

Louvain School of Management

The Complementarity of Corporate Sustainability and Innovation

Evidence from the Pharmaceutical Industry

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Foreword

This master thesis would not have been the same without the support of some key people. In the first place, I would like to thank Professor Denis for allowing me to pick a topic that genuinely fascinated me, teaching me a new perspective on business success and providing me with valuable feedback. Without her help, this thesis would have looked very different. Second, I would like to thank the librarians from both Ivey and EADA business school for helping me out finding the data and for always being enthusiastic about giving a second opinion. Next, I would like to thank Ozana Pascual-Madorran, for supporting me during this challenging project and reviewing my work. Lastly, I would like to thank my parents. I truly appreciate their unfaltering support and continuous care throughout my student life.

Victor Mortreu, June 2019.

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Introduction

Corporate Social Responsibility (CSR) has become a popular term in business and academics: Much research focused on the different dimensions of CSR such as the determinants of engagement, CSR measurement and the link between CSR and value creation or corporate performance. Although there is substantial research on the business benefits of CSR, a significant gap exists between CSR and innovation (Bocquet, Le Bas, Mothe, & Poussing, 2013). CSR information is widely available, yet there is little evidence of research that explicitly addresses the link between CSR and innovation. This research attempts to address this weakness in CSR research and aims to enhance the theoretical and empiric understanding between CSR and innovation, with a specific focus on the pharmaceutical context.

CSR literature has previously tried to identify the effect on financial performance but has contradictory results (Orlitzky & Benjamin, 2001). Moreover, the relationship between CSR and the performance of companies is still not clear (Ioannou, 2017). Innovation may be a missing link to explain the relationship between CSR and financial performance (Surroca, Tribo, & Waddock, 2010). Therefore, this research will study the mutually reinforcing relationship between CSR and innovation. As a consequence, it will contribute to the business case of CSR, through arguing whether CSR should be seen as a compliance cost to meet stakeholder's demands, or, rather as an investment fostering innovation of all types in the long run.

This thesis is organized as follows: First, a discussion of both the concepts, innovation and corporate sustainability, and the industry of focus, the pharmaceutical industry, is conducted. Next, the literature study covers the current knowledge on the CSR-innovation relationship and closes with a conceptual framework on the potential links of CSR and innovation. After, the research question chapter discusses the current knowledge gap, the main research question, and the hypothesis development. Third, the methodology section discusses the positivist research paradigm, the research method and the statistical tools and instruments used in this study. Afterwards, the data collection and cleaning process are described, followed by the results of the statistical analyses. Lastly, the results are discussed and the theoretical and managerial implications, as well as the limitations and the potential for further research, are covered in the conclusion.

Literature Review

In the first part, the origin, evolution, types, and definition of the concept innovation are discussed. Next, the importance, drivers, obstacles, and measurement of innovation are explained. In the second part, the concept of Corporate Social Responsibility (CSR) is discussed in a similar way. A strong focus is put on CSR's effects on firm-level competitiveness. Third, the pharmaceutical industry is presented and an assessment in terms of innovation and CSR is conducted. Lastly, the complementarity of innovation and CSR in literature is discussed, with specific attention for the pharmaceutical industry.

1 The concept of Innovation

1.1 Introduction

Innovation is considered to be one of the main drivers of corporate success in competitive environments in the long run (Hassan, Hadeem, & Fatima, 2014). Although many companies pursue innovation, it is often wrongly interpreted as depending only on technology and R&D (OECD, 2009). However, innovation exists in many forms and is a mean to higher market valuation and competitive advantage (Distanont & Khongmalai, 2018). It should be managed strategically as it pushes companies to move forward with the development of new products, processes, ideas, etc. Additionally, organizational learning and innovation drive business performance and sustainable competitive advantage (García-Morales, Lloréns-Montes, & Verdú-Jover, 2008). Companies with higher capacities to innovate are proven to be faster and better in responding to environmental challenges, transferring knowledge on solutions to new requirements or satisfying unmet (social) needs by implementing the new ideas and decisions (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016). As a result, innovation is one of the hottest contemporary issues amongst senior management.

1.2 Definition

Extensive literature exists on the subject of innovation and various ambiguities can be found regarding its definition. To understand the notion of innovation, it is important to understand the differences between innovation and creativity, which is often confused. Innovation is typically seen as the ultimate result of a creative process, e.g. an invention in R&D. However, we can only speak of innovation when the result of the creative process is commercialized (Schumpeter, 1942). Creativity thus only responds to the initial discovery of ideas. Nevertheless, creativity can be a source of innovation (Ferauge, 2013). In addition, one should

also distinguish innovation and change. Although the implementation of innovation systematically brings change, organizational change does not always imply innovation (Ferauge, 2012).

Third, innovation and innovation management should be distinguished. While innovation is about inventing, changing, or enhancing products, services, business models, or value propositions, innovation management is about processes and people (Ferauge, 2012). It has reference to how an organization can cultivate a climate in which innovation can flourish. Issues include how to improve team motivation, flexibility, diversity, and creativity. Thus, the relationship between innovation and innovation management has to be interpreted as a relation of means and ends, where innovation management serves as a tool to develop innovation for greater corporate success (Ferauge, 2012).

Lastly, innovations can be categorized as either disruptive/radical or incremental. Whereas incremental innovations follow the logic of an existing business model, disruptive innovations will either change the logic and rules of an existing business model or replace the entire business model and value proposition in itself. However, this paper only analyzes how this key driver for corporate success has to be redesigned if innovation is to keep its primary role in sustaining corporate and societal prosperity. In contrast to efficiency, cost-cutting, and organizational or process measures, innovation and innovation management promise high results in terms of profitability. It is the golden bullet for corporate success (Glauner, 2018).

To conclude, innovation is a complex phenomenon which can be understood in various forms. In this study, the most common definition of innovation, from the OECD, is used because it focuses on the innovation activity and implementation aspects: “An Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD & Eurostat, 2005).

1.3 Evolution and Recent developments

1.3.1 *Schumpeter's Theory*

One cannot discuss the study of innovation without Joseph Schumpeter. He was among the first who systematically thought about innovation within economic analysis. He conceived innovation in a broad sense as ‘doing things differently’. For example, the introduction of new

commodities, new ways of producing old commodities, opening up new markets or new sources of supply of materials. He made a distinction between invention, which involves scientific novelty, and innovation which might or might not be related to invention. Similarly, he made the distinction between the inventor and the entrepreneur: “Whereas the inventor produces ideas, the entrepreneur ‘gets things done’ which may but not need to embody anything that is scientifically new” (Martin, 2009).

Schumpeter’s view about market structure and innovation relationship changed over time. His first hypothesis on who innovates is referred to as Schumpeter I, where the entrepreneur plays a central role in the process of innovation (Martin, 2009). This vision on innovation, which Schumpeter called ‘Competitive Capitalism’, follows the intuition of a life-cycle model of a person. The entrepreneur is central to innovation and will put in place novel methods or products, but at the end of his life, when he gets old and conservative, it is the new firm that will carry out the innovation. As the firm becomes old and large, it will become more and more inflexible. Eventually, the old company will be outcompeted in the industry and disappear. A more innovative entrepreneur will start a new company and replace the old one by doing things differently and better, which is called ‘creative destruction’ (Martin, 2009).

Later on, as the industry became more characterized by concentrated market structures in the early 20th century, which he called ‘Trustified Capitalism’, his vision of innovation changed (Schumpeter, 1942). In this more orderly world, innovation becomes more a matter of routine. So, in his revised analysis of innovation, called Schumpeter II, it is the established firm that drives technological progress. This is because large firms have advantages over smaller firms regarding the three market failures: uncertainty, indivisibilities, and externalities of innovation (Schumpeter, 1942). Large companies are able to spread the risk involved in R&D by undertaking many projects at the same time and spread the (fixed) costs over a larger sales base. Moreover, they have an advantage in raising financing for R&D and can hire more skilled people. Third, they can exploit both economies of scale and scope in R&D, and, they are more likely to exploit an unexpected discovery (serendipity). All these arguments supported Schumpeter to conclude that a concentrated supply-side market structure favors innovation (Martin, 2009). However, many of Schumpeter’s theories are still being debated today and it is unlikely that an unambiguous truth will be found.

To conclude, it became clear from his initial thoughts that the incentives to innovate play an important role in technological progress and the welfare of nations. Incentives are frequently financial, which is why policymakers often use subsidies to foster incentives to innovate. Nevertheless, economists still debate these incentives since Schumpeter (1942). Second, innovation is an opportunity for every entrepreneurial firm, as it gives them the opportunity to gain earnings through the temporary establishment of a monopoly, based on the competitive advantage of the innovation. Market dynamics, profit expectations, and long-run growth thus provide the key ingredients of Schumpeter's innovation theory (Martin, 2009).

1.3.2 Recent developments in innovation

After the Schumpeterian Innovation theory, many other academics reformulated the definition of innovation: Peter Druker (1985) defined it as "the tool for entrepreneurship, the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth.", Mohr (1969) described it as "the degree to which specific new changes are implemented in an organization" and the European Commission perceived it even broader as "the successful production, assimilation, and exploitation of novelty in the economic or social environment" (Das, 2018).

It is clear that the current definition of innovation addresses two important distinctions. First, the innovation process comprises the technological development of an invention, known as 'novelty'. Second, the market introduction of that invention to the end-users, known as 'commercialization'. Additionally, since the innovation process is iterative in nature, it becomes an important organizational capability (Saunila & Ukko, 2012). In conclusion, innovation is a combination of theoretical conception, technical invention and commercial exploitation (Das, 2018).

1.3.3 Innovation as a peculiar investment

Like any other type of investment, an investment in innovation is characterized by an investment period 't' and expected profits in periods 't + x'. However, innovation investments are different from other types of investments, because other investments' resources typically go into physical assets. Innovation investment is different in the sense that it can hardly be recouped. It is characterized by high sunk costs (e.g. due to a large component consisting of wages), incomplete appropriability of returns and high risk. There always exists an uncertainty of the innovation outcome (is the result feasible?) and the uncertainty of its returns (will the

result be profitable?). Additionally, there is a high probability of no returns at all, because the investment has a low internal collateral value, a high adjustment cost and intrinsic asymmetric information (Czarnitzki & Hottenrott, 2011). Not only does innovation come with a significant risk, but it is also costly to finance externally because it involves intangible assets. Innovation suffers from uncertainty and asymmetric information. Therefore, it will experience external financing constraints. Innovation will thus mainly rely on internal funds, which might constrain innovation if they are too scarce (Czarnitzki & Hottenrott, 2011).

1.4 Types of Innovation

For a long time, managers equalized innovation with the development of new products or services. But product/service innovation is not the only way to innovate, and on its own often not enough to be successful. Kelley and Littman (2006) suggest that organizations need to value all types of innovation: “A great product can be one important element in the formula for business success, but companies that want to succeed in today’s competitive environment need much more, they need innovation at every point of the compass” (p. 6) (Kelley & Littman, 2006). As a company can make many types of changes in its work methodology, production factors, and the types of output that improve its productivity and/or performance, innovations were categorized into four types, based on the 2005 Oslo Manual: product/service innovations, process innovations, organizational innovations and marketing innovations. In each type, an example of the pharmaceutical industry is given.

1.4.1 Product/Service Innovation

Product Innovation is the generation and diffusion of a ‘new’ product or service that involves significant changes or improvements to the existing ones (OECD & Eurostat, 2005). It often allows the firm to earn increased profits through price discrimination because a differentiated product provides a temporary ‘monopolist’ status (Schumpeter, 1942). The power of the innovator depends if the innovation is non-drastic, where some consumers will still buy the older/cheaper versions and rivals can still compete (e.g. generic drugs), or drastic, where the new product makes the old ones obsolete and the replacement effect is the highest (e.g. novel drugs). The same holds for service innovations, which will enhance the utility, performance and apparent value of an offering (OECD & Eurostat, 2005).

A pharmaceutical firm can product innovate in two distinct ways. The first way is on product performance, which addresses the value, distinguishing features, functionality, and quality of

a company's offering. Two examples are drugs that are more effective against a disease (e.g. fight the disease) or drugs that increase a patient's quality of life (e.g. relieve symptoms or pain). Product performance innovation involves both entirely new products as well as updates and line extensions that add substantial value. The second way is on product system, which is rooted in how individual products/services connect or bundle together to create a robust and scalable system to solve the customer's problem, e.g. in innovative therapies. Product system innovations help companies to build ecosystems that captivate and fulfill customer needs and defend them against competitors (Keeley, Pikkell, Quinn, & Walters, 2013).

1.4.2 Process Innovation

Process Innovation is the generation and diffusion of a new production process and/or delivery methods (OECD & Eurostat, 2005). It refers to new ways of doing the activities and operations that produce an enterprise's primary offerings. While the product may stay completely unchanged, the way of producing it is new, better, more efficient or more reliable. In the pharmaceutical industry, examples can be found in digitalizing the manufacturing process, with e.g. 3D printing, robotics and smart sensors for enhanced process controls or improved operational efficiency (Johnson & Johnson, 2017). They require dramatic changes from "business as usual", but enable the company to develop unique capabilities, e.g. function efficiently, adapt quickly and build market-leading margins by reducing the marginal costs. Process innovations often form the core competency of an enterprise and may include patented or proprietary approaches that yield advantage for years or even decades, because competitors find it very hard to replicate (Keeley, Pikkell, Quinn, & Walters, 2013).

1.4.3 Organizational Innovation

Organizational innovations refer to the implementation of new organizational methods (OECD & Eurostat, 2005). In this type of innovation, the product and process may stay the same, but the way of organizing and managing people has changed. The first sub-category is structural innovations, which are focused on organizing the company's assets and talents in an aligned way to create superior value, e.g., by using AI and data scientists in the drug discovery process. A second sub-category is network innovations, which encompass how you connect with others to create value, something vital in today's hyper-connected world (Keeley, Pikkell, Quinn, & Walters, 2013). These 'network' innovations provide a way for firms to take advantage of other companies' processes, technologies, offerings, channels, and brands. It helps them to

capitalize on their own strengths while harnessing the capabilities and assets of others, e.g. partnering with digital health start-ups to get data on patient progress (Keeley, Pikkell, Quinn, & Walters, 2013). Other examples of organizational innovations can be found in new business practices for organizing procedures (i.e. supply chain management, business re-engineering, knowledge management, etc.), new methods of organizing work responsibilities or decision making, and new methods of organizing external relations.

1.4.4 Marketing Innovation

Marketing innovations encompass innovations about the context in which products or services are introduced (OECD & Eurostat, 2005). It can be divided into multiple sub-categories: new marketing methods (changes in product design/packaging, placement, promotion or pricing), brand innovations (new ways of representing your offerings), product delivery innovations, customer engagement innovations, etc. Examples in the pharmaceutical industry can be found in customer-centric marketing initiatives, lifestyle advertising focusing on prevention over treatment, and e-commerce, which has emerged as a dominant force in the last decade. More advanced marketing innovators will often find multiple complementary ways to bring their products and services to customers (e.g. O2O strategies) and are even expected to come up with personalized medicine advice in the near future (Johnson & Johnson, 2017).

One could argue that profit model innovations can be categorized under both marketing and organizational innovations (Keeley, Pikkell, Quinn, & Walters, 2013). Innovative profit models find a fresh way to convert a firm's offerings and other sources of value into cash. Similarly, many innovations can be categorized under multiple types in practice (OECD & Eurostat, 2005). Despite the overlapping categories, defining the different types of innovation is vital to develop a sound understanding of innovation. Most important, innovation challenges the industry's assumptions on what to offer, what to charge and how to collect it (Keeley, Pikkell, Quinn, & Walters, 2013).

1.5 The Importance of Innovation

As mentioned before, companies innovate to enhance their competitive position in the market and create more value, by increasing revenue, decreasing cost or enhancing asset utilization (Das, 2018). Companies that manage to look at problems differently can come up with solutions that competitors cannot. Moreover, they can improve productivity, processes

and overall organizational efficiency. They can increase their revenues and market share, increase customer loyalty, have a faster speed to market, and enjoy enhanced employee engagement and retention (OECD & Eurostat, 2005). Additionally, innovating can reduce the overall risk of disruption by competitors. As a result, enterprises may engage in innovation activities for several reasons. Identifying enterprises' motives for innovating and their importance is helpful when examining the forces that drive innovation activity, such as competition and opportunities for entering new markets. An overview of factors relating to the objectives of innovation can be found in Appendix 1 (OECD & Eurostat, 2005).

