		4	2	3						
P3	1	+		1	2	7		4		5	3			6
	2	+		1		4	2	3						
	3	+		1		4	2	3						
	4	+		1		4	2	3						
P4	1	+	3					1	2					4
	2	+	3					1	2					4
	3	+				3	1	2						
	4	-		1									2	3
P5	1	+	4	1	3	5	6					7		2
	2	+	2	1	3	4	5							
	3	+	6	1	4	3	5							2
	4	-	3	2	6	4					7	5	1	8
P6	1	+		1	4	3		5	2		6			
	2	+		1	4	3		5	2		6			
	3	+		1	4	3		5	2					
	4	+		1	4	3		5	2		6			
P7	1	-		2									1	3
	2	+		1				2			3			
	3	+										3	1	2
	4	+		1				2			3			
P8	1	+	3			2	4	1	5					
	2	+	6	5	4	3		2	1					
	3	-	4	3		2	1	5	6					
	4	+	3	4		5		2	1	6				
P9	1	+		1		3		4	5					2
	2	+		1										
	3	-		4		5						3	1	2
	4	+		5	4	1	2	3	6					
P10	1	+		1	5	2		3	4					
	2	+		1	5	2		3	4					
	3	+		1	5	2		3	4					
	4	+		1	5	2		3	4					
Count**			10	35	16	31	14	27	16	3	8	5	5	13
Total amount			37	55	64	104	39	83	52	16	37	19	6	46
Scored average***			3,7	1,6	4,0	3,4	2,8	3,1	3,3	5,3	4,6	3,8	1,2	3,5

Figure B2 | Overview of the results in the pulp- and paper industry

* Difference between product (-) and process (+) eco-innovations
** Total number of times a factor was mentioned by the organisations
*** The scored average of all the numbers of a specific factor (total amount/count)

