

TO INFINITY, AND BEYOND

An explorative study of how innovative companies in Sweden take responsibility for actions and outcomes in their innovation process.
For a better and more sustainable future

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Master's Thesis
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June 2022



UNIVERSITY OF GOTHENBURG
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ACKNOWLEDGEMENTS

We want to express our deepest gratitude to the case companies of our thesis for contributing with both valuable insights as well as taking the time to participate in our study. We would also like to thank both Maureen and Richard, our interviewed experts, for bringing their expert knowledge to the table. This has helped us to gain a deeper understanding of the studied phenomenon and the innovation ecosystem as a whole. Without the contributions from the companies and the experts, this thesis would not have been possible to finalize.

Moreover, we want to show our appreciation to our supervisor, Viktor Ström, for always taking the time to guide us, as well as to provide valuable knowledge and advice throughout the process of this thesis. Also, a big thanks to our colleagues in our supervision group, as well as our opponents, for giving us valuable and constructive feedback. Lastly, we want to express our gratitude towards the School of Business, Economics and Law at the University of Gothenburg for providing us with foundational knowledge, to help prepare us for what's to come next in our careers.

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ABSTRACT

The view of innovation is often portrayed as a fundamental component of prosperity and societal development, thus highlighting the positive implications of innovation. However, innovation is a more nuanced phenomenon that entails negative impacts upon society as well. Meaning that innovation has indeed contributed to the grand societal challenges of today, which needs to be further addressed by new technological development. Although, in order to gain momentum and bring forward innovation that facilitates sustainable and responsible solutions, there is an increased need to reflect upon the potential impacts of one's innovative ideas. Therefore, the theoretical framework of 'responsible innovation' was brought to attention by researchers in order to address issues of potentially harmful innovation and to highlight the need for precautionary and reflective innovation processes. There is however a discrepancy between theory and practical implications of the framework, which is investigated further in this thesis. This study therefore investigates if innovative Swedish firms with sustainability-focused innovations are considered to act responsibly in their innovation process, by using the dimensions of the framework of responsible innovation - *anticipation, reflexivity, inclusion* and *responsiveness* as a means for translation. Seven Swedish cases were studied in order to gain insights with regards to how or if companies work responsibly in their innovation process. In addition, two expert interviews were made to further explain company behaviors as well as to gain useful insights regarding the innovation ecosystem in which innovative companies operate in.

The research strategy is of qualitative nature using an abductive approach in order to gain a deeper understanding of the phenomenon. The design used is a multiple case study, which focuses on the context of the studied cases and investigates why diverse settings might have implications concerning certain company behaviors. Insights that are considered valuable for this thesis. Through the application of existing theory, featured in a literature review as well as through empirical data gathered from semi-structured interviews, within-case and cross-case analysis is adopted to discover patterns and relationships in the data. Thus, the empirical findings are compared and analyzed with existing literature to build theory as highlighted by Eisenhardt, using triangulation as a method to gain credibility of findings.

Even though the subjects of this thesis were not familiar with the framework of responsible innovation, it is argued that the phenomenon was conceptualized to a great extent within each case context. Mainly through the innovations of the cases per se, focusing on sustainable and responsible solutions, however in addition to responsibility being the main component of company culture and mindset. This study therefore contributes with insights concerning how companies act responsibly in order to facilitate an understanding of the practical implications of the framework of responsible innovation.

Keywords: *Harmful innovation, innovation, innovation governance, responsible innovation, risk governance, RRI, the bright side of innovation, the dark side of innovation.*

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1 INTRODUCTION

This chapter will present the phenomenon examined throughout this thesis along with a related problem discussion. It continues with establishing the research purpose and the stated research questions. Moreover, the companies participating in the study are introduced, before delimitations and disposition of the thesis are outlined.

1.1 BACKGROUND

Innovation has become ubiquitous. Its increased attention over the past years has resulted in a diffusion of it into all different parts of society. Not only is innovation a competitive concern of companies to sustain in their markets (PWC, 2013), but it is also of interest from a political and a macro-economic perspective (Kahn, 2018) as it helps to address grand societal challenges and to increase the well-being of populations (OECD, 2015). Despite the wide spread of innovation, however, it is no new concept. All of history has been characterized by mankind's tendency to improve, evolve and do better (Fagerberg, 2003). Being ubiquitous, no single definition exists of innovation as a phenomenon, rather the definitions are as many as there are publications about it (Goffin & Mitchell, 2017). Altogether, the definitions highlight two distinct characteristics, the first being novelty and the second being commercialization or implementation (Baregheh et al., 2009). The latter characteristic of commercialization is what differentiates innovation from an invention. An invention, which is an idea of something new, may it concern a new product, service, process, or business model, is not an innovation until it is implemented in the market or within the unit of the innovation, to generate commercial value (OECD/Eurostat, 2018). The characteristic of novelty is often described as a continuum, ranging from smaller improvements to radical changes that challenge the current way of doing business, transforming society (Nagji & Tuff, 2012). The minimum requirement per definition is for the idea to be new or improved to the firm of the innovation, despite any previous implementation of other firms. Nonetheless, innovation can also be new to the market, or new to the world (OECD/Eurostat, 2018).

The need to innovate originates from various sources. The constantly and rapidly changing environment characterizing our world, is one driver of the necessity to innovate, for companies and societies alike. To a firm, technological advances, intensified competition, changed customer needs or a changing business environment, are external triggers of innovation. Although a firm can aspire to innovate for strategic reasons as well (Goffin & Mitchell, 2017). From a societal perspective, the need to innovate could originate from social and global issues (OECD, 2015). Innovation has become one contributing means for making the world a better place; to improve the environment, to increase the well-being of populations, and better the use of global resources. New ways of thinking and doing fosters entrepreneurship, which in turn sets the foundation for new businesses to be created. With new businesses, new job opportunities are created, and with employment personal wealth increases, improving living standards and in turn, human health. With new businesses, economies improve their productivity, and so the economy grows (OECD, 2010; 2015). As

the economy grows, so does global competitiveness improve, meaning that societies strengthen their means for sustainable growth and income for the time ahead. Innovation is one of the twelve pillars of global competitiveness (Schwab, 2018). Cann (2016) states that “basically, rising competitiveness means rising prosperity”. In the corporate world, innovation with its opportunities has become a top priority among management teams (Boston Consulting Group, 2021). It has come to be considered the main driver for corporate growth and essential in order to gain competitive benefits in the market (PWC, 2013). Besides driving success, Gripenberg et al. (2012) describe how innovation has come to be perceived as vital for firm survival and sustaining presence. Supportive of a positive relationship between firm innovativeness and performance are various scientific studies (cf., Gunday et al., 2011; Rubera & Kirca, 2012; Bowen et al., 2010). It is perhaps not surprising that innovation now has become ubiquitous.

International indexes find the Nordic countries to have unique business environments fostering innovation. Sweden in particular, is ranked as number one on the European Innovation Scoreboard (European Commission, 2021), being considered the innovation leader of the European Union. In the Global Innovation Index (WIPO, 2021), Sweden ranks as number two, being the only country alongside Switzerland to remain in the top three countries for more than a decade. Sweden has a long history of entrepreneurship and innovation (Swedish Institute, 2021a) and the capital of Stockholm has been the home of many new and successful companies over the years (Sanandaji et al., 2022). In 2021, Bloomberg wrote that “Sweden’s capital has bred more tech unicorns per capita than any other region in the world save for Silicon Valley” (Daly, 2021), making it an important region for global innovation. Although Stockholm is one important hub for innovation in the country, the unique strength shared among the Nordic countries is the cooperation and collaboration between innovators. This occurs across companies, sectors and national as well as international borders. Sweden and the Nordic region succeed because innovation is not centered around one hub. Instead, innovation occurs in over 26 regions in the Nordic countries. Eight of these regions are in Sweden (Sanandaji et al., 2022).

Moreover, the region of Sweden is considered at the forefront of sustainability-related work. Sweden ranks second in The Sustainable Development Report which assesses work toward the UN Sustainable Development Goals (Sachs et al., 2021). Sweden also tops the Global Sustainable Competitiveness Index as number one, where countries are assessed on policies and actions regarding the environment of the nation (Mulhern, 2020). The Swedish Institute (2021b) further describes how Sweden has been a pioneer in the environmental area, being the first host to the UN conference on the global environment back in 1972.

Recently however, discussions have emerged of innovation being not solely as good as portrayed around society, and that the phenomenon of it is much more nuanced (cf., Sveiby et al., 2009; Gripenberg et al., 2012; Soete, 2013; Coad et al., 2021; Biggi & Giuliani, 2021). This new perspective on innovation in research has come to be referred to as ‘the dark side of innovation’ (Coad et al., 2021). It will be further explained in the section below, Section 1.2.

1.2 PROBLEM DISCUSSION

The potential of innovation, and the possibilities that it enables, have come to create a mindset that 'innovation is always good', hence more of it is better (Coad et al., 2021). This is a mindset that is widely accepted and characterizes not only the general society but the research society as well. The label of this mindset is 'pro-innovation bias' (Abrahamson, 1991), and it is also considered a contributing factor to the marginalization of research about the consequences of innovation, especially those being unintended and undesirable. Instead, these consequences are considered mistakes and are therefore overlooked (Gripenberg et al., 2012). Moreover, the pro-innovation bias involves unconscious assumptions that the consequences of innovation activities will be positive and as desired by the innovative unit (Sveiby et al., 2009). Still, there is evidence of innovations being more ambiguous with negative consequences causing damage to the environment and our social welfare. At the same time as innovation contributes to economic growth, it is to some extent unsustainable being based on extensive pollution, the use of non-renewable sources of energy (Biggi & Giuliani, 2021), and encouraging increased consumption that further degrades the ecological environment (Soete, 2013). Innovations are moreover causing issues of diversity through artificial intelligence technology (Howard and Isbell, 2020), discrimination and safety issues through design (Perez, 2019), diffusion of fake news (Nohira & Taneja, 2021), and impaired mental health through the use and development of social media (Baccarella et al., 2018). Examples like these are in literature considered part of what has come to be labeled 'the dark side of innovation'. A perspective to innovation emphasizing that innovation is not always good. It can be harmful in many ways. These consequences are triggered by the increased uncertainty following the continuously changing environment in which actors of the innovation system operate (Nohira & Taneja, 2021). The uncertainty further increases the more radical the innovation developed (McDermott & O'Connor, 2002).

Whether the negative consequences of these innovations are intended or unintended, desired or undesired, researchers call for increased responsibility in the phases of innovation development (Owen et al., 2012; Hellström, 2003; Voegtlin & Sherer, 2017). Theory has been developed under the label 'responsible innovation' or 'responsible research and innovation' (cf., Von Schomberg, 2011; Von Schomberg, 2013; Stilgoe et al., 2013; Blok & Lemmens, 2015), aiming at conceptualizing the implications for actors of innovation. It is a rather new phenomenon in research (Blok & Lemmens, 2015) and is defined by Stilgoe et al. (2013, p. 1570) as "taking care of the future through collective stewardship of science and innovation in the present". The phenomenon emphasizes a process of innovation that is about minimizing harm and increasing purposefulness (Voegtlin et al., 2022), balancing social, environmental and economic aspects (Blok & Lemmens, 2015). One of the most dominant approaches to responsible innovation is the framework of Stilgoe, Owen and Macnaghten from 2013 (Lubberink et al., 2017), which frames the concept in four dimensions; anticipation, reflexivity, inclusion and responsiveness. Researchers however are not the only societal actors to call for responsibility. Our world currently faces various grand societal challenges, i.e., challenges that are complex and multi-dimensional issues of social or environmental character that cross national borders (Voegtlin et al., 2022). These include issues related to, for instance, climate change, changing demographics or resource scarcity (OECD, 2015). With these challenges, actions for responsibility have become a concern for policymakers

and intergovernmental actors as well. These issues are, for instance, foundational to the United Nations (UN) launch of the Sustainable Development Goals (Voegtlin et al., 2022) accepted by all member states in 2015, as well as for the Horizon 2020 program of the European Union (EU). A program for research and innovation towards a growth that is smart, sustainable and inclusive (European Commission, 2014). While being one of the causes of these issues, innovation is also the way forward to address and successfully solve these challenges (OECD, 2010; Read et al., 2016). As companies are considered important in the work of innovation, and because they possess the necessary resources, they are also valued as important in addressing mutual social challenges (Voegtlin & Scherer, 2017).

Given the role of companies in innovation and their ability to significantly contribute to improving the state of society, socially as well as environmentally, there is a need for this actor to increase targeted actions towards responsibility. As the phenomenon of responsible innovation has grown in interest over the last years, so has the volume of literature on it. Much previous literature, however, is perceived to have concentrated on conceptualizing what responsible innovation is and theoretically what the implications are for practitioners of innovation (cf., Owen et al., 2012; Owen et al., 2013; Stilgoe et al., 2013; Von Schomberg, 2013; Koops, 2015). Summarized in a systematic literature review by Lubberink et al. (2017), there are previous studies that have empirically been looking into responsible, social or sustainable innovation developed in a business context. Hence, investigating practices of responsible innovation within these companies in various regions globally. Based on the literature review, Lubberink et al. (2017) explore what practices are beneficial to implementing responsibility in the innovation process, however excluding the political and socio-economic system. To the knowledge of the authors of this thesis, no such study has been applied to a Swedish context. Sweden, as described in Section 1.1, is one of the top innovative countries in the world (WIPO, 2021; European Commission 2021). The same goes for its sustainability work (Mulhern, 2020; Sachs et al., 2021). Because the call for increased responsibility in innovation prevails and amplifies, it is interesting to turn the perspective to an innovation region like Sweden, investigating the practices of companies engaging in sustainability-focused innovation. This is to enhance the practical understanding further. A 'sustainability-focused innovation' is, throughout this thesis, considered an innovation (product, service, process etc.) that has an environmentally and/or socially sustainable purpose. Hence aims to make a positive impact on the greater good. In contrast to the study of Lubberink et al. (2017), potential external pressure through the system in which the companies operate is considered in this study. This in order to understand underlying motives for companies' behavior.

The combination of investigating responsible actions in practice whilst (briefly) considering the system in the region of Sweden, has not been identified in previous literature. A seemingly unique feature of this thesis is moreover the context of sampling companies that had a sustainability-focused innovation from the initial founding of the business. The context is deemed valuable in increasing understanding of innovative behavior and activities.

1.3 PURPOSE AND RESEARCH QUESTION

As demonstrated so far in this chapter, there is a nuanced view of innovation as a phenomenon, and there is evidence that it potentially could result in negative consequences. Moreover, there seems to be a discrepancy between theory and practice, given the prevailing and increased call for responsibility. Hence, the purpose of this study is to explore how innovative firms in Sweden consider actions of responsibility throughout their innovation processes. Companies play an important role in innovation and possess the necessary and requisite resources to make a change for a better future. Being one of the top innovative countries in the world, it is of interest to turn the focus to the region of Sweden. Increasingly so with Sweden being at the forefront of sustainability as well. With a prevailing call for responsibility, this study aims at enhancing the understanding of responsible actions of practitioners by identifying the current activities of companies founded and operated from Sweden. The focus relies on a sample of companies who have grown a business around sustainability-focused innovation, i.e., an innovation that aims to address societal issues, either in terms of social issues and/or in terms of environmental issues. The theoretical framework of responsible innovation as developed by Stilgoe, Owen and Macnaghten (2013) is utilized throughout the study as a means for facilitating an understanding of organizational practices being responsible activities. The thesis aims to inspire companies who are seeking to become increasingly responsible, but also companies who are about to transition to more responsible operations. Moreover, the purpose of this study is to contribute to the ongoing debate amongst researchers, policymakers and intergovernmental actors concerning the dark side of innovation as well as responsible innovation.

Based on the purpose of this study, the following research question has been formulated:

- o How do Swedish firms with a sustainability-focused innovation consider responsibility for outcomes and actions in their innovation process?

To briefly understand the underlying motives for responsible actions of these companies, the following question was added as a complementary one:

- o What external factors entail potential implications for companies' responsible actions?

1.4 CASE COMPANIES

To fulfill the purpose of this study, a multiple-case study is performed to better enhance the understanding of actions of responsibility in innovation processes. In total, seven different companies of various businesses, industries and sustainability focus on their innovations, are serving as a foundation for the research. It is argued necessary to consider the perspectives of different settings to better understand the phenomenon of study (Eisenhardt, 1989). Furthermore, Eisenhardt (2021) argues that the selection of cases should consider the likelihood of the focal phenomenon occurring, although cases should be distinct and vary. The judgment of focusing on companies who originally intend to do good through their innovation is based on this note.

All companies involved in the research are presented in Table 1 together with basic information about their industry and operations. Each context and innovation of the case will be further presented in Chapter 4 Empirical Findings of this thesis as part of the empirical data.

Table 1. Thesis Case Companies.

Case Companies			
Company	Founded	Industry	Business
Cellink	2016	Biotechnology	Addressing medical issues through 3D bioprinting tools
H2 Green Steel	2020	Steel production	Steel production with sustainable manufacturing processes*
HVR Water Purification	1990	Water purification	Making clean water accessible and affordable
Liquid Wind	2017	Energy	Conversion of CO2 and wind energy to liquid fuel*
Mycorena	2017	Biotechnology/food	Production of mycoprotein, a fungi-based and vegan protein
Norban	2019	Real estate	Platform assisting people to sell their homes themselves
Sproud	2018	Food	Plant-based milk products made of yellow split peas

* Companies are still in the process of developing and have not yet commercialized

1.5 DELIMITATIONS

Given the broad purpose of responsibility in the process of innovation as well as the magnitude of different contexts, some delimitations have been made. This will affect not only the scope of the research but potentially the findings as well. First, as mentioned in previous sections, Sweden constitutes the region of study, as being a prosperous environment for innovative activities. Second, focus is placed on a sample of companies that have been founded with a purpose of contributing to a change or a more sustainable alternative in their market, hence their innovation is sustainability-focused and foundational to the business. Not only is the focal phenomenon likely to be demonstrated here, but there could be meaningful learnings for others to be inspired by. It however excludes work of other kinds of companies, for instance, those who instead transition with a sustainability-focused innovation. Finally, the kind of innovation within the case companies has been focused on breakthrough innovations or radical in nature, i.e., innovations that explore new opportunities for business and value creation (Nagji & Tuff, 2012). As previously stated, these usually involve a greater uncertainty which could require some additional effort from the developing company. This consequently means that innovations of incremental degree are excluded from the scope of this study. Incremental innovations are, per definition, smaller changes to an offer that involves less risk. Hence, easier to control, also because of the opportunity of adopting this idea from what someone else already does (Nagji & Tuff, 2012).

1.6 DISPOSITION

The disposition of this thesis is illustrated in Figure 1. This text marks the end of the introduction chapter which has presented and motivated the forthcoming study. The next section involves a literature review of theoretical concepts that, by the authors of this study, are considered relevant contributions to the topics of the 'bright' as well as the 'dark' side

of innovation, responsible innovation, and governance of innovation and technological development. Thereafter, methodological choices along the research process are described and motivated. Following that chapter is the empirical data concerning practices of responsible innovation, corporate governance of innovation as well as societal. This section is based on themes identified through the collection of data gathered. In chapter five, analyses are made of the empirical results concerning the theoretical contributions of the literature review. Finally, the last chapter provides answers to the research questions. Practical and theoretical implications, as well as recommendations for future research, are also considered.

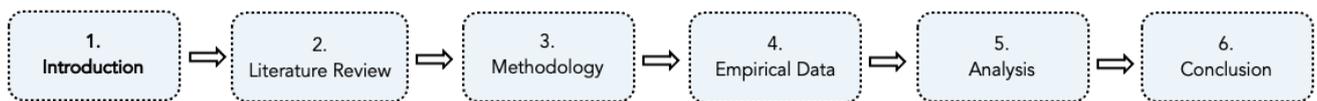


Figure 1. Disposition of Thesis.

2 LITERATURE REVIEW

The following chapter presents existing literature on the topic of research. First, the concept of innovation is presented followed by sections on 'the bright side' as well as 'the dark side' to it. This in order to contribute to a nuanced perspective of innovation, as is the background of this thesis. Secondly, the phenomenon of responsible innovation is introduced and explored. Finally, literature on corporate as well as societal governance of innovation is presented to broaden the understanding of managing innovations.

2.1 DEFINING INNOVATION

Innovation is ubiquitous, seemingly everywhere in our society, influencing individuals, businesses, and institutions (Kahn, 2018), yet it is no new phenomenon, "it is as old as mankind itself" (Fagerberg, 2003, p. 2). The tendency to improve, to do better, and to evolve, has characterized all of history, and it has come to shape the way of being and living throughout time (ibid). When defining innovation, there is no single definition in use, but rather various views and understandings of what it is. The phenomenon was acknowledged already in the 1930s by the economist Joseph Schumpeter. At the time however, it was labeled 'development'. According to Schumpeter (1934, p. 66) development is "defined by the carrying out of new combinations". These are new combinations of knowledge, resources, equipment, etc. (such as already existing or newly acquired), that are commercialized or put into practice. The combinations can concern the introduction of a new good, a new method of production, opening of a new market, finding a new source of supply, or finding new ways of competition in an industry (ibid). Hence, different dimensions of innovation are emphasized. Based on various definitions of innovation throughout time, Baregheh et al. (2009,) have attempted to find one multi-disciplinary definition of the phenomenon based on a literature review. They suggest that "innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, to advance, compete and differentiate themselves successfully in their marketplace" (p. 1334). To better understand the phenomenon of innovation, it must be distinguished from the concept of invention. While an invention is a novel idea of how to do things, an innovation is an invention carried out in practice (Schumpeter, 1934). Hence, the distinguishing factor is implementation or commercialization, and the concept of innovation can be defined by two characteristics, novelty and implementation (OECD/Eurostat, 2005; Baregheh et al., 2009).

A common misconception is that innovations must be completely new and revolutionizing (Kahn, 2018). Besides being new to the world, innovations can also be new to the market or even new to the producer or user of the innovation (OECD/Eurostat, 2005). Definitions further recognize innovations as something new or improved (Baregheh et al., 2009). Roger (2003) even emphasizes a 'perception' of newness with the unit of adoption, indicating that the innovation must not be new per se. Hence, an idea could be labeled an innovation (in terms of novelty) within one firm, despite its previous implementation in other firms, within the same or in any other industry (OECD/Eurostat, 2005).

The concept of innovation is moreover frequently described as a continuum ranging from smaller incremental innovations to increasingly radical ones (cf., Dewar & Dutton, 1986; Nagji & Tuff, 2012; Goffin & Mitchell, 2017; Kahn, 2018). Figure 2 summarizes the degrees of innovation and the related key characteristics. Incremental innovations could be described as improvements or changes to existing offers, targeted toward existing markets, whereas radical innovations have the potential to transform markets or industries, and even create new ones (Nagji & Tuff, 2012). If incremental innovation means exploiting the present, current products, operations, and markets; radical innovation means exploring the future, finding new opportunities for business and value creation (O'Reilly and Tushman, 2004). Goffin & Mitchell (2017) acknowledges an in-between as breakthrough innovations. These innovations involve substantial changes to market offerings that are perceived as new to the existing market, and growth occurs through movements into adjacent markets. The description of innovation as a continuum, is valued relevant to this thesis that will follow, as it helps establishing its context. The more radical the innovation, the greater the related uncertainty and risk (McDermott & O'Connor, 2002). Uncertainty about the offering itself, the development process, market acceptance and diffusion, as well as profitability (Jalonen, 2012). An additional aspect of uncertainty concerns the consequences of innovation. Innovation has proven beneficial for society, businesses and individuals alike, however innovation could also have negative consequences, being harmful in aspects of environmental, social and economic sustainability (Coad et al., 2021). The concept of the so-called 'dark side of innovation' will be further described in Section 2.3.