Despite being a contemporary hot topic, firm-level innovation itself is still not a managerial priority, but rather the corporate success and higher market valuation it generates. A firm's attitude towards innovation, the types of innovation it pursues and the level of risk it accepts, are still not solely determined by the value innovation can generate, but also by the situation of the firm in the market (Cohn, 2013). Considering the current dynamic and increased competition in business environments, the ability to innovate has become a key element for businesses to stay ahead. It allows companies to stand out from their competitors by offering their customers something innovative and unique, certainly in the pharmaceutical industry. This leads to the second argument: innovation makes it easier to grow, regardless of the size of the business (Tredgold, 2018).

Third, innovators are better at predicting changes in the market and consequently provide better solutions, even before clients realize they need them. Businesses can only meet their customer's future needs if they are willing to innovate (Tredgold, 2018).

Last, companies need to innovate to attract the best talent. Innovative people want to work in companies that already showcased to be innovative. Innovators want to be challenged and supported to create on a regular basis, so a culture of innovation will be key to attract the best talent, which will eventually turn the companies even more innovative (Tredgold, 2018).

1.6 What are the drivers of innovation?

In short, the crucial driver of innovation is our human pursuit of progress and success (Schumpeter, 1942). To become innovative, a company has to cultivate its innovation capability. This capability consists of three main elements: Innovation potential, Innovation process, and Results of innovation activities, see Figure 1 (Saunila & Ukko, 2012).

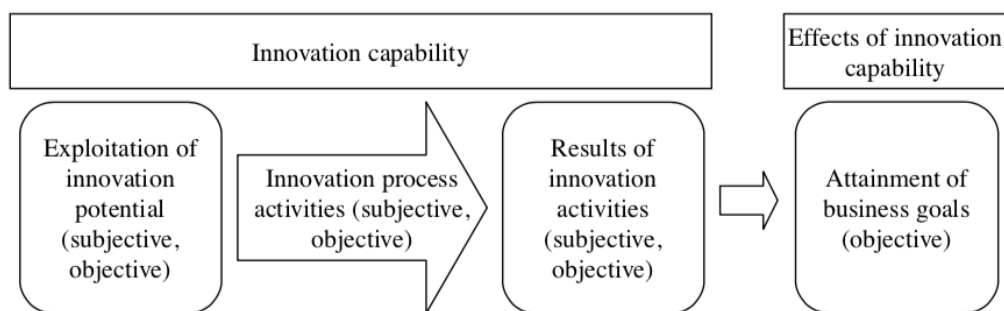


Figure 1. The basis for the measurement of innovation capability and its effects (Saunila & Ukko, 2012).

The first element, Innovation potential, consists of factors that affect the present state of innovation capability. These factors reflect the potential that organizations have to produce innovations and can be divided into five categories: (1) leadership and decision-making processes, (2) organizational structures and communication, (3) collaboration and external links, (4) organizational culture and climate and (5) individual creativity and know-how. The second element, Innovation processes, are systems and activities that assist organizations to utilize their innovation potential and therefore enable innovations. They are the way systems and activities are carried out. Therefore, the subcategories of innovation capability can be either enablers or obstacles to innovation processes. Last, Results of innovation activities, are for example product/service innovations, and process innovations (Saunila & Ukko, 2012).

1.7 Barriers for Innovation

Innovation activity may be hindered by different factors. These factors can create reasons for companies not to start or to slow down innovation activities, which can negatively affect expected results (OECD & Eurostat, 2005). Examples in the pharmaceutical industry include economic factors (e.g. high costs or lack of demand for a drug), enterprise factors (lack of skilled personnel or knowledge, mainly in R&D), legal factors (regulations or tax rules, which are very strict for pharma), etc. An overview of factors that could act as barriers to innovation can be found in Appendix 2 (OECD & Eurostat, 2005).

Barriers to innovation are interesting to research as sustainability reporting might influence them. For example, pharmaceutical companies may identify a lack of available financing as an important barrier. This might be reduced by a lower cost of capital in case of good sustainability performance, as is the case in Philips' EUR 1bn 'sustainable loan' with ING (ING, 2017). Another barrier can be a lack of demand for new products at high prices to have an

R&D break-even, a heavily debated topic for neglected tropical diseases (Trouiller, et al., 2002). This could be overcome by using tools such as equity-based tiered pricing and partnerships with public health organizations, e.g. the 'HIV access and partnership efforts' by Johnson & Johnson, to provide affordable and sustainable access to HIV medicines in resource-limited settings through a variety of licensing agreements and collaborations (Johnson & Johnson, 2017). A third example is enterprises who may not have skilled employees to engage in innovation activities. Here as well, benefits of sustainability, e.g. company reputation, might help to attract more talent (OECD & Eurostat, 2005).

1.8 Measuring Innovation

As the importance of innovation grows, its nature, role, and determinants receive increasing attention, requiring more innovation metrics (OECD, 2009). People tend to assume a causal relationship between business innovation and levels of investments in R&D or the number of patents held. However, today a growing number of studies challenge this simplistic approach. They argue for a broader and more balanced view which considers the impact of investing in intangible assets (Zambon & Monciardini, 2015).

According to Saunila & Ukko (2012), the current measures of innovation capability, which lead to producing intangible assets, can be divided into two categories: input measures and output measures. Input measures evaluate how resources are allocated to innovation activities, e.g. the funds used in R&D activities and education. However, it only shows how much is committed to investing, and not if innovation has been accomplished. Moreover, they also underestimate smaller innovation activities, because smaller companies do not have opportunities to invest in R&D. As a result, input measures do not completely reflect the actual innovation capability (Saunila & Ukko, 2012).

Second, output measures evaluate the outcomes of innovation capability. It is hard to express all innovations quantitatively, so output measures only measure the results of successful innovations. These mainly include the organization's patents and licenses; hence they are only suitable for certain types of innovations and companies. Also, it is not suitable for service innovations, e.g. educating patients on their diseases, nor do output measures compute the economic value of innovations (Saunila & Ukko, 2012).

In order to collect data for these two categories of innovation capability, Oslo Manual (OECD & Eurostat, 2005) suggests two approaches. First, there is the 'subject approach', which starts with the innovative behavior and activities of the firm as a whole. The idea is to explore the factors influencing the innovative behavior of the firm. This includes strategies, incentives, and barriers to innovation, combined with innovation outputs. Second, the 'object approach', which involves the collection of data about specific innovations, e.g. R&D budget for drug development. These two approaches involve collecting descriptive, quantitative and qualitative data about the particular innovation (OECD & Eurostat, 2005).

To conclude, innovation is thus a broad concept that is complex to measure. However, improved innovation metrics are necessary to enhance the knowledge of firm-level innovation. They are crucial for designing effective innovation policies and practices. In this research, the pharmaceutical company's innovation is measured holistically through a set of 6 metrics. The exact metrics are described in the research question and results section.

2 Corporate Social Responsibility

2.1 Introduction

Corporate Social Responsibility (CSR) is “a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis” (European Commission, 2001). CSR is recognized to have the potential to “play a key role in contributing to sustainable development while enhancing innovative potential and competitiveness” (European Commission, 2005).

There has been significant growth in the number of enterprises that have an explicit policy on CSR. Simultaneously, there has been considerable evolution in the practice of CSR. For many companies, CSR and corporate sustainability have become prominent issues that are deeply integrated into operations and strategy. It is renowned for enhancing a firm’s social and environmental value creation. However, there is still disagreement on its economic impact. Both academics and managers are still arguing whether CSR should be viewed as a (compliance) cost or a long-term investment. The aim of this chapter is to outline the basic concept of CSR, its definition, importance, evolution, drivers, and effects on the firm-level competitiveness. Finally, the different firm-level strategic approaches to CSR and CSR measurement techniques in this study will be discussed.

2.2 Definition

Even though the impact of CSR is still unclear (Hahn, Figge, Pinske, & Preuss, 2011), CSR is gaining more and more attention in both business and literature (Carroll, Corporate social responsibility., 2015). Yet, the definition of the term is still ill-defined (Rahman, 2011). Rahman’s research states that “rather different definitions during different segments of time represent different dimensions of CSR”. As a result, the roots and evolution of CSR will first be discussed, before stating the definition that will be used in this thesis.

2.2.1 Roots of the CSR concept

CSR has a long history, which evolved with the development of businesses and emerging needs of the society. Howard Bowen (1953), one of the early contributors to CSR in the academic literature, defined CSR as the obligations of businesspersons to make decisions, which are desirable for the objectives and values of our society (p. 6) (Bowen, 1953). But, even though the discussions on CSR and its concepts started in the 1950s, the main roots of businesses involved in social issues can be traced back at least to the 19th century (Carroll,

2008). However, then, and now, it is difficult to differentiate what organizations are doing for business reasons, i.e. making the workers more productive, and what the organizations are doing for social reasons, i.e. helping to fulfill their needs, make them better, and more contributing members of society (Carroll, 2008).

With Bowen, more comprehensive and systematic CSR approaches came up in the 1950s. Bowen's publication 'Social Responsibilities of the Businessmen' (1953) is often seen as the first milestone in CSR history. Since the definition of CSR is still vague, it is still considered to be in the early days of this concept.

In the early 1960s, it became clear that CSR had to do with taking responsibility beyond the economic aspects. The topic became more and more debated among economists. However, Milton Friedman strongly disagreed in his book 'Capitalism and Freedom' (1962). Despite being one of the most influential economists in the 20th century, his rejection of CSR did not significantly affect the further development of the topic. Actually, CSR even evolved into a more comprehensive concept. Not only did academics agree that corporate responsibilities should go beyond just economic goals and legal compliance, but also, they criticized the term 'responsibility' as just covering the assumption of an obligation, but not focusing on CSR's outcomes (August, 2018).

In the late 1970s, Archie Carroll proposed a four-step classification of CSR performance, known as the four responsibilities or Carroll's CSR Pyramid (Figure 2).

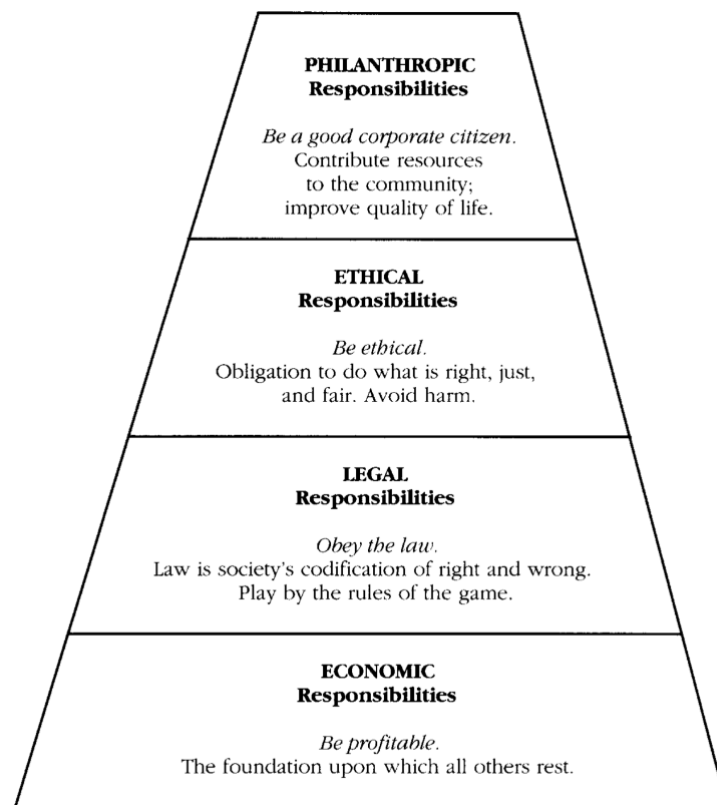


Figure 2. The Pyramid of Corporate Social Responsibility (Carroll, 2015).

The basic and most relevant responsibility is the economic one: If a company does not survive in the market, all other responsibilities become obsolete. Second, there is legal responsibility, which states that a company should act within the rules of law. After the basic levels, Carroll differentiates between ethical and philanthropic responsibilities, “Even though ethical responsibilities are ill-defined, they are clearly demanded by society. Lastly, philanthropic are those about which society has no clear expectations for business” (Carroll, 1979).

Later on, Carroll states that: “During the 1990s, CSR practices became commonplace, more formalized, varied, and more deeply integrated into business practices.” As a result, he discusses some alternative concepts: “Business ethics is a system of thought that is rooted in moral duty and obligations. It can also be seen as principles or values. Business ethics is concerned with the rightness or fairness of business, manager and employee actions, behaviors and policies taking place in a commercial context” (Carroll, 2015). In corporate reality, business ethics translates into anti-bribery rules, codes of conduct, fair trade, etc. As a result, business ethics have a more tangible and narrower focus, mainly dealing with how to act the right way in business. The most important areas for business ethics are sales, accounting, outsourcing, and the relations to stakeholders in general. This brings us to the

next concept discussed: The stakeholder approach, which suggests that businesses should only formulate and implement processes that satisfy all stakeholders' needs in order to ensure long-term success of the firm. It became a popular approach in the mid-1980s and is still relevant today, for example in the ISO 9001 and ISO 14001 standards (2015 versions), where stakeholder identification, consideration, and management play a crucial role.

The most widely quoted definition of sustainability is the one from the Brundtland Report (1987): "Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The commission put environmental topics on the political agenda and asked for sustainable development. Nowadays, sustainability is commonly defined as a combination of economic, environmental, and social issues, based on the Triple Bottom Line (Elkington, 1997). Furthermore, corporate reports covering CSR nowadays are quite often published as sustainability reports, blurring the difference between CSR and sustainability (Bansal, 2014).

2.2.2 Recent Developments

More recent developments are the 'Creating Shared Value' article of Porter and Kramer (2011) which states that shared value can be defined as policies and operating practices that enhance the competitiveness of a company, while simultaneously advancing the economic and social conditions in the communities in which it operates. Shared value thus focuses on the creation, identification, and expansion of the connections between societal and economic progress. Another important facet of more recent discussions is that stakeholders not only ask if profits are used for social or environmental topics but also how these profits are earned (August, 2018).

To conclude, since the beginning of the 21st century the perceived importance of CSR by the general public has been continuously growing. As a result, the emphasis within the academic world shifted from formulating theories about CSR to conducting empirical research on CSR and its effects (European Commission, 2001). The 21st century has been marked with an exponential increase of internet users, which helped to spread knowledge of social and environmental issues, which acted as a catalyst for CSR. Anti-social practices became more and more scrutinized, so companies were forced to pay more attention to CSR. Over time, the internet became a tool for publicizing CSR reports, a common practice in the pharmaceutical industry (Capriotti, 2011), e.g. Novartis Corporate Responsibility Report (Novartis, 2017)

2.2.3 Definition of CSR

As mentioned before, the meaning of CSR has had a broad range of interpretations over time. Overall, CSR is about a (voluntary) commitment to act in the interest of all stakeholders. It started as an internal organizational policy but moved more and more towards an industry-wide practice. Therefore, CSR transformed into an international corporate self-regulation that allows corporate entities to consider issues that relate to the 3Ps (People, Planet and Profit) (Elkington, 1997). The multiple definitions of CSR generally talk about companies' positive and negative impacts on society & environment, and prevention, management and mitigation of any negative impacts that they may have (European Commission, 2001).

In this study, one of the most common definitions is adopted from the European Commission (2011): Corporate Social Responsibility (CSR) is defined as the "responsibility of enterprises for their impacts on society". Furthermore, the EU advises companies to adopt a long-term, strategic approach to CSR, and to explore the opportunities for developing innovative products, services, and business models that contribute to societal wellbeing in order to maximize the creation of shared value (European Commission , 2011).

Lastly, the terms CSR, corporate sustainability and business responsibility are used interchangeably throughout this thesis. Although sustainability and sustainable development mainly address meeting current needs without compromising future generations to do so (Brundtland Commission, 1987), company's contribution to sustainability comes close to the concepts of CSR. They mostly share the following principles (Denis, 2014):

- CSR is a voluntary, and not legally mandatory, response of a company that wants to protect its long-term goals.
- CSR is strategic and at the core of the business.
- CSR is a process of continuous improvement, not a label.
- CSR is a commitment to minimize negative externalities and to maximize positive impact of doing business.
- CSR is about being transparent and having good communication between the company and all its stakeholders.