Annex C – High scoring factors

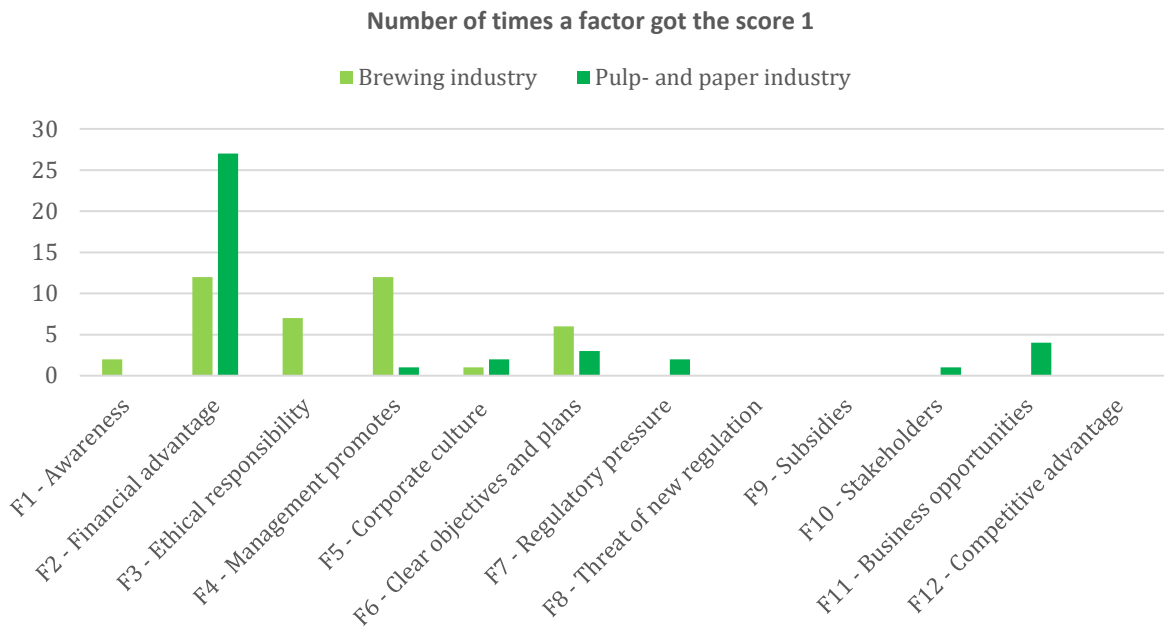


Figure B1 | Number of times a factor got the score 1

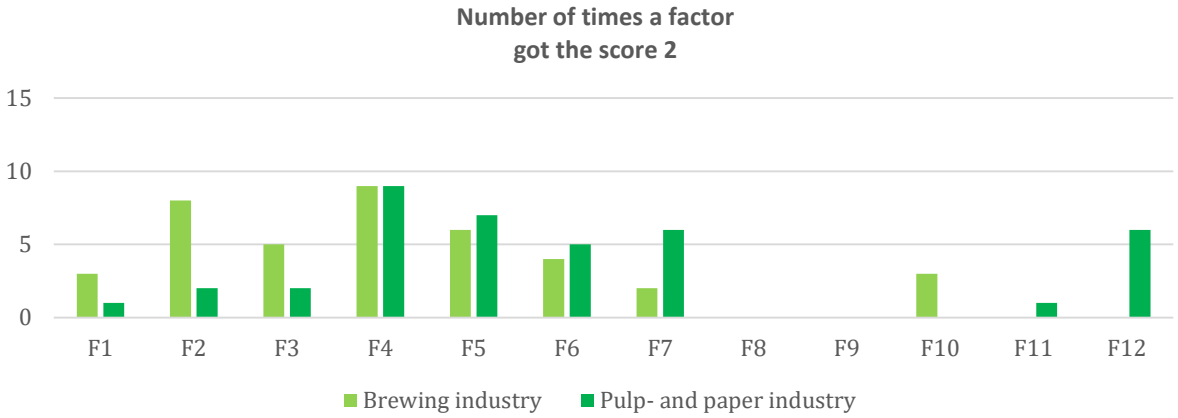


Figure B2 | Number of times a factor got the score 2

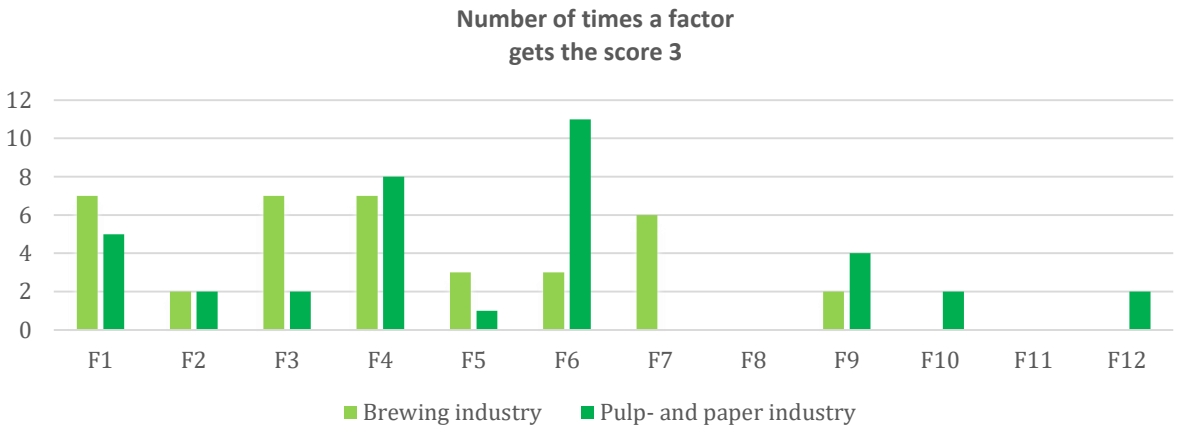