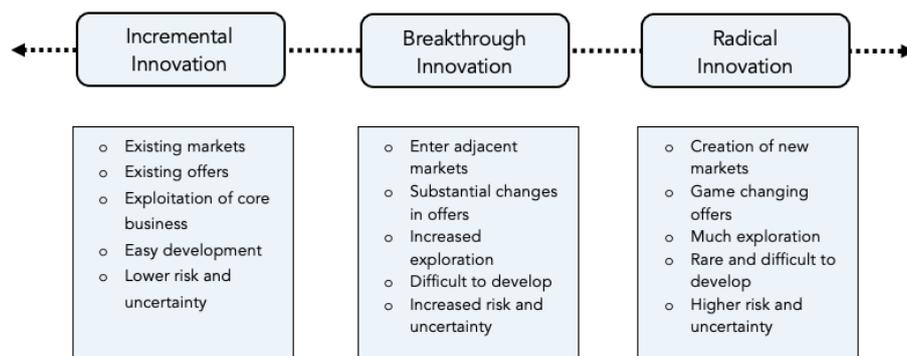


Figure 2. Degrees of innovation. Adapted from Goffin & Mitchell (2017), Nagji & Tuff (2012), and O'Reilly & Tushman (2014).

To sum up, this thesis will adapt the widely recognized definition by OECD/Eurostat (2018, p. 20) that “an innovation is a new or improved product or process (or a combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (products) or brought into use by the unit (process)”. Innovations can moreover be of various degrees, involving different levels of uncertainty.

2.2 THE 'BRIGHT SIDE' OF INNOVATION

Though unpopular at first, the idea of innovation has come to play a major role in the development of society as well as corporate organizations (Goffin & Mitchell, 2017; OECD, 2010). While the previous section outlined what innovation is, the following sections will

present the often-highlighted positive sides of innovation. Innovation is now one essential driver for societal progress and economic growth, but also for corporate expansion, competitiveness and survival. Consequently, this favors every actor and person in the economic system – individuals, businesses and society alike (European Central Bank, 2017; PWC, 2013; Schwab, 2018). Hence, the below sections separate corporate benefits of innovation from societal. Individual benefits are incorporated into societal benefits as those eventually, and on a larger scale, impacts society as a whole.

2.2.1 CORPORATE BENEFITS OF INNOVATION

While the innovation system previously was made up of actors such as research and university laboratories, both private and public sectors, it has now grown to include the civil society (OECD, 2010) and actors such as corporate firms, non-governmental organizations, and individuals (Sener & Saridogan, 2011). Innovation has, in the latest years, become a top priority of firms, and it has come to be considered the main driver of corporate growth as well as for longer-term firm competitiveness (Boston Consulting Group, 2014; Goffin & Mitchell, 2017; Gunday et al., 2011; PWC, 2013). Besides innovation, the main levers for this kind of growth are globalization, digitalization and customer impact. While globalization used to be the most viable path to growth, it has now been replaced with innovation as the greatest contributor (PWC, 2013). A study of 1500 global innovation executives performed by Boston Consulting Group in 2021 discovered that innovation is among the top three organizational priorities in 75 percent of the organizations. It is an increase of ten percentage points from the same study in the year 2020. One third of these companies place innovation as their number one organizational priority. For companies to invest in and allocate necessary resources towards innovation, there must be a perceived value to appropriate, although appropriability mechanisms differ among industries (Dosi, 1988). Innovation provides opportunities for companies and organizations to not only deliver new or increased consumer value through developed products or services but also to increase internal efficiency, develop new markets and find new ways to compete. In these ways, innovation provides the potential for companies to increase revenues, decrease costs, increase customer satisfaction, as well as improve competitive positioning (Boston Consulting Group, 2014). Even more so with innovations of breakthrough or radical nature (Goffin & Mitchell, 2017). According to Fagerberg (2003), innovation is an explanatory factor for differences in performance amongst companies.

2.2.2 SOCIETAL BENEFITS OF INNOVATION

From the greater perspective of society, innovation is beneficial in more than one way. The current economic landscape, characterized by great technological development and rapid change is changing the drivers of growth. Together with factors of human capital, resilience and agility, innovation does not only drive but defines, economic success (Schwab, 2018). Traditional sources of growth such as investments in physical capital (OECD, 2010) or cost-cutting through efficiencies (Schwab, 2018) are no longer sufficient for long-term growth of economies. Intangible capital, innovation and technological development enable opportunities for new businesses to start, by converting knowledge and new ideas into new operations. With new operations and businesses, new opportunities for employment arise. With increasing opportunities for employment, more people can work, and hence increase

their personal wealth through salaries paid (OECD, 2010; OECD, 2015). With increased personal wealth, so do living standards improve. As living standards rise, so do poverty and sickness decrease, and quality of life increases while people can live longer and healthier lives (Schwab, 2018). Moreover, innovative workplaces that are inclusive of employee contributions have the ability to enhance learning and knowledge, among individuals as well as in the organization. This in turn fosters human capital as well as greater creativity that is foundational to innovation and productivity (OECD, 2010). The same goes for developed countries, having the ability to, through global value chains and foreign direct investments, develop competencies and knowledge in less developed countries through spillover effects (Mudambi, 2008).

Besides driving economic growth in society, innovation and technological development are considered important drivers in addressing greater societal challenges, such as demographic shifts, climate change and resource scarcity (OECD, 2010; Read et al., 2016). According to the European Commission (2011), a scarcity of key assets such as water, minerals, land and fuel require productivity to become increasingly efficient for these to not run out. Research, innovation and technological development are considered important factors contributing to increased efficiency of productivity. Hence with efficient use of inputs, i.e., lower levels of key inputs generating the same level of output, the point of running out of important assets is put forward (ibid). As for climate change, the United Nations (n.d) considers the energy sector to be “at the heart of the climate challenge - and key to the solution”. Fossil fuels such as oil, coal and gas together account for 75 percent of greenhouse gas emissions and close to 90 percent of all carbon dioxide (CO₂) emissions. With innovative solutions to incorporate renewable sources such as sun, wind water or waste for energy, emissions are reduced to little to no greenhouse gasses or pollutants. A reduction of polluted air will furthermore not only improve the climate and the environment but also conditions of health (ibid).

In the OECD Innovation Imperative (2015), innovation is claimed to align economic growth with sustainability. New ideas and new ways of working will allow for growth to be both environmentally green and inclusive of social groups. Addressing these challenges will, however, require a collective approach with collaboration across nations' borders (OECD, 2010).

2.3 THE 'DARK SIDE' OF INNOVATION

As presented in the previous Section 2.2, the activity of innovation provides great benefit to society, companies and individuals alike. Through these positive effects of innovation, society has come to grow a belief that innovation is always good, and therefore that more innovation is better (Gripenberg et al., 2012; Coad et al., 2021). This perspective of innovation has been labeled 'pro-innovation bias' (Abrahamson, 1991). It has units of innovation to unconsciously assume that the consequences of the innovations will be positive and as intended and desired (Sveiby et al., 2009). Even in research, Gripenberg et al. (2012) argue that studies of consequences, unintended and undesirable ones in particular, are marginalized and rarely studied. As such, researchers are now drawing attention to the phenomenon of innovation being more nuanced than portrayed around society and in research (Sveiby et al., 2009; Gripenberg et al., 2012; Coad et al., 2021; Biggi & Giuliani,

2021). As argued by Coad et al. (2021), there is no need to 'cherry pick' data to support either side of innovation, but there is a need to enhance both sides in combination.

The greater the novelty of innovation, the greater the level of uncertainty related to the innovation throughout its process (McDermott & O'Connor, 2002), and the more difficult the anticipation of the outcome of the innovation (Jalonen, 2012). According to Sveiby et al. (2009), literature on consequences in relation to innovations is mainly represented in the theory of diffusion, i.e., the process of adoption of an innovation by a social system through communication over time (Rogers, 2003). In contrast to classical definitions of innovation that take the perspective of the innovator, diffusion theory presents the concept from the perspective of the adopter. Thus, the adoption by the social system impacts the full outcome and consequences of innovation. When describing consequences, there are several dimensions to them. They can be direct or indirect, desirable or undesirable, as well as intended or unintended, a few of these or many simultaneously. Distinctions can be made between 'unintended consequences' and 'unanticipated consequences', implying that unintended consequences still could be anticipated (Sveiby et al., 2009). With these dimensions in mind, innovations that are purposely good could also cause consequences that were not intentional. These could be either benefits or drawbacks, but also perverse, contrary to the initial intention (Merton, 1936).

Perspectives of both the bright side and the dark side of innovation are important components in a nuanced understanding of innovation as a phenomenon. An established concept in innovation theory is that of 'creative destruction', developed by Joseph Schumpeter. It describes the process by which industries are continuously evolving through innovation and disruption, where technologically superior products of new entrants are replacing old ones, displacing incumbents of an industry (Schumpeter, 1934). This cyclic process becomes a driver of growth for industries and consequently economies as societies evolve with new technologies (Sveiby et al., 2009). The failure of many established firms at the introduction of radical innovations (O'Reilly & Tushman, 2004) demonstrates that innovations by nature are good to some but not as good to others (Sveiby et al., 2009). The following subsections will outline and exemplify the dark side of innovation, i.e., innovations with a more negative or ambiguous nature, in various dimensions. It should be noted, however, that the provided examples are not exhaustive. Harm to individuals of society is exemplified as part of the societal level. Hence, following the same structure as with the benefits of innovation. When issues at an individual level are aggregated, they will rather become issues on a societal level (Coad et al., 2021),

2.3.1 CORPORATE LEVEL

To connect back to Schumpeter (1934), the process of creative destruction has innovations that outcompete other businesses. As such, there is a risk for companies to fall out of the market and lose profitability if an innovation is superior to one's own market offer.

Another stream of literature presents harm to businesses as one negative impact of the consequence of innovations. It especially highlights the adoption of Information and Communication Technologies in organizations as negatively impacting employees' productivity, and in turn, the company performance. In relation to this, examples also

highlight issues (Biggi & Giuliani, 2021). With this type of literature taking the perspective of a firm as an adopter of innovations facing negative consequences, Simpson et al. (2006) present a perspective of the innovative firm facing such consequences. An innovation orientation could produce unprofitable innovations, cause too much change for the sake of changing, and expose the firm to market risk, but also cause job stress and dissatisfaction amongst employees which consequently affects the turnover of a firm.

2.3.2 SOCIETAL LEVEL

For individuals of society, the damages or issues caused by innovations mostly relate to different public health aspects. It is where innovations could worsen the well-being of individuals both mentally and physically. Luzziati et al. (2018), for example, argue that increased cancer incidence, i.e., new cases of cancer a year, is partly due to environmental degradation and exposure to toxic emissions that individuals face. Biggi and Giuliani (2021), however, describe how much previous research on the topic of harmful innovations has given attention to consequences affecting the work environment. These consequences subsequently affect the individuals employed in an organization. Examples include issues of work-life balance as technologies enable employees to work from home in combination with work from the office (Gardner & Bryson, 2021), as well as monitoring wristbands, as is the case of Amazon (Coad et al., 2021).

The entrance of social media has made the world more open, accessible and connected (Nohira & Taneja, 2021), allowing companies to improve several aspects of their business and private people to, for instance, build relationships and form communities. However, social media has its dark sides too, with, for example, cyberbullying, addictive use, fake news, and abuse of privacy (Baccarella et al., 2018). Moreover, digital innovations such as artificial intelligence technology struggle with diversity issues and racial bias. One issue specifically relates to people of color being underrepresented and not recognized for their color (Howard & Isbell, 2020), which in turn can preserve and enlarge issues of racism (Coad et al., 2021). Diversity issues, specifically relating to gender, are further present in the design of various products and services. This is the case in products such as seat belts and voice recognition software, which apart from comfort cause safety issues for the female population, as it was designed from a typical male perspective (Perez, 2019).

On an aggregated level, Soete (2013) argues that innovation does not always represent a process of creative destruction that results in greater economic growth. At times, the opposite occurs, a process of 'destructive creation', a pattern of reduction in growth and welfare in society. Instead of benefitting the many over destroying the few, few are benefitting at the cost of many. Planned obsolescence in manufacturing is one example of such a phenomenon. 'Planned obsolescence' is defined as "the production of goods with uneconomically short useful lives so that customers will have to make repeat purchases" (Bulow, 1986, p. 729), which aims at stimulating replacement purchases of consumers (Guiltinan, 2009). Apple is one company that has been repeatedly accused of this phenomenon (Svensson et al., 2018). The concept is of increasing interest as a continuous process of product development is emphasized among businesses as means for competition through innovation in new product development. Planned obsolescence could concern both physical aspects of a product as well as technological aspects. Well-functioning products

are replaced, and they end up being disposed (Guiltinan, 2009). According to Soete (2013), this increased consumption results in an unsustainable growth that negatively impacts the environment and the ecological footprint. Relating to environmental damage, Biggi and Giuliani (2021) generally describe how the economic growth of today's society relies upon extensive use of chemicals and energy sources that are non-renewable, producing great volumes of waste which cannot be recycled. While the industrial revolution has contributed to major societal transformation, it has caused major problems of pollution that are damaging the environment (Nohira & Taneja, 2021).

Besides issues relating to environmental sustainability, literature presents several issues in relation to social issues. Biggi and Giuliani (2021) describe how the introduction of subprime loans, collateralized debt obligations and credit default swaps in the financial sector all contributed to what became the financial crisis in 2008. Furthermore, though not intended at first, the Facebook platform has been accused of impacting the storming of the Capitol in the United States (Nohira & Taneja, 2021). The application and introduction of social media in politics have come to raise an issue of 'fake news' in elections which has come to threaten the foundation of democracy (Coad et al., 2021). AI technology, as previously mentioned, deals with issues of diversity, both in terms of race and gender (Howard & Isbell, 2020). As robotics, automation and computers advance in various workplaces, humans risk losing control of processes and competencies themselves. Additionally, harm could also threaten the economy. According to Coad et al. (2021), this could be the case of poor management of innovation policies. Too great of a use of patents or monopoly protection for previous innovation could negatively affect the dynamics of the economic system and consumer welfare.

As previously mentioned in Section 2.3, and as demonstrated throughout the subsections, there is a complexity to innovation and its consequences (Coad et al., 2021; Sveiby et al., 2009). There are ambiguities to many innovations, which involve both good and bad effects (Biggi & Giuliani, 2021). The consequences can be direct, intended or desired, as well as they can be indirect, unintended or undesired, or various combinations thereof (Sveiby et al., 2009). The intention might not always be to cause harm with innovation, but sometimes it is. Coad et al. (2021) describe how innovations such as atomic bombs or the electric chair are intended to be harmful. These kinds of innovations are developed to better perform harm. Sometimes, innovation is unintended to cause harm, yet it can be anticipated, such as lung cancer being a well-known effect of smoking cigarettes (ibid). At other times, innovations designed for positive contributions have 'rebound effects'. This is the case with, for example, technological innovations intended to improve the energy efficiency of products, but that in the long run is outweighed by increased overall consumption (Herring & Roy, 2007). Given that consequences of innovations at times are delayed, subsequent regulations are too, hence innovations not proven harmful can furthermore be created as a way to escape current regulations. At its worst, innovations could be created in order to deceive stakeholders. According to Coad et al. (2021), Volkswagen is one company that has been accused of programmed misleading metrics of emissions in the testing of one of their cars.

An important dimension to consider in relation to the development of innovations and their consequences, is the issue of scale as presented by Coad et al. (2021). Innovation by nature

is unclear, hence the process involves trial and error throughout (Goffin & Mitchell, 2017). Innovations causing negative effects might be acceptable on a small scale during their development, but as it scales up and diffuses into the mass market, new problems could occur. Pollution, for example, could be acceptable in smaller proportions, but if the problem remains during diffusion, the pollution could cause greater environmental issues (Coad et al., 2021).

2.4 RESPONSIBLE INNOVATION

The potential negative consequences of innovation have come to raise discussions about increased responsibility in the processes of developing innovations. Through this, a new phenomenon referred to as 'responsible innovation' have emerged in research. The following sections will present the concept further.

2.4.1 BACKGROUND

Responsible innovation or responsible research and innovation (RRI), which is used interchangeably in the literature, is a relatively new concept of research. The bright side of innovation has formerly been emphasized in literature focusing on economic growth and value creation for shareholders, rather than the dark side where society and ecosystems have been affected negatively. It is rather important to highlight the concept as a new approach to innovation where social, economic and environmental aspects are considered and spoken for (Blok & Lemmens, 2015). The concept offers an approach and framework of foresight, considering and reflecting upon the potential social impact of both research and innovation (Jakobsen et al., 2019). However, crucial to highlight is that negative or unintentional impact is generally difficult to foresee, and it is therefore important to continuously monitor the process of innovation and facilitate dynamic practices (Von Schomberg, 2013). Moreover, the idea behind the concept offers both new and old knowledge and insights into research (Stilgoe et al., 2013). For instance, as mentioned in Koops (2015), the concept descends most prominently from several strings of Science, Technology and Society Studies (STS) as well as ethics. STS considers that responsibility should be based on the understanding that science and technology do not only reflect technical aspects, but also bears political and social features. Nonetheless, it also appears in legal theory, as well as governance and policy research. Where the focus on how to govern has shifted from more controlled regulations to creation of 'softer' regulatory methods (Stilgoe et al., 2013).

The concept of responsible innovation has several definitions, however one which is most recurring in literature, by Von Schomberg (2011, p. 9):

“Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).”

Blok and Lemmens (2015, p. 20) however describe the concept as a new approach towards innovation; “in which social and ethical aspects are explicitly taken into account and

economic, socio-cultural and environmental aspects are balanced". As previously stated, the concept of responsible innovation considers the development of new technology, and thus creation of value for stakeholders, while preventing negative outcomes in the process of innovation. Hence, considering the external environment and involving actors in the ecosystem in the innovation process (Bacq & Aguilera, 2022). One can argue that the main goal is to minimize harm and to increase purposefulness of innovations. This through the adoption of a responsible innovation process and approach to innovation (Voegtlin et al., 2022). Simply put, not only achieving economic goals but also striving for meeting the social, ethical and environmental needs (Fløysand & Jakobsen, 2017). Voegtlin et al. (2022) argue that responsible innovation carries three building blocks; do good, avoid harm and collaboration between actors of society to protect both people and the environment.

To overcome the current crises of society one is required to create smarter solutions to accomplish a greener economy, where research and innovation constitute a crucial part. However, all players in society such as researchers, policymakers, organizations, companies and especially the overall public are responsible to make the difficult decisions on how science and technological development will enable conversion towards a society of awareness, where one is able to overcome the grand societal challenges (Owen et al., 2012). As stated by Koops (2015), responsible innovation is indeed transformed in practice where all actors of society collectively explore how research and innovation can establish responsibility. Meaning that the agenda of responsible innovation is more likely to be accomplished through the involvement of a larger group of stakeholders in the research and process of innovation. It is crucial that research and innovation correspond to the ambitions of society in order to create value for everyone and to not indulge in damaging activities (Owen et al., 2012). Nevertheless, Jakobsen et al. (2019), additionally argue that there is a need to reframe the concept of RRI in order to clarify what is considered responsible as well as a need to emphasize collective responsibility. It is stated that RRI should engage all actors of the ecosystem and not the researchers alone, such as policymakers, entrepreneurs, institutions or other legitimate actors in the research and innovation system (ibid).

The concept of responsible innovation has foremost gained attention in the EU, stretching from a decade back in time, leading to increased actions towards governance and policy connected to responsible innovation, such as RRI policy framing within Horizon 2020 strategy. Horizon Strategy 2020 stresses important goals in which the common good has the potential to be realized. This through goals of for instance development of industrial leadership, competitive industries as well as a realization of essential steps to overcome 'societal challenges', prominently within the union. Such goals need to be reflected throughout science and innovation, such as through more efficient ways to allocate resources, greener transports, cleaner energy conversion as well as through creation of more purposeful and responsive solutions (European Commission, 2014). As argued by Stilgoe et al. (2013), there is indeed a growing interest to create policies addressing grand challenges. Although, a central challenge is for responsible innovation to become more responsive in its approach to such challenges, mainly since the challenges of society are not preordained. Nonetheless, due to a diverse landscape of responsible innovation and the context-sensitivity, it is required to carefully elaborate actions according to the certain context of innovation. Meaning that one is required to consider not only place and time, but also the

character of innovativeness of the specific technology, as well as framing of the problem at hand. Thus, taking all available knowledge, disciplines and research which are considered useful into acknowledgement, including regulatory and normative aspects (Koops, 2015).

2.4.2 THE FOUR DIMENSIONS OF RESPONSIBLE INNOVATION

As stated in Chapter 1 Introduction, one of the most dominant approaches to responsible innovation is the framework presented by Stilgoe et al. (2013) (Lubberink et al., 2017). The dimensions of this framework will therefore be used as a reference in order to later translate the actions of the case companies into what is considered as responsible. Each dimension of the framework is summarized with key characteristics and supportive methodologies in Table 2.

As conceptualized in Stilgoe et al. (2013), there are four dimensions of responsible innovation - *anticipation*, *reflexivity*, *inclusion* and *responsiveness*. Firstly, *anticipation* relies upon the question of 'what if?', meaning reflection and research regarding both known and unknown factors, such as plausible outcomes connected to the anticipated technological development. Thus, concerns as stated by Stilgoe et al. (2013, p. 1570), are "what is known, what is likely, what is plausible and what is possible". It involves flexibility and a systematic approach as well as consideration, while still discovering new possibilities of innovation. In addition to shaping risk governance and policies to consider social and political aspects of innovation. Nonetheless, anticipated to mitigate the risk of new technological development due to the fact that innovation both entails negative and positive plausible outcomes. The concept of anticipation is also presented in the article by Owen et al. (2012), who describe a need for analyzing both intended and potential unintended consequences which have the ability to arise from new development. Hence, consideration of different factors such as economic, social and environmental implications. Another explanation of anticipations is presented in Jakobsen et al. (2019), where they describe it as the practice of involved actors' capability to reflect upon potential impacts of innovation, considering both positive and negative aspects. However, it also concerns the actor's ability to respond to potential impacts. Also brought to attention by Owen et al. (2012), is the need for reflection regarding the main purpose, motive and goal of technological development. Considering the risks and uncertainties as well as not to ignore the potential negative impacts. Meaning focusing on creating the 'right impact' where social, environmental and economic factors are of main interest. Supporting mechanisms for achieving anticipatory actions are methods such as foresight, technological assessment and scenario planning (Stilgoe et al., 2013).