2.3 The Importance of CSR

Addressing CSR is in the interests of enterprises because it enhances their competitiveness when used in a strategic manner (European Commission , 2011). It can bring benefits in terms

of risk management (e.g. better auditing and reporting), cost savings, access to capital, customer relationships, human resource management, brand differentiation, innovation capacity, etc. Due to increased engagement with internal and external stakeholders, CSR enables companies to better anticipate and take advantage of fast-changing operational and societal conditions (European Commission, 2008). Therefore, CSR may stimulate the development of new markets and the creation of opportunities for growth. Moreover, socially responsible enterprises are proven to build long-term employee, consumer, and citizen trust, which will help them in turn to create an environment where they can innovate and grow. This trust is thus the basis for every sustainable business model (European Commission, 2009).

Second, actions above companies' legal obligations are in the interests of society because they can solve some of the most challenging environmental and social problems. Through CSR, enterprises can significantly contribute to the world's sustainable development and social market economy with inclusive growth. Moreover, CSR is especially important when private companies provide public services. CSR offers a set of values on which a more cohesive society and the transition to a sustainable economic system can be based (European Commission , 2011).

2.4 Impact of CSR on firm-level competitiveness

The link between CSR and firm-level competitiveness has been an important topic since CSR's foundation. Both researchers and practitioners have tried to prove and disprove the business case of CSR over time. In this study, we defined firm-level competitiveness as "the ability of a firm to produce products or services of superior quality or lower costs than its domestic and international competitors". Of course, firm-level competitiveness is not only a question of producing products and services of superior quality or at lower costs but also entails producing new or different products and services, which is why the innovation capacity also is a source of firm-level competitiveness (European Commission, 2008).

This section will discuss the effects of CSR on six factors of firm-level competitiveness, namely cost structure, HR performance, customer perspective, risk and reputation management, financial performance and innovation.

2.4.1 Cost Structure

The first way for CSR to increase a firm's competitiveness is to reduce costs (European Commission, 2008). The issue of cost savings has been at the center of the business case of CSR. On the one hand, proponents argue that responsible business behavior can lead to cost savings and research programs already indicated that the benefits of pursuing sustainability practices outweigh the costs (Economist Intelligence Unit, 2008). Mainly the environmental dimension of CSR can have a positive effect on costs, by for example reducing energy consumption or material inputs, e.g. Johnson & Johnson's innovative geothermal energy project for the heating and cooling of Belgian production facilities, which will reduce energy consumption and carbon emissions by 30% (Johnson & Johnson, 2017). On the other hand, some academics counter this argument, for instance with CSR-related waste reduction practices, which are associated with significant costs for manufactories (Chapple, Harris, & Catherine J., 2006).

CSR can thus contribute to cost savings in certain circumstances. It not only results from environmental measures but might also result from other approaches, such as from HR, risk management or access to finance, which will be addressed below. However, the discussion of CSR and competitiveness is not only limited to the question of cost savings but also covers the topic of value creation. Porter & Kramer (2006) stated that "the prevailing approaches to CSR are so fragmented and so disconnected from business and strategy as to obscure many of the greatest opportunities for companies to benefit society. If, instead, corporations were to analyze their prospects for social responsibility using the same frameworks that guide their core business choices, they would discover that CSR can be much more than a cost, a constraint, or a charitable deed – it can be a source of opportunity, innovation, and competitive advantage". The next sections will thus look at the link between CSR and competitiveness from both perspectives.

2.4.2 HR Performance

CSR can have a positive impact on HR performance, as it was found that "Firms that have good employee relations are likely to have significantly lower turnover rates and a substantially more enthusiastic workforce." (Cochran, 2007). The workplace dimension of CSR can create an ideal environment for high labor productivity and innovation. Thus, CSR can act as a lever for motivating and retaining employees.

Moreover, CSR would also be of value in attracting the best talent: “Representatives from large companies comment that potential new recruits now often ask questions about CSR-related issues in interviews. Large companies realize that they increasingly need to be able to demonstrate strong CSR credentials in order to attract the right candidates” (European Commission, 2008). Besides that, CSR’s employee diversity policies come with some business benefits. For example, it can have a potential impact on innovation capability, which will be discussed part 4 of the literature review. The main HR value thus lies in employee satisfaction, retention, attraction and diversity (European Commission, 2008).

2.4.3 Customer Perspective

Although the extent to which CSR can drive customer loyalty is still heavily debated, consumers tend to respond positively to whether they are willing to pay a premium price for products with good social and environmental credentials (European Commission, 2008). The business case for CSR from the customer perspective will thus be highly dependent on the company’s competitive strategy and market positioning. For example, CSR might be more beneficial to high-end brands than to traditional low-cost brands, although a minimum set of social and environmental standards is nowadays even demanded from discount retailers (Visser, 2010). It is expected that the competitive advantages of CSR from the customer perspective will evolve with the changes in customer demand. The rapid growth of fair trade and organic goods might indicate that customer demand is slowly changing towards sustainability, but inflation or economic downturns might interrupt this trend (European Commission, 2008).

Another undeniable trend is green and sustainable procurement practices. “Many enterprises, especially large enterprises, now impose social and environmental requirements on their suppliers. The growth of business interest in supply-chain partnerships such as the Business Social Compliance Initiative and the Global Social Compliance Programme suggests that the number and seriousness of CSR-related supply chain requirements will continue to increase” (European Commission, 2008). So, the competitive benefits of CSR from the customer perspective seem to be increasing as a result of growing demand from both customers, enterprises, and authorities.

2.4.4 Risk and Reputation Management

CSR as a strategic risk management tool was initially introduced by Bowman in 1980, who proposed using it as a means of anticipating and reducing potential sources of business risk. Afterwards, it was identified that CSR might reduce different kinds of business risks, such as governmental regulations, labor unrest or environmental change: “the relationship between CSR and risk appears to be one of reciprocal causality, because prior CSR is negatively related to subsequent financial risk, and prior financial risk is negatively related to subsequent CSR” (Orlitzky & Benjamin, 2001). Additionally, CSR might even help companies to prepare for possible new regulations on social or environmental issues (European Commission, 2008).

An increasing number of companies also view CSR not only as a risk mitigation tool but also as a means of enhancing the company’s reputation in the eyes of all stakeholders. However, according to the European Commission Report from 2008 “Company representatives often report that, by making public commitments on CSR-related issues, they in fact become more vulnerable to criticism from nongovernmental organizations and other stakeholders. In the medium to long term, CSR is only likely to improve competitiveness through a better company reputation if it is deeply embedded in the company’s values and operations” (European Commission, 2008). This clearly highlights the importance of managing CSR strategically.

Lastly, CSR reporting helps to increase a company’s transparency. Although many firms initially issued it to protect themselves from the criticism of NGOs, they found that it leads to other advantages such as employee pride and morale, an improved capacity to manage and measure environmental and social issues and eventually better anticipation of difficulties with external stakeholders (Pohle & Hittner, 2008).

2.4.5 Financial Performance

Stock markets are strongly related to the economic dimension of CSR and can act as an economic performance indicator for firms. So, under the assumption of efficient capital markets, they should reflect the discounted value of CSR practices. Overall, there are many different conclusions on the stock market effects of CSR, but several meta-analyses found that the overall effect is positive but small (Margolis, Elfenbein, & Walsh, 2007). Although a causal link is still unproven, researchers found that “High sustainability companies are more likely to have established processes for stakeholder engagement, to be more long-term oriented, and to exhibit higher measurement and disclosure of non-financial information. Finally, high

sustainability companies significantly outperform their counterparts over the long term, both in terms of stock market and accounting performance” (Eccles, Ioannou, & Serafeim, 2014).

Also, “firms with better CSR performance face significantly lower capital constraints” and evidence suggests that “both better stakeholder engagement and transparency around CSR performance are important in reducing capital constraints” (Cheng, Ioannou, & Serafeim, 2013). Moreover, the recent growth in Socially Responsible Investment (SRI) is an excellent example of the competitive advantages in access to finance for firms who have CSR policies, mainly driven by Environmental, Social and Governance (ESG) reporting in the financial world. ESG is the dominant metric in the area of non-financial reporting and is top of mind for contemporary executives, because “corporations will soon be held accountable by shareholders for their ESG performance” (Eccles & Klimenko, *The Investor Revolution*, 2019).

To conclude, research indicates that there is a positive (but small) relationship between CSR and financial performance (European Commission, 2008). However, it is important to understand that “managers should particularly focus on communicating the value of CSR strategies to the investment community. Highlighting not only short-term costs but also long-term benefits could mitigate difficulties that investors may face in understanding the value generated” (Ioannou, 2010).

2.4.6 Innovation

Several company executives cite innovation as a major beneficial outcome when asked to explain their motivations for addressing CSR (European Commission, 2008). The acknowledgment of the link between CSR and innovation proves that the business case of CSR is no longer viewed in terms of potential cost savings, but also encompasses the potential for new value creation and the development of new revenue streams. The links between CSR and innovation are complex and not immediately obvious in the case of competitiveness determinants research (European Commission, 2008). The exact links between CSR and innovation will be discussed in part 4 of the literature review.

2.5 CSR’s multiple dimensions

According to the OECD, UN Global Compact and ISO 26000 principles and guidelines, CSR at least encompasses adherence to human rights, good labor and employment practices (e.g. training, diversity, gender equality, employee health and well-being), heed to environmental

issues (e.g. biodiversity, climate change, resource efficiency, life-cycle assessment and pollution prevention), and combating bribery and corruption. Other dimensions of CSR can be found in community involvement and development, the integration of disabled people, and appreciating consumer interests, including privacy, which are also part of the CSR agenda. More concrete, CSR includes important actions as the promotion of social and environmental responsibility through the supply chain, and the disclosure of non-financial information (European Commission , 2011).

2.6 The different approaches to CSR

This section will discuss the different approaches towards CSR a company can take, based on Wayne Visser's five stages of CSR (2010).

The first approach is Defensive CSR, in which the limited corporate sustainability and responsibility practices are initiated. They are only undertaken if it can be shown that shareholder value will be protected. For example, employee volunteer programs are not uncommon because they show evidence of improved staff motivation, commitment, and productivity.

A second approach is Charitable CSR, in which a company supports various social and environmental causes through donations and sponsorships. This type of CSR is typically aimed at empowering community groups or civil society organizations. Close to this concept is Visser's third approach, which is Promotional CSR. This concept is linked to marketing and mainly happens when corporate sustainability and responsibility is seen as a public relations opportunity. The goal of this type of CSR is to enhance the brand, image, and reputation of the company. It draws on the practices of Charitable and Strategic CSR but enhances them with a PR spin, often characterized as 'greenwashing'.

The fourth stage is Strategic CSR. Here, CSR activities are related to the company's core business (e.g. 100% of Active Pharmaceutical Ingredients (API) discharges from AstraZeneca sites assessed as safe, improving product quality). This approach to CSR often happens through adherence to CSR codes and implementation of social and environmental management systems. Systems typically involve cycles of CSR policy development, goal, and target setting, program implementation, auditing and reporting, which allows us to measure CSR progress since it is key to the company's strategy.

Finally, Visser talks about Systemic CSR, which focuses its activities on identifying and tackling the root causes of our present unsustainability and irresponsibility. This is often done through innovating business models, revolutionizing a business' processes, products, and services. An example from the pharmaceutical industry is the 'access to healthcare' projects in emerging economies (Johnson & Johnson, 2017). While Strategic CSR is focused at the micro-level – supporting social or environmental issues that happen to align with a company's strategy but without necessarily changing that strategy – Systemic CSR focuses on understanding the interconnections in the macro-level system (society, communities, economies, and ecosystems). Systemic CSR changes a company's strategy to optimize the outcomes for this larger human and ecological system. However, businesses will often have to go through a journey to get into the last stage. They have to build on each previous stage of CSR to build full maturity within the business.

To conclude, Visser argues that all businesses should move to the last stage of CSR to make it live up to its promise. Otherwise, CSR will fail to turn the tide on the environmental, social, and ethical crises that we face (Visser, 2010).

2.7 Measuring CSR through ESG

Whether you call it CSR, corporate responsibility, sustainability, or ESG, they all report on the common understanding that a company's long-term financial success goes hand in hand with its records on social responsibility, environmental stewardship, and corporate ethics. So, in this study, we will use the ESG score as a proxy to measure CSR, because it refers to the three central factors in measuring the sustainability and ethical impact of a business (Kell, 2014).

3 The Pharmaceutical Industry

3.1 Introduction

The pharmaceutical industry is responsible for the development, production, and marketing of medications. Pharma is widely considered to be an innovation-driven and R&D-intensive industry. It was one of the first industries to (voluntarily) adopt sustainability reporting initiatives, which makes it the perfect industry for this research. Although sometimes grouped with the chemical manufacturing sector, the pharma sector differs in many aspects, with the central role of innovation being the most important one (Blum-Kusterer & Hussain, 2001).

The pharmaceutical industry is a very peculiar industry. It is much more linked to science and regulations than any other industry. It has a complex structure due to its impact on people's quality-of-life. As it is designed to protect the patient's well-being, it faces unique regulations and sales channels. The pharmaceutical industry is big business: It consistently grows 4–7 % per year and has more than US\$1 trillion market size (Ding, Eliashberg, & Stremersch, 2014). However, it faces enormous innovation and marketing challenges, the main drivers for a drug company's success. According to Ding et al. (2014), "A firm with subpar innovation for an extended period will see its differentiation potential decrease, with deteriorating margins as a consequence. (...) On the other hand, a firm without strong marketing capabilities will not fully unlock the value of innovation and thus it stands to miss out on billions of dollars for its stakeholders and on the resources needed to sustain continuous innovation". As a result, many big pharmaceutical companies have disappeared in the past due to mismanagement of innovation, marketing or a combination of the two, e.g. Hoechst (Ding, Eliashberg, & Stremersch, 2014).

3.2 Innovation in the Pharmaceutical Industry

The pharmaceutical industry is all about product innovation. In general, discovering new drugs is at the core of their business model. Comparing the industry as a whole, the most important departments are production, R&D and marketing & sales. However, strategic focuses vary depending on the company's typology. Research (mainly for product innovation) is proportionally more important for innovative companies, production (cost leadership) for the generic companies (selling copies of existing products after the patent expiration at a price substantially lower than the inventors' original product) and marketing (niche strategy) in the self-medication sector (Blum-Kusterer & Hussain, 2001). In addition, pharma became a two-

tiered industry over time: It consists of a small number of large multinationals (Figure 3), who are autonomous in the development of ‘blockbuster products’, and a large number of small companies, who assist in specialized areas of the development process or act as generic companies (Ding, Eliashberg, & Stremersch, 2014).

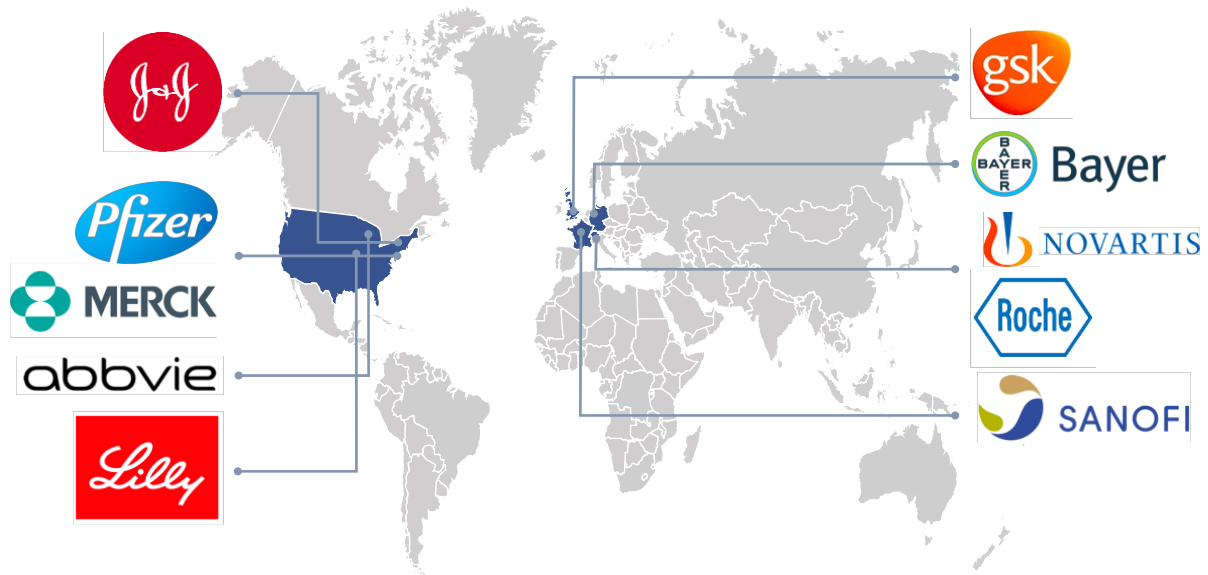


Figure 3. Top 10 Pharmaceutical Companies by revenue.