Figure B3 | Number of times a factor got the score 3

Annex D – Barriers

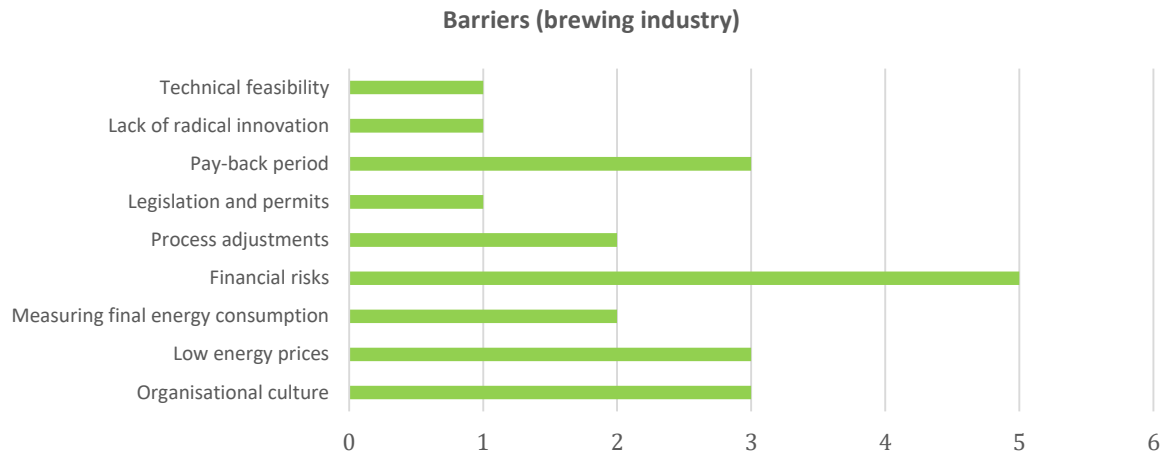


Figure C1 | Number of times a barrier was mentioned in the brewing industry

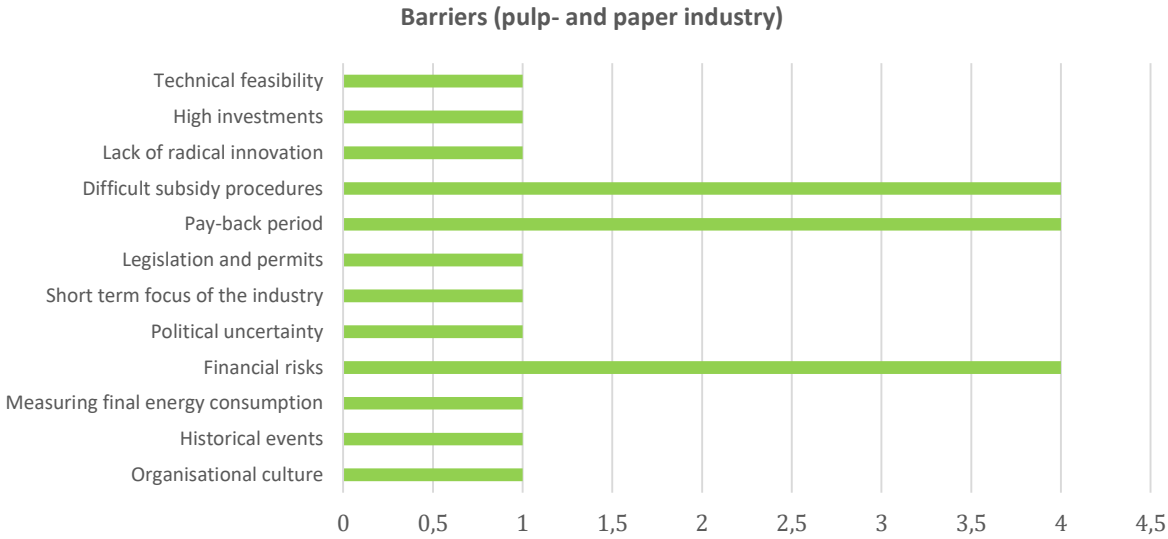


Figure C2 | Number of times a barrier was mentioned in the pulp- and paper industry