Secondly, *reflexivity* considers the awareness of actors' limitations of both practices and knowledge as well as keeping in mind that one's problematic framing might not mirror others' conception of a problem (Stilgoe et al., 2013). More simply framed, the actors of the innovation process have the capacity to acknowledge their own interests as well as the needs of their environment and surroundings (Jakobsen et al., 2019). This is more specifically called second-order reflexivity, where responsibility converts reflexivity into a societal concern (Stilgoe et al., 2013). Reflexivity enables organizations and society to evaluate and address the complexity and uncertainty of societal challenges as well as to engage in practices of responsiveness to deal with potential errors of implementation and facilitation (Voegtlin et al., 2022). Voegtlin et al. (2022) consider reflexivity as the practice which facilitates

responsible innovation, due to the fact that it resembles an essential counterpoint for strict strategic planning and top-down practices. According to Koops (2015), it is crucial to incorporate reflexivity into all actions and procedures of an innovation project in order to be considered responsible. Procedures enabling second-order reflexivity to be built are practices such as codes of conduct and ethical technology assessment (Stilgoe et al., 2013).

The third dimension presented by Stilgoe et al. (2013) is *inclusion*, which considers incorporation of the external environment in the process of innovation. Hence, questions the power of decisions in the innovation process. It emphasizes the importance to include a broader audience in the process in order to truly create value of appreciation (Jakobsen et al., 2019), thus to appropriate value. There is an underlying need to broaden the spectrum of involvement including external stakeholders in a deliberation process. Increase the engagement of important actors of the innovation system in order to receive a more nuanced perception of the needs in society (Owen et al., 2012). Thus, engaging in a more bottom-up approach to innovation. Blok and Lemmens (2015) argue that stakeholder involvement presents a key characteristic of responsible innovation and is seen as a strategy where involved actors evolve into mutually responsive and anticipate that there is a shared responsibility to tackle the grand societal challenges. Von Schomberg (2013) also states that in order to overcome these challenges it is crucial to involve society in the process. Even though there are several approaches to responsible innovation there is only one common element of resemblance to all approaches, which is stakeholder engagement. Researchers in the field emphasize the significance of stakeholders and transparency within the process of innovation (Koops, 2015). Thus, similar as to the customer-centric goals and practices of open innovation to appropriate value, hence delivering value to consumers. The approach of responsible innovation is of stakeholder-centric character creating purposeful and thought through innovations, which carry social benefits. Opening up the process of innovation in the early stage of development to include a broader spectrum of goals, facilitates legitimacy as well as access to greater knowledge and identifies potential consequences and benefits, in order to minimize potential risks (Voegtlin et al., 2022). In order to achieve inclusiveness, one can adopt methods such as open innovation, focus groups as well as user-centered designs (Stilgoe et al., 2013), where design-thinking and lean-startup are examples of user-centric approaches (Blank, 2013; Brown & Martin, 2015).

Lastly, is the measure of *responsiveness*. Due to the circumstances of a dynamic and fast-moving environment, it is crucial for actors in the ecosystem to be flexible and responsive in order to cope with changes. It is therefore essential that the process of innovation has the capacity to be as responsive as possible to for instance changing public values and stakeholder needs (Stilgoe et al., 2013). Meaning adaption of an agile and iterative innovation process where both research and innovation have the ability to change direction in order to respond to emerging circumstances (Jakobsen et al., 2019). Hence, adopting governance structures that allow organizations to act responsively. Several mechanisms have the potential to enable organizations to become more responsive such as technology assessment or foresight, but also techniques such as stage-gating or creation of certain standards which may entail new practices towards responsive governance (Stilgoe et al., 2013).

Table 2. The Four Dimensions of Responsible Innovation. Adapted from Stilgoe et al. (2013).

The Four Dimensions of Responsible Innovation		
Dimension	Key Characteristics	Supportive methodologies
Anticipation	<ul style="list-style-type: none"> o Reflection and analysis of intended as well as unintended consequences o Reflecting on "what if...?" o Reflection of: <ul style="list-style-type: none"> - Underlying purposes and motives - What is known or not known - Associated risks, uncertainties, areas of ignorance and dilemmas 	<ul style="list-style-type: none"> - Foresight - Technology assessments - Scenario planning
Reflexivity	<ul style="list-style-type: none"> o Recognizing one's own reality might not correspond to that of others o Scrutinizing value systems shaping innovation and governance to live up to wider moral responsibilities 	<ul style="list-style-type: none"> - Multi-disciplinary collaboration and work - Codes of conducts - Ethical technology assessment
Inclusion	<ul style="list-style-type: none"> o Involving and inviting other stakeholders to the innovation process o Opening up about visions, dilemmas and questions to collective deliberation o Communicating, engaging, debating and listening to perspectives of other stakeholders 	<ul style="list-style-type: none"> - Open innovation - User-centered design - Deliberative polling or mapping - Citizens' juries and panels - Focus groups
Responsiveness	<ul style="list-style-type: none"> o To have the innovation process agile and iterative through the collective process of inclusion and deliberation o Ability to adapt and change given new circumstances, values or needs 	<ul style="list-style-type: none"> - Regulations and standards - Open access for transparency - Stage-gates - Constitutions of grand challenges

To conclude, one can argue that responsible innovation introduces an approach of awareness to innovation where reflexivity, anticipation, inclusion and responsiveness allows for society to respond to the grand challenges of our time in a responsible manner, especially considering more uncertain areas of emerging technological development (Stilgoe et al., 2013). Hence, implicates the direction of emerging technologies. RRI can be seen as a useful tool to identify limitations in policy etc., especially in segments of development that can be questioned or even considered an ethically problematic area, such as Information and Communication Technologies (ICT), geoengineering and gene modification, in addition to an increased awareness of the global impact of emerging technologies (Owen et al., 2012). The concept of responsible innovation is valuable in any setting of innovative character, not only concerning technological development but also institutional, regulatory practices or similar which affect society (Koops, 2015).

2.5 GOVERNANCE

Essential and closely related to the phenomenon of responsible innovation as recently described, are theories of governance of various kinds - of risks and innovation, in corporations and in societies. Throughout this following section, governance will be presented in relation to these areas. Generally at first, and later focusing on the corporate perspective of governance in relation to innovation in Section 2.5.1, and the societal perspective of such in Section 2.5.2.

Governance is an essential configuration appearing at multiple levels of society, performed by governments, networks, organizations or even among families. One can define governance as every practice of social coordination or regulatory patterns. Governance is the end product of all practices in society, which influences the direction of government activities (Stough et al., 2018). Nonetheless, governance must be a dynamic process establishing itself in the fast-changing environment of today, as well as the changing values and beliefs of society. It is also a process of learning, meaning that governance rises from practical knowledge and trial and error. Thus, learning is a cornerstone of governance and is deemed for success if adapted accordingly. This since learning indeed facilitates purpose, meaning and content of practice (Rainey & Goujon, 2011). Governance is also closely related to responsible innovation, which can be seen as a framework for governing and evaluating potential impacts of innovations and emerging technologies. It is however important that these evaluation methods follow and are facilitated in the structure of governance in organizations (Voegtlin et al., 2022). As stated by Stilgoe et al. (2013), governance is at large related to responsibility and has historically concerned how to manage potential unacceptable and negative impacts on society, as a product of innovation and science. Evaluating and recognizing limitations in governance has created an incentive to introduce post hoc practices and regulations to evaluate risk, as well as reflection and framing of responsibility, accountability and liability. In tradition, risk management is closely related to governance, due to the fact that it concerns minimizing the risk for stakeholders (Nathan, 2015).

Nonetheless, governance has in general moved away from more controlled practices to more open approaches, meaning inclusion of stakeholders in the processes. Creation of trust and nurturing relationships among stakeholders is considered essential, thus including the public, in order to develop legitimacy and enable value appropriation as well as sustainable development. Developing effective governance requires the participation and inclusion criteria to be fulfilled, hence cooperative measures emphasize communication between the actors of the ecosystem. Meaning inclusion of actors in the value chain as well as the public, in order to facilitate adaptive processes (Read et al., 2016). As stated by Von Schomberg (2013), effective governance practices consider not only legislative actions, meaning relying on set regulations, there is rather limited dependency on the government. Good governance instead builds its foundation on its surroundings, meaning builds on the insights and knowledge of society, including collaboration with actors of society, especially considering governance of emerging technologies. In concern to emerging technologies, which can be of both radical and destructive descent, it comes with a large set of uncertainty and unique challenges which is a product of the low perception regarding the understanding of potential

impacts of the novel technology (Isigonis et al., 2020). Thus, of grave importance to facilitate a governance system in order to deal with such uncertainty. The use of codes of conduct, standards and certifications and similar has indeed created a new form of governance, basically replacing the legislative system of the state. It is crucial to facilitate governance practices, which conceptualize the mechanisms and perception of society and thus create collaborative actions. An exhaustive framework of governance thus relies on such beliefs (Rainey & Goujon, 2011). As mentioned by Rainey & Goujon (2011), when norms and social values are accounted for in the process of technical development, only then adoption of effective governance takes place and the creation of legitimacy. Nevertheless, governance aims to ensure clarity and define the rules of what is considered acceptable, as well as provide means of what is considered as best practices and operating practices overall. The governance system also weighs the potential positive and negative impacts of innovation if commercialized (Isigonis et al., 2020). In the following sections governance of innovation from a corporate perspective, as well as from a societal will be presented more in detail.

2.5.1 CORPORATE GOVERNANCE

As previously stated, governance is practiced in all social entities, including corporations, where this practice is more specifically called corporate governance. In a similar notice as more general governance, Scherer & Voegtlin (2020) argue that it is a steering mechanism, which enables the steering of an organization's innovations to avoid harmful outcomes and focus on the benefit of society. Meaning that corporate governance has the capacity to facilitate processes that allow for development of innovations that considers societal needs, hence increasing potential positive impact and minimizing harmful ones. Moreover, Scherer & Voegtlin (2020) also state that responsible innovation is a useful framework that enables the facilitation of governance practices, which avoids negative impacts and promotes doing good. Thus, corporate governance should indeed guide an organization's innovation process to produce innovations that reach social legitimacy and correspond to the goals of sustainable development. The authors also present three different approaches to corporate governance - the shareholder value approach, the stakeholder approach and the political CSR approach. The first one concentrates around protecting owner interests. The second one acknowledges a larger set of stakeholders' values and needs, hence those who are affected by the innovation. Lastly, the approach which considers organizations as political actors who produce public goods where the government is not willing to intervene (ibid). Nonetheless, Scherer & Voegtlin (2020) consider corporate governance as a crucial tool and complement to regulatory measures.

2.5.1.1 INNOVATION GOVERNANCE

Nathan (2015) describes innovation governance as an organization's intra-firm structure of innovation, as a practice to maximize returns and mitigate risk. The goal of innovation governance regards aligning the process and structure of innovation with the overall strategy, organizational culture and leadership practices in order to effectively manage innovation. Hence, the magnitude of innovation governance is diverse, considering, for instance, the respective roles of stakeholders; the process of decisions making; organizational structures and culture; use of KPIs or the overall vision and strategy of an organization. Considering the large number of stakeholders of the innovation system, one can argue that

innovation governance is extremely complex. This since diversity implicates several different goals to be fulfilled and different ideas regarding what is considered a societal priority as well as how to manage innovation. In addition, if innovation is related to more radical or breakthrough decent, one also needs to consider the uncertainty inherent in such innovations, which also implies that the innovation governance system is required to be revised if outcomes do not correspond to previous concerns. Hence, it is crucial that the process of governance is agile to cope with potential unexpected outcomes. This in order to avoid potential future negative outcomes as a product of innovation (Mckelvey & Saemundsson, 2021). Nonetheless, there is increased pressure for organizations and other actors in the innovation system to ensure that emerging technologies correspond to the priorities of society. If one does not succeed in doing so, one could potentially set up barriers for themselves, due to contributing to negative societal impact. And thus, could potentially be perceived negatively by the public (Read et al., 2016). As stated by Nathan (2015) it is crucial that innovation governance facilitate both participatory and anticipatory measures in the innovation process, in order to sincerely manage the collective responsibility of innovation.

2.5.1.2 RISK GOVERNANCE

Considering the great uncertainty of technology-led innovation it is important to implement practices that manage the risks in order to gain legitimacy. Hence, there is a need to facilitate risk management practices to effectively deal with the uncertainty of emerging technologies. However, it is crucial that such practices minimize potential harm and facilitate social acceptance, without creating barriers for innovations to flourish (Read et al., 2016). Innovation by nature is associated with uncertainty due to novelty, and any practice which inherits uncertainty also needs to deal with such (Tidd & Bessant, 2013). It is therefore of essence that innovation processes include mechanisms that enable conversion of uncertainty to risk to manage potential risks of innovation. Calculating potential risks enables organizations to deal with the uncertainty of their innovations (Nathan, 2015). Risk governance traditionally concerns reducing negative impacts of emerging technologies and can therefore be seen as a back-end reaction to innovation. It is crucial to have set practices to manage actions or outcomes that are related to high potential risks (Read et al., 2016). As a part of the European Union's Horizon 2020 program, a risk governance council was formed and initiated. The development of such a council is based on a clear perception of risk and practices of risk governance, as well as society's understanding of risk (Isigonis et al., 2020).

2.5.2 SOCIETAL GOVERNANCE OF INNOVATION

Governance in relation to innovation and technological development is concerned with how to manage research, development and the application of science and technology. Thus, how to control and steer emerging technologies (Read et al., 2016). An essential part of the steering function considering governance as previously mentioned in regards to taking the perspectives of people involved and governed into consideration. Where change is of necessity, it is crucial that people affected by the change are able to adopt the idea rapidly, which is more easily facilitated if their opinions are considered initially. Thus, considering the public's perspective is of essence due to them being steered (Rainey & Goujon, 2011). Governance is of course also concerned with mandatory regulations and policies, however, is more generally applied in the context of more flexible approaches within organizations to

govern and monitor activities. It is key that both regulations and the voices of society are considered, and that the emerging technology is aligned with such knowledge. Effective governance requires institutions and other actors of the ecosystem to collaborate and communicate, counting those who innovate, regulate and manufacture novel products. This to facilitate sustainable development of emerging technologies (Read et al., 2016). One can argue that one of the main purposes of innovation governance is to facilitate innovation that avoids harm and essentially benefits society (Scherer & Voegtlin, 2020). Hence, acts as a system of protection that focuses on the common good, providing opportunities for improvement of the fundamentals of human well-being, as well as the protection of the environment. Effective governance indeed has the potential to facilitate safe and sustainable practices, as well as society focused development, which corresponds to the objectives of the society. However, approaches to governance can vary from more 'hard' sets of governance, including compliance with mandatory policy, to more 'soft' based approaches, incentivized by organizations such as codes of conduct and applied standards (Read et al., 2016).

Innovation governance models are of increased importance for any organizational configuration that wishes to proceed with effective innovation management. Such models consider the organizational structures, innovation processes as well as steering mechanisms such as strategies and leadership (Nathan, 2015). Nonetheless, the aim of innovation governance is to intentionally guide technological decisions in a direction which coincides with societal priorities (Read et al., 2016). Innovation governance is a broader concept than traditional governance practices (McKelvey & Saemundsson, 2021) and risk governance (Von Schomberg, 2011) since it considers the complete innovation system. It includes how the diverse set of actors interact in the science and innovation system, in addition to public regulation, structure the development process of innovation and how they are produced, as well as the facilitation and diffusion process. It is a collective action, where the actors of the ecosystem together shape regulation and discuss how to tackle issues of societal concern (McKelvey & Saemundsson, 2021). More simply put, McKelvey and Saemundsson (2021) define innovation governance as the process where the actors of the innovation system attempt to arouse and regulate the generation of novel knowledge in regard to science, technology and innovation in general. Hence, seeing two main goals for innovation governance. Firstly, as a collective action to stimulate the generation of science, technology and innovation processes, considering the benefits of such an approach. Secondly, regulate collaborative actions in order to avoid undesirable outcomes.

2.5.2.1 INNOVATION POLICIES

The conversation surrounding the role of innovation has gained interest during the last two to three decades, and innovation policy as a concept has become more diffused in society as a consequence. Especially public policy which is an area that is growing rapidly, particularly considering defining innovation policy and how such measures should be designed, implemented and governed (Elder & Fagerberg, 2017). The terminology of innovation policy has been conceptualized quite recently and the emergence of this field in politics is often concerned with innovation as a crucial source for economic growth. In addition, Fagerberg (2017) argues that there are several ways to interpret the concept of innovation policy, whereas Edquist (2004) describes innovation policy as all policies which are concerned with

or have an impact on innovation, or the more narrow approach which regards policies that are aimed to affect innovation intentionally. Fagerberg (2017) however emphasizes the broader description of innovation policy as more important since it regards all aspects that influence innovation. In addition, having a broader definition includes more aspects of innovation since it considers the entire process and not only the initial occurrence of a new idea. Nonetheless, innovation policy is not one-dimensional and there are especially three different types of innovation policies that are highlighted in the literature; mission-oriented policies, invention-oriented policies and system-oriented policies (OECD, 2020; Elder & Fagerberg, 2017).

Elder & Fagerberg (2017) argue that mission-oriented policies aim to focus on the provision of new solutions in order to tackle specific challenges brought to political attention. A similar definition is presented by OECD (2020), where such policies are set to achieve specific goals concerned with a targeted challenge, however, it adds that such policies focus on not one specific step but rather the entire innovation process to ensure mission alignment to achieve goals. OECD/OPSI (2021) also highlights that it is used as a framework in order to tackle the grand societal challenges existing today. The framework is argued to support inclusive governance, progressive politics, generative environments and systemic impact. The second type of innovation policy, invention-oriented policy, is referred to as the classic approach according to OECD (2020), where such a policy framework focuses on R&D-related activities or the invention phase of innovation. Meaning, presenting a more narrow focus on the more technical aspects to innovation (Elder & Fagerberg, 2017). The last classification, systematic-oriented policy, is of quite recent descent and emphasizes the importance of linking the different essential actors of the entire innovation system, hence focusing on the complete system as a unity (OECD, 2020). Fagerberg & Elder (2017) further argue the approach to consider the interactional aspects between actors of the system and reflects upon the vital components and capabilities of the system and how to use such aspects in order to make improvements. It is closely related to the emergence of the concept of “national innovation systems”, which is described as a concept that rests upon the conceptualization of how actors are linked and how they co-evolve in the innovation system (OECD, 1997).

Nonetheless, the process of developing effective innovation policies is not straightforward and requires one to gather extensive knowledge in order to understand the underlying problems of a certain phenomenon. One needs to acquire the right set of capabilities in order for the developed policies to resonate well-foundational conclusions, established through enquired knowledge and experience (Elder & Fagerberg, 2017). One attempt to help policymakers to facilitate innovative solutions in regard to specific challenges was through the ‘technological innovation system’ approach, which was created and revised in Sweden through consistent interaction between policymakers and field experts. The approach considers gaining an understanding of the entire development process, from initial idea to diffusion and adoption of certain technologies. Thus, focus on the complete dynamics of the system of innovation (Fagerberg, 2017). Another model which is conceptualized by McKelvey & Saemundsson (2018), regards the growth of knowledge and increased learning concerning the development process of innovation policy. The method's focal point concerns the dynamics of learning, attaining crucial knowledge regarding complex organizational routines, as well as contributing special consideration towards self-organizing systems in

transformation. The method also highlights policy capacity building and gaining essential associated knowledge, as well as the need to formulate and consider policy alternatives within each field of policies. The model adds to the current discussion surrounding capacity building through mission-oriented policies in order to address the concern of grand societal challenges.

2.5.2.2 THE PRECAUTIONARY PRINCIPLE

Closely related to innovation policy and risk governance is the perception of precaution. Wright et al. (2011) argue that the use of precaution is the most efficient framework in order to deal with uncertainty. In fact, the principle of precaution is for such reasons considered a general principle of European Commission law. The precautionary principle was created as a response to facing the knowledge that technological development is not only beneficial for society. Meaning that innovation can also lead to negative impacts, which indeed can have catastrophic consequences for both the environment and human health, such as for instance, the Chernobyl catastrophe (ibid). The precautionary principle is defined as the principle that “enables decision-makers to adopt precautionary measures when scientific evidence about an environmental or human health hazard is uncertain and the stakes are high” and this principle is closely related to governance practices, especially risk governance (European Parliament, 2015). It should be used when uncertainty is high to mitigate risks and minimize potential harm both present, however, especially in the future. When actions are characterized by high uncertainty it should be used as a guide in order to minimize risks, which might not be present yet but have the potential to become evident in the long run. When new technological development is characterized by high uncertainty with the potential to cause a negative impact on human well-being or the environment, then institutions have the right to take proactive measures even before the impact has become fully evident. Meaning that the precautionary principle has the power to interfere before harm has become apparent. Thus, when facing potential negative impact immediate action is required (Wright et al., 2011). As stated by Von Schomberg (2011), the principle equips governmental authorities to intervene when confined appropriately in order to prevent negative consequences.

However, the precautionary principle should not be seen as a principle that blocks innovation, it rather incorporates greater rational deliberation. Thus, fosters rational reflection regarding potential outcomes of innovation, and works as a steering mechanism and innovation pathway which considers important social aspects. One can argue that the precautionary principle highlights the need for further reflection and opens up a pathway for solutions that deals with uncertainty and ignorance as an end-product of innovation. It emphasizes strategies that directly address potential risks and focus on the greater good. Precaution prioritizes alternatives that scrutinize uncertainty, maximize research and thereby increase knowledge and the quality of research. It also advocates flexibility and diversity, which is essential to consider in research as well as for innovation policy. Nonetheless, diversity facilitates legitimacy through the recognition of multiple stakeholders' interests. More simply put, the precautionary principle works as a steering mechanism which facilitates innovation that benefits human health and the environment (Stirling, 2014). Moreover, the precautionary principle is incorporated into Swedish regulation and is located in Miljöbalken 1998:808 (Sveriges Riksdag, 2021).

3 METHODOLOGY

This chapter outlines the research strategy and design chosen for the thesis as well as how the study was conducted. That includes descriptions of methodologies related to collection, processing and analysis of data. Lastly, quality measures of research are presented and discussed.

3.1 RESEARCH STRATEGY

As mentioned in the introduction chapter, the objective of this study is to investigate how actions of responsibility, through definitions of a theoretical framework, are occurring amongst innovative companies with a sustainability focus. That is, how the call for responsible innovation is considered in a practical setting amongst innovative Swedish firms through their innovation processes. The experience is that previous literature has been focusing on conceptualizing what the call for increased responsibility means for practitioners when developing new innovations. Though previous studies have explored the connection between theory and practice there is still a perceived discrepancy as the call for responsibility is prevailing and amplifying. The overarching research strategy of the following study is therefore of qualitative nature as the purpose of the research is mainly explorative. Supportive of the explorative nature as associated with the qualitative strategy, are the research questions formulated, which aim at asking questions on 'how' and 'what'. This in order to clarify and enhance the understanding of the focal phenomenon (Saunders et al., 2019). However, the choice of strategy further originates from ontological and epistemological assumptions about research. That is, how the researchers perceive reality and how it can be studied. A qualitative research strategy perceives reality as an outcome of social constructions rather than being objectively present, hence it is dependent on individuals and social interactions amongst them. Consequently, it means that knowledge about one phenomenon can be gained through an understanding of human behavior, answering questions of how and why (Bell et al., 2019). This study is interested in understanding the phenomenon of responsible innovation through the behavior of companies and organizations. As these are social constructions, the reflection of companies could be argued to be represented by the experiences and beliefs of people within these, why employees are considered appropriate subjects for the study. Moreover, employees are those within an organization who enables the existence and further development of a company. It is of interest for this study to understand patterns, underlying reasons as well as motives relating to the phenomenon in order to gain increased depth to the understanding. The focus of this study is the debate and call for responsibility within innovation development. The actual implementation of the theoretical framework is set aside to, through exploration, emphasize the expression of the debate within organizations, why a qualitative approach is considered favorable.