The industry is typed by frequent innovation and intense international competition. The product innovations have three peculiar characteristics.

First, a pharmaceutical company needs to be sufficiently innovative to keep producing patented drugs. A firm cannot survive if its level of innovation decreases substantially and it can no longer generate new drugs with sufficiently profitable patent protection. This is because a considerably large percentage of the profit of a typical branded pharmaceutical firm comes from drugs under patent protection.

The second characteristic is that each innovation tends to generate a large amount of revenue for a firm. Since late 1990s, firms have adopted strategy of developing so-called blockbuster drugs, which are drugs that will generate at least US\$1billion revenue per year.

Lastly, innovations in the pharmaceutical industry only have a finite time to create value for its shareholders, which is defined by the patent validity. Chemical drugs, which are the overwhelming majority of drugs, have no other tools (e.g., trade secrets or manufacturing know-how) to extend their standard lifespan. The manufacturing of chemical drugs is

standardized. So, once the patent expires, they can be easily reproduced as generics by competitors. (Ding, Eliashberg, & Stremersch, 2014). For example, Novartis AG has an operating division (Sandoz) with the sole purpose of bringing generic products to the market as soon as its patent expires.

These three characteristics set the context of pharmaceutical innovation, in which the firm must consider and balance four key dimensions: cost, uncertainty, return, and time (Figure 4).

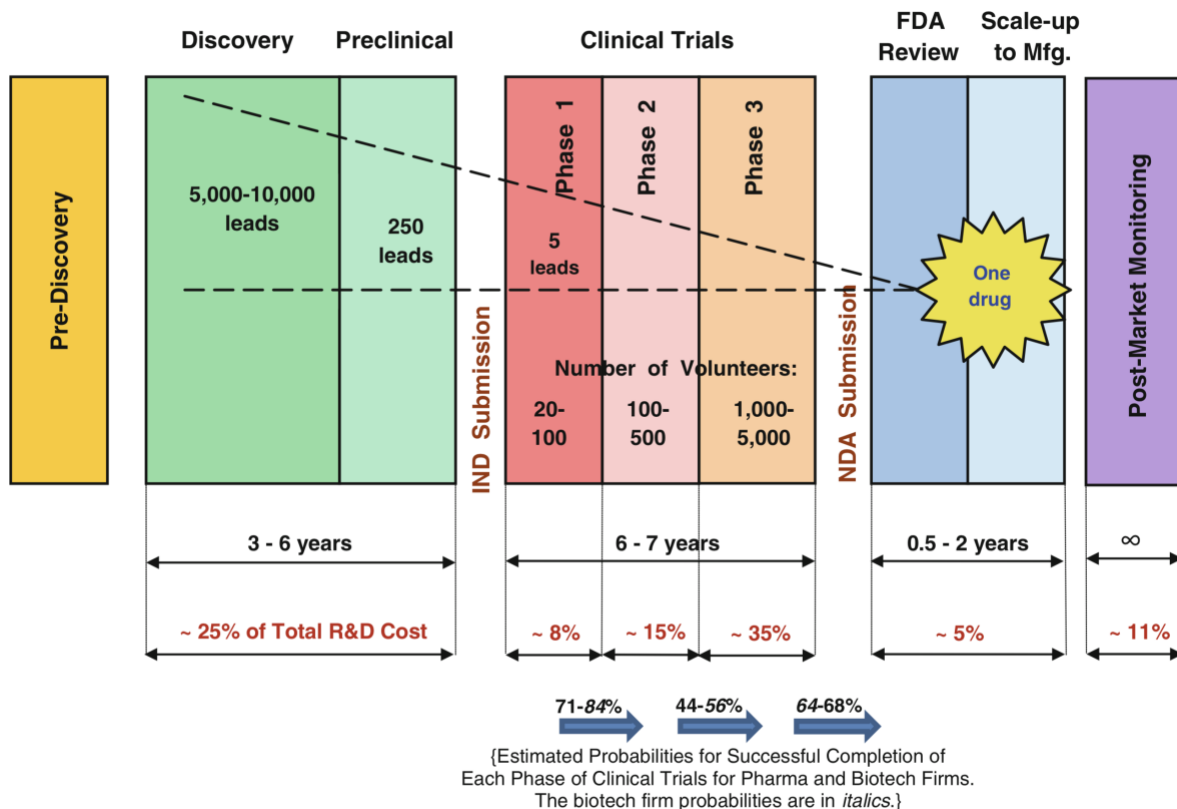


Figure 4. The research and development process for new drugs (Petrova, 2014).

The cost of pharmaceutical innovation has surpassed the staggering amount of US\$1Billion, if they include the cost of dry holes (90% of projects fail in the R&D process) and the opportunity cost due to the long-term horizon of development (the large time gap between investment and return). Even without those two costs, clinical trials for drug candidates are extremely expensive. As a result, the cost of developing a drug plays a constraining role in the innovation decision, limiting the number of new drug projects that a firm can support. However, cost plays less of a strategic role in the innovation decisions compared to the uncertainty factor. As the probability of success is low, there is a need to actively manage the success rate. The main challenge is that the uncertainties of passing each stage are different for drug

candidates. Moreover, uncertainty is closely related to return. The firm must select innovation projects that can potentially provide large-scale returns (with a minimum equal to lost income due to patent expiration of existing blockbuster drugs). Thus, the firm must balance how much uncertainty it is willing to take, in order to have a return. Finally, firms need to consider time: Since the majority of the income comes from drugs with patent protection, pharmaceutical firms have to manage their product timing, as its income will evaporate once the protection ends. Consequently, the revenue of a pharmaceutical firm is unstable. To smooth out these kinks, it is critical for a firm to plan ahead so that new drugs can be launched at least in time to replace the expected loss in revenue due to patent expiration. Due to the long-term horizon of development, which usually lasts 12 years, this balancing act is extremely challenging (Ding, Eliashberg, & Stremersch, 2014).

To conclude, a pharmaceutical firm must be able to balance return, uncertainty, time and cost within its finite budget. This is not an easy task considering the pressures from financial markets. As a result, pharmaceutical companies do more short than long-term optimization of product innovation (Ding, Eliashberg, & Stremersch, 2014). Investing in other types of innovation thus might be a solution to this challenge.

3.3 Marketing in the Pharmaceutical Industry

In order to unlock the full value of successful product innovations, a pharmaceutical company needs to have the right marketing capabilities. However, marketing pharmaceutical products is not so obvious as they have ‘double personalities’. Society perceives them as a conventional product that addresses certain customer needs (health), and as something to which human beings have a fundamental right. In the first case, all rules of commerce should apply to it. However, in the second, many standard marketing practices must be modified. For example, some expensive medicines might be scrutinized if low-income people cannot afford it. It might be argued that people should have access to medicine regardless of their financial status (Ding, Eliashberg, & Stremersch, 2014), e.g. social scrutiny of Novartis AG, due to the FDA’s recent approval of the world’s most expensive drug of \$2.1m for the treatment of spinal muscular atrophy (The Financial Times, 2019).

As a result, pharmaceutical companies must take into account these two conflicting attributes of drugs while trying to maximize the value from their innovation. In order to achieve this, careful management of relationships between the key players—patient, provider (e.g.,

physician), and payer—as well as the relationship among competitors (within the existing regulations) is required (Figure 5).

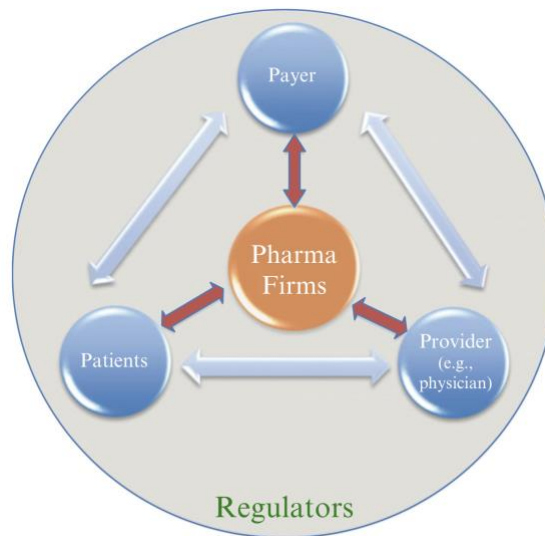


Figure 5. *Players and relationships in the Pharmaceutical Industry (Ding, Eliashberg, & Stremersch, 2014).*

The pharmaceutical industry is unique as its consumers are often not the ones who pay and make the purchase decision. drug purchase is a decision by the user (patient) and gatekeeper (physician). In this relationship, the gatekeeper has the final decision-making power (Ding, Eliashberg, & Stremersch, 2014). However, the patient is not completely powerless as he can go to another physician or passively protest by not getting the prescribed medicine. This relationship heavily changed due to the internet and the rise of the self-directed consumer. A firm must thus be mindful of this relationship and the role of (online) social networks when formulating and executing its marketing strategies. A second complication is that drugs are paid for by a third party, which often influences firms, physicians, and patients (Ding, Eliashberg, & Stremersch, 2014). They often put pressure on physicians or pharmacists regarding the drugs they should prescribe, steering them towards low cost and older drugs. In some cases, physicians and pharmacies even receive financial incentives from payers for prescribing more generics and preferred drugs. Moreover, a third-party payer may induce patients to choose lower-cost drugs by imposing different levels of copayments for drugs. The last complication is the payers using their market power to demand drug discounts

Besides the complex relationships in this industry, there is also a severe regulator. Regulation takes many forms in this industry, for example, new drug approval, drug monitoring, manufacturing, promotion/advertising practices to physicians, etc. For example, in direct-to-

consumer advertising, firms can communicate their drugs to patients, but all advertisements are subject to the oversight and must include a balanced presentation on both efficacy and side-effects as in the corresponding label. As a result, pharmaceutical firms heavily rely on promotion to physicians to market drugs. In most countries, governments play the dual role of regulator and payer. So, drug price is often regulated in different ways and the profits of pharmaceutical firms are sometimes even restricted.

To conclude, a successful pharmaceutical firm must implement a marketing plan that builds upon the complex decision-making process and the multi-faceted role of a third-party payer, while at the same time adhering to the rules set by regulators.

3.4 CSR in the Pharmaceutical Industry

The pharmaceutical industry is recognized as a leading sector in CSR with substantial sustainability activity (Schneider, Wilson, & Rosenbeck, 2010). Sustainability has been on the radar of the major pharmaceutical firms for almost three decades and has become central to the business strategy of these companies (Esteban, 2008). Although the industry has significant involvement in sustainability, it continues to have high profile ethical lapses, such as major product safety issues leading to recalls and financial losses, i.e. a recent Reuters report that claimed that some of Johnson & Johnson's baby powders were contaminated with carcinogenic asbestos, which led to millions in loss and huge brand damage (Reuters Investigates, 2018). As a result, sustainability-related activity has increased both in breadth and depth. Over time, it shifted towards corporate social responsibility, reflecting a corporate need to satisfy public sentiment. Moreover, research suggests that it is becoming a standard of practice for the industry (Schneider, Wilson, & Rosenbeck, 2010). Therefore, the pharmaceutical industry is the perfect industry to analyze the mutual effects of innovation and corporate sustainability, since it is both an innovation-driven and 'mature' corporate sustainability industry.

4 The complementarity of Innovation and CSR

4.1 Introduction

This thesis argues for the business case of CSR, where CSR is not seen as a reaction to external demands, but rather as a source of competitive advantage, often referred to as strategic CSR. Since CSR implies numerous changes from companies, research has shown that innovation can constitute as a tool to support both the implementation process and achievement of CSR objectives (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016). On the other hand, sustainable development has been proven to generate new opportunities or possibilities to innovate (Ferauge, 2013). As there is relatively little work on the complementarity of CSR and innovation, the goal of this fourth part is to provide better insight regarding the connections linking CSR and innovation. Simultaneously, it will act as the rationale linking the two concepts and answering a part of the research question with the conceptual framework (Figure 6).

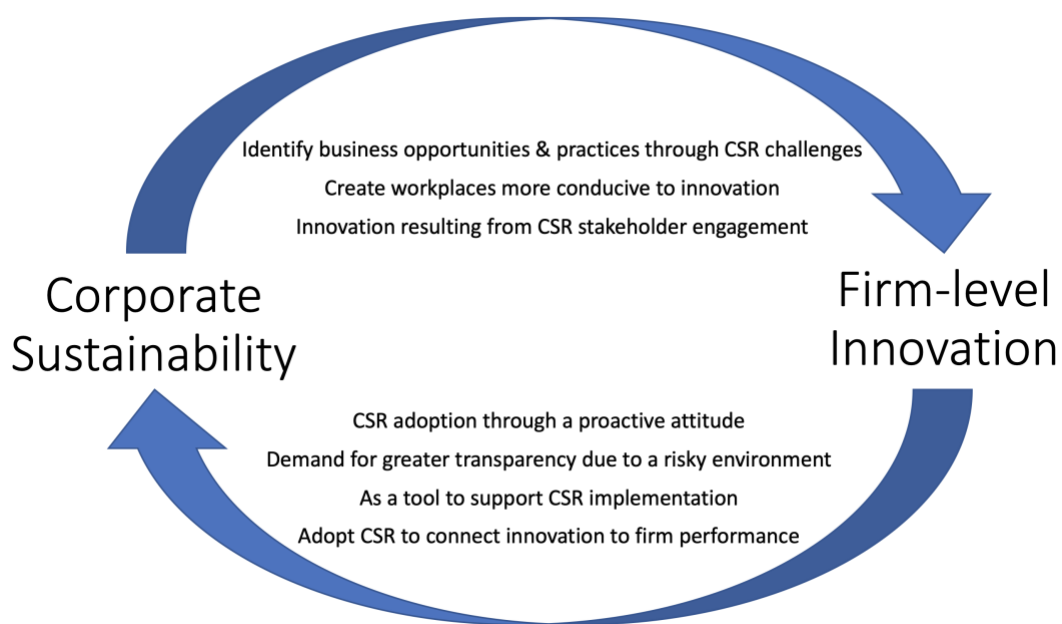


Figure 6. Conceptual model of the mutually reinforcing relationship between CSR and innovation

4.2 The effects of innovation on CSR

As discussed before, innovation is a complex phenomenon, which can be interpreted in many different forms (Saunila & Ukko, 2012). Despite being an ambiguous concept, research has shown that innovation represents an important tool for achieving and supporting CSR (European Commission, 2008). This study identified four ways of how innovation can cultivate CSR, based on the literature review.

4.2.1 Leveraging on the innovative firm's proactive attitude for CSR adoption

The diffusion of innovation is a classic view of social systems that seeks to explain why, at what rate and how ideas and technologies spread (Rogers, 1962). It was used by MacGregor et al. (2007) in an exploratory research that connects the innovation diffusion theory with other works in the CSR field. More specifically, they looked at the conditions under which firms are proactive in their sustainable development. This is important because reactive approaches are supposed to generate lower value, because they are slower to adapt to change. The research states that social innovation requires a proactive attitude, which industry leaders and best practice firms often have due to their innovation capabilities (MacGregor, Bianchi, Hernandez, & Mendibil, 2007).

For example, in fulfilling customer demand before it manifests itself. Similarly, a proactive approach to CSR is what makes a CSR strategy create value. By anticipating legal requirements and social trends, proactive firms are best positioned to reap the gains from social innovations. Therefore, mainly proactive actors will foster change in the overall production and consumption system. This facilitates CSR progress towards the tipping point of the adoption curve, where sustainable business practices will become the norm rather than the exception (MacGregor, Bianchi, Hernandez, & Mendibil, 2007).

Similarly, Brown and Eisenhard (1995) pointed out that companies with the capacity to innovate are faster and better in responding to environmental challenges than companies that are not. Padgett and Galan (2010) also proved that R&D intensity positively affects CSR in manufacturing industries, indicating a positive relationship between the proactive attitude and CSR. The innovative attitude proves to be a valid way to transfer knowledge to offer better solutions and implement innovative ideas and decisions, leading to more CSR (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016).