Annex E – Stimulatory measures

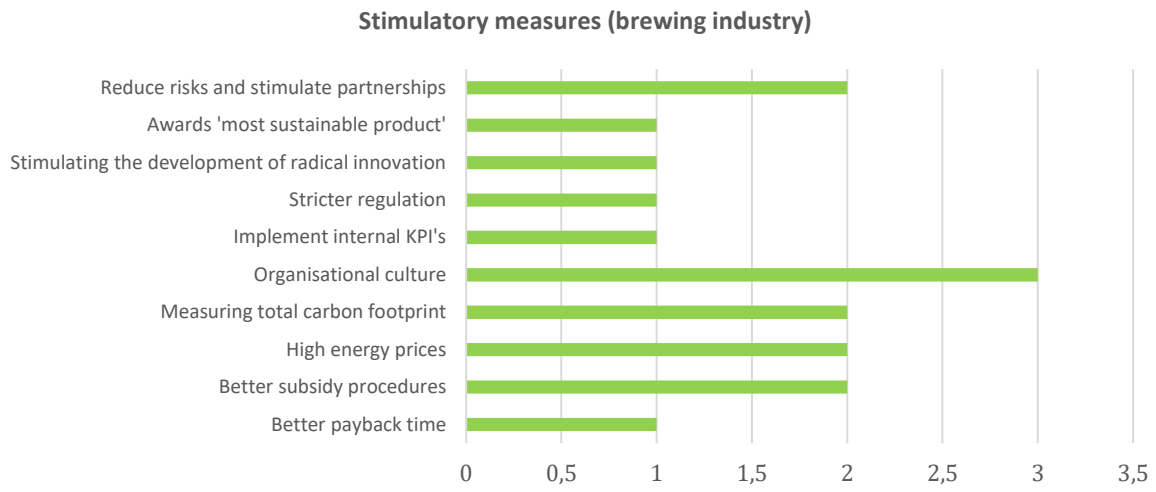


Figure D1 | Number of times a stimulatory measure was mentioned in the brewing industry

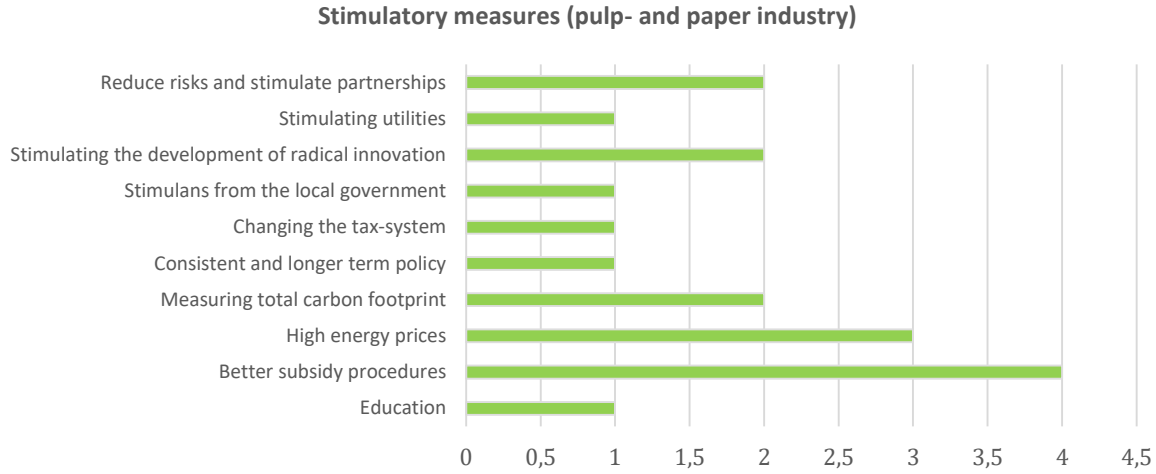


Figure D2 | Number of times a stimulatory measure was mentioned in the pulp- and paper industry