Related to a qualitative strategy of research is an inductive approach, meaning that the study aims at extending present literature through observations. The outcome of this approach can be new theory and concepts to a phenomenon (Bell et al., 2019) but according to Eisenhardt

(1989), qualitative research can also elaborate on existing theory as an outcome. Hence, the approach of this study is abductive, allowing for increased flexibility throughout the research process. Though the research aims at contributing to present theory by extending it through empirical findings, existing literature will also be used as a means for understanding the explored reality. Empirical data and previous literature are thus alternated in an iterative process, why the process cannot be argued to strictly follow an inductive approach. Moreover, abductive reasoning is favorable in seeking the best explanation for the phenomenon of study given the collected empirical data (Mantere & Ketokivi, 2013).

One risk with this approach, however, is confirmation bias, with the researchers seeking to confirm prior understandings of the phenomenon. This risk is mitigated by allowing the researchers to be surprised by empirical findings (Bell et al., 2019).

3.2 RESEARCH DESIGN

The research design of a study outlines a framework for data collection and its subsequent analysis. When establishing a research process, the methodological considerations and how the research is conducted, are affected by the overall strategy chosen for the study (Bell et al., 2019), i.e., the explorative and qualitative nature of this study came to affect the following research design and research methods. Although qualitative research aims at building or extending theory, there is not only one approach to it. Rather there are diverse approaches on how to go about when conducting the research. Approaches of various underlying ontological and epistemological assumptions. The three most prominent designs within qualitative research are those of Gioia, Eisenhardt and Langley (Gehman et al., 2018).

To this thesis, the multiple-case study approach as advocated by Kathleen Eisenhardt (1989) was considered most suitable. The main influencing factor was the ability to involve various perspectives in the current period of time. To better understand how companies work with matters of responsibility for their innovations, it was considered favorable to involve more than one perspective in the study. With this particular focus, there are two possible design alternatives. Besides the multiple-case study design, as chosen for this study, the alternative would be a cross-sectional design. Both allow for comparisons to be made, although Bell et al. (2019) distinguish these designs by their respective focus on the unique contexts of the cases. To this study, 'contexts' refer to different industries, innovations and settings of each participating company. If the emphasis of the study is the individual cases and their contribution to the phenomenon, the appropriate design would be a multiple-case study. If the study emphasizes the sample of cases however, the appropriate design would instead be a cross-sectional design. According to Eisenhardt (Gehman et al., 2018), testing of theory and building of theory are much related. "Theory building from cases is centered on theory that is testable, generalizable, logically coherent, and empirically valid" (p. 287). On the one hand, the sample was interesting in order to shed light on the debate and how it was expressed in practice. The aim was not, however, to generalize the findings for the whole population of innovative companies in Sweden, but rather to reflect, in different settings, how the phenomenon takes place. How it might differ in different contexts. By emphasizing the context of each case, comparisons could be made to find similarities and differences among the companies. Each unique setting was valued as important in contributing to increased

understanding of motives and underlying reasoning in taking responsibility, whether factors were pushing for increased concern or an internal drive guiding the organization. The involvement of several cases does, according to Bell et al. (2019), allow for theoretical reflections of the empirical findings and could result in a better understanding of the phenomenon of study. Hence, the study of multiple cases in research improves the generalizability of generated theory for the phenomenon of interest, which usually is not common with qualitative research or a single case study. Furthermore, it is considered an appropriate design when finding answers to how things are happening (Gehman et al., 2018).

3.3 DATA COLLECTION

Given the abductive research approach to this thesis, the data was initially collected through a narrative review of the literature with systematic review elements in order to increase the quality of research. The procedure of such is described thoroughly in Section 3.3.1. The primary data however, originates from semi-structured interviews, mainly with companies who are the subjects of the study, but also with experts. This is all elaborated in Section 3.3.2 and the related subsections. In an iterative process, these data sources are alternated to shape the research. Noteworthy is that no secondary data are included in the study¹.

3.3.1 LITERATURE REVIEW

The existing literature on the topic of interest served different roles throughout this study. As previously described in Section 3.1, the approach to this qualitative study was abductive, meaning that literature and empirical data were iterated throughout the research process in order to get as true of an understanding as possible of the phenomenon of study. In this approach to research, the role of the current literature was first to outline what was already known about the topic, to further guide the direction of research and to narrow down its scope of focus. Second, it was used as a basis for the data collection, and in particular, the interview guides. Finally, it was alternated with empirical data to evolve the theory about the phenomenon of focus. As an abductive approach involves flexibility for researchers to shift boundaries of the research as new insights are gained with data collection, a narrative review was found appropriate and aligned with that kind of process. This type of review is, compared to a systematic review, broader and less focused in terms of its scope and considered applicable when the outcome of research is theory, as in this case. It allows the researchers to continuously discover important perspectives to the theory, which was not valued initially, hence, to revise the literature section as per new discoveries (Bell et al., 2019). However, to increase transferability and quality of the study, as is often considered an issue with qualitative research, the narrative review was complemented with elements of a systematic review. In other words, a narrative review was performed systematically. Elements of such a review make the narrative review increasingly structured and help to reduce potential researcher bias (ibid). Hereafter, the term 'literature review' will be used for the chosen narrative review with systematic elements.

¹ Secondary data sources such as company websites were solely approached to verify and validate empirical findings of the semi-structured interviews.

After stating the research questions and delimitations for the thesis, boundaries were set to help determine what literature should be included in the research and what literature should not. These boundaries are referred to as inclusion and exclusion criteria. To this thesis, the inclusion criteria cover peer-reviewed literature and literature published in acknowledged academic journals or books. Nevertheless, this study emphasizes a debate and a call for responsibility in innovation. A debate that to a great extent affects entrepreneurs and companies. For this reason, inclusion criteria further cover reports provided by globally recognized intergovernmental organizations (e.g., OECD), and global consultancy firms (e.g., PWC or Boston Consulting Group). Additionally, non-academic texts emphasizing the dark side of innovation and its debate, as well as conference papers and periodicals (e.g., Harvard Business Review) are included. Prior to the inclusion of these kinds of sources, a review was made with regards to legitimacy of the source. Finally, Swedish literature was included when no English literature could be found. This, if it was considered needed to understand the Swedish context characterizing the study. As the focal phenomenon of this thesis, responsible innovation, is relatively new and has grown in research over the past years, research before 2010 was excluded. Related to that, literature related to pure CSR activities was excluded to highlight the new phenomenon separately. Finally, literature in languages other than English (and as mentioned amongst the inclusion criteria, Swedish at times) was excluded due to the literacy of the authors of this thesis.

Following these establishments, the initial stages of the literature reviews explored literature through a use of keywords. The keywords were related to topics considered relevant in addressing the purpose of the study. This included the dark side of innovation, responsible innovation, responsible research and innovation, as well as sustainability in innovation. To motivate the context for this research, it was considered needed to cover definitions of innovation, and to contribute to a more nuanced perspective of innovation, topics covered the bright side of innovation and benefits provided by the concept. To refine and recombine the applied keywords were part of the iterative process (Bell et al., 2019) and was considered appropriate relating to the abductive research approach. The full list of keywords can be found in Appendix A together with the listed inclusion and exclusion criteria. Throughout the review, searches for literature were made through online data sources such as EBSCO Business Source Premier, Google Scholar and "Supersök", a search engine provided by the university library at the University of Gothenburg; sources that are all considered legitimate by Bell et al. (2019) and Saunders et al. (2019). Moreover, the regular Google search engine is used to encounter non-academic literature and sources. Another method of use was the identification of literature through the reference lists of articles used, i.e., a snowball technique (Bell et al., 2019).

The primary understanding of literature was guiding, not only for the direction of research including the research question and relevant keywords, but the interview guide which was used for primary data collection. Later stages of the literature review occurred alongside the data collection process. With the same strategy of keywords, inclusion and exclusion criteria the literature review was revised as new findings were discovered. All these systematic elements are supported by methodology researchers such as Bell et al. (2019).

3.3.2 PRIMARY DATA: SEMI-STRUCTURED INTERVIEWS

Due to the qualitative nature of this thesis, interviews were held with the targeted companies with representatives who were knowledgeable regarding the innovation processes of the company. The data obtained from the interviews are to be seen as the primary data source of this study. Primary data, also called empirical data, is gathered concerning specific topics which are connected to the research question, using methods that best correspond to the aim of the study (Hox & Boeije, 2005). For this study, the interview method chosen was semi-structured interviews. Interviews per se is the most prominent method for collecting data, where semi-structured interviews is the technique which is adopted most frequently when conducting qualitative research. The major reason for the popularity of such methods is concerned with both flexibility as well as adaptability of the approach. The main structure of the method can vary depending on the purpose of the study as well as the intention behind the research questions (Kallio et al., 2016).

The predominant reason for adopting a semi-structured approach was due to the nature of the method, which allows for both structure and flexibility. The fundamental structure pursued was applied through the pre-constructed interview guide, which consisted of several questions covering the specified topic of the thesis. However, the conductors were not required to follow the order of the schedule meticulously due to the flexibility of the approach. Although, the interviewer is essentially required to ask all questions presented in the guide as well as using similar wording to guarantee comparability of the data gathered through the different interviews. This was seen as crucial for the following analysis of the data. Due to the design of the research of multiple-case studies, cross-case comparability was essential in order to find similar patterns or dissimilarities in the data. Hence, it is imperative to follow the fundamental structure of the interview guide, although allowing the conductor to depart from the guide if deemed suitable for the particular conversation or due to the direction the interview is headed (Bell et al., 2019). The ability for reciprocity between the interviewer and the interviewee, is argued as one of the main strengths of using a semi-structured method. Thus, enabling follow-up questions to be asked in regard to the response attained by the participant, as well as allowing the participants to express their thoughts concerning a specific topic more freely (Kallio et al., 2016). Such an explorative approach was deemed necessary in order to attain the insights of importance and more detailed knowledge. This approach is specifically useful when the goal of the interview is to obtain individual thoughts regarding the research topic (Adams, 2015). Hence, structure serves as steering the outcomes of the interviews, yet the flexibility allows for asking other questions as well in order to obtain necessary information in order to answer the research question at hand (Bell et al., 2019).

Prior to initiating the interviews, interview guides were created. The overall setup of the guide consisted of well-formulated questions divided into different topics, to ask each respondent. However, the questions were often altered a bit during the interviews in order to fit the specific context of the respondent and circumstances of the interview. An interview guide is not required to be extremely structured and contains distinct questions when conducting semi-structured interviews (Bell et al., 2019), however it was argued necessary in order to gain an overall structure for the interviews. The development process for the

questions mainly reflected the literature and research used for the thesis, thus the problem discussion, however also reflected the main objectives of the research question.

3.3.2.1 COMPANY INTERVIEWS

The empirical data, foremost the company interviews, is the main foundation for this thesis, which was collected through the semi-structured interviews. The semi-structured interviews were held through Zoom with one company representative at each targeted Swedish company. The initial e-mails or In-mails requests were sent 25th of February reaching to the 7th of March, to a total of fifteen companies. In total, seven companies participated in the interviews (See Table 3), where all interviews were held through Zoom between March 14th to 25th. As mentioned, an interview guide was developed in order to gain company-specific insights of each company, regarding a few different segments of questions; *background, the innovation process, responsible innovation* and *other* (see Appendix B1). The interview started with a few general questions regarding their business and operations, moving forward to more specific questions in order to obtain insights related to the topic of research. The order of the questions asked varied between interviews depending upon which subjects were touched upon when answering other questions of the interview guide. Questions were also reformulated in regard to the specific industry context, thus obtaining specific knowledge concerning their operations. The interview guide generally worked as a steering mechanism and foundation for all interviews, however the conductors at times departed from the guide if suitable for the particular conversation.

3.3.2.2 SELECTION OF CASE COMPANIES

The main criteria with regards to choosing companies to target for this study were companies of Swedish descent with business ideas that generate a higher degree of innovation such as breakthrough or radical innovations, as well as presenting a sustainable innovation focus. Meaning presenting unique ideas or solutions or components which are completely new or fairly new to the market or the world. This is because a higher degree of innovation is associated with a higher level of uncertainty. It is considered favorable to focus on these kinds of innovations because it requires companies to be increasingly careful in their work. The majority of companies targeted were chosen from a report called 'Nordic Innovation Triangle 2022', which emphasizes relatively new innovative companies within the Nordic region. The Nordic Innovation Triangle which constitutes the four capital cities within the Nordic region; Stockholm, Helsinki, Copenhagen and Oslo is argued a prominent global region for innovation, where their major success is built upon collaboration. However, innovation does not only occur within the triangle but also in the surroundings within the Nordic countries and the 25 regions altogether play a crucial role in global innovation. The report is published with the aim to emphasize companies with high success factors in their journey of facilitating their business idea, this to push their ideas forward and to enable their success. The essence of success in the Nordics is the widespread of innovation occurring within the countries and not just in the major cities. According to the European Innovation Scoreboard, Sweden, Finland and Denmark are the top three countries within Europe which have the best performing innovation systems, whereas Norway is among the top performers as well (Sanandaji et al., 2022). For this thesis, companies within the regions of Västra Götaland, Stockholm and Malmö were targeted from the report due to finding these

companies' business ideas interesting and presenting a higher degree of novelty. In addition to the previously mentioned report, the website of 'Innovation Sverige' was also used to find innovative companies, where one of the companies of this study was targeted from an article published on their website. Moreover, the last company which is a part of this study was targeted based on prior knowledge of their novel business idea. Leading to a total of seven companies as subjects of this study. This is argued a suitable number of subjects considering the approach chosen of a multiple-case study, where four to ten subjects are considered sufficient. However, a fixed number of subjects is not inherent in a multiple-case study, although it is common for such a method (Eisenhardt, 2021).

The method of sampling used is a form of purposive sampling or more specifically generic purposive sampling. This is commonly used when the researchers establish criteria in regard to what kind of cases is of interest for the specific study. As in this case, as previously mentioned, are companies of Swedish descent with business ideas that are considered to possess a higher degree of novelty, as well as present sustainability-focused innovations. The criteria are set in order to address the objectives of the research question. When the appropriate cases were identified then a sample of such cases was targeted (Bell et al., 2019). For this particular study the majority of cases chosen, as mentioned before, were presented in a report emphasizing novel innovative firms. From this report, eleven companies were contacted whereas six of these showed interest, however only five participated in the study. In addition to the companies of the report, four other companies were also contacted, and two of these companies chose to participate. The aim was not to target a specific industry, and the sample therefore reflects different contexts and industries which is argued beneficial for a multiple case study to increase the generalizability of the findings (Eisenhardt, 2021). The main objective was to reach companies that presented novel business ideas, essentially due to the fact that novelty often inquires higher degrees of uncertainty. Hence, to some extent ensuring applicability of the concept of responsible innovation. Careful selection of cases, hence targeting cases where the focal phenomenon is likely to occur, is deemed an appropriate method in regard to multiple case studies (Eisenhardt, 2021).

When potential company subjects were established, further research regarding potential company representatives which held sufficient knowledge regarding the research topic was the next step before initiating first contact. Channels such as LinkedIn and company websites were mainly used to locate appropriate organizational members. However, general company email addresses to the companies were also utilized in order to facilitate first contact, when information was insufficient regarding individuals' professional role at each company on the different channels. The main objective when finding potential individuals of representation was them inquiring possession of knowledge regarding the innovation process or development process of their innovations. The initial email emphasized such criteria in order to find suitable individuals to interview. Hence, covering for the scope of the study to target the optimal candidates within each company. Meaning that the snowball sampling method was used at times in order to initiate contact with key individuals possessing the right capabilities (Bell et al., 2019). The final company representatives mainly held leading positions at each company, possessing roles such as *Founder* and *Chief Technology officer* (CTO). However, one of the interviewees was a *project manager*, although just as knowledgeable, mainly since working with questions related to the innovation process at the

company. Important to mention regarding the data and reflections collected during the interviews, is the argument that some data might be considered subjective due to the fact that humans are individuals who are affected by the complete ecosystem. Hence, may portray their own thought and not the complete view of one's company. Although, due to the fact that most companies are considered as small businesses might imply that a united view and culture has the potential to permeate the entire businesses. Thus, entails representatives to possess a similar view as the vision of the company. In addition to interviewing individuals who are either knowledgeable about the innovation process or work close to the innovation processes within every respective company. Hence, covering for some of the risk concerning subjectivity. Nonetheless subjectivity is indeed a factor to consider, and in regard to the presentation of the empirical findings as well as analysis, one should keep in mind that even though the findings are presented as the companies, there is still one individual behind the specific answers. Although, it resembles the company's view to a great extent.

Table 3. Company Interviews.

Company Interviews					
Company	Respondent	Role	Date	Setting	Duration
Cellink	Johan Norrman	Chief Technology Officer	2022-03-18	Zoom	35 min
H2 Green Steel	Gustav Rehnman	Project Manager	2022-03-17	Zoom	46 min
HVR Water Purification	Aapo Säask	Co-Founder	2022-03-17	Zoom	1 h 2 min
Liquid Wind	Thomas Stenhede	Co-Founder	2022-03-21	Zoom	47 min
Mycorena	Frida Persson	Chief Technology Officer	2022-03-25	Zoom	40 min
Norban	Adrian Miller	Co-Founder	2022-03-18	Zoom	57 min
Sproud	Christopher Robertson	Co-Founder	2022-03-17	Zoom	1 h 7 min

3.3.2.3 EXPERT INTERVIEWS

As a complementary source of data, in addition to company interviews, a few expert interviews were also conducted. As presented by Carter et al. (2014), gaining insights from various data sources, covering the same topic, may increase validity of the data and present a more nuanced picture of reality, as well as enable confirmation of findings. This approach is called triangulation, which is often used in qualitative research to gain a deeper understanding regarding the phenomena of research. For the sake of this thesis, expert interviews were deemed suitable in order to gain contextual knowledge regarding the innovation ecosystem in which the subjects operate in. Moreover, through expert interviews one is also able to obtain unbiased insights regarding the studied phenomenon, due to the fact that organizational members may have a tendency to be subjective, reflecting only the positive aspects of their organizations. In addition, the aim was also to gain more specific knowledge regarding the innovation policy landscape of Sweden in which the selected companies operate. Gaining insights from experts in the field was considered useful in order to obtain different perspectives regarding topic of choice, as well as to facilitate validity of the data. Organizations such as RISE and Vinnova were contacted due to being

knowledgeable actors in regards to the innovation system as a whole. However, focus was to gain an understanding of the policy landscape and therefore more specifically targeted people with explicit knowledge of such measures. In addition, a few researchers and professors within the innovation and policy field were targeted for interviews. In the end, one interview was conducted with a representative at RISE and one with a professor at the University of Gothenburg. Table 4 presents an overview of the experts interviewed.

In a similar manner to the company interviews two separate interview guides were developed beforehand, for each expert interview subject focusing a bit on their area of expertise. The interview guides were deemed necessary in order to gain structure and comparability of data sources. The questions formulated for such a guide were covering the same topics as presented in the company interview guide such as, *background* questions and *responsible innovation*, however also covered the topic of *the Swedish innovation system*, *the dark side of innovation*, as well as *innovation regulations* and *policies* (See Appendix B2 and B3). The latter topic of questions was asked in order to obtain knowledge regarding policies, which innovative companies have to take into account when working in the innovation spectrum. In regards to the approach used for the expert interviews it was semi-structured as well. Although, in general addressed more freely than the company interviews and adapted in accordance with the answers given by the expert, in addition to departing a bit more from the guide if touching upon an interesting conversation to explore further. Throughout Chapter 4 Empirical Findings and Chapter 5 Analysis, the experts will be referred to as E1 and E2 to enforce equality of reference between the cases and the experts of this report.

Table 4. Expert Interviews.

Expert Interviews					
Expert	Name	Occupation	Date	Setting	Duration
E1	Maureen McKelvey	Researcher and professor in innovation & entrepreneurship. Focus on interaction between the private business actors and public goods actors in innovation as well as the debate of responsible research and innovation, and the dark side of innovation.	2022-03-18	Zoom	35 min
E2	Richard Englund	Senior project manager and business developer at RISE – research institutes of Sweden. Unit for policy and innovation.	2022-04-11	Zoom	46 min

3.3.2.4 EXECUTION OF INTERVIEWS

As previously mentioned, the company interview guide was sent to the respondents in advance in order for the more reflective questions to be considered before initiating the interviews. All company interviews were then held through Zoom in a time span of two weeks, during mid-March. The expert interviews were also held through Zoom. Using online methods such as Zoom enables much flexibility, reduces the need for travel and is argued to be an efficient method, almost equal to face-to-face interviews. However, technical issues may become apparent and can be seen as a limitation (Bell et al., 2019), although functioned properly during all our interviews. The interview sessions were all held in Swedish due to all

respondents presenting Swedish as their native or preferred language. Meaning that one is able to speak and express oneself more freely.

Both conductors of the report were present at each interview, taking on different segments of questions to ask the respondents from the interview guide. The commonly used approach was methodical, following the structure of the interview guide, with some exceptions due to the direction of the conversation. Meaning that the order of questions was at times different compared to the guide. Each interview was recorded upon permission of all respondents. Before asking any other question, permission was requested, hence each individual was given the opportunity to turn the request down. Recording of meetings enabled each researcher to focus on the content and to be active in the development of the conversations, prompting or asking follow-up questions when needed, rather than splitting attention in simultaneously taking notes. Each recording was transcribed after each interview. Besides increased activity, the benefits associated with recordings are several. Firstly, it helps the researchers to not solely rely on memory when continuing the research process. Secondly, it provides possibilities for the material to be reviewed and examined at multiple occasions and by both researchers, which in turn allows for a more thorough analysis. Finally, the recorded and transcribed material enables comparison with the conducted analysis in order to ensure that interpretations were accurate, reasonable and not exaggerated (Bell et al., 2019). As all interviews were held in Swedish, the same language served as the foundation for the transcripts. Translations were not made until converted into the text of this thesis.