The proactive attitude is thus one of the main characteristics of innovative companies. They do not wait for competition or external pressure to take action, which exactly is the attitude and culture that is required for CSR adoption and success. Moreover, both open-minded and proactive attitudes are required for the successful implementation of a CSR strategy (MacGregor, Bianchi, Hernandez, & Mendibil, 2007).

4.2.2 The risky environment of innovation demands greater transparency

Innovation is a risky and expensive activity that has the potential to deliver high value. However, it brings some negative implications, e.g. the increased exposure to market risk, higher costs, employee dissatisfaction and unwarranted changes (Guerrero-Villegas, Sierra-García, & Palacios-Florencio, 2018). As innovation is inherently linked to highly risky operations, stakeholders that are close to firms that deal with high levels of innovation can demand greater transparency. This might give them more control over the firm's operations, and they will have a better judgment on the firm's sustainability and responsibility in its processes. Following the stakeholder theory, it is argued that the level of debt in the firm's capital structure influences the importance of this creditor stakeholder group. As a result, management is more likely to address their financial claims potentially resulting in more engagement in CSR activities (Bruns, 2017).

To conclude, high-innovation firms are often motivated to signal their sustainability through CSR, as this will relieve stakeholder's concerns. This might attract more financing and give them a less expensive cost of capital overall. Ultimately, achieving sufficient capital investments to commercialize new products and services is critical for achieving success from innovative activities (OECD, 2009).

4.2.3 Innovation as a tool supporting the implementation of CSR

While senior management wants to integrate the three pillars of profitability into their company, research suggests they should leverage their innovation processes and capabilities (Ferauge, 2012). Since CSR is about finding an effective balance between social, environmental and economic achievements and convincing people to act on it, innovation processes should be used to create unity of purpose. For example, a company could leverage HR and change processes to implement the CSR vision and objectives into daily operations. A good example is pushing process innovation to reduce waste in the drug production, resulting in eco-innovation. Also, the company's capacity to innovate will allow managers to share the organization's mission with the rest of the company members. This could drive internal stakeholders (e.g. managers and employees) to search for unique opportunities and relate them to the organization's strategic direction.

Using innovative capacity and processes for CSR has the advantage that the firm has more control over the process of change (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016).

Innovation involves making both knowledge creation and innovative action a way of life. Exactly the same needs to be done for CSR to succeed: novel (sustainable) practices need to be invented and commercialized or implemented. For example, a prior step towards transforming companies into greener and more sustainable entities demands innovation in technology development, employee training and redesigning the organizational structure. Over time, such innovations will fuel the company's CSR efforts. In addition, new innovations help organizational members to be flexible in negotiating goals and objectives in a way that is appropriate to balance the conflicting demands of stakeholder groups (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016).

To conclude, in the pursuit of these sustainable goals, the firm should implement new activities through its innovation processes. Research suggests that some of the barriers that affect the adoption and success of CSR initiatives include the lack of integration with business strategy and appropriate measuring tools to weigh the success of these initiatives. Leveraging on the firm's existing innovation processes can be a solution to this problem (Mendibil, Hernandez, Espinach, Garriga, & Macgregor, 2007). As a result, the innovation process is considered a necessary business tool to integrate CSR (Ferauge, 2012).

4.2.4 Innovation leads to better firm performance when combined with CSR

Guerrero-Villegas et al.'s (2018) research further supported the theory that CSR is a way by which innovation positively impacts firm performance. Managers wanting to increase firm performance should thus focus on innovation enhanced by CSR practices, which brings us to the concept of social innovations. This concept represents new practices that aim to meet social needs in a better way than the existing solutions, for example working conditions, education, community development or health. Social innovations are created with the goal of extending and strengthening civil society in combination with enhanced firm performance.

Accordingly, innovative activity can improve stakeholder satisfaction and, consequently, the firm's CSR practices. For instance, innovations could bring more socially environmentally responsible technology, covering external stakeholders' needs about the environment. Concerning the internal stakeholders, innovation also could bring more responsible practices to its employees, for example by allowing and/or promoting the development of employees' skills and careers. In short, these innovative actions can improve corporate image and maximize social welfare as a whole.

To summarize, the literature states that there exists an indirect effect of innovation on firm performance which can be enhanced through CSR practices. As a result, being innovative should thus lead to more CSR (Guerrero-Villegas, Sierra-García, & Palacios-Florencio, 2018).

4.3 The effects of CSR on firm-level innovation

On the other hand, CSR also fosters firm-level innovation. Sustainable development brings some considerable challenges to businesses that emphasize the directions that innovation activities can take (Rexhepia, Kurtishib, & Bexhetic, 2013). It can highlight new business opportunities and numerous other occasions to innovate. It is argued that CSR initiatives can lead to innovation through the use of 'social, environmental or sustainability drivers to create new ways of working, new products, services, processes and new market space' (Little, 2006). CSR has pushed many companies to redefine their business models. Also, the European Competitiveness Report comprehensively states the three ways in which CSR can contribute to innovation and performance (European Commission, 2008):

- Identifying business opportunities through addressing societal challenges
- Creating workplaces that are more conducive to innovation
- Innovation resulting from engagement with a variety of stakeholders

4.3.1 Generation of new business opportunities, practices, and innovations.

In recent years we have witnessed an exponential increase of initiatives around the concept of CSR as a response to new legislation and an increased awareness of the public on societal and environmental issues. As a result, programs to protect the environment, develop eco-friendly products, support local communities, engage in fair trade activities and develop sustainable economies are now high on the agenda of many organizations and governments (European Commission, 2009).

The first effect from CSR on innovation is the improvements in the CSR process, often referred to as social innovation. Here, CSR enables the firm to identify business opportunities, i.e. through addressing societal challengers e.g. poverty or climate change. This identification of new business opportunities arising from social demands results in more environmental products, more efficient processes or even new business models aimed at the so-called bottom of the pyramid, formed by people with fewer resources (Rexhepia, Kurtishib, & Bexhetic, 2013).

Second, the research from McWilliams and Siegel (2000) shows that the adoption of environmental practices, going beyond the legal requirements, can promote investments in research and development, which in turn can produce either a process or product innovation. Vilanova et al. (2009) also proved that once CSR is integrated into the business process, it will generate innovative practices (and improved competitiveness eventually). So, CSR has an effect on firm competencies, specifically innovation, which is key because it enables the firm to adapt to the ever-changing needs of the marketplace. Moreover, it is pivotal to the profitability and long-term survival of any firm (Luo & Du, 2014).

In a more recent research paper, Peñalver et al. (2018) research the Spanish Agribusiness and validate that the implementation of CSR practices has a significant, positive influence on innovation strategy. As a result, they conclude that innovation has a mediating role between CSR and competitive success, which means that innovation likely increases when the company is socially responsible (Peñalver, Conesa, & Nieto, 2018).

4.3.2 Creating workplaces that are more conducive to innovation.

A second way CSR can foster organizational innovation is through the creation of better working conditions. Employee-friendly workspaces and jobs favor innovation and creativity based on increased employee participation, performance, and confidence (HO, 2012). From an internal point of view, a company should be able to influence the behavior of employees. If a firm wants to increase its innovativeness, it should incentivize a production unit to adopt new ideas relatively early (Rogers, 1962) For example, by making them accept innovation as a core value and trying to commit them to it, as the feature that most influences innovativeness are the values shared by the staff (Rogers, 1962). Having clear values and a good CSR reputation will foster this value alignment between the personnel and the firm (Voegtlin & Greenwood, 2016). On the other hand, a good CSR can act as a relational governance mechanism. CSR policies are a good way to prove a degree of compliance with corporate obligations to stakeholders, which might make them more excited to collaborate on projects related to innovation (Peñalver, Conesa, & Nieto, 2018).

Moreover, CSR mainly aims for excellence in the organization, with particular attention being paid to individuals and their working conditions. Barnett (2007) introduced the concept of the ability to influence stakeholders as ‘the ability of a firm to identify, act on, and profit from opportunities to improve stakeholder relationships through CSR.’ As employees are one of the

most important stakeholders, CSR should thus be able to influence them for a pursuit of excellence.

4.3.3 Innovation resulting from engagement with a variety of stakeholders.

A last way CSR can enhance firm-level innovation is as a result of dialogue with different stakeholders. Stakeholder dialogue, both internal and external to the company, is often an element of the CSR process and leads to enhanced cooperation. Cooperation allows a firm to have agreements through which companies share resources, capacities, or activities, with the objective of carrying out an exchange of knowledge. In their research Peñalver et al. (2018) prove that CSR has a positive influence on the cooperation of agribusiness companies. This can be useful in a complex and unpredictable environment, because cooperation allows more flexibility as the sources that determine innovation do not reside exclusively in the company. The same research also validates that cooperation positively influences innovation. It can thus be concluded that they proved the indirect relation between CSR and innovation through enhanced cooperation (Peñalver, Conesa, & Nieto, 2018).

A good example of this can be found in Mendibil et al.'s paper (2007): "Involvement of the user/customer in the development of product and services strengthens the relationship between SMEs and the society. This can lead to innovation in products and services aimed at needs/groups of society that were not previously targeted." This cooperation between the firm and customers is called inclusive design, a true source of future innovation. Another example is the best practice stakeholder relationship table, which identifies CSR-related practices that can potentially impact innovation.

Overall, research confirms the positive influence of a firm's stakeholder orientation: "CSR activities reflect a firm's stakeholder orientation and often range from community outreach, cause-related marketing, and employee well-being programs, to environmentally friendly sourcing and manufacturing practices" (Smith, 2003). This orientation strengthens the relationship between the firm, universities, and government. Firms with greater CSR activities thus enjoy broader access to valuable external knowledge from external stakeholders, which benefits innovation (Luo & Du, 2014). Smith (2003) also concludes that there often exists a compelling innovative business case for making a substantial commitment to CSR.

Lastly, multinationals often request deployment of CSR practices in their supply chain and enforce a social audit of their supply base. This creates a need for the suppliers to increase their value of product and services, which often leads to innovations in management processes. Similarly, penalizing the use of certain types of energy, processes or materials by external groups can lead to product and process innovations.

Mendibil et al. (2007) visualized the relationships between some of the stakeholders in the CSR-innovation relationship of the SME with the CSR:I actor model (Figure 7). It highlights the relationship between the internal and external stakeholders that interact in the CSR cycle.

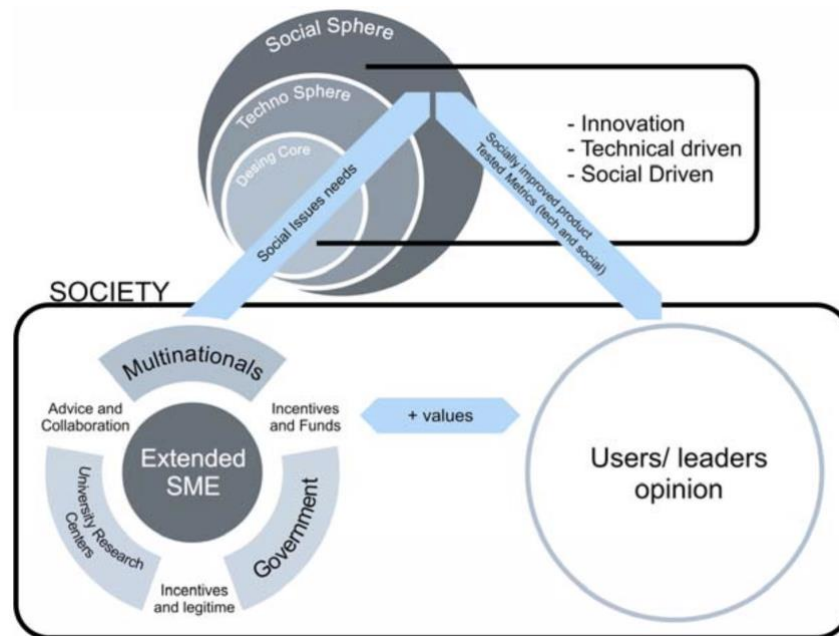


Figure 7. CSR:I Actor Model (Mendibil, Hernandez, Espinach, Garriga, & Macgregor, 2007).

Moreover, they visualized a simplified innovation process (i.e. idea generation- development-exploitation) and the relationships with stakeholders at different stages of the process. This model allows us to identify and visualize specific CSR activities that at each stage of the process can generate innovations (Figure 8). They argued that the existence of an established innovation process within the company can increase the potential of CSR generating more value to companies. It also appeared that a closer relationship between the different stakeholders is required to develop core competencies in developing socially responsible products and services (Mendibil, Hernandez, Espinach, Garriga, & Macgregor, 2007).

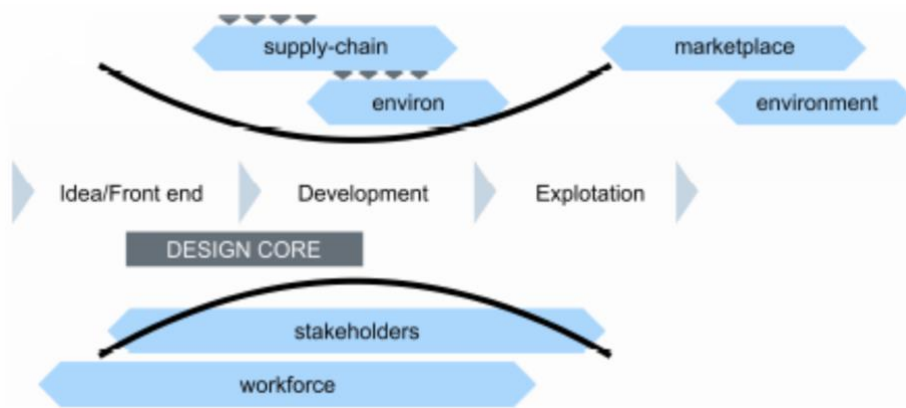


Figure 8. CSR: I Process of Innovation Model (Mendibil, Hernandez, Espinach, Garriga, & Macgregor, 2007).

To conclude, a firm's CSR program will enable it to build deeper relationships networks with its stakeholders and cultivate new relationships (research institutes, community leaders, environmental organizations, etc.). This will facilitate the sharing and exchange of valuable external resources and knowledge of its stakeholders because CSR will be a proof a company's good intentions and trustworthiness. Such an inflow of external knowledge complements the firm's internal knowledge and triggers innovation (Luo & Du, 2014).

4.4 Conclusion

From the knowledge-perspective, a firm's CSR programs will enable it to build broader and deeper relationships, identify more opportunities and creating workspaces that attract the right talent and foster knowledge sharing. This complements the firm's existing internal knowledge and triggers innovation. By showing that CSR activities boost innovation, there is again evidence that stresses the argument that expenditures on CSR may be better viewed as capital investments rather than operational costs. Managers should purposefully use CSR as a driver of innovation and find ways to channel stakeholders' external knowledge and ideas into the firm (Luo & Du, 2014). On the other hand, innovation in firms are argued to drive CSR as well (Ferauge, 2012). Innovative firms seem to have a better mindset, attitude and culture to adopt and successfully implement CSR. Moreover, the innovative environment demands for more transparency, such as CSR, leading to more access to capital and better firm performance (Cegarra-Navarro, Reverte, Eduardo, & Wensley, 2016). Also, the existing processes and tools for innovation are suggested to increase CSR adoption, through e.g. eco-innovation (Rexhepia, Kurtishib, & Bexhetic, 2013). There is thus a robust rationale supporting the complementary relationship between CSR and innovate.

Research Question

1 Introduction

This chapter presents the research question that this study tries to validate. Second, it lists the objectives that the research seeks to achieve, which are informative about the way the research question is approached. Afterwards, the concrete hypotheses that proxy the main research question are explained.

2 Questions and Objectives

Following Prof. Ioannou's call for "a more rigorous and evidence-based understanding of how corporate responsibility affects the performance of companies (Ioannou, 2017), this study aims to answer the following research question:

"How do company-level innovation and corporate sustainability relate?"

In order to do so, this study is focused on quantitative data from a very innovative and mature CSR industry, the pharmaceutical industry. After, similar research is conducted in a low-innovation industry context, the real estate industry. The research is centered on achieving the following research objectives:

- Build a theoretical framework that can proxy the innovativeness of a pharmaceutical firm and compare them to the metric for corporate sustainability, the ESG score.
- Ascertain a correlation between the company-level innovation metrics and corporate sustainability, building on the theoretical framework.
- Conceptual model: Discuss how the two concepts might complement each other.
- Conduct a similar analysis in a low-innovation industry context.