3.4 DATA ANALYSIS

The method chosen in regards data analysis goes in line with Eisenhardt's approach (1989) to a multiple-case study which is referred to as a theory building approach. The heart of such a method is analyzing data, which however is considered as one of the more difficult tasks and the least established one. One fundamental and essential procedure of such a method is within-case analysis, which is driven by building volumes of insights. Within-case analysis generally entails writing detailed case study descriptions, however not considered as a standard practice, although such insights are argued beneficial when managing larger volumes of data in order to generate contextual knowledge for analysis. This through presenting every case as a stand-alone entity. The results sections commence with some contextual knowledge in order to get familiar with the studied cases, however do not throughout the complete results chapter present each case at the time. The later sections are instead divided into overarching themes with under categories, which are called constructs in accordance with the Eisenhardt method, where cross-case comparison and general patterns in the data are presented. In addition to within-case analysis one searches for patterns in the data in order to find certain central behaviors. When analyzing the data, it is crucial to be as objective as humanly possible and to configure different explanations of behaviors in order to not create false conclusions. The approach chosen for data analysis was selecting certain categories which corresponded with the literature used for this study, and later looking at within-group similarities as well as inter-firm differences for the rest of the categories. Using such tactics enabled the authors of this thesis to look beyond introductory impressions through analyzing the data by using different lenses. Hence, facilitates more accurate conclusions and therefore builds more reliable theory. In addition, cross-case tactics

establish higher probability that the researchers will distinguish novel insights hidden in the data set (Eisenhardt, 1989) as well as increase creativity and reliability in the analysis (Eisenhardt, 2021).

As previously mentioned, constructs were formulated in order to enable both within-group and cross-case comparison and is argued essential when building any theory. Prior to that, measures were also generated to ensure that the emerging theory is well-established as well as verifiable (See Appendix C). Thus, the data analysis composes two important steps to ensure patterns and codes are established in the data set. The method is similar to other grounded theory approaches such as the Gioia method, where the denominator is the iterative and organized approach where one classifies the raw data and later constructs theoretical categorizations through continuous comparison of both theory and empirical data (Eisenhardt, 2021). When viewing the interview transcriptions, every company received their one color to keep specific findings from each company separate. The findings were later categorized into measures where certain patterns and repetitions in the data became more apparent, a step which is argued as essential for first-order analysis (Bell et al., 2019). In some cases, data were categorized into several measures to capture the full perspectives. The second step was then to conceptualize such insights, hence measures, into constructs, meaning that the measures of similar nature formed specific groups. As a third step, the constructs were conceptualized again into our main themes which corresponded to certain concepts in the literature used for this study. Using similar wording enables building coherence throughout the thesis, as well as helps when comparing the empirical data with the existing theory, which in our case mainly concerned the framework of responsible innovation. In addition to repetitions in the data, similarities and differences in the data were also recognized. When cross-comparison within the empirical data was conceptualized then additional analysis was carried out with the existing literature concerning the focal phenomenon. As mentioned earlier, the data analyzing method is not clearly specified (Eisenhardt, 1989), although it concerns essential steps such as developing measures and constructs in order to find patterns in the data (Eisenhardt, 2021). In addition, the data analysis, according to Eisenhardt, also involves discovering and explaining theoretical arguments to 'why' certain patterns are apparent in the data set (ibid).

3.5 QUALITY OF RESEARCH

3.5.1 TRUSTWORTHINESS

The approach often used to facilitate trustworthiness of qualitative research presented by Lincoln and Guba (1985), is based on four criteria which are credibility, transferability, dependability and confirmability. The following sections in this chapter provide insights with regards to how such measures have been considered throughout this study.

3.5.1.1 CREDIBILITY

The criterion credibility is an alternative measure to internal validity in qualitative research, which regards the trustworthiness of the empirical finding in the study (Bell et al., 2019). The criterion is closely related to the participants of the study and their perspectives of the studied phenomenon and therefore means that it is of essence to present the empirical

finding in such a way that it aligns with the respondents' truths and realities (Shenton, 2004). In accordance with these criteria, interviews were held with the respondents in quite an early stage of the study, presenting the motives and goals of the study in order to validate the initial research of the studied topic. The explicit method used for this thesis was triangulation, meaning using multiple sources of reference, such as for in this case; company interviews, expert interviews as well as former research of the topic at hand. Triangulation is seen as an efficient method for qualitative research to ensure credibility (Guba & Lincoln, 1985). The expert interviews were aimed to validate the findings of the company interviews in order to rule out biases as well as to cross-check the findings (Bell et al., 2019). They were however also used in order to gain a deeper understanding in regard to the ecosystem in which innovative companies operate. Hence, attaining greater knowledge in order to facilitate comprehension of certain behavior traits of the studied companies. Kanter (1977) proposes that the method of triangulation is the most efficient method to validate data as well as develop reliable observations of the social construct and reality. In addition, triangulation enables the researcher to find multiple truths, meaning to encounter diverse levels of the precepted reality. Due to the nature of the study, it was important to reach companies with a higher degree of innovativeness and to reach representatives within each company with the insights necessary in order to answer the questions. This in order to ensure that the point of view of the respondent aligned with the overall standpoint of the company. We therefore targeted individuals within each organization which worked close to the development process and/or innovation process. As previously mentioned, these individuals either were founders or CTOs, meaning that one could assume that they are deeply invested in such questions. Ensuring that the correct individuals were targeted, one can argue increases the trustworthiness of the empirical findings. In regard to the literature, the majority of articles used were peer reviewed to ensure quality as well as using reports from established organs of society, as previously mentioned. In order to ensure transparency and credibility, different databases were utilized to attain the data of the literature review (Bell et al., 2019).

3.5.1.2 TRANSFERABILITY

The criterion of transferability refers to external validity, hence regards to what extent the empirical findings can be transferred into another setting or population. However, since the empirical findings of qualitative studies are often tied to certain contexts or rather specific to certain environments, such criterion is often difficult to fulfill, due to the limited scope of qualitative research. Meaning that it is difficult to demonstrate if such findings have the possibility to be utilized to describe another population (Shenton, 2004). External validity is therefore more commonly achieved in quantitative studies, where the context is often broader and therefore more general in its application. Qualitative research is essentially associated with more detailed and explicit knowledge, hence larger depth regarding the produced insights and therefore might not be applicable in any context (Bell et al., 2019). However, as argued by Lincoln and Guba (1985) it is in the researchers' interest to bring forward sufficient knowledge regarding the context of the fieldwork to enable any reader to make their own judgment about whether such findings could be transferred into another environment. These barriers are addressed through, for instance, choosing cases very carefully, as well as targeting cases in which the studied phenomenon is likely to occur, although expressed in different settings to increase the generalizability of the findings. Such features are argued to increase transferability (Eisenhardt, 2021). The subjects in this case

study are indeed born from a sustainable point of view, meaning that responsible actions are present in the very foundation of the organizations. However, the companies at hand are present in different contexts and hence generate different findings regarding the phenomenon depending on the specific setting of each company.

3.5.1.3 DEPENDABILITY

In qualitative research, dependability is the alternative to reliability which is used as a criterion in quantitative research. Dependability concerns with ensuring that all records are preserved in regard to the entire strategy and its implementation (Shenton, 2004), meaning the methodical execution of the research, including the problematic formulation, how and why participants were selected, data gathering methods, method of data analysis etc. (Shenton, 2004; Bell et al., 2019). Such features are described in detail mainly throughout Chapter 3 Methodology, enabling repetition to be executed by peers. Explaining the research strategy, design and execution in detail enables future researchers to follow the explicit method of practice, however not necessary to discover similar results. Although, gaining an understanding of the method's effectiveness as well as establishing if a proper method has been chosen for the problem at hand (Shenton, 2004).

3.5.1.4 CONFIRMABILITY

The last criterion for quality is confirmability, which emphasizes the essence for the authors to be as objective as possible in the research in order to not manipulate the findings. Hence, not accentuating personal values or opinions (Bell et al., 2019). Ensuring complete objectivity is however a hard task since the research is conducted by humans which are driven by subjectivity; hence biases might be inevitable. It is therefore crucial for the researchers to look through their objective lenses when conducting the research to emphasize the insights of the participants and the literature in the area of research. Thus, focus on the empirical findings produced in the study as well as former research on the research subject. One method to promote confirmability is triangulation, which is an effective way to reduce researcher biases (Shenton, 2004). As previously mentioned, triangulation is the research method used for this study and therefore plays an additional role in the research to advocate confirmability. However, the authors of this study recognize the difficulty of truly fulfilling the criteria of confirmability due to the nature of the data collection method of semi-structured interviews. Hence, allows for a more flexible interview approach and thus enables departure from the interview guide if deemed suitable for the particular conversation. Although, following the main structure of the guide which contains non-leading questions in order to increase objectivity. Nonetheless, since both conductors were present at the interviews, as well as transcribed the interviews, one can argue that higher confirmability is achieved.

4 EMPIRICAL FINDINGS

This chapter of the thesis presents empirical findings of the primary data collected through the interviews with companies and experts. Initially each company is presented in greater detail in order to establish the specific context of each case. This is followed by sections relating to responsible innovation, corporate as well as societal governance of innovation. The structure aligns not only with the Chapter 2 Literature Review but also the overarching themes identified in the data. Moreover, each subsection of the chapter corresponds to the identified concepts of the data, as can be found in Appendix C. Noteworthy is that company names are used for reference throughout this chapter to better comprehend the context, although each individual representative is the source of information.

4.1 CASE COMPANIES

This section of the empirical data aims at introducing the various businesses, innovations and setting of the different companies included in the study. Table 5 summarizes the contexts for each of the participating companies. All information has been retrieved during the execution of the interviews. Some information, including the industry column in Table 5, was however validated through secondary data sources.

Table 5. Case Company Contexts.

Company Contexts				
Company	Industry	Innovation	Sustainability Focus*	Degree of Novelty
Cellink	Biotechnology	Product innovation	Social and ethical	Radical
H2 Green Steel	Steel production	Technology and process innovation	Environmental	Breakthrough
HVR Water Purification	Water purification	Technology and process innovation	Social and ethical	Breakthrough
Liquid Wind	Energy	Technology and process innovation	Environmental	Breakthrough
Mycorena	Biotechnology/food	Technology and product innovation	Environmental and social	Breakthrough
Norban	Real estate	Business model innovation	Social and ethical	Breakthrough
Sproud	Food	Product innovation	Environmental	Breakthrough

* Primary sustainability focus of innovation

4.1.1 CELLINK

In 2016, Cellink was founded in Gothenburg with the purpose of making 3D bioprinting affordable, providing researchers and scientists with a lower cost of entry to the industry. The company develops, produces and sells products and services related to 3D bioprinting, i.e., providing the possibility to print organic material and tissues that can be used for 3D cell culturing, drug development and tissue engineering. Cellink is the developer and producer of both hardware and software of the products as well as of the bioink that is printed. In addition to these products, the company offers related services such as creation of applications or installations. As a subsidiary and part of the BICO Group, Cellink takes part in the transformation of bio convergence, where various technologies are combined with biology to

create the future of health (Cellink, n.d.). The business idea addresses three areas of issues in the healthcare and medicine industry. First, the products reduce time of development for new drugs, replacing certain studies with tests on bioprinted material. Second, the products allow for a reduction in animal testing which is common development of pharmaceuticals and other substances. Third, a longer-term ambition of the company is to develop products able to print functioning human organs that can help address the lack of such in healthcare.

When the company was founded, the technology of 3D bioprinting in itself was not new nor unique. It was however expensive to invest in and complex to work with, making the access to it much limited. What Cellink did was to produce the technology in a cost-efficient manner which enabled the company to offer it at an affordable price. Furthermore, as the substance for printing at the time was patented, Cellink had to develop a new substance of other material. Thus, while the technology was already developed, it was scaled down to make it affordable and available. That is what is new. The competitors of Cellink can be found outside of Sweden, a few larger actors in the global market, although what makes Cellink unique is the company creating a global market for themselves. Given the work towards the long-term goal of enabling 3D printing of human organs, the innovation of this company is considered to have radical innovation potential.

4.1.2 H2 GREEN STEEL

The company of H2 Green Steel relies on the idea to decarbonize hard-to-abate industries, eliminating almost all CO₂ emissions from production processes, first targeting the steel industry. Based in Stockholm, the company was founded in 2020 with a vision to accelerate a sustainable change in the industry. The flagship project of the company is about building a new large-scale production plant for high quality green steel in Boden, able to produce five million ton of steel per year by the year of 2030. The process for green steel production is fully integrated, digitized and automatized utilizing fossil-free energy sources and green hydrogen, replacing the traditional source of coal. This replacement throughout the production process could reduce emissions by 95 percent.

The innovation happening in H2 Green Steel is a process innovation, where proven industry processes and technologies are replacing traditional activities or scaled up in a way that has not been done previously. These processes include, for instance, electrolysis for decomposing water into hydrogen and oxygen, as well as a DR reactor for re-mining iron to direct-reduced iron. Though there is some innovation in the exchange of energy sources throughout the process the main innovation emphasizes the scale of already existing technologies and process activities. The main competitor in Sweden is a collaboration between SSAB, LKAB and Vattenfall who also addresses large-scale production of green steel. Because both initiatives are still in a phase of development, there is a possibility for H2 Green Steel to introduce an innovation new to the market. Hence, the innovation is considered an innovation of breakthrough nature.

4.1.3 HVR WATER PURIFICATION

HVR is a company that was founded in 1990 (HVR, n.d.) in Stockholm as a subsidiary to Scarab Development AB, a company with a long history of research and scientific

collaborations. HVR licenses a technology developed in Scarab for water purification that is used in drinking water applications. According to HVR, pure water is a basic human right, why the vision of the company is to make pure water available, healthy and affordable for all people globally. To make it as natural for other people as it is for inhabitants of Sweden. While a conventional purification process requires multiple technologies to remove enough contaminations to make water drinkable, the innovative technology and process of HVR has the ability to remove all contaminants in one process. With this technology, local water can be used in the purifying process, hence lowering transportations and use of plastic bottles, making it sustainable also from an environmental point of view. Besides development of home appliances for water purification, HVR has ongoing projects in India and Egypt to build production plants driven by solar energy.

Though water purification is no new technology, the uniqueness of HVR is the technology and the process developed to remove every single contamination in one module as compared to conventional approaches. While still in the phase of development, the markets targeted by HVR has the innovation being considered a breakthrough innovation.

4.1.4 LIQUID WIND

The company Liquid Wind was founded in 2017 in Gothenburg, Sweden, with a business idea to convert CO₂ and wind energy into liquid fuel, producing eMethanol, to accelerate the transition of transportation into becoming carbon neutral, for a more sustainable future. Today, the business is focused on ocean freight and shipping, but the product is useful in other areas of transport as well. While operations and executions occur in subsidiary companies, Liquid Wind is the developer, financier and manager of projects setting up eMethanol facilities. Methanol is produced from renewable energy sources and materials, and is offered as an alternative to traditional fuels with opportunities of being both accessible and scalable. Like H₂ Green Steel, the company addresses hard-to-abate sectors, offering viable alternatives that are easily adopted. At the heart of Liquid Wind there is an ambition to address the demand for renewable fuels and related issues caused by CO₂ emissions, greenhouse gasses affecting not only the environment but human health.

Though the production process in itself is relatively new, the uniqueness of Liquid Wind, however, lies in their goal of building the world's first large-scale production plant for carbon neutral electro-fuel as well as in their approach to market. Still the company is in the phase of development. As such, the criteria of implementation to an innovation is not yet fulfilled. Together with strong actors such as Siemens, Alfa Laval and Carbon Clean, who hold proven processes and technologies critical to the production plant, a collaboration is established to produce cost-competitive fuel alternatives. With the potential of this innovation, it is considered a breakthrough innovation.

4.1.5 MYCORENA

Mycorena is a biotechnology company and a producer of fungi-based alternative protein for the food industry, at a lower cost of sustainability. The company was founded in 2017 in Gothenburg, at the time focusing on developing a protein product as fish feed for aquaculture, but which came to evolve into production of food for human consumption,

resulting in a strategic shift of business in 2019. Mycorena produces a protein, a filamentous fungi called mycoprotein, that serves as an alternative to pea or soy protein for example, but also to animal protein in various food products. The food industry in particular has been subject to discussions about sustainability transitions. Mycoprotein offers a high protein and vegan source with no sugar, high fiber and multiple vitamins, making it a healthy and high-quality option to consumption of animal protein. Being produced in a closed system, the production process is independent of geographic location and climate conditions, hence it requires less use of land, water and electricity than other options on the market, having a smaller environmental impact.

The way of producing food is both new and unique, although fermentation as a technique has been used for other purposes previously, such as for cheese or tempeh. The major competitor of Mycorena is the British company Quorn who have held a monopoly position in the market protected by patents, and whose products can be found in Swedish grocery stores. Mycorena, being a Swedish actor in the market, has chosen to locate their production plant in Sweden, as a local alternative, but also to have their products vegan as compared to Quorn. Globally, many new actors like Mycorena are entering the market, but this company is a fast mover, being relatively unique in Europe and Scandinavia. The circumstances have the innovation being considered a breakthrough innovation to the industry.

4.1.6 NORBAN

Norban was founded in 2019 in Malmö, located in the south of Sweden, with the purpose of transforming the real estate industry. The idea is to do this by offering a platform and service that improves the full experience of buying or selling a house or residence, addressing all pains of different actors involved in the process, including the real estate agents. The offer of the company is a combined marketplace and transaction service, served through a platform. Norban has created a business model that allows the seller to post the residence on an online marketplace when comfortable and before contacting an agent as well as to sell given one's own set of terms at a fixed agent fee without any stress or pressure. Moreover, the seller has an opportunity to sell at a pre-market, the marketplace of Norban. When selling at pre-market, the fixed agent fee is paid by the buyer. This is because the buyer explores residences otherwise not available. In addition, the platform allows the seller to follow the process thoroughly through every step of the way, as well as to keep in contact with the real estate agent. From the perspective of the agent, Norban offers fixed salaries and other benefits of paid vacation, pension etc., reducing stress and increasing the likelihood of extending employment with the company. Commission-based salary/compensation is not a motivating factor for every agent. This business model allows for both buyers, sellers and agents to feel more comfortable, eased and safe.

The subject of innovation within Norban is the business model and the service process combined with tech development, in an industry that previously has not been as digitized. The concept of pre-market selling is not unique, and there are other digital platforms. What is unique to Norban however, is them owning the transaction throughout, end to end. Norban is responsible for acquiring customers, converting customers, keeping them all to the end. To do this, the company has developed back-end systems, customer relationship management systems and how the employees work, but also front-end systems such as webpage, web

application and phone application. This composition of a business model addresses pains and gains of various actors involved in the business of the company. The full combination of a solution is, to the knowledge of Norban, unique in Sweden but also globally. This has the innovation being considered a breakthrough innovation.

4.1.7 SPROUD

Sproud is a plant-based food producer founded in 2018 in Malmö with a purpose of providing “better” and more sustainable food alternatives. Currently the company offers dairy-free milk alternatives that are based on protein from yellow split peas, however the vision of the company is to be a plant-based lifestyle brand that makes climate-friendly vegan products to make the world a better place. The main product being the pea is one of the most sustainable to culture. It requires less water than producing almonds and less land than producing oat. Furthermore, it is a crop that is used in crop rotation to fix hydrogen in the soil so that fertilizers can be avoided growing other crops and plants. It is high in fiber, protein and vitamins, and low in sugar and fat, making it a nutritious crop to develop food alternatives of. Overall, there is an inherent belief of Sproud to make use of locally grown crops and to produce locally to reduce the climate footprint. The peas used in the production are cultivated in France and in Canada, and further processed in Sweden and Canada, making transportation short. Future plans involve a use of peas that are cultivated in Sweden as well, reducing the footprint even further.

Globally, there are few competitors to Sproud, mainly one in the United States and one in England. Otherwise, Sproud holds the largest market share globally, making their pea-based product innovation unique but especially new to the Swedish market. Even four years later, no other producer has come to offer products with the same plant-based product. This has the innovation being considered a breakthrough in nature.

4.2 RESPONSIBLE INNOVATION

4.2.1 THE DEBATE OF INNOVATION

During the expert interviews, it was emphasized by E1 that there is an ongoing debate about innovation and its effects on society. She describes it as an interesting debate that has grown in interest lately amongst certain actors of society; policymakers, researchers and university students included. Most usually the positive effects of innovation are enhanced somewhat neglecting that it could cause negative consequences. According to E1, there are dark sides to it that need to be considered and brought to light as well, partly for policy and regulation purposes. According to E2, the general role of innovation in society is to solve identified problems and challenges through practically implemented inventions. However, that innovation process in itself involves experimentation as well as trial and error, making not only innovation as a phenomenon but also the debate increasingly bisectional (E1). E1 says that:

“Somehow that is always innovation, you must fail in order to succeed. That is the foundation of entrepreneurship and innovation” – E1

To create and bring forward new knowledge and new solutions, existing boundaries must be tested. Sometimes that testing will go wrong, possibly having negative effects on the external environment, but the wrongdoing cannot be too extensive. Although, “*who will determine what is wrong or right in this*”, E1 asks? And “*who will decide whether an innovation is good or not*”, E2 adds? E1 says that “*I think it is important to ask these questions. [...] It is a necessary and important debate.*”

In one way, society is regulated to avoid negative consequences, but sometimes the consequence of an innovation is not what was originally intended. “Ghost telephones”, for instance, are encrypted phones that could be considered good for GDPR reasons, but the phones have come to play a major role in communication of criminals (E1). At other times, negative consequences could be temporary as society undergoes larger transitions, such as with the current transition to electrification. The development and debate of electric vehicles and their batteries was the main topic of discussion. Transitions like this take time, and the kind of batteries used today will probably be just a temporary solution, transitioning into something more sustainable in the future, “*because by then, I believe that we will find ways to generate energy that is extremely efficient*”, E2 says. Given that there is still time to address grand societal challenges, he is confident that solutions will be found.

4.2.2 SUSTAINABILITY-FOCUSED INNOVATION

When discussing the business of each company with its respondent, five out of seven companies have been in business for no more than five years. Six out of seven companies have been in business for no more than six years. Seven out of seven companies in this study have an innovation that is focused on issues related to sustainability and ethics. Both Cellink and Mycorena, for instance, express that it is foundational to their business ideas and operations. Liquid Wind states that they “*have entered this business because it is sustainable from an environmental point of view*”, offering liquid fuel produced with renewable materials and energy sources. The environmental focus is shared with other companies such as H2 Green Steel, Mycorena and Sproud, who all aspire to change their industries by offering alternative products that have been produced in a more sustainable way. These production processes make use of techniques and technologies that, in comparison with conventional processes, reduces CO2 emissions (H2 Green Steel), and requires less water as well as less land (Mycorena; Sproud). Another aspect of environmental sustainability considered in the businesses involves exploitation of local opportunities. Mycorena, H2 Green Steel and Liquid Wind are currently investing in building production plants in Sweden. HVR is investing in building facilities in India and Egypt, two areas of need for pure water. According to Sproud, products should not only be produced locally, but also be developed from locally accessible goods and materials. They strongly believe that “*every country has its own specific crop of which one should try to develop new products*”.

Besides offering more environmentally sustainable alternatives to the market, the food producing companies value social sustainability in terms of producing healthy and nutritious products (Mycorena; Sproud). Another company whose innovation is focused on social innovation is Cellink. By making bioprinting affordable, its availability increases, which in turn enables better opportunities to address current issues in the healthcare industry. Like Cellink, the technology developed by HVR for water purification allows for safe drinking water to be

accessible for poor and lower-income people of the world. HVR states that *“this company was founded because there is a societal issue”*. Joining Cellink and HVR in social sustainability as well as ethics are Norban. According to them, their business model addresses issues of stress in an industry of low trust levels. The stress relief does not only concern the buyer or seller of a residence, but also the real estate agent, creating value for all actors involved.

4.2.3 ANTICIPATION

With regards to the reflection concerning potential positive and negative outcomes of their innovations, the majority of the case companies answered that they feel that it is their responsibility to consider all potential factors which would in some way contribute to increased value for society or potential negative impacts. For instance, H2 Green Steel mentioned that they both have a social and environmental responsibility in the process of establishment. They reflected upon potential negative impacts and positive aspects with their facilitation and building processes of their first steel production facility, however argued that the potential gain of such establishment is greater than the potential negative impact.

“If looking at the bigger picture we see that we will have a positive effect on our surroundings, however, work meticulously with how the surroundings will be affected, both socially and environmentally” - H2 Green Steel

Every company has a focus on producing more sustainable offers than their competitors and therefore emphasizes the importance of transparency. However, the companies in general have not identified any potential negative impact of their products, due to having a sustainable focus to begin with. Another honorable mention is the importance that their view is also transferred to partners in order to produce as much value as possible. Liquid Wind for instance mentioned that *“We need to work throughout the complete value chain. If you have a product which has different components, then you need to look at the impact of each part of the end product”*. Liquid Wind also states that it is essentially impossible to control every stage and each specific impact, but needs to contribute where such is possible. Sproud also highlights the importance to ally with partners which have similar mindsets as oneself, this in order to truly produce sustainable products for a sustainable future. Cellink states the importance to early produce prototypes or concepts to evaluate the functionality. The reflection however is more focused on the fact if the products fulfill the needs of the customers.

“Our thought process concerns more continuous reflection if our products meet the needs in the market [...] we seldom think in terms of if our products have a negative impact on society, due to our business idea regards making products which have a positive impact on society” - Cellink

In a similar manner the reflection of Norban mostly concerns if there could be any potential negative impact for their customers or their workforce, thus reflection in regards to more moral and ethical aspects. HVR however does not intentionally reflect on potential negative impacts, however mentions that there is always some uncertainty in regards to one's impact, although have not yet stumbled upon any negative effects. HVR also mentions that if there would be any negative outcomes, then it would also have an impact on the commercial

activities of the business and thus shows the importance to carry out some sort of scenario planning. Mycorena, does however thoroughly considers what potential positive or negative impacts their product might entail, although agrees with the other subjects of the study that their product provides an opportunity to consume more sustainable products, in their case both in terms of beneficial health aspects as well as for environmental reasons; *“...if sustainable development is of priority, then we need to develop more healthy options”* (Mycorena).

4.2.4 REFLEXIVITY

The main business ideas of all companies in this study concerns presenting solutions to society which to some extent contributes to the greater good or provides a better alternative than what is already in the market. Thus, acts upon a need in society in order to contribute to the creation of a better future. As stated by HVR *“Our company was founded due to a pressing societal need [...] we saw big commercial potential”*. HVR also claims that even if they do not become profitable in the end, they still have the intentions to increase the quality of life for those in need. They could have chosen the subsidized way of business, but went with the commercial one. Norban, Cellink, H2 Green Steel and Liquid Wind mention that it is the consumers' needs that are the greatest driving force in what they do. Although, in Liquid Wind and H2 Green Steels case, it is not only their particular customers who are important stakeholders, but also their customers' consumers in a second stage; *“...our future potential customers, are in turn driven by their consumers...”* (H2 Green Steel). In addition, Mycorena also stresses the fact that without the consumers one cannot continue with their business. There are however other stakeholders that are presented throughout the data, for instance the shareholders. The companies however seldom act upon the shareholders' needs; their implications come more secondary, meaning that if the customers' needs are satisfied, then the shareholders will gain most. *“...they will be satisfied as a result of fulfilling the needs of our customers”* (Norban). Liquid Wind and HVR for instance states that their shareholders are risk takers who see the potential in their ideas and their wants and needs will therefore become evident if one satisfies the customers. *“...the customers are considered on the firsthand. This is due to having owners who are willing to take risks because they see the future potential”* (Liquid Wind). Cellink however, talked more of a balance in regard to acting upon the interest of internal actors, such as shareholders and more external counterparts such as consumers or partners.

“If we neglect their interest, we cannot produce good products and without good products then our stock value will not increase” - Cellink

Sproud however claims that things always become more complicated when working with investors since they are prone to make statements. Although, their investors are often compliant, letting the founders do their thing. In addition, Mycorena also states that the investors are important since they are not yet making profits and relies upon those investments up until this point. However, as previously mentioned the business will not become profitable without potential customers and is therefore one crucial stakeholder. H2 Green Steel stresses the importance of perceptive owners with similar sustainable mindset who are willing to take risks in order to make sustainable change. As mentioned by Norban,

in order to become profitable and to earn money for the owners, one needs to create value for others, hence appropriate values in the marketplace.

4.2.5 INCLUSION

The inclusion dimension of responsible innovation appeared in general to be one crucial factor for the majority of companies in the study. Most subjects mentioned that potential and existing consumers had been involved in the innovation process from the start in order to gain as much insights as possible to produce products which fulfill their wants and needs (Norban; Cellink; H2 Green Steel; Mycorena).

“...we have different projects where we let our customers have a great influence on the overall picture of requirements for the development of our products [...] from a very early stage in the process”- Cellink

In a similar manner H2 Green Steel presents themselves as very customer oriented and stresses the importance of listening to the customers in regard to essential characteristics and functions in order for their steel to fulfill their requirements. In the case of Mycorena, the inclusion process surrounds letting potential customers get familiar with their product, due to being completely new to the market. So potential customers are involved from an early stage to evaluate the product and its functionality. They also send out samples and gain feedback in return to develop their product. For Norban inclusion has occurred both intentionally and unintentionally. Since they provide a service, they work very closely to their customers and receive lots of feedback on a daily basis. Such feedback runs through the business into further development of their offer. They also measure all activity on their platforms to gain more insights and data, which is generated by their customers. *“Our complete support team and our realtors have the responsibility to forward all feedback from customers to our development and technology team...”* (Norban). Sproud frequently uses their social media channels as one way to communicate with their consumers. They have for instance used their platforms for customers to vote for which product to develop next.

However, it is not just potential consumers that are included in the innovation processes. *H2 Green Steel* mentions that the suppliers also are very important for their innovation process and are therefore involved in the innovation process through collaboration, *“our suppliers need to deliver in accordance with our sustainability profile, which means that great parts of the innovation process is in collaboration with...”* (H2 Green Steel). In the case of Liquid Wind, their collaborative partners have been very important for the innovation process such as Siemens, Topsoe and Carbon Clean, which presents crucial parts for their electro methanol facility. In the case of HVR, their inclusion process does not entail the same characteristics as many of the other companies. Mainly due to developing products to geographically distant and unprivileged consumers, hence harder to target, as well as producing a product which one could argue is of necessity for every living organism. They have mainly worked with actors such as KTH and Chalmers, where they have gained a foundation in their development process. In addition, Mycorena and H2 Green Steel state that they work closely with governmental actors such as the municipality of Boden in the case of H2 Green Steel and state agencies as well as state control organs.

4.2.6 RESPONSIVENESS

Most companies in this study argue that they have agile procedures and that they continuously innovate in order to co-evolve with their surroundings. Since the majority of subjects are quite small in size and relatively new in the market, it to some extent creates an environment where one is able to make quick turns when needed based on changing circumstances. The respondent from H2 Green Steel for instance stated that it is of advantage to be a new actor in the market and that one is able to make quicker decisions, relative to larger more hierarchical organizations. Sproud presents a similar view where our respondent mentioned that there are no specific steps to go through when making decisions, where certain people in the organization need to be on board, and thus one can move forward at a faster pace. Sproud also argues to be one of the quicker actors in the food industry where they are able to launch a new product in approximately three months from initial idea. They have also built close relations with their suppliers and partners which enables them to move quicker than many other companies. On the contrary, HVR states that it is a difficult question to answer if they work agile, however to some extent at least work iteratively due to continuously evaluating and correcting mistakes in the innovation process.

Moreover, Norban argues that they can work agile due to having individuals within the organization who have a background in agile development and their technology developers work in sprints and they also own all their technology themselves which enables them to make fast changes in accordance with a fast-changing and dynamic environment. Mycorena has a large focus on cooperating with other actors in the market and stresses the importance to be a part of the ecosystem in order to co-evolve in the dynamic setting that organizations face today:

“...one cannot isolate oneself from others and fully believe that one will reach the organizational goals within a certain timeframe, it is required to cooperate with others to reach goals” - Mycorena

Liquid Wind presents a similar view and argues that it is crucial to be active on the market together with the big players. Cellink works both agile and iterative, using two different types of development processes which are a more traditional new product development- process and an ideation- framework, similar to design-thinking, presenting early prototypes and concepts for evaluation. In addition, they work iterative due to the innovation process being continuous.

“It is agile due to continuously working with our priorities and we are prepared short term to make new priorities in the innovation process in order to meet new circumstances [...] and it is iterative since it is a persistent process”. - Cellink

4.2.7 SENSE OF RESPONSIBILITY

A risk in managing a business is, according to HVR, that mistakes occur throughout the process. Innovation is a process of trial and error, involving experimentation in terms of testing various alternatives, trying out technology as well as market needs (E1). In terms of responsibility for consequences caused by the innovation process, all case companies agree that one is responsible for outcomes caused by one's own actions. As Cellink expresses it:

“... all companies operate in some kind of environment, and all companies are part of society. [...] each company is also responsible for what they do and how they do it” - Cellink

The question is whether there is a legal responsibility or if feelings of guilt arise as consequence to a decision made primarily of a commercial interest (Norban).

“You could do things that are illegal, and for those you are fully responsible. You are also responsible for optimizing decisions that, from a sustainability perspective, might not be optimal. However, that responsibility is just a construction of what you consider important” - Norban

Besides fundamental business ideas that considers issues of sustainability and ethics, the case companies incorporate it into all parts of their organization (Cellink; H2 Green Steel; Mycorena; Sproud). As a niched company offering green alternatives, you face, according to Sproud, higher expectations regarding your work and organization being sustainable. H2 Green Steel describes how they investigate and evaluate both social and environmental consequences of their business as building a large production plant affects the surrounding municipality but also causes some emissions. At Cellink, the company has developed a 4R model of sustainability; reduce, reuse, repair and recycle. To produce and develop products of less material, with reusable components, possible to repair, and able to recycle. They consider it important to deliver high quality products while simultaneously reducing their climate footprint in relation to industry benchmarks. In taking responsibility, a company should work on impacting all parts of the value chain of which it can reach (Liquid Wind). Some companies explicitly enhanced careful selection of, and consequently, requirements on suppliers and partners in terms of sustainability and ethics (H2 Green Steel; Mycorena; Sproud). Sproud, for example, performs an audit on all new suppliers to the company, and has a code of conduct that applies for all their partners. Furthermore, they make risk assessments for all partners, may it be other companies for a joint project or influencers for marketing purposes, as this could potentially hurt the brand. Mycorena on the other hand have certification requirements of which suppliers need to have a vegan production and where 75 percent of the product must be produced in Sweden. However, the companies themselves are considerate of who they work with.

“...it is essential for us to keep in close contact with our suppliers. We are a small company, and we want to find companies who want to join us on our journey” - Mycorena

Being a software or service provider, Norban explains that their responsibility is relatively different from that of a producing company, and that there are other types of questions and areas of sustainability and ethics that arise. Although they could establish policies regarding cars or means for transportation to a residence showing, they operate in an industry where people make big life decisions and experience high levels of stress. A few of the case companies explain that many employees in the organization work with them because of their sense of responsibility and aspiration to make a difference for the industry, and or the world (Cellink; H2 Green Steel). At H2 Green Steel, values of sustainability are an important part of the recruitment process. The respondent explains that these values are shared with top

management and that these interests work their way from the top of the organization all the way down. It has become part of the corporate culture.

“It is something that I notice clearly from the top. Everyone is very genuine in their willingness to make a difference. It is refreshing and I think that is what is needed for this kind of project [transforming the steel production process, eds. note]” - H2 Green Steel

When these matters are valued and worked with at the very top of the organization, it will be easier to focus activities to make a valuable change in the industry. Hence, it is considered important, as an organization, to reflect upon the positioning of sustainability work. A placement on lower or middle levels of the organization could make driving change more difficult. In terms of that, it could be considered a benefit to be a start-up company, as an established incumbent more easily could have conflicting interests throughout the levels (H2 Green Steel). The same feelings are shared between HVR and their shareholders. Most investors are patient towards a financial payback because of the purpose of the company.

4.2.8 BALANCE OF SUSTAINABILITY AND PROFITABILITY

Despite the degree of sustainability and ethics in a business, there is a fundamental goal in each profit-making organization to create profitability and to increase value for shareholders (E2). From the perspective of the case companies, there is always a balance between the two objectives (Cellink; Liquid Wind; Mycorena). According to HVR, there are many companies who engage in greenwashing, who make use of sustainability to polish the picture of their company. Contrary to those, the companies of this study were founded with a sustainable and/or ethical purpose (see also Section 4.2.2). Cellink, for example, expresses that *“we exist because we want to do great things for medical research”*. *“...to most companies that [sustainability authors’ note] is secondary”* (HVR). However, profitability is considered important for continuation of the business (HVR; Liquid Wind; Mycorena), as it otherwise is a limiting factor for development of new projects (Mycorena). Cellink describes how business interests are always carefully evaluated. The financial interest of shareholders needs to be considered because these investors are crucial for the existence of the whole company. To H2 Green Steel, the economic perspective is important for them in order to make a product that is competitive in the market. To do so, their operations need to be focused on securing revenues and lowering costs. It is emphasized though, that a profit-making business is a business that can continue the sustainability work of the industry, driving change (HVR; Liquid Wind; Norban; Sproud). *“Hopefully we will become big enough so that we can make an even bigger difference in society”* (Sproud). Liquid Wind agrees, implying that *“we cannot be sustainable if we do not make money in the end”*. A company can pursue profitable projects and initiatives while having a focus on sustainability and ethics (Cellink). Norban believes that a profitable business is a business who has happy employees and who can provide a pleasing service to customers. The respondent from H2 Green Steel personally believes that values such as sustainability and profits are increasingly compatible to be combined. That the sustainable way eventually will be the most profitable.

From an expert perspective, E1 emphasizes that companies, being part of a capitalistic society, have a role that involves running a profitable operation so that people in an economy

can be employed and earn money through salaries. For the companies themselves, capital is needed, either in terms of profits or attaining investments, despite their entrepreneurship being sustainable, in order to keep pursuing their business. The financial aspect can be a challenge for organizations, and that challenge will persist (E1). To HVR, money and financial assets have been the greatest limiting factor. They consider it a key reason why many innovative ideas never commercialize. From a philosophical perspective, E2 explains that everything that occurs, does so by coincidence. If companies can operate in an environment that allows for many ideas and suggestions to come forward, then some will survive and some will not, for a thousand number of reasons, *“that is part of life”*.

Furthermore, E2 describes the concept of money as a “smart” way to make large groups of people cooperate. Having experiences from working in both small and large companies in the private sector as well as in a publicly financed organization, hence both with and without profit-making requirements, he finds significant differences regarding efficiency and operations of the organization. With goals relating to profitability, every employee knows about opportunities of presenting ideas. What determines a course of action is a mutual agreement about prioritization of the organization. That is not the case in a publicly financed organization.

4.2.9 USEFULNESS OF THE FRAMEWORK

Nowadays, there are many different things that a business or an entrepreneur needs to focus on in their operations. Sustainability and ethics are two of those things. It is either incorporated into one’s innovation, being the reason for its creation, or the company needs to address it through other CSR related work. It is not surprising that companies do not know about the framework for responsible innovation (E2). On a spectrum of individualism and collectivism, responsible research and innovation, according to E2, assumes fundamental values of human rights, while allowing individuals a freedom to be and act as wanted. Even if individuals increasingly agree on a collective responsibility, a discussion will however remain in terms of the meaning of being responsible in such a setting. Although the framework of responsible innovation has provided a means for discussion about responsibility in relation to innovation work, E1 sees some issues with the definitions of each dimension. For instance, when reflecting on underlying purposes, potential impact, what is known and not known; there is a concern with who would determine what is known or unknown?

“I think it provides a framework for discussion, but it is another thing if it solves the problem” - E1

She continues to explain that subjectivity will impact the choices made through the four dimensions. That there will be different perceptions of different stakeholders of the situation, and that perception will depend on previous experiences and different interpretations. It will be difficult to measure what is responsible and what is not. The discussion is however considered both important and needed, but the framework could be hard to grasp sometimes in a sense that it sounds very good, but how should it be used and applied in businesses?

4.3 CORPORATE GOVERNANCE OF INNOVATION

4.3.1 INNOVATION GOVERNANCE

The companies of this study use some different methods to bring innovative ideas forward and to facilitate such ideas. As previously mentioned, Cellink works through two different methods one which is a more traditional formal new product development process and one which one can argue to be more modern, an ideation framework. Which is basically focused on bringing forward both small and big ideas within the walls of our own organization, thus building upon the capabilities already existing within the organization. The framework is currently in progress and is built upon how to take an idea to a complete concept. Making early prototypes and concepts to validate and verify functions in order to create thought-out products or services.

"...a model where we create early prototypes and concepts to evaluate functions, to make sure that the functions perform correctly in accordance with our expectations. Meaning having extensive processes to control what we develop, to validate and verify functions" - Cellink

Mycorena has a very similar model for innovation where they start with an idea and create small projects surrounding that idea to validate the potential, and thereafter set up longer projects for further evaluation and build concepts. The technical team then needs to pitch the idea to the commercial team in regard to the idea's potential, who then decides the next step. Norban works similarly however, since being a service company their process is more based on insights created through the innovation process. They call their development process "*what needs to be true*", which focuses on what assumptions need to be true for our model to be successful. It is closely related to frameworks such as design thinking and lean start up and focuses on minimizing the risks in their assumptions; "*The framework is about creating as extensive and perfect information as possible before making a decision*" (Norban).

The innovation process of Sproud was basically a trial-and-error process to begin with, where the initial idea was to create a high-protein milkshake. After the first successful experiment after many faces of error, it took even two more attempts before landing on the product they then launched, which in the end became a pea protein milk. Meaning that the initial idea developed into something which was never planned to begin with; "*We never planned for launching a milk to begin with.*" (Sproud). In terms of H2 Green Steel and Liquid Wind innovation process one can argue that they carried a similar approach as they base their idea and development process on already established and proven processes, however focus on how to make the production more sustainable and at a larger scale than what is currently in the market. Hence, producing greener options than what is already in the market based on procedures that are proven effective.

4.3.2 RISK GOVERNANCE

Something the companies have in common is that risk management practices is a substantial process within their organizations. Norban for instance argues that "*No innovation is allowed to occur without minimizing the risk in the process of creating something new*". Mycorena has

a similar view and says that they always produce different risk assessments where one identifies potential risks and how to mitigate such risks. They build a matrix to look at the different risks in order to categorize and to identify the main concerns in the different processes. However, argues that different risks might require different measurements and management methods. Cellink uses similar methods to evaluate risks and try to methodically chart their risks and calculate the probability of occurrence. When risks are identified then they make estimates of the risks value and thereafter find solutions to mitigate the risks.

“We try to methodically map out our risks, and evaluate the probability of occurrence and what potential effects such risks might generate”- Cellink

Liquid Wind argues that risk assessment is a continuous process where one tries to build and develop as perfect knowledge as possible in order to lay a good foundation for success. In a similar manner, Norban argues that through the creation of insights and knowledge one creates a good foundation in order to mitigate risks in the development. Furthermore, one can use those assumptions in order to build trust and confidence, in regard to the business idea, towards investors and other important actors of the ecosystem. Building insights to mitigate risks is a continuous process for Norban as well, when developing their offer. On the contrary, Sproud argues that it is important to take risky decisions in order to gain the most.

“For us, being innovative is not associated with taking risks, quite the opposite, it is a bigger risk if we do nothing because then we risk not getting noticed” - Sproud

H2 Green Steel argues that the most effective way to mitigate risks is to create different scenarios of potential outcomes. Such efforts are an ongoing process where one creates different scenarios in order to be prepared to handle any outcome in the best way possible. However, states that one is not able to prepare for any risk especially if unexpected, although mentions that substantial risk assessment facilitates the best possible tools and capabilities to tackle most risks.

“Risk assessment is an ongoing process, and an efficient way is to plan for certain risks given different scenarios [...] if one has a solid process of risk assessment then one has potentially prepared for most risks” – H2 Green Steel

4.4 SOCIETAL GOVERNANCE OF INNOVATION

4.4.1 EXISTING POLICIES AND REGULATIONS

In regard to currently existing policies and regulations that the companies need to take into account in their businesses, appears more industry specific in its nature. There exists ISO standards which E2, the expert from RISE mentions, such as the ISO 56002 which regards Innovation Management practices. E1 however argues that Sweden is generally quite heavily regulated compared to other countries, especially some industries. She argues that one of the reasons for having more regulations is to some extent to avoid negative consequences. Moreover, the majority of existing regulations are industry specific.

Looking at the different regulatory frameworks which the companies need to adhere to, it is quite diverse in nature, due to serving different industries and contexts. Sproud and Mycorena for instance are affected by regulations and standards provided by The Swedish Food Agency, thus Swedish food standards. There are also global food certifications which Mycorena strives to implement, such as FSCC 22000. They are also “V-label” and “Från Sverige”-certified, which entails high expectations and demands on suppliers, as well as the requirement to produce products where at least 75 percent of the ingredients are of national descent. Sproud is also fairtrade certified and indeed needs to live up to such standards. Liquid Wind and H2 Green Steel face similar requirements, especially connected to emission licenses, however both companies strive towards zero- emission operations. Liquid Wind is also governed by IMO, an UN-organization which decides what rules to follow etc. Another framework which they are controlled by is Fit for 55, which is a framework developed by the EU, however still in progress.

Norban argues that they are only controlled by real estate laws, due to providing realtor services. Cellink on the other hand mostly needs to consider different ISO standards, such as ISO 9000 and 13485, however no specific regulations related to their products. Although, argues that if looking a few years forward such circumstances will most likely change; *“Within 3-5 years, there will most likely appear regulatory frameworks concerning our products, however, does specifically not exist today”* (Cellink). As for HVR they are not controlled by any specific framework and only have one policy which is to make pure water.

4.4.2 GOVERNANCE OF REGULATIONS AND POLICIES

There are some different views presented by the subjects in regard to how to govern regulation and policies. Liquid Wind argues that it is best to let the politicians to regulate and for companies to follow and stated that it is *“Better to make efficient law, than for companies to engage in greenwashing”*. Another way rather than hard sets of regulations, in order to steer innovation, mentioned by E1 is to create mission-oriented policies, where reaching certain goals is of focus. She however argues such measures to be difficult for politicians to manage on their own and there is a need to broaden such approach. Another statement also presented by E1 is concerning the ongoing debate regarding how much power companies or the state or other actors of the ecosystem should have when it comes to policy making, which has changed over time. In her opinion there is no right or wrong, however there needs to be a balance and that all parties to some extent agree upon the terms. Another point of view which is held by both E2 and E1 is in regard to if one should regulate innovation or not. E1 mentions the difficulties to regulate innovation due to innovation being an ongoing process where circumstances change over time. It is easier to create regulations when an innovation has reached complete maturity. Some industries are more heavily regulated than others which at times limits the development of such industries. Heavy regulations are especially related to when innovation is concerned with negative outcomes. There are also cases where actors disregard regulations (E1), which is an area E1 has investigated further, more specifically the Macchiarini case. Hence, it questions the effectiveness of regulations. An active system of regulation is required to ensure compliance and impose consequences if needed. Sproud argues that there are different degrees of maturity in regard to innovation practices and states that it is better to not intervene and let nature run its course.