3 Hypothesis Development

In order to empirically prove or disprove the relation between innovation and sustainability in the pharmaceutical industry, a proxy for both concepts has to be made. This research chose to proxy a pharmaceutical firm's sustainability with its environmental, social and governance (ESG) score because engagement and compliance activities across the different ESG dimensions capture various aspects of stakeholder issues and CSR. Considering that innovation is a broad and complex concept, it cannot be directly measured. Innovation is thus indirectly measured in a holistic way. It will be measured by five innovation-related metrics: Resource Use Score, Innovation Score, Gross Margin, R&D Activity (with a proxy for both

absolute and relative expenditure), and a company's Gross Intangibles value. These five objective metrics give the research a broader perspective on the concept of innovation. The research takes the current literature one step further by measuring innovation quantitatively in a more holistic way compared to the traditional, R&D-focused, view of innovation measurement (Saunila & Ukko, 2012).

As a result, the five following hypotheses were developed to meet the objectives:

- Hypothesis 1: "A Pharmaceutical firm's ESG Score positively relates to its innovative capacity to reduce its Resource Usage in the supply chain"
- Hypothesis 2: "A Pharmaceutical firm's ESG Score positively relates to its Innovation Score"
- Hypothesis 3: "A Pharmaceutical firm's ESG Score positively relates to its Gross Margin%"
- Hypothesis 4: "A Pharmaceutical firm's ESG Score positively relates to its R&D Activity"
 - Hypothesis 4a: "A Pharmaceutical firm's ESG Score positively relates to its R&D Expenses (USD)"
 - Hypothesis 4b: "A Pharmaceutical firm's ESG Score positively relates to its R&D Expenses to Total Revenue, %"
- Hypothesis 5: "A Pharmaceutical firm's ESG Score positively relates to its Gross Intangibles"

After, similar research is conducted on a low-innovation industry, the real estate industry. Due to the nature of the industry, only hypothesis 1 to 3 will be tested in this new context. This additional perspective will enrich the discussion of the results and enable it to comment on the potential relationship between firm-level innovation and corporate sustainability in other industries than the pharmaceutical one.

A Theoretical Framework with proxy metrics for both firm-level innovation and corporate sustainability was developed. The structure holds the theory with the 5 hypotheses researched in this study (Figure 9).

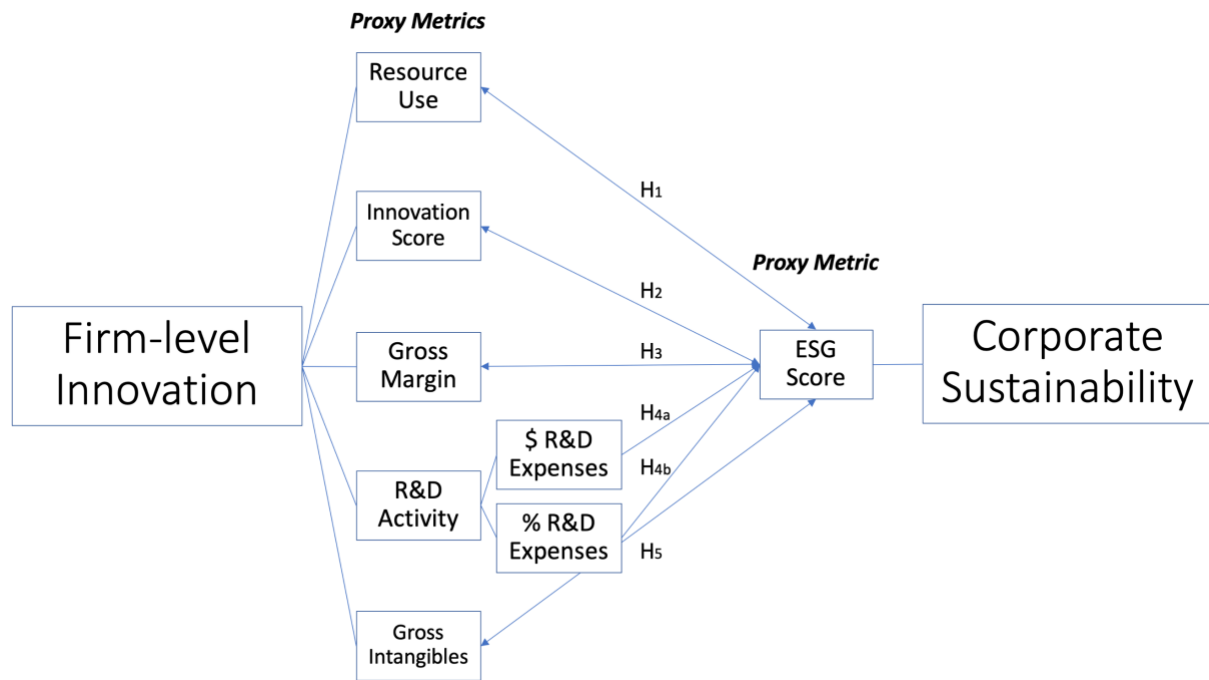


Figure 9. Theoretical Framework of Innovation-CSR relation hypotheses

Research Methodology

1 Introduction

In this chapter, the methodology of the research is discussed. Different research methods have been used in order to find and analyze the relationship between firm-level innovation and CSR in the pharmaceutical industry. In the first part of this chapter, the different methods will be discussed, followed by the research paradigm and the research methods used in this study. It describes the paradigm to highlight the philosophy that underpins the methodology. Second, an account of the quantitative research approach is given, as this is the approach that has been adopted for this study. Finally, a detailed description of the instruments is provided followed by a description of the way in which the data has been analyzed.

2 Overview of methods

In order to answer the research question and fulfill the objectives, both financial and non-financial data on listed pharmaceutical companies has been gathered from Thomson Reuters' Eikon platform, one of the largest providers of data to financial professionals. The company-specific data was accumulated through the examination of online-published annual reports, CSR reports, stock filings, news sources, and both NGO and company websites. All publicly available information was standardized to make it comparable. After, the totality of data was collected, cleaned and used to test the complementary relationship between innovation and CSR with statistical research methods.

3 Research Paradigm

In order to empirically test the relationship between firm-level innovation and CSR, an appropriate research paradigm has to be chosen to guide the research. Positivism has been adopted as the research paradigm of this study. This paradigm centers on the notion that there is a single reality or truth, and that this reality can somehow be measured. Hence, the focus is on reliable and valid tools (e.g. statistical analysis) to obtain the truth.

Positivism can be applied to social phenomena under the assumption that "the social world can be studied in the same way as the natural world, that there is a method for studying the social world that is value-free, and that explanations of a causal nature can be provided" (Mertens, 2005). As this thesis advocates for a mutually reinforcing relationship between firm-level innovation and corporate sustainability, it should empirically test this theory through

observation and measurement, in order to predict the forces influencing the subject. These characteristics perfectly fit the positivist paradigm. The potential relationship between the two concepts was thoroughly described in the literature review, now the positivist research paradigm is adopted to empirically validate the correlation between the two concepts using statistical tools on the gathered objective and quantitative data.

4 Research Method

A quantitative research method, which involves collecting numerical data and analyzing it, is used for this study. Both univariate and bivariate analysis are prominent: Univariate analysis is one of the simplest statistical analysis. It involves one variable and mainly describes the data. The bivariate analysis involves the analysis of two variables, for the purpose of determining an empirical relationship between them. The advantage of this quantitative method is that the research is highly structured and the results are objective, also, it allows to make predictions on the researched variable (Creswell, 2013). As a result, quantitative data analysis is chosen as a research method.

First, an exploratory data analysis (EDA) is conducted. The data is examined and displayed in relatively straightforward ways, e.g. with scatter plots or histograms to control the distribution of the numerical data, which did not require any hypothesis testing but rather focused on data visualization. Afterwards, bivariate statistical data analysis is conducted to test the hypotheses of association developed. The statistical association of the two variables of every hypothesis is measured through correlation and linear regression analysis. This type of analysis is often used to predict the extent to which a certain independent variable can predict the dependent variable. Both univariate (analysis of single-variable distributions) and bivariate (cross-classification, correlation, analysis of variance, and simple regression used to analyze two variables) analyses are conducted.

The regression analysis uses the ordinary least squares (OLS) technique which reports the T,P,F-statistics for every predicted variable. The T and F-statistics test whether the impact of the predictor variable on the outcome variable is significant or not, the p-value is a probability value that shows the likelihood of a valid null hypothesis. In this research, the OLS regression analysis is used in order to validate or disprove the hypotheses with both p and F values <0.05 significance.

Lastly, the same research is conducted on a low-innovation industry, the Real Estate Industry, using this second analysis as a control variable to test the hypothesis properly. According to multiple studies, the industry in which a firm operates actively influences whether or not a company engages in CSR (Bruns, 2017). This thus also influences whether or not CSR is used strategically, which potentially impacts innovation as well. So, validation from a low-innovation industry would strengthen the main hypothesis. However, due to the characteristics of this industry (influencing the availability of certain types of data), only hypothesis 1 to 3 are tested.

5 Tools and Instruments

Due to the positivist nature of this research, a numerical database is chosen as the main source of research. The database is built based on electronically available company data from annual reports, sustainability reports, ESG ratings and other high-quality news sources on the Thomson Reuters Eikon Platform. After that, the data is cleaned, explored (with EDA techniques using IBM's Watson Analytics) and analyzed using Microsoft Excel program's statistical features in order to determine the variables' association. First, the correlation analysis tool is used to calculate the correlation coefficient between the measurement variables. Second, the regression analysis tool is used to perform linear regression analysis by using the OLS method to fit a line through a set of observations. It is analyzed how the single dependent variable, the ESG Score, is affected by the values of independent variables. Lastly, the regression results can be used to predict the ESG Score of other companies.

The advantages of these statistical tools are that they can analyze larger sample sizes which make conclusions from quantitative research more reliable and generalizable. Second, statistics are well-suited for CSR research, which needs more systematic and standardized comparisons to convince businesses (Creswell, 2013). However, the statistical tools have the limits of missing out on the causal relationship, they neglect some context and might show a false impression of homogeneity in the sample.

Data

In this chapter, the data sample of this study will be discussed. First, data collection and cleaning are discussed. The sample will be described, as well as the selection criteria. Subsequently, preliminary analysis of the dependent variable is presented.

1 Data Collection

The research subjects for the hypothesis testing were carefully selected. All subjects are listed pharmaceutical companies that filed ESG reports for 2018 from the Pharmaceuticals (562010) Industry Group of the Thomson Reuters Business Classification (TRBC), an industry classification of global companies that covers over 70,000 public companies from 130 countries and provides over 10 years of classification history. TRBC is owned and operated by Thomson Reuters and classifies companies based on a degree of impact on markets, rather than establishment-based classification systems, such as the famous NAICS system. Together with the TRBC, the Thomson Reuter Eikon Platform was used as a tool to build the database and connect data from multiple sources.

The listed companies' documentary data was gathered from their annual reports, ESG ratings and sustainability reports from 2018. Moreover, the database was built on Eikon's unique data sets, which come from a range of trusted sources, with multi-asset content that includes company and economic data, news, and analytics. Pharmaceutical companies' ESG and sustainability reports were critically reviewed to represent the entire truth, as there is always the possibility to fulfill a specific agenda when compiling them. The researched data was examined alongside data from the other instruments, which were used to provide additional context. During the data collection, data was contemplated as if they might have been biased or inaccurate. Afterwards, a structured data cleaning process was executed.

2 Data Cleaning

After the Pharmaceutical Industry Group data collection, the data needs to be cleaned, because it is often incomplete, noisy or inconsistent. In this dataset, there is incompleteness for some records because the values for some attributes are missing. There are mainly two ways to solve this issue. The first option is to delete the whole record that misses data, which is viable when the number of records with missing data is relatively small compared to the whole dataset. The other option is to fill the missing values, where one can use the expected

value on the corresponding attribute or regression on other attributes to predict the missing value. In this study, the first option was executed, as can be found in Figure 10: First, all companies without ESG scores are deleted, this dramatically reduces the data pool from 1497 subjects to 159 subjects. After, companies without values on R&D expenditure are erased. This mainly concerns Chinese pharmaceutical companies, who often do not report on R&D investments. Third, companies without information on their gross margin were removed. An overview of company names, ticker and ESG Score can be found in Appendix 3.

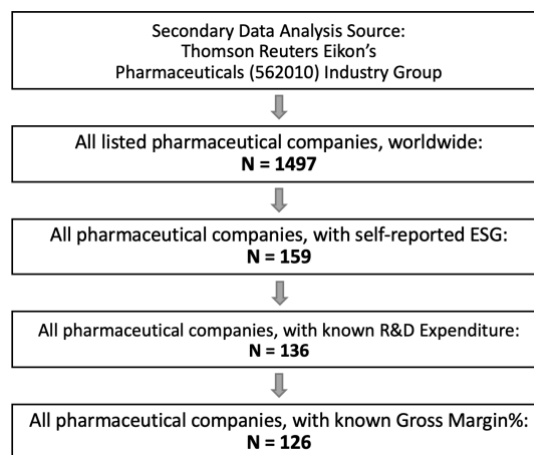


Figure 10. Structured Data Cleaning Process.

The second problem relates to noises, which refer to random factors that can only be quantified in a probabilistic way. They confound observations and cause outliers that are far away from normal observations. The primary task of data cleaning is thus to identify and 'smooth' out of these outliers. When performing the regression analysis for every hypothesis, the number of outliers is examined and the number of values exceeding two standard deviations of the predicted value were kept below 5% of the data set. In one case, extreme values were compared to industry standards and excluded from the data set. As a result, the whole records were deleted, which will be explained in the results section of the relevant hypothesis test.

3 Preliminary Analysis

The data sample was analyzed in an exploratory way through both descriptive statistics and graphs. Descriptive statistics are chosen because they are quantifiable while graphs are used because they are more intuitive. As presented in Table 1, a univariate analysis on the dependent variable, a company's ESG Score, was conducted in combination with an analysis

of its distribution. One could argue that the dependent variable is close to following a normal distribution when looking at the distribution: 1 in the 0-20 range, 36 in the 20-40 range, etc.

<i>ESG Score</i>		<i>ESG Score</i>	
Mean	53,36	<i>Bins</i>	<i>Frequency</i>
Standard Error	1,65	0,00	0
Median	52,23	20,00	1
Standard Deviation	18,49	40,00	36
Sample Variance	341,89	60,00	42
Range	73,95	80,00	36
Minimum	19,48	100,00	11
Maximum	93,43	More	0
Count	126		

Table 1. Descriptive Statistics of ESG Score

Further exploratory analysis on Watson Analytics, IBM's machine learning-based computer system, showed some promising relations in the data gathered as presented in Figure 11.

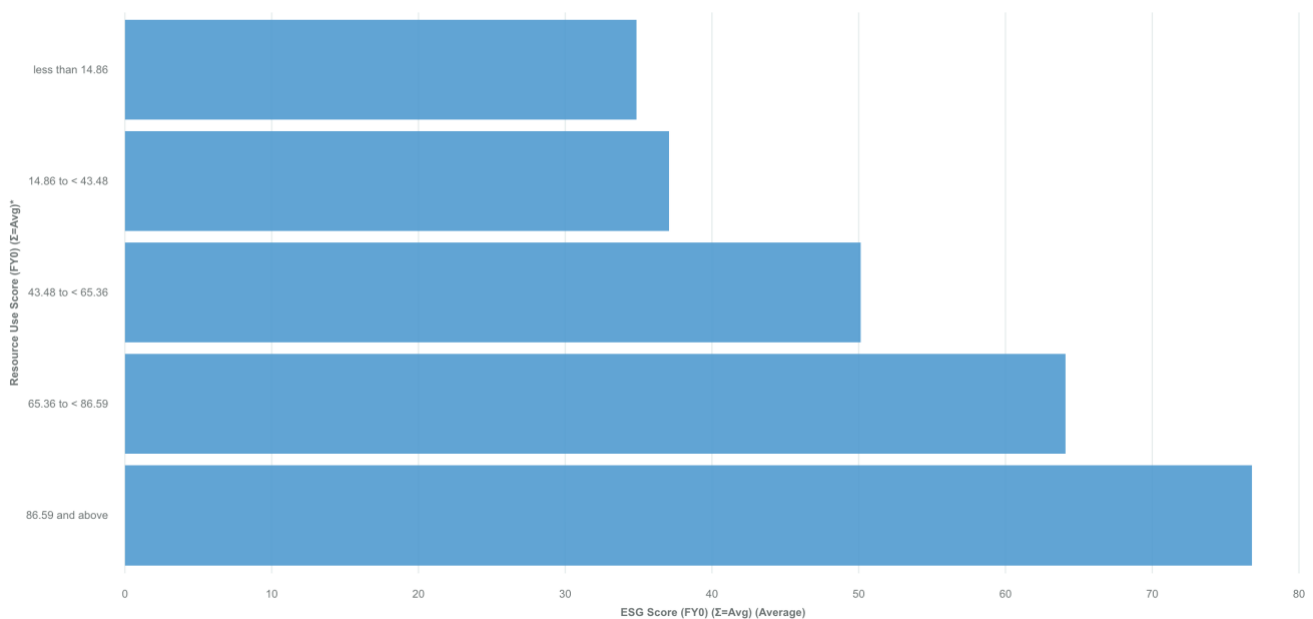


Figure 11. How do the Values of ESG Score compare to Resource Use Score (IBM Watson Analytics)

For the regression analyses, all key assumptions (linear relationship, normal distribution, little multicollinearity, no auto-correlation and homoscedasticity) were tested (Creswell, 2013). The correlation matrix can be found in Appendix 4.