A frequent discussion especially presented by both experts is how behavior related to innovation should be governed. When regulations are required, it is often concerned with top-down management, from governments or other authorities. In relation to this, there is also a discussion about who should be involved in formulating the regulations (E1). E1 argues that knowledge is of essence and therefore experts should be involved in the governance process to facilitate a well-established decision. Another point of view in regard to governance, predominantly presented by E2, enhances a balance of individualism and collectivism. He emphasizes the importance of collectivism, to let societal stakeholders continuously discuss the terms of decision making. It might not be efficient to let specific actors within the ecosystem make decisions themselves in regard to what is considered responsible, due to self-interests. Still, it is important for all individual actors to express their opinion in the matter and to act autonomous (E2). The collective agreement process however is not a simple one, although usually successful (E1). E2 argues that society can create an effective process of decision, where actors together develop guidelines surrounding the direction of development.

“I believe that most actors and individuals will agree upon the collective decisions, it is stronger than just one individual” - E2

4.4.3 RESPONSIBILITY IN THE INNOVATION SYSTEM

When discussing the question of responsibility throughout the interviews, it was pointed out that society consists of other actors but companies in the innovation system. Actors all of which have different roles of responsibility towards sustainability, ethics and harm to the environment or others (Cellink; H2 Green Steel; HVR; Liquid Wind; Mycorena; Norban; Sproud; E1; E2). In terms of possible negative consequences caused by the innovation process, companies are considered responsible for their own outcomes (Cellink; Mycorena; Norban; E1), being a part of larger society and environment (Cellink). Mycorena considers them to have a great responsibility in living up to what is communicated externally. According to Norban, any company who has the opportunity to make conscious choices should make choices for the better. It is noticed however that a company makes “*a thousand decisions everyday*” (Norban), and a share of those is difficult to make due to imperfect information or limited time for commitment. Although “*you bear the responsibility for everything you do and have the possibility to impact*” (Norban). According to E1, it is difficult to say whether companies in general take enough action to avoid negative consequences of their innovations. There are companies that external contemplators perceive as responsible, but who turn out to make payments to a corrupt officer.

In terms of responsibility to address current and existing societal challenges, the respondent from H2 Green Steel argues that companies have an important role in addressing these kinds of issues. Emissions are presented as an example of which companies are the greatest contributor, why there is a responsibility to address the caused problem (H2 Green Steel). HVR explains that they are founded because there is a societal issue. All companies of the study share this purpose (see Section 4.2.2 and 4.2.7) To many other companies this responsibility is secondary to making profit, making use of it as greenwashing their business. E2, the expert, explains that the overarching role of innovation in society is to address identified issues, and companies are one major actor in innovation. The respondent of

Mycorena argues however that a real transition in sustainability requires change in consumer behavior. In the end, they are the users of products and services provided by companies. The responsibility of companies then, is expressed as making sustainable and better choices available for the consumers to choose instead. Demands concerning companies' responsibility are although important to establish from an EU and governmental level (Mycorena). E1 adds however that there is, at times, a discrepancy in what consumers say and what they do. According to the respondent of Liquid Wind, a company should stick to following current policies and regulations. To have politicians decide what should be done so companies can act thereafter. HVR questions whether companies or governmental organizations should address humanitarian needs as their experience is low interest from, for instance the United Nations. E1 explains that it is, and will continue to be, an ongoing debate about who should bear the greatest responsibility in society, how much should be placed on companies or the government respectively. There is a continuous balance over time. In one way, it is a collective responsibility, in another way, the answer to the question of responsibility varies over time. Regulations are set when needed. At other times there is a mutual agreement between these actors in the system (E1). To not have companies sub-optimizing their business, E2 believes that jointly agreed upon visions for innovation and society can be guiding in operational decisions.

4.4.4 STIMULATING INNOVATION

A common theme which was highlighted during the interviews, especially when being a new player in the market, was the importance of financing and investors. HVR for instance argued that their main concern during the years was receiving enough funding in order to reach the stage of commercialization. HVR also stated that many great ideas unfortunately do not survive due to not attaining sufficient funding to continue with their business. Mycorena also emphasizes the importance of their investors in order for them to continue their business at this point in time, since they are not yet profitable. E2 however argues that it is a game of "survival of the fittest" and that Sweden has an extremely favorable environment to start businesses. Hence, argues that it is a part of life. *"Let 1000 flowers grow, we have an environment where many ideas are welcome, however only the best ones survive"* (E2). Liquid Wind has a similar view and mentions that one is allowed to start businesses in Sweden without putting their private lives in danger; *"Sweden has a favorable environment in that sense, because the company is allowed to go bankrupt without harming one's ability to still put food on the table"* (Liquid Wind).

Furthermore, looking at the other potential ways to finance there are other ways to gain funding than finding partners. The need for other ways to fund businesses has gained larger attention in the EU, where they have realized that enthusiasm is not enough to succeed, rather large amounts of capital. One initiative in the EU is Horizon, where HVR for instance has through this initiative gained funding towards evolving their business to reach one step further to commercialization. HVR argues Horizon to be a great opportunity where good ideas, which have not yet succeeded, have the potential to flourish. E1 similarly emphasizes the need to stimulate innovation and to direct funding towards new and emerging technologies, since it is essential for future development. HVR however argues that single angel investors or incubators are often deceiving since smaller amounts of money is often not sufficient in order to facilitate an idea; *"...it is deceiving, it is of course good to receive one*

million in order to start your business, but it does not work that way, it is not enough” - HVR. In addition, HVR claims that many innovative companies in Sweden unfortunately go bankrupt due to believing too much in angel investors. Liquid Wind however argues that angel investors can be one great potential source of financing, in addition to family members, the national authorities, where Vinnova and the Swedish energy agency are two sources of funding for Liquid Wind. H2 Green Steel also claims different funding possibilities through both Swedish and EU funds to be great potential sources of capital for their project, since many funds are applicable for their kind of business idea. Another actor in the Swedish innovation system which aims to help innovating firms through the process towards commercialization is RISE research institute. Where E2 claims their role to be somewhere between 5-8 and 6-9 on the TRL scale (Technology Readiness Level).

“Our entire mission is to help innovators to industrialize and commercialize their innovations to well-functioning products” - E2

4.4.5 EXTERNAL PRESSURE FOR CHANGE

Many of the studied organizations claim that there is a shift in the market, where there is an increased consumer demand for more sustainable alternatives. Mycorena for instance states that consumers today are more well educated in regard to what is considered sustainable and not. In addition, consumers have gained a deeper understanding in regard to different nutritious components, which means that many consumers have increased demands on their food supplies, where there is also an increased demand on local produce. Mycorena and H2 Green Steel also claim that the consumers possess great power and are one main driving forces towards more sustainable alternatives. Similar view is emphasized by Liquid Wind, where they argue that the consumers are poised to pay more for a greener alternative, even if it is more expensive than the fossil alternatives in the market. A nuanced view is however emphasized by E1, where she states that consumers have historically claimed that they want more sustainable alternatives but, in the end, might not be prepared to pay more for such products; *“There is a discrepancy between what people claim they want and their actions”* (E1). Hence, consumers actions do not reassemble the pressure for change set by the consumers. H2 Green Steel, however, enhances a belief that society, in general, has reached a point of change, where social and environmental concerns have increased importance, yet still focuses on maximizing profitability however by being more sustainable.

“When such mentality permeates the market then companies feel pressured to adapt their businesses in accordance” - H2 Green Steel

H2 Green Steel also mentions that the EU is another main driving force for change in Europe, where more focus and capital is directed towards supporting more sustainable alternatives. In addition, Mycorena claims that it is crucial to encourage sustainability on a higher level in society, such as in the EU but also on a national level, through increased requirements on corporations concerning sustainable measures as well as to formulate crucial societal goals.

5 ANALYSIS

In this chapter, the empirical findings are analyzed and compared with the literature, following a similar structure as previous chapters. The innovation processes of the case companies are discussed in relation to the framework of responsible innovation. Moreover, discussions are made concerning corporate governance of innovation as well as societal governance of innovation.

5.1 RESPONSIBLE INNOVATION

In this section, analyses regarding the four dimensions of responsible innovation are separately presented. Following those are a more general analysis concerning responsibility and the innovation processes of the studied case companies.

5.1.1 ANTICIPATION

Even though the companies are not familiar with the framework of responsible innovation per definition, it stands clear that the dimensions are more or less expressed in the different cases. The dimension of anticipation however might not be as clearly distinguished, mainly due to having products or services which, from an initial standpoint, are sustainable in focus and aims to either provide a better alternative than presently existing in the market or a completely new offer. Although, one can argue that traditional risk governance practices are present in all companies to some extent, where one reflects upon potential negative aspects and aims to mitigate different potential risks of their innovations and its process. As stated by Stilgoe et al. (2013), it is important to base assumptions on the question 'what if?' and reflect upon both known and potentially unknown factors which can affect the outcome. Thus, anticipate mitigating the risks of new technological development. One aspect mentioned by Owen et al. (2012) considering methods to mitigate risks is scenario planning which one can argue is a method used by for instance H2 Green Steel as a practice of risk management. When analyzing the results, it shows that H2 Green Steel might be more evolved regarding evaluating potential risks than the majority of subjects and considers such factors throughout the process of establishment. Nevertheless, they argue that the potential risk is less than the potential gains of building a zero-emission steel production facility. Nonetheless, the risks of developing such a facility at a large scale might also entail more risks than the potential risks of the other subjects of this study, and thus requires a larger focus on mitigating risks. However, Liquid Wind is in a similar position to H2 Green Steel and risk assessment is considered crucial in their organization as well, although it does not appear to be equally as present in their innovation process.

Moreover, looking at Cellink they seldom reflect upon the potential negative impacts for such reasons that their business idea focuses on having a positive impact on society. Still, they continuously reflect upon if their products fit the requirements set in the market, and one can also argue that by having an idea that focuses on creating positive outcomes for society then negative aspects might indirectly be reflected upon. As mentioned by Owen et al. (2012)

anticipation is also closely connected to reflection of the main purpose, motives and goals, which one could claim are of main focus in every studied company of this thesis. This through developing solutions that focus on creating something better and more sustainable than what at that time currently existed in the market when the business idea blossomed or satisfying a need that was not covered by other actors in the ecosystem. One can argue that such measures are a common denominator of each company. Provision of a service such as in the case of Norban might not entail the same environmental risks as for a producing company, and thus focus more on ethical and moral aspects of their innovation. In addition, since they own their complete solution, it does not entail the same reflection throughout the complete value chain as in the case of for instance Sproud, H2 Green Steel, Mycorena and Liquid Wind, which have to consider their suppliers and other actors of the value chain impact as well.

5.1.2 REFLEXIVITY

One can argue that the dimension of reflexivity is crucial in order to be considered responsible, which Koops (2015) also highlights. It is essential to consider the perception of reality of others and incorporate such aspects into the innovation process. It enables corporations to grasp the fundamental configurations of society and to gain knowledge to deal with the complexity and uncertainty of societal challenges (Voegtlin et al., 2022). When looking at the different cases it is clear the underlying reason for initiating the companies is grounded in the idea to do good, which is argued as one of the main building blocks of responsible innovation as a whole (Voegtlin et al., 2022). The companies have in different ways gained a deeper understanding of certain challenges or phenomenon in society and provide solutions which are intended to tackle such challenges. HVR for instance, was founded due to a pressing need in society to enable provision of purified water for everyone. They are grounded in the moral policy that everyone should have access to clean water, which one can argue is essential for human survival. Even though their aim is to become profitable, they bare the intention to increase the quality of life for people in need, which one can argue is a foundation of reflexivity as a concept.

Many of the other cases of this study are very customer centric in their approach. They base their actions on customer preferences and needs and see their customers as the main driving force. As Norban argues, other stakeholders will be satisfied if the consumers' needs are cared for. Similarly, as stated by Mycorena and Cellink, in the end, without the customers, one is not able to increase profitability and increase market value, which indeed makes the shareholders happy. Hence, the needs of the shareholders are indirectly satisfied by appropriating value in the market. Still, some of the subjects who are not yet profitable, rely heavily on their investors and shareholders, and thus need to at least acknowledge their needs. Sproud however claims that investors can make business more complicated, however do work with investors which are compliant. Furthermore, even though all companies mainly consider customer values and relatively small challenges and thus might not be solving any grand societal challenges on their own, they still contribute with what they can to make the world better. HVR might be considered as more reflexive through their different projects, although they have not yet commercialized their main product. Hence, have not managed to diffuse their product, but the business ideas foundation is to do good by everyone in need. They might be considered as more reflexive due to the setting they intend to enter, where

people die from not having access to clean water, whereas the other focus on less pressing needs in society in comparison. Still, everyone intends to either make life easier for their customer or provide more sustainable and healthier products or contribute to lowering emissions or save lives, which are all reflexive actions.

5.1.3 INCLUSION

One can argue that the dimension of inclusion is well present in the majority of companies, where they are excessively determined to produce products or services which fulfills a need in the market that is yet not entirely covered for. Norban for instance includes their consumers to a great extent into their innovation process and are constantly improving their service based on insights created by their customers. As stated by Owen et al. (2012) to increase the engagement of important actors enables value appropriation, hence gaining important knowledge to truly fulfill the needs in society. It is argued a key characteristic of responsible innovation since legitimacy increases by involving the public and thus creates a shared responsibility between actors (Blok & Lemmens, 2015). One can argue that Norban might perform more closely in accordance with the inclusion criteria, and one potential reason for such is due to providing a service and hence having closer contact with customers than the other cases. Furthermore, the majority of subjects more or less involve important stakeholders into the process, such as Mycorena through letting potential customers get familiar with their product or such as Cellink which involves customers from an early stage of their development process to evaluate function. H2 Green Steel does similar in order to create a product which satisfies consumer requirements. One company which however stands out by not involving key individuals in which their product specifically targets, is HVR. One potential reason for such is due to their potential customers being geographically distant, as well as located in more rural areas of the world. Thus, it might be more difficult to incorporate them into the innovation process. Important to notify however is that their needs are still evaluated, since the product per se is developed due to seeing a fundamental need in society where people do not have access to clean water, which is argued essential for every human. They, however, involve other actors than their potential customers, such as universities or appliance companies to gain crucial insight in order to enable commercialization of their product. Nevertheless, if looking at how the dimension of inclusion is defined one can argue that the companies might not fully saturate the criteria, due to mainly including the close stakeholder interests and maybe not the perception as society as a whole. Although, since the innovations does not imply any obvious negative effects, one might not need to consider the entire population, rather just the ones who adopt the innovation.

5.1.4 RESPONSIVENESS

The last dimension of the framework, responsiveness, one can argue is a critical aspect for almost any company that operates in the dynamic environment of today. It was clear that most of the companies, especially since being one of the first actors in the market, valued being responsive highly, due to the importance of being up to date to truly appropriate value. As stated by Stilgoe et al. (2013) organizations must be agile and change direction if needed in order to cope with changed circumstances of the environment. As previously mentioned in the result, since they are quite small actors and work in an innovative environment one is

able to make quick changes if the market or customer needs evolve. For instance, as stated by H2 Green Steel and Sproud, due to having less hierarchical structure one is able to make quicker decisions based on having less steps to go through before initiating new ideas. Where Sproud also claims to be one of the fastest actors in their market. However, if looking at HVR they might not have the same agile approach, which potentially can be explained by the need they are addressing of providing solutions to purify water. A fundamental need that per se does not change overtime to the same extent as other needs and challenges in this case study.

In the case of Norban, it is claimed that they are able to work agile due to recruiting individuals with a background in more agile development practices. Having knowledge in regard to such practices is of course an advantage since one is able to use experience as a measure for success. Similar to Norban, Cellink also uses methods which are considered as more agile methods such as ideation frameworks. Both companies more or less base their innovation practices on insights which one can argue is fundamental in order to appropriate value when innovating. Insights are for instance gained by both companies through working with their customers throughout the processes of innovation. Cellink also claims that they are well prepared to make quick changes and new priorities short-term in order to meet new circumstances. Mycorena however, emphasizes the need to collaborate within the ecosystem, which is similar for Liquid Wind as well who claims the importance to be active in the market with the big players. Likewise, E2 states that the collective is stronger than the individual. There is also in general a need to collaborate with others in order to truly be innovative today, and especially if one works with several components and does not enquire the certain expertise or capabilities needed to carry such tasks. Open innovation and using one's network are in general a hot topic in modern literature and is often highlighted as essential in order to navigate a dynamic environment.

5.1.5 SENSE OF RESPONSIBILITY

As part of the selection criteria, all companies of this study share a sense of responsibility for the greater good of society. Companies such as Mycorena and Sproud, as well as H2 Green Steel and Liquid Wind want to provide their markets with more sustainable alternatives, allowing their consumers to make better decisions and conscious choices. Norban has found a model of business where both consumers and real estate agents can make better choices for themselves. Cellink enables increased medical research and addresses issues related to human health, as does HVR by making sure more people have access to pure water. Besides having the innovation and business growing from a bigger purpose, sustainability in its various dimensions serves as a foundation to these companies, where this sense of responsibility seems to be affecting several different parts of the operations. This is exemplified by incorporation of proven sustainable processes in production (H2 Green Steel; Liquid Wind; Mycorena), by consideration of governmental interests (H2 Green Steel; Liquid Wind; Mycorena), by evaluation of suppliers against a sustainable profile (H2 Green Steel; Mycorena; Sproud), by involvement of external actors in the development process (Cellink; H2 Green Steel; HVR; Mycorena; Norban; Sproud), or by development of a sustainability model for the product development process (Cellink). As expressed by the respondent for Mycorena, "*sustainability is in everything we do*". Furthermore, the companies make sure to address more than one dimension of sustainability. HVR and Cellink whose businesses

primarily have a social and ethical purpose, make sure to address environmental aspects of their organizations. H2 Green Steel, Mycorena and Sproud whose businesses primarily have an environmental focus, make sure to also address social aspects of their operations.

While these companies have a business that is centered around a sustainability-focused innovation, they are still companies run with a commercial interest. It is widely recognized that profitability is the ultimate goal of companies (E2). Sustainability and profitability could be argued seemingly contradictory as sustainable options in many cases, from the perspective of supplying, pricing and consuming for example, is a less affordable choice. As described by H2 Green Steel and Liquid Wind, their aim is to accomplish a sustainable offer that does not require too large of an increase in price for the consumer. *“These products that we are developing are definitely not cheaper [...], we can only say that this process will provide cheaper fuel than the alternative green process.”* (Liquid Wind). Is it possible for sustainability and profitability to co-exist with equal emphasis and interest? Some statements made by the companies could standalone be interpreted to emphasize a greater interest in profitability, such as Sproud not engaging in partnerships that potentially could be hurtful to the brand, HVR choosing the commercial way of business rather than the subsidized, Cellink considering the interest of their shareholders to make good products and increase stock value, or Norban expressing a responsibility of optimizing decisions which might not be optimizing from an environmental point of view. Considering all data together however, the commercial side of the organization enables all companies to continue with their business and consequently to continue with making a difference for their respective industry and for society at large (HVR; Liquid Wind; Mycorena; Norban; Sproud). The co-existence of sustainability and profitability objectives is supported by research within the field of responsible innovation. Both Fløysand and Jakobsen (2017) as well as Bacq and Aguilera (2022) emphasizes that responsible innovation is not only about focusing sustainable and ethical activities, but rather to create economic value while simultaneously considering needs of the external environment, hence implying that one objective must not exclude the other. Taking one further step back, sustainability appears to become an important factor for the profitability of a company. There is an external demand or pressure for sustainability, as demonstrated in both literature (cf., Owen et al., 2012 and European Commission, 2014) and empirical data (cf., H2 Green Steel; Liquid Wind; Mycorena), that suggests sustainable considerations to be the strategically smart option in terms of profit. The respondent from H2 Green Steel mentioned in their interview that a transition is ongoing where revenues can be maximized while being socially responsible. With this transition, all companies will benefit from increased focus on sustainability and ethics, while also benefiting societal needs. However, HVR and Liquid Wind argue that the external demand for responsibility could trigger greenwashing in many companies. A behavior where companies portray themselves as more sustainable than they are to gain economic benefits. Not all companies in society (in comparison to those of this study) engage in sustainability are as honest or genuine in their work.

5.2 CORPORATE GOVERNANCE OF INNOVATION

As evident in the previous section, the case companies of this study, through the framework of responsible innovation, demonstrate responsibility in more than one way. Besides growing

a business around an innovation that aims at addressing various societal needs, a sense of responsibility characterizes several different areas of the organization. This despite the unfamiliarity of the theoretical phenomenon. Throughout the interviews, the companies describe how they, in their innovation processes, work with stakeholder insights in product or service development (Cellink; H2 Green Steel; Liquid Wind; Mycorena; Norban), early prototyping and evaluation of such to verify and validate function (Cellink; HVR), finding like-minded employees and partners (H2 Green Steel; HVR; Liquid Wind; Mycorena; Norban; Sproud), analyzing and mitigating risks (Cellink; H2 Green Steel; Liquid Wind; Mycorena; Norban; Sproud), etc. Conventional organizational methods such as scenario planning (H2 Green Steel), lean start-up (Norban), ideation (Cellink), stage-gate model for project management (Cellink), risk management (Cellink; H2 Green Steel; Liquid Wind; Mycorena; Norban; Sproud) are presented in the interviews as means for operations, making one question the need of usefulness for a specific framework for responsible innovation.

Given that innovation could potentially result in negative outcomes, responsible innovation theory is about considering different kinds of outcomes throughout the innovation process (Owen et al., 2012; Jakobsen et al., 2019). As some consequences could be more difficult to detect beforehand, theory emphasizes foresight and visualizing different scenarios and change course of action whenever necessary (Stilgoe et al., 2013). With theory relating itself to conventional methods such as scenario planning and foresight techniques, it could be argued that those activities already, at least to some extent, consider important aspects of responsibility. Furthermore, theory stresses an involvement of innovation ecosystem actors into the development process in order to create value for more than oneself (Stilgoe et al., 2013). Management practices such as the lean start-up, as brought up by Norban for instance, and design thinking encourages a process involving work with insights from customers (Blank, 2013; Brown & Martin, 2015). These also emphasize an iterative process, as do responsible innovation, meaning that companies must be responsive to a changing environment (Stilgoe et al., 2013; Jakobsen et al., 2019). The responsible innovation framework later highlights the importance of considering risks and uncertainties in a continuous manner through an innovation process (Owen et al., 2012; Stilgoe et al., 2013). This part of the theory is also closely related to governance literature and innovation as well as risk governance in particular (Stilgoe et al., 2013; Nathan, 2015; Voegtlin et al., 2022). An innovation process that, for instance, involves prototyping or is governed by a traditional stage-gate model involves evaluation and judgment of function and other objectives there might be, before moving along further with the project (Stilgoe et al., 2013). This presentation illustrates that aspects involved in the framework of responsible innovation are already practiced within companies, although under a different name or traditional methodology. Whether a company is familiar with responsible innovation as a framework might not matter, but what then triggers the need for a separate framework?

As expressed in literature, innovations to this day contribute to social, environmental and ethical issues through negative consequences (Gripenberg et al., 2012), may them be intended or unintended, desired or undesired. Consequently, researchers are calling for increasingly responsible innovation processes (Owen et al., 2012; Stilgoe et al., 2013). To companies who, like the companies participating in this study, have an initial focus on sustainability and ethics, responsibility in the innovation process might come more naturally.

As described through the interviews, sustainability is part of the culture and everything these companies do. They are guided by a bigger sense of purpose which works its way from the top and down through all levels of the organization (cf., Cellink; H2 Green Steel; Mycorena). To established companies that need to transition into a mindset and work of sustainability it might require a greater effort. Anyhow, the sense of crisis around society relating to environmental and social issues (Owen et al., 2012; E2) still triggers increased responsibility of all actors in the innovation system, perhaps from companies in particular, where a large share of innovation occurs. It can be argued however, that the theoretical framework helps translate activities into responsible ones, helping companies and other innovators to better understand what is required throughout the innovation process. While necessary, Voegtlin et al. (2022) argue that conventional risk governance practices are not sufficient to facilitate innovations that 'do good' and 'avoid harm'. Hence a separate framework could be interpreted helpful as a complement to corporate governance of innovation. Such a separate framework would also ease the process of taking responsibility. The absence of such would require quite many conventional practices to achieve the same result. But companies have many different things to focus on whilst operating (E2). The sense of crisis and other external factors might be pushing companies towards increased responsibility, hence towards experiencing the framework.

E1 however questions whether a framework like this will solve any issues, while it does serve as a means for a joint discussion between matters of responsibility and innovation. It is highlighted that the definitions of the dimensions as somewhat problematic being subjects to subjective judgment. Who will determine what is responsible or not? This study has had a focus on companies who intentionally and from the beginning have worked with helping society. There are many different initiatives that indicate them being responsible in their innovation processes. Although, what is required for one to be labeled "responsible"? As of today, theory does not provide any measures as indicators for responsibility. Hence, it is impossible to state or evaluate whether companies are doing enough for a better future.

5.3 SOCIETAL GOVERNANCE OF INNOVATION

As clearly stated throughout this thesis is the sustainable mindset and foundation of the studied cases. Despite the sustainable focus, are there any external factors which might affect the behaviors and actions taken by the organizations? One factor, which was brought up during the interviews was legislation and policies, especially focused on what regulations the different subjects needed to adhere to. In general, there seemed to be a lack of rules to consider, however as for instance Cellink stated that in a few years it might look different. Governing innovation does not appear to be an easy task, especially concerning new technologies since they are not yet fully explored, however there are different views on how to manage innovation. There is a more conservative view presented by Liquid Wind, where they propose to let the policymakers regulate and for everyone else to follow and argue that it is better to develop effective laws than for companies to engage in greenwashing. Compared to a more inclusive view presented by the researchers where knowledge and expertise should be of essence in regard to regulatory measures, when regulations are needed. In addition, a softer governance approach where societal actors should collectively and continuously discuss the terms of decision making in order to steer the development

towards a sustainable path (E2; E1). Hence, actors of society should together decide upon the course of action and development. As also highlighted by literature, the actors of the ecosystem are able to shape regulations and policies together, and structure the route of development (McKelvey & Saemundsson). However, the experts also highlight the need to let every actor act autonomous in order for innovation to flourish. Although, it is argued that society is able to effectively govern the process of decision, where collaborative actions develop the guidelines in terms of the direction innovation and development is heading. Where the collective is stronger than one single actor (E2). Collective agreement is however not an easy task (E1) due to the fact individual actors might present different views but is at times considered as essential.

If analyzing the literature one can argue that a similar but also different view is presented by McKelvey and Saemundsson (2018) concerning the need to build capacity and enquire sufficient knowledge in order to make well-established decisions in regard to regulatory measures. They also present a need to develop policy alternatives in each segment of policies, thus enabling flexibility in the policy approach. They argue to add to the discussion regarding mission-oriented policies which is presented as a sufficient method in order to address the grand societal challenges of today (Elder & Fagerberg, 2017; OECD, 2020). Although, the mission-oriented approach is at times considered as too narrow according to researchers and they therefore speak for a broader approach in regard to policy making, to establish an extensive foundation of knowledge (McKelvey & Saemundsson, 2018), as well as to involve experts in the field (E1). There are several reasons why it might be important to build necessary capacity and capabilities, especially since one can argue that more effective regulations are prone to be facilitated when building a solid foundation through involvement of experts. For instance, one can argue that someone with experience and knowledge in the field might present more accurate statements compared to someone who only bears an interest in the subject.

Another view concerns how much one should intervene in the course of development. For instance, as presented by Sproud, who argues that it is better for nature to run its course. Similar is stated by E2, *“let 1000 flowers grow [...] the best ones survive”*. Meaning that one should not interfere with extensive regulatory measures. As also highlighted by Read et al. (2016) who state that one needs to minimize risk and harm, without developing barriers for innovation to flourish. However, the reason for interference is often connected to uncertainty and for prevention or reactively to avoid negative outcomes (E1), which is necessary at times. If there is no need to regulate then it might be better to not in order for innovation to run a natural course. There is however one crucial principle which every organization or individual needs to adhere to, the precautionary principle. It clearly states that precaution is of essence when there is evident that human-health or the environment is to be affected negatively. Precaution should indeed interfere when it is evident that there are potential negative risks and outcomes connected to a certain phenomenon. It should be used as a measure of prevention to mitigate risks and to minimize harm (European Parliament, 2015). The principle is clearly reflected in Swedish law in *“Miljöbalken”* where it is clearly stated that one is not allowed to pursue activities where the outcome negatively affects human health or the environment. One can argue that many organizations indeed break the *“principle”* since it is clear that many activities performed in the business world are hazardous or have the

potential to have catastrophic outcomes, such as Chernobyl or the pharmaceutical industry, both affecting human health and the environment negatively. The principle alone should be effective enough to prevent negative outcomes, however it is also evident that all outcomes are not easily foreseen. Important to mention however, is that the companies of this study engage in activities with a focus to positively affect the environment they operate in, as well as having extensive risk management practices in order to minimize their risks (Liquid Wind; Cellink; Mycorena; Norban; H2 Green Steel). There is no presented evidence that any of these specific cases would contribute negatively to the environment, rather have a positive impact due to their sustainable focus.

One additional factor which has the potential to affect the behaviors of the cases in this study is the pressure set on the organizations by their external environment. Although the companies of this study might not feel pressured into pursuing sustainable activities by their environment, they are still adhering to and values stakeholder interests and needs. The companies especially value their customers' interests (Norban; Mycorena; Cellink; H2 Green Steel; Sproud). Meaning that they are indeed influenced by their customers throughout innovation activities, since customers are one of their main driving forces in what they do. Although, there is at times a discrepancy amongst consumers in the pressure they place on companies and how they act thereafter. It is of importance that all different actors contribute to making sustainable and responsible choices. Nevertheless, since the case companies are founded in a sustainable purpose one can argue that sustainable aspects are core values, and the cases are therefore not pushed by outer forces to pursue such measures. Although crucial to consider stakeholder perspectives and values as well as society in general, in order to build trust and legitimacy (Read et al., 2016). Including the perception and appropriating value in society indeed grounds legitimacy as well as develops shared responsibility among stakeholder and other societal actors (Rainey & Goujon, 2011; Blok & Lemmens, 2015). Where innovation governance practices, if effective, are considered a sufficient method to facilitate collective responsibility, if including anticipatory and inclusive measures into the innovation process (Nathan, 2015).

A question to discuss further however is 'who is responsible'? Companies are of course responsible for their own actions and outcomes and 'repair' any damages they may cause (Cellink; Mycorena; Norban; E1). Companies however exist in a larger ecosystem configured by different sorts of actors who are all responsible for their actions and are just as responsible to make sustainable choices. Hence, companies are not alone when it comes to solving the grand societal challenges of today. As stated by Norban, companies who have the opportunity to make conscious choices should do so. It does not however only apply to companies but every actor or individual of society. It is not sufficient that only a few companies or other actors take actions for the greater good, since no one alone is able to make prominent change. In order to fully create a positive impact, everyone needs to take responsibility in doing so. For instance, to facilitate the intended sustainable purpose and solutions of organizations, then individuals and society as a whole needs to adapt such ideas. It is important to emphasize the shared responsibility (Jakobsen et al., 2019) meaning that society as a unit is mutually responsible to facilitate such actions towards a sustainable future. One can argue that governance plays an important role of facilitation. This since governance is intended to work as a steering mechanism of both innovation and change,

although of essence that the objectives of society are considered for governance to be effective (Read et al., 2016; Rainey & Goujon, 2011). Thus, effective governance should steer people and actors in society to engage in more sustainable activities.

6 CONCLUSION

The final chapter of this thesis emphasizes concluding marks by initially summarizing and answering the research questions. Later, it states the contributions to theory and implications to practice, as well as it presents a few limitations and proposes recommendations for future research.

6.1 CONCLUSIONS OF THE STUDY

The purpose of this thesis aimed to explore the concept of responsible innovation and how Swedish sustainability-focused companies act responsibly through their innovation process. It does not consider how the framework as a whole is applied in a practical setting, rather works as a foundation to gain an understanding of what is considered responsible actions. Hence, the company's actions were translated through the framework, to conceptualize how and if companies can be considered as acting responsible throughout their activities. The main research question of this thesis, as mentioned in the introduction, is therefore formulated as follows:

How do Swedish firms with a sustainability-focused innovation consider responsibility for outcomes and actions in their innovation process?

With regards to this question, it was clear that even though the companies did not express any former experience of the framework per se, they still engaged in practices which more or less corresponded to the dimensions of the framework. However, the main objective of the framework is to utilize such methods when addressing grand societal challenges as well as to avoid harmful behaviors, and thus incorporates a larger meaning behind the application. Which therefore entails some limitations for this study in regard to what is considered as responsible actions in the meaning of the framework. Although, if looking at the cases of this thesis they present a deep understanding in regard to sustainable actions in their innovation process and partly contribute to solving grand challenges. And even though they might not live up to the framework as one unit, they could still be considered responsible due to pursuing a sustainable purpose and aims to contribute towards the common good. One can argue that they mainly consider responsibility through their innovation per se, since sustainability is incorporated in their solution and therefore might not reflect over potential negative aspects to the same extent throughout the process as presented in the framework. Although, growing a business around a sustainable purpose entails such focus to permeate the entire organization and its processes. They do for instance evaluate the function of their innovations in order to ensure non harmful activities, include stakeholders and other important actors of the ecosystem in the innovation process and manifest reflexivity through the provision of sustainable solutions.

To gain an even deeper understanding concerning why these companies act responsibly, an additional research question was formulated. This to investigate if there exist any external

pressures, from their surrounding or business contexts, influencing the companies' behavior. So, the second research question was formulated as follows:

What external factors entail potential implications for companies' responsible actions?

Considering this question one can argue that there are indeed external forces that might present implications regarding company behaviors. Most companies to some extent have regulations or policies they need to adhere to, which influences how the companies act. Although it is obvious that regulations are scarce and therefore do not imply any extensive limitations. In addition, the companies indeed are to some extent reflexive in their approach since they aim to provide more sustainable solutions and appropriate such values in the market and are therefore indirectly influenced by their external environment when facilitating their products or services. Thus, they are not considered pressured into certain behaviors, due to having a core focus on sustainable innovation, however present evidence that their environment influences their development process.

6.2. CONTRIBUTIONS AND IMPLICATIONS

6.2.1 IMPLICATIONS FOR PRACTICE

As presented in this thesis the targeted case companies all display a sustainable focused business, meaning that the focal phenomenon of responsibility is likely to occur in such a setting, as demonstrated by the cases. Therefore, the findings of this thesis could contribute to gain an understanding on how companies can work more responsible in their innovation process and hence inspire other companies who aim to do so as well. Foremost companies whose purpose and focus from start aims to contribute to the common good through responsible activities. However also companies in their journey towards adapting more sustainable or responsible operations. There is indeed a wave of conversion in society towards more responsibility and accountability and as stated in this study in order to be profitable and to stay competitive, companies might need to become more sustainability-focused. As previously stated however, is the belief that companies on their own are not capable of solving the grand societal challenges of today, and thus there is a mutual responsibility for all actors of society to adopt a more sustainable mindset. Meaning that not only companies could be inspired but also other actors in society, everywhere from one individual to entire ecosystems. All actors are accountable for their own actions and are mutually responsible to enable facilitation of more responsible and sustainable practices.

6.2.2 THEORETICAL CONTRIBUTIONS

Since there is a perceived discrepancy concerning theory and practical implications of the framework of responsible innovation, this study aims to contribute with valuable insight about how the framework translates in a practical case setting. Thus, aims to contribute to the overall discussion surrounding the concept of responsible innovation as well as responsibility in society in general. There is indeed a need to highlight such a framework since it enables conversations to be further elaborated concerning responsibility, not only among researchers and governmental actors as currently, but also to diffuse such knowledge into society. By focusing on the phenomenon in a practical setting this study aims to

contribute with additional knowledge to extend current theory, since such studies are currently limited in amount, and therefore considered as necessary in order to gain a deeper understanding concerning the phenomenon.

6.3 LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The purpose of this thesis was to contribute to the current debate on sustainability and responsibility in relation to the work of innovation. This by examining seven companies in Sweden who have incorporated a greater purpose of doing good into their breakthrough or radical innovation, and through that, their whole business. Everything from culture and who is recruited to who is considered suitable as a supplier and other decisions of the operation. This “natural” sense of responsibility inherent in these case companies could frame the work of the innovation process as rather simple in terms of responsibility. However, for companies who instead transition towards increased responsibility, may it be driven by a competitive opportunity, external pressure of stakeholders, or an urge to change to make a difference, the process and choices might be different. These companies would have to change a current, and perhaps, well-functioning business. The contrasting starting points of these two kinds of companies could have implications for the innovation processes being different. The same goes for companies with innovations of more incremental nature. Hence, it is argued that outcomes and findings could vary with context.

Future research could focus on contexts of companies whose priority is not responsibility for the greater good, innovations of more incremental nature, or companies located in other regions. Contexts could furthermore be compared and contrasted for deeper understanding of the phenomenon in practice and to broaden the scope of activities in an innovation process favoring the external environment. Several types of innovations of radical or breakthrough nature have through this study been considered within different industries. Though all companies of this thesis demonstrate the focal phenomenon in various ways, no extent of the responsibility through the existing framework could be established as there are no clear nor distinct criteria. The analysis highlighted issues with the reach of responsibility, such as how much of a value chain one actor can control for. It also highlighted issues of subjectivity in the explanations of the framework dimensions. To be able to measure the amount of responsibility taken, or to determine whether an innovative unit is responsible enough, quantification of such would be necessary.

Moreover, this thesis has identified policies and regulations as well as stakeholder interest and pressure as entailing possible implications for the actions of responsible nature with companies. However, the system perspective of innovation is only briefly considered. Future research is recommended to include this perspective to a greater extent in order to understand the collective nature of responsibility for the environment and social welfare. As discussed previously, companies are but one actor required to better their actions towards a better future. In what ways would companies be encouraged to prioritize innovations and activities favoring a prosperous world?

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APPENDICES

APPENDIX A: KEYWORDS AND INCLUSION/EXCLUSION CRITERIA

Keyword	
Innovation	
The dark side of innovation	
Harmful innovations	
Responsible innovation	
Corporate governance	
Innovation governance	
Risk governance	
Innovation policy	
Keyword	AND
Innovation	Benefits (Societal + Company)
	Economic growth
	Downsides
	Negative consequences
	Unintended consequences
	Uncertainty
	Responsibility
Risk governance	Governance
	Uncertainty

Inclusion Criteria	Exclusion Criteria
Peer reviewed literature	Literature before 2010 in terms of the focal phenomenon: Responsible innovation
Literature published in acknowledged academic journals or books	CSR-related literature
Reports provided by global institutions > e.g. OECD	Literature in languages other than English (and Swedish when necessary)
Reports provided by global consultancy firms	
Non-academic text emphasizing the debate of the dark side of innovation	
Conference papers and periodicals > e.g. Harvard Business Review	
Swedish literature when no English literature can be found	

APPENDIX B1: INTERVIEW GUIDE - COMPANIES

Introduction and Background

- Can you provide us with a short description of your company and business idea? What was the reason for creating the company?
- How novel is your business idea? Is it new to the company, new to the market, or completely new to the world? What makes your company unique?
- Can you tell us about who you are and what your role is at this company?
- How do you define sustainability within your company? (How do you incorporate it?)

The Innovation Process

- How does your development process go about, from initial idea to commercialization?
- How do you balance sustainability and ethics regarding your innovation process with profit driven factors of your business? Thus creating value for your company and shareholders, while preventing negative outcomes in the process of innovation.
- What kind of rules, regulations or policies do you have to consider or take into account in your innovation- or development process?

Responsible Innovation

- In general, what role do you consider companies to have in addressing grand societal challenges?
> Do you experience a sense of responsibility for outcomes and actions of your own process affecting the external environment?
- Do you reflect upon both the potential benefits as well as potential negative outcomes of your innovation, including the innovation outcome and activities throughout the value chain?
- Would you argue that the main driver in the process of innovation is the interest of the company and its shareholders or is other stakeholders' interests acknowledged as well?
- Do you, in any way, involve stakeholders, external to the company in the innovation process? How do you involve them?
- Do you consider your innovation process as agile and iterative in order to co-evolve with the dynamic environment?
- How do you manage uncertainty and risk? Both in terms of the innovation outcome and throughout its process.
- How would you manage unexpected outcomes from your innovations? Is there a set process?

Other

- Is there anything else you would like to mention that we have not yet talked about in terms of responsibility and innovation?
- Are you aware of the framework concerning responsible innovation? Is it something you have implemented or do you use any other framework?

APPENDIX B2: INTERVIEW GUIDE – EXPERT 1

Interview Guide: Expert – Maureen McKelvey

Introduction and Background:

- Can you tell us briefly about who you are, your background?
- What is your main focus of research?
- What is your experience with innovation policies?

Responsible Innovation

- What is your perspective on the dark side of innovation?
 - > In general, do you think that the conversation around the dark side is diffused in the innovation landscape? Not just among researchers but also among companies and other important actors in the ecosystem.
 - > Do you think that enough actions are taken in order to avoid potential harm in the future?
- What role do you consider companies to have in addressing grand societal challenges?
 - > In general, do you feel that companies take responsibility for their actions and outcomes of their innovation process? Especially when it results in harmful consequences.
- In practice, do you consider the framework of Responsible Innovation to be useful in order to address the dark side to innovation?

Policies and Regulations

- What does the innovation policy landscape look like in Sweden? How is innovation governed in Sweden?
- What kind of laws, policies and regulations do companies need to adhere to in terms of innovation?
- What EU regulations affect the innovation landscape of Sweden?
- What do you consider being the most important pillars of innovation policy?
- Do you consider the current policy landscape to be balanced in terms of stimulation vs. regulation of innovation processes? Why?
- What challenges exist in relation to innovation policy?
- Have the raised discussion of and attention to responsible innovation in any way impacted policy discussions?

Other

- Is there anything else you would like to mention that we have not yet talked about?
- Can we reach out to you again if any further questions arise?

APPENDIX B3: INTERVIEW GUIDE – EXPERT 2

Interview Guide: Expert – Richard Englund

Introduction and Background

- Can you tell us briefly about who you are, your background?
- Can you tell us briefly about your role at RISE and what you work with?
- Can you tell us about the role of RISE in the Swedish innovation system?

Innovation in Sweden

- What is your perspective on innovation and its role in society?
- What role do you consider companies to have in the innovation of Sweden?
- Given the focus of companies in our thesis, what other actors are there within the Swedish innovation system? How do these actors interact with each other?

Responsible Innovation

- Do you consider innovation to have positive characteristics only? Or is the picture of innovation more nuanced, consisting of negative sides as well? If yes? In what ways?
- In which ways could innovation be negative or hurtful?
- What role do you consider companies to have in addressing grand societal challenges? Social as well as environmental?
- In general, do you feel that companies take responsibility for their actions and outcomes of their innovation process? Why or why not?
- If not, should they take more responsibility? How can companies be motivated to take more responsibility?
- How much should companies be allowed to experiment with innovations? Given that innovation is a process of trial and error which can be harmful to the external environment during development.

Innovation Policies

- Do you consider innovation to be much or little regulated in Sweden?
- Is there any general regulation towards innovation or is it mostly industry specific regulations?
- How are policies and regulations from the EU incorporated into Swedish policies and innovation?
- How does society balance stimulation of innovation with regulation of innovation in Sweden?
- How are policies and regulations formed and what challenges are there with innovation policies?

Other

- Have you at RISE had any discussions regarding the dark side of innovation or responsibility for innovation and its consequences?
- Is there anything else you would like to add that we have not yet talked about?

APPENDIX C: CODING SCHEDULE

Coding Schedule			
Measure	Construct	Theme	
There are dark sides and grey zones to innovation	The debate of innovation	Responsible innovation	
"You have to fail in order to succeed" – E1			
Consequences can follow an unintended use of the innovation			
To offer more sustainable alternatives to the market	Sustainability focused innovation		
To drive a change for the industry	Responsible innovation: Anticipation		
Reflecting on both benefits and drawbacks, socially and environmentally			
No potentially negative effects identified due to sustainable purpose			
General judgement of risks and evaluation of products			
Interests of external stakeholders are strongest	Responsible innovation: Reflexivity		
Investors and shareholders are important of financial reasons	Responsible innovation: Inclusion		
It is a continuous balance of interests			
Customers are involved in the development process			
Joining forces with different actors to drive change in industry			
Involving governments and other public actors	Responsible innovation: Responsiveness		
The innovation process is iterative and agile			
Co-operation with other actors of the innovation system			
"Companies are responsible for what they do and how they do it"	Sense of responsibility		
Sustainability is in everything we do			
"We exist because we want to do good things"			
Cannot be sustainable and make a change if no profits are made	Balance of sustainability and profitability		
The business idea is based on a sustainable and/or ethical purpose			
To make profit for shareholders is an overarching goal for businesses			
Not sure it solves any problems, but it does facilitate discussion	Usefulness of the RI framework		
Subjectivity will impact choices along the framework			
Sounds good, but how should it be implemented in businesses?			
Identification and evaluation of risks, their probability and effect	Risk governance		Corporate governance of innovation
Minimizing and mitigating risk	Innovation governance		
Early prototyping to evaluate function			
Insights driven innovation process			
Incorporate established processes proven sustainable	Existing policies and regulations		Societal governance of innovation
Industry specific regulations			
Sweden is compared to other countries quite heavily regulated			
Collective interaction between different actors of the system		Governance of regulations and policies	
To which extent should innovation be regulated?			
Have the politicians decide the law, and companies will follow	Responsibility in the innovation system		
Who is responsible?			
Companies exist in a greater environment and a society			
It is an ongoing debate in society	Stimulating innovation		
Importance of financing			
Sweden has a favorable business climate supportive of businesses	External pressure for change		
Increased consumer demand for sustainable products and services			
EU is one main driving force for change			