Results

1 Introduction

This section of the paper details the results of the research. First, every hypothesis and its concrete relation to the main research question “How do company-level innovation and corporate sustainability relate?” is discussed. Second, a motivation of the chosen independent variable to proxy the hypothesis variable in combination with a potential explanation of statistical interventions is given. Lastly, the results from the correlation and regression analysis are provided. In every hypothesis, a company’s ESG score acts as the dependent variable ranging from 0 to 100. The ESG Score is used as a proxy to research a company’s sustainability because it is an overall company score based on the self-reported information in the environmental, social and governance pillars. Descriptive statistics of the independent variables can be found below in Table 2:

	<i>Resource Use Score</i>	<i>Innovation Score</i>	<i>Gross Margin, Percent</i>	<i>R&D (USD)</i>	<i>R&D, %</i>	<i>Intangibles, Gross (USD)</i>
Mean	53,31	53,74	0,61	1202310805,42	0,17	8486811865,60
Standard Error	2,92	2,76	0,02	254330043,64	0,03	1894043205,07
Standard Deviation	29,81	28,12	0,20	2593667710,78	0,33	19315526524,44
Minimum	14,64	1,09	-0,02	378203,15	0,00	1070130,00
Maximum	99,64	98,57	0,99	11257387405,75	2,00	95954000000,00

Table 2. Descriptive statistics of the independent variables

2 Hypothesis 1: “A Pharmaceutical firm’s ESG Score positively correlates with its Innovative Capacity to reduce its resource usage in the supply chain”

As discussed in the literature review, corporate sustainability is assumed to influence a company’s innovation capability by the generation of new business practices. One of the most popular types of internal innovations for a firm are product and process innovations for lower resource use. It is a very obvious case where CSR and Innovation reinforce each other. As a result, it is chosen to measure the relationship between sustainability and this kind of innovation by linking a firm’s ESG score to its Resource Use Score. The resource use category score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management. Data metrics were found for 126 pharmaceutical companies, and both EDA and bivariate analysis were performed. The results are shown below (Table 3).

Regression Statistics	
Multiple R	0,869
R Square	0,755
Adjusted R Square	0,753
Standard Error	9,179
Observations	126

Analysis of Variance					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	32288,28	32288,28	383,20	9,6682E-40
Residual	124	10448,29	84,26		
Total	125	42736,57			

Linear Regression						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	23,97	1,71	14,02	0,00	20,59	27,35
Resource Use Score	0,54	0,03	19,58	0,00	0,49	0,60

Table 3. Regression results Resource Use Score

As the regression statistics show, Resource Use has a strong and positive correlation with a firm's ESG score. Multiple R amounts 86,9% and proves significant linearity in the way the two variables relate to each other. Correspondingly, the covariance is significant and 75.5% of the variation in ESG score can be explained by the linear relationship to the Resource Use Score.

Accordingly, the F value is high enough to conclude that the regression is significant. The regression equation coefficient indicates that for every extra point in resource use score, the ESG is predicted to increase by 0,54. This leads to the conclusion that hypothesis 1 is significant and that we can accept that a pharmaceutical firm's ESG score positively correlates with its innovative capacity to reduce its resource usage in the supply chain.

3 Hypothesis 2: "A Pharmaceutical firm's ESG Score positively correlates with its Innovation score"

The second hypothesis results from the idea that increased engagement with stakeholders would benefit a companies' understanding of its customers' problems and environmental impact. As a consequence, a firm's innovation score is chosen as a proxy to measure the correlation with innovation. The environmental innovation category score reflects a

company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products. The correlation and regression analysis were conducted on the same group of listed pharmaceutical companies from the constructed database. The results can be found in the table below (Table 4).

Regression Statistics	
Multiple R	0,260
R Square	0,067
Adjusted R Square	0,060
Standard Error	17,929
Observations	126

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2878,366	2878,366	8,955	0,003
Residual	124	39858,207	321,437		
Total	125	42736,574			

Linear Regression						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	45,330	3,122	14,518	0,000	39,150	51,510
Innovation Score	0,160	0,054	2,992	0,003	0,054	0,267

Table 4. Regression results Innovation Score

The regression model shows a moderate yet significant positive correlation between the ESG Score and the Innovation score. The multiple R amounts only 26%, but still proves a linear relationship between the two variables. The covariance, on the other hand, indicates that only 6,7% of the variance of ESG scores can be explained by the innovation scores.

However, the linear regression analysis can be accepted based on the significant F and p values. The innovation score coefficient is positive and the ESG score is predicted to increase by 0,14 points for every extra point on the innovation score. As a result, the data allows us to accept the second hypothesis that a pharmaceutical firm's ESG Score positively correlates with its Innovation Score.

4 Hypothesis 3: “A Pharmaceutical firm’s ESG Score positively correlates with its Gross Margin %”

The third hypothesis is built on the assumption that superior innovation leads to superior margins. In the literature review, it was already highlighted that innovation leads to better firm performance when combined with CSR. Also, research has shown that there is a ‘significant correlation between the ideation rate and growth in profit’ (Minor, Brook, & Bernoff, 2017). So, if more sustainability results in higher innovation, it should result in higher margins in the long run. In the third hypothesis, the pharmaceutical’s gross margin percentage is taken as a proxy for its innovation. Again, a regression and correlation analysis are conducted on the 126 pharmaceutical companies that form the constructed database. The summary output of the analysis can be found below (Table 5).

Regression Statistics	
Multiple R	0,237
R Square	0,056
Adjusted R Square	0,049
Standard Error	18,036
Observations	126

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2399,820	2399,820	7,377	0,008
Residual	124	40336,754	325,296		
Total	125	42736,574			

Linear Regression						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	40,512	4,995	8,110	0,000	30,625	50,398
Gross Margin %	20,892	7,692	2,716	0,008	5,668	36,117

Table 5. Regression results Gross Margin %

Again, the regression shows a moderate yet significant correlation between a pharmaceutical company’s ESG Score and its Gross Margin percentage. The two variables move for 23,7% in relation to each other. Correspondingly, the covariance shows that the gross margin percentage only explains 5,6% of the variation in a firm’s ESG Score. Based on the F and P values, the regression analysis can be accepted. Looking at the coefficients of the model, it is predicted that a firm’s ESG value will increase with 0,208 point for every percentage point that

the gross margin increases. It can thus be concluded that the regression model is significant enough to accept the third hypothesis that the pharmaceutical firm's ESG Score positively correlates with its Gross Margin %.

5 Hypothesis 4: "A Pharmaceutical firm's ESG Score positively correlates with its R&D Activity"

Following the resource-based view perspective, engaging in corporate sustainability can help firms to differentiate and achieve a competitive advantage by providing both internal and external benefits (Frynas, 2015). On the other hand, companies can also differentiate themselves through R&D because this can lead to innovative products and processes (McWilliams & Siegel, 2000). Research has already argued that investments in R&D and CSR are positively correlated because they both relate to product and process differentiation (Padgett & Galan, 2010). So, one could view CSR as a mechanism for product differentiation, and firms that want to differentiate themselves through R&D can thus also do this by applying CSR into their products and/or processes (Bruns, 2017). It could thus be suggested that firms that invest in R&D, also engage more in CSR activities through innovative processes or products (Padgett & Galan, 2010). As a result, the fourth hypothesis was developed: A pharmaceutical firm's ESG Score positively correlates with its R&D Activity.

In order to measure the amount of R&D, often the absolute figure of R&D investments are used, however, this number is likely to be influenced by the firms' sales numbers and the size of the firm (Bruns, 2017). Moreover, corresponding with the legitimacy theory, it is argued that larger corporations are more likely to invest in CSR initiatives because of the greater public scrutiny over their behavior (Bruns, 2017). Therefore, this hypothesis is split and will be tested with both absolute and relative R&D numbers. So, large multinationals, who might be more likely to engage in ESG, would not bias the approval or disapproval of the fourth hypothesis. The first independent variable is the actual research and development expenses (in USD) of the pharmaceutical firms, the independent variable for the second analysis is the R&D expenses over the total revenue (USD) percentage. After the univariate analysis, it is decided to exclude seven outliers. All outliers have R&D expenses that outnumber their revenues, which should be considered an unusual case. As a result, they would create noise in the regression, so their entire records are excluded. Therefore, only 119 firms, with R&D

expenses up to 50% of their revenue, are analyzed. The regression and correlation results can be found below (Table 7 and 8).

5.1 Hypothesis 4a: “A Pharmaceutical firm’s ESG Score positively relates to its R&D Expenses (USD)”

<i>Regression Statistics</i>	
Multiple R	0,612
R Square	0,375
Adjusted R Square	0,369
Standard Error	14,238
Observations	119

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	14202,837	14202,837	70,0	0,000
Residual	117	23717,959	202,718		
Total	118	37920,796			

<i>Linear Regression</i>						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	49,629	1,445	34,344	0,000	46,767	52,491
R&D (USD)	4,48E-09	5,35E-10	8,370	0,000	3,42E-09	5,54E-09

Table 7. Regression results Research and Development Expenses (USD)

The first correlation and regression analysis with the absolute R&D Expense variable shows a strong and positive correlation with the firm’s ESG score. According to the covariance value, 37,5% of the variation in ESG Score can be explained by the R&D Expenses. The linear regression model is accepted, and the equation predicts that a firm’s ESG score should increase by 4,48 points for every extra billion USD invested in R&D. So, based on absolute R&D expenses, the fourth hypothesis could be accepted. Next, the regression analysis of the relative variable is given.

5.2 Hypothesis 4b: “A Pharmaceutical firm’s ESG Score positively relates to its R&D Expenses to Total Revenue, %”

<i>Regression Statistics</i>	
Multiple R	0,316
R Square	0,100
Adjusted R Square	0,092
Standard Error	17,081
Observations	119

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	3783,895	3783,895	12,969	0,000
Residual	117	34136,901	291,768		
Total	118	37920,796			

<i>Linear Regression</i>						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	47,738	2,514	18,990	0,000	42,760	52,717
R&D Expenses/ Total Revenue, %	61,576	17,099	3,601	0,000	27,713	95,439

Table 8. Regression results Research and Development Expenses to Total Revenue, %

First, the correlation analysis shows that there is a positive and moderate yet significant linear relationship between the firm’s ESG Score and its percentageal R&D expenses. The covariance variable indicates that 10% of the variation in ESG can be explained by the variation in relative R&D expenditure. The F and P values are again significant, which allows us to accept the linear regression. For every percentage point increase of the R&D%, the ESG score is predicted to increase by 0,615 points. Also, the relative independent variable regression analysis allows us to accept the fourth hypothesis.

5.3 Conclusion

Considering the acceptance of both sub-hypotheses, it can be concluded that a pharmaceutical firm’s ESG Score positively correlates with its R&D Activity. This is in line with McWilliams and Siegel’s research (2001) which found that R&D investment may result in both CSR-related process and product innovation, benefitting the ESG score.

6 Hypothesis 5: “A Pharmaceutical firm’s ESG Score positively correlates with its Gross Intangibles”

For the last hypothesis, a pharmaceutical firm’s past innovation performance is linked to its sustainability score. As mentioned before, a firm can leverage its innovative, proactive attitude to adopt corporate sustainability. As a result, past innovative performance should thus positively correlate with corporate sustainability. In this study, a firm’s gross intangibles (USD) are taken as a proxy for its innovation performance in the past. It consists of patents, copyrights, franchises, goodwill, trademarks, trade names, secret processes, and organization costs. Intangibles thus include ownership of innovative property and human resources that make a company unique (Keller, Korkmaz, Robbins, & Shippa, 2018). Data metrics were found for 104 companies since 18 companies from the final dataset had no information on the independent variable. Accordingly, their records are deleted and both EDA and bivariate analysis are performed on the remaining firms. The results are shown below (Table 9).

Regression Statistics	
Multiple R	0,506
R Square	0,256
Adjusted R Square	0,249
Standard Error	16,154
Observations	104

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	9156,019	9156,019	35,086	0,000
Residual	102	26617,526	260,956		
Total	103	35773,545			

Linear Regression						
	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	48,827	1,732	28,198	0,000	45,392	52,261
Intangibles, Gross (USD)	4,88E-10	8,24E-11	5,923	0,000	3,24E-10	6,52E-10

Table 9. Regression results Gross Intangibles (USD)

As the regression statistics show, Gross Intangibles has a strong and positive correlation with a firm’s ESG score. The Multiple R amounts 50,6% and proves significant linearity in the way how the two variables relate to each other. Correspondingly, the covariance is significant and

25,6% of the variation in ESG score can be explained by the linear relationship to a firm's Gross Intangibles (USD).

Moreover, the F value is high enough to conclude that the regression is significant. The regression equation coefficient indicates that for every extra billion USD in Gross Intangible assets, the ESG is predicted to increase by 0,49. This leads to the conclusion that hypothesis 5 is significant and that we can accept that a pharmaceutical firm's ESG Score positively correlates with its Gross Intangibles.

7 Result Analysis in a Low-Innovation Industry

As mentioned before, the industry in which a firm operates actively influences whether or not a company engages in certain CSR activities (Bruns, 2017). It is argued that different industries face different forms of public visibility and public scrutiny, leading to different rates of CSR adoption. In order to obtain clear results, it is important to control these industry effects. So, as all hypotheses were found significant, comparing the pharmaceutical industry with a low innovation industry is necessary to make the right conclusions.

Correspondingly, a similar analysis was conducted on the 'Real Estate Rental, Development and Operations' Industry (RE). The RE Industry is typically seen as a low innovation industry (Kittaneh, 2016). A dataset based on Thomson Reuter's Eikon Platform was built, following the TRBC 55402010 Industry Code classification, which exists of 2276 companies. After data cleaning, 170 listed companies remained. Due to the nature of the industry, only hypothesis one to three were tested. Data on R&D activity and intangibles were not available for the majority of data points.

As the regression statistics in Appendix 5 show, both Resource Use Score and Innovation Score have a strong and positive correlation with a firm's ESG score. The Multiple R amounts 80,1% and 59,4% respectively, which proves significant linearity in the way the two variables relate to ESG Score. Correspondingly, the covariance is significant and 64,2% and 35,3% respectively of the variation in ESG score can be explained by the linear relationship to a firm's Resource Use and Innovation Scores. Moreover, the F value is high enough to conclude that the regression is significant in both cases. However, the correlation between the ESG Scores and Gross Margin% was not significant for the Real Estate Industry, with an R of only 4,4%. This might indicate that Innovation has a low effect on profitability in this industry.

Discussion

1 Introduction

In this chapter, the results of the study and the implications will be discussed in detail. The results will be compared to the insights that were gained within the literature review so that they can be related to and positioned in the previous research. The overall aim of this chapter is to detail the precise significance of the findings in relation to the subject of research.

2 Discussion of the Results

A number of different aspects from firm-level innovation appear to relate positively to a firm's CSR performance. In this study, all researched hypotheses proved that firm innovation, innovative activity or its effects correlate with corporate sustainability in the pharmaceutical industry. One could thus argue that CSR compliance should not be viewed as an operational cost to meet external pressures, but rather as a strategic long-term capital investment. Similar to innovation, CSR is a peculiar investment that has low collateral value, but a high potential long-term return, if used strategically (Eccles, Ioannou, & Serafeim, 2014). As mentioned in the literature review, CSR can help companies in the pursuit of innovation and financial performance. But on the other hand, innovation can also help companies to adopt corporate sustainability and enhance both their environmental, social and governmental pillars.

In the first hypothesis, a strong correlation between the ESG Score on the Resource Use Score was found. This indicates that there exists a linear relationship between a company's sustainability performance and its innovative capacity to reduce the use of resources. This supports multiple studies that show that CSR strategies can lead to better firm-level innovation (Bocquet, Le Bas, Mothe, & Poussing, 2013). However, CSR-related innovations are mainly concentrated around environmental improvements and local community development (Frynas, 2015), of which the first is supported here. It could be argued that the biggest opportunity lies in environmental improvements such as the reduction of waste, emission, material usage, etc. Also, recycling and other eco-friendly practice innovations can contribute to the resource use score, and potentially generate a win-win outcome with corporate sustainability.

For instance, a pharmaceutical firm that is heavily concerned about its externalities and sustainability will thus probably be better at innovating its processes or products to use fewer

resources. On the other hand, a firm with strong supply chain management focusing on eco-efficient solutions to improve its department is likely to have better corporate sustainability metrics. These results provide strong evidence of a potential relationship between sustainability performance and the potential to generate eco-efficient innovations in the pharmaceutical industry. However, the nature of the potential causal relationship and which concept is the cause and which one the effect, still need to be researched specifically.

Second, the hypothesis on the positive correlation between the pharmaceutical firm's ESG score and its innovation score was accepted. A moderate yet significant correlation was found, indicating that there is a positive relationship, although it is far from sure that the relationship is linear. This could potentially be due to the fact that changes do not immediately pay off. However, the correlation highlights that the ESG score modestly relates to the company's capacity to reduce the environmental costs and burdens for its customers by creating new markets, eco-designed products, etc. These results align with previous research which suggested that CSR can contribute to the development of new products and services, another important area of innovation (Frynas, 2015). For example, new products and business models targeting poor consumers proved that multinationals can help reduce poverty and increase poor people's health while being profitable (Frynas, 2015), e.g. Johnson and Johnson's Health for Humanity project (Johnson & Johnson, 2017)

Since CSR implies numerous changes from companies, innovation might act as a tool to support this implementation and change process. Also, it should be leveraged to achieve higher CSR objectives. On the other hand, focusing on sustainability can help in the generation of new opportunities, leading to a higher innovation score in the long term. Due to time lag, the complementarity of CSR and innovation in the dataset could be softened. Further research could address the exact linkages between CSR and innovation.

Third, a weak correlation was found between the pharmaceutical firm's ESG score and its gross margin percentage. The assumption behind this test was that innovative firms have or create more competitive advantages which lead to better margins due to the differentiation from competitors. Again, the argument that time lag can be a cause for weak correlation in the pharmaceutical industry is relevant. The industry is known for its extremely long R&D innovation processes, which can take more than ten years. So, the effects of CSR-driven innovation might only show up in the coming years. Perhaps the most important conclusion

from this hypothesis validation is that higher ESG scores mutually relate to better financial performance, through higher gross margins. This is in line with Eccles et al. (2014) longitudinal study that verified sustainability's profit potential by proving that high-sustainability companies notably outperformed their counterparts in financial performance. The ESG-Gross Margin correlation thus adds up to the business case of CSR in the pharmaceutical industry.

Next, the fourth hypothesis was accepted after a double bivariate correlation analysis. Both the absolute and relative R&D variables, 'R&D Expense' and 'R&D/Total Revenue %', are significant. The first shows a strong correlation, indicating that firms that heavily invest in R&D correspond to firms with a higher ESG score. For this type of high-innovation companies, research suggest that it is more in their interest to engage in corporate sustainability. Guerrero-Villegas et al.'s (2018) research suggest that CSR is a way by which innovation positively impacts firm performance. Maximizing firm performance via innovation would thus be enhanced by engaging in CSR. Moreover, results are in line with several studies that investigated R&D expenditure levels of firms as a determinant of CSR. They argue that firms that want to differentiate themselves by investing in R&D, can do this by applying CSR aspects into their products or into their processes or both (Bruns, 2017). As a result, firms that invest in R&D will also engage more in CSR activities through innovative processes or products and have higher ESG scores. However, caution should be taken because a higher ESG score might be due to a larger firm size, with more resources and more financing going towards R&D. This leads us to the second variable, which showed a weaker, yet significant correlation with ESG. This allows us to conclude that the ESG score and R&D Activity compare in the pharmaceutical industry. One can thus expect that increased product innovation in the pharmaceutical industry will parallel with higher corporate sustainability.

Lastly, the hypothesis related to a firm's past innovation activities, proxied by a firm's gross intangibles, was tested. The regression statistics showed a positive and significant correlation between a firm's gross intangibles and its ESG score. Intangibles such as reputation, trust, and capacity to innovate are widely recognized as fundamental to strong financial performance (White, 2006). Again, indirectly advocating for the business case of CSR. Also, this is a strong indication that R&D intensity might positively affect corporate sustainability, which is in line with Padgett and Galan's research (2010). One argument could be that a seasoned innovative firm can leverage its ability to change, or its proactive attitude, to adapt to corporate

sustainability and get the most out of it. Second, innovative companies are also more experienced in transferring new knowledge, which could help them in addressing more unarticulated needs and meeting new requirements. This can be an advantage to them in terms of addressing social and environmental needs, which can over time result in a better CSR performance. On the other hand, one could argue that firms with a legacy in innovation are more competent in transparency. Considering the risky environment of innovation, they might be more familiar with sharing company information with external stakeholders, e.g. financiers, which now benefits them in sustainability self-regulations, leading to better ESG scores. Once more, one should be careful with drawing conclusions because bigger firms can be expected to have higher intangibles assets, and thus possibly more resources for corporate sustainability. However, it can be concluded that pharmaceutical firms with historically higher innovation activity, mainly concerning drug and production process innovations, correspond to firms with higher corporate sustainability (under the assumption that gross intangibles are a good proxy for this past innovativeness).

For our ‘control’ low-innovation industry, the Real Estate Industry, only the first two hypotheses – on Resource Use and Innovation Score – are found positive and significant (Appendix 5). This indicates that also in a low-innovation industry, increased innovative capacity, in resource use and potential to reduce both environmental costs and burdens for customers, relates to higher corporate sustainability. The third hypotheses, “a positive relation between the firm’s ESG Score and its Gross Margin %”, was rejected due to a low correlation. This could be a result of the low-innovation industry context. As innovation is not that important to real estate companies, it will not really influence their gross margins or profitability, which in turn results in lower innovation. So, the rejection of the third hypothesis in the RE industry does not lead us to reject the overall conclusion that corporate sustainability and firm-level innovation positively relate to each other in low-innovation industries.

Conclusion

1 Introduction

In this study, the bi-directional relationship between corporate sustainability and firm-level innovation is analyzed. Both the impact of CSR, through the adoption of environmental practices, etc., on innovation and the impact of innovation on CSR is extensively studied and empirically tested in the pharmaceutical industry. CSR and innovation have rarely been discussed in combination in literature, even though CSR is increasingly becoming a part of strategy, and innovation is one of the main drivers of success. To be innovative and successful today, businesses have to consider the social and environmental impact of their operational processes, encourage and support employees to be creative, and collaborate with their customers, suppliers and other stakeholders in designing and developing new products and services.

More than any other industry, the pharmaceutical industry has to keep innovating while bearing the responsibility for humanity's health. As a leading sector in CSR with substantial sustainability activity, this high-innovation industry is the perfect sector for research. Moreover, the pharmaceutical industry faces some tough challenges due to rising drug development costs. Since there currently is more short-term than long-term optimization of product innovation, a new source of innovation is desperately needed.

2 Conclusion

2.1 Research Summary

Based on the extensive literature study, a conceptual model explaining the potential mutually reinforcing relationship between the CSR-Innovation concepts was developed. This theoretical understanding highlights the three ways CSR is expected to influence innovation: the generation of new business opportunities, creating workplaces that are more conducive to innovation, and innovation resulting from an enhanced engagement with multiple stakeholders. Likewise, it featured the four ways how innovation can foster CSR adoption and performance: Leveraging on the innovative firm's proactive attitude, the risky environment of innovation demanding greater transparency, innovation as a tool for implementing and supporting CSR, and adopting CSR so that innovation would lead to better firm performance.

Afterward, a theoretical framework was created to test the positive relationship between the two concepts. Corporate sustainability was proxied by a firm's ESG score, and innovation was holistically measured through a set of input and output metrics: Resource Use and Innovation Score, Gross Margin %, R&D Activity, and Gross Intangibles. Through statistical analysis, evidence for all five hypotheses was found. This empirically proves a positive relationship between the two concepts, with a strong indication of a potential mutually reinforcing relationship in a high-innovation industry like the pharmaceutical sector.

2.2 Practical Implications

There is a strong indication that firm-level innovation and corporate sustainability are mutually reinforcing in the pharmaceutical industry. As traditional innovation gets more and more expensive, pharmaceutical companies might want to engage more and find a strategy in CSR to embark on new ways of innovation, e.g. creating medical value through technology enablement as digital health. Companies should try to move up Visser's (2010) stages of CSR, moving from CSR as risk management to value creation, where CSR is a strategic activity that creates value for the long-term. So, CSR should be viewed as an investment rather than a cost.

3 Limitations

3.1 Firms with a CSR reactive approach

Of course, not all CSR practices create value. In particular, the type of CSR reactive practices might have a very different impact on innovation than the CSR proactive strategy practices, and even hinder innovation (Bocquet, Le Bas, Mothe, & Poussing, 2013). Moreover, this research did not prove which CSR activities contribute to innovation and vice versa.

3.2 Sample bias: "only successful and big companies report ESG"

Since ESG is mostly reported on a voluntary basis, only the sustainable and successful pharmaceutical companies might report, resulting in a biased dataset. Second, this database mainly consists of Western companies due to the data cleaning process, which again might result in a biased sample of listed pharmaceutical companies. No control on the exact representation of the sample to the listed pharmaceutical industry was conducted.

3.3 Implication for other (low-innovation) industries

A small “control” research was already conducted on the Real Estate industry, accepting two of the three hypotheses tested. As the third hypotheses – linking ESG with Gross Margin % - was not accepted, linkages such as ‘engaging in CSR to connect innovation to financial performance’ might not be valid anymore. Further research on other industries is needed to validate the complementary relationship of innovation and corporate sustainability in general.

4 Suggestions for further research

For future research, the strong correlation between innovation and CSR highlights the importance of further analysis into the causality between the two concepts, certainly within the pharmaceutical industry. More specifically, examining the exact links, building on the conceptual model, would be of interest for the business case of CSR. Proving the causal relationship between the two concepts would bring significant added value to the firm strategic perspective of both CSR and innovation. Second, similar research into other industries, certainly in low-innovation industries, can be of interest to know more about the context of the perceived relationship. Lastly, specific research into the effects of responsive CSR on innovation performance or the types of innovation’s relation to CSR, are of interest.

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Appendixes

1. Factors relating to the objectives and effects of innovation (OECD & Eurostat, 2005).

Relevant for:	Product innovations	Process innovations	Organisational innovations	Marketing innovations
Competition, demand and markets				
Replace products being phased out	*			
Increase range of goods and services	*			
Develop environment-friendly products	*			
Increase or maintain market share	*			*
Enter new markets	*			*
Increase visibility or exposure for products				*
Reduced time to respond to customer needs		*	*	
Production and delivery				
Improve quality of goods and services	*	*	*	
Improve flexibility of production or service provision		*	*	
Increase capacity of production or service provision		*	*	
Reduce unit labour costs		*	*	
Reduce consumption of materials and energy	*	*	*	
Reduce product design costs		*	*	
Reduce production lead times		*	*	
Achieve industry technical standards	*	*	*	
Reduce operating costs for service provision		*	*	
Increase efficiency or speed of supplying and/or delivering goods or services		*	*	
Improve IT capabilities		*	*	
Workplace organisation				
Improve communication and interaction among different business activities			*	
Increase sharing or transferring of knowledge with other organisations			*	
Increase the ability to adapt to different client demands			*	*
Develop stronger relationships with customers			*	*
Improve working conditions		*	*	
Other				
Reduce environmental impacts or improve health and safety	*	*	*	
Meet regulatory requirements	*	*	*	

2. Factors hampering Innovation activities (OECD & Eurostat, 2005).

Relevant for:	Product innovations	Process innovations	Organisational innovations	Marketing innovations
Cost factors:				
Excessive perceived risks	*	*	*	*
Cost too high	*	*	*	*
Lack of funds within the enterprise	*	*	*	*
Lack of finance from sources outside the enterprise:				
Venture capital	*	*	*	*
Public sources of funding	*	*	*	*
Knowledge factors:				
Innovation potential (R&D, design, etc.) insufficient	*	*		*
Lack of qualified personnel:				
Within the enterprise	*	*		*
In the labour market	*	*		*
Lack of information on technology	*	*		
Lack of information on markets	*			*
Deficiencies in the availability of external services	*	*	*	*
Difficulty in finding co-operation partners for:				
Product or process development	*	*		
Marketing partnerships				*
Organisational rigidities within the enterprise:				
Attitude of personnel towards change	*	*	*	*
Attitude of managers towards change	*	*	*	*
Managerial structure of enterprise	*	*	*	*
Inability to devote staff to innovation activity due to production requirements	*	*		
Market factors:				
Uncertain demand for innovative goods or services	*			*
Potential market dominated by established enterprises	*			*
Institutional factors:				
Lack of infrastructure	*	*		*
Weakness of property rights	*			*
Legislation, regulations, standards, taxation	*	*		*
Other reasons for not innovating:				
No need to innovate due to earlier innovations	*	*	*	*
No need because of lack of demand for innovations	*			*

3. List of Companies (Thomson Reuters)

Identifier (RIC)	Company Name	ESG Score
AZN,L	AstraZeneca PLC	93,43
JNJ,N	Johnson & Johnson	89,89
AMGN,OQ	Amgen Inc	89,50
ROG,S	Roche Holding AG	88,24
GSK,L	GlaxoSmithKline PLC	87,79
BIIB,OQ	Biogen Inc	86,16
ABBV,N	AbbVie Inc	84,25
NOVN,S	Novartis AG	83,95
SASY,PA	Sanofi SA	82,14
MRCG,DE	Merck KGaA	81,34
NOVOB,CO	Novo Nordisk A/S	80,04
4503,T	Astellas Pharma Inc	79,61
CSL,AX	CSL Ltd	79,60
4523,T	Eisai Co Ltd	78,38
4528,T	Ono Pharmaceutical Co Ltd	77,67
BMY,N	Bristol-Myers Squibb Co	76,95
PHMR,MC	Pharma Mar SA	76,83
UCB,BR	Ucb SA	75,72
MRK,N	Merck & Co Inc	75,71
4502,T	Takeda Pharmaceutical Co Ltd	75,57
MYX,AX	Mayne Pharma Group Ltd	75,45
LLY,N	Eli Lilly and Co	75,36
PRGO,N	Perrigo Company PLC	73,69
GRLS,MC	Grifols SA	73,66
PFE,N	Pfizer Inc	73,62
DIVI,NS	Divi's Laboratories Ltd	71,99
BAYGn,DE	Bayer AG	71,20
4578,T	Otsuka Holdings Co Ltd	71,15
1530,HK	3SBio Inc	70,17
RECI,MI	Recordati Industria Chimica e Farmaceutica SpA	69,70
CELG,OQ	Celgene Corp	69,69
HIK,L	Hikma Pharmaceuticals PLC	68,72
CIPL,NS	Cipla Ltd	66,88
600196,SS	Shanghai Fosun Pharmaceutical Group Co Ltd	64,64
4568,T	Daiichi Sankyo Co Ltd	64,53
KRKG,LJ	Krka dd Novo Mesto	64,43
EBS,N	Emergent BioSolutions Inc	64,29
4536,T	Santen Pharmaceutical Co Ltd	63,67
IPN,PA	Ipsen SA	63,48
MNK,N	Mallinckrodt Plc	62,86
000963,SZ	Huadong Medicine Co Ltd	62,50
4506,T	Sumitomo Dainippon Pharma Co Ltd	62,13
INDV,L	Indivior PLC	61,90

TEVA,TA	Teva Pharmaceutical Industries Ltd	61,31
4508,T	Mitsubishi Tanabe Pharma Corp	61,17
VIFN,S	Vifor Pharma AG	61,04
ZTS,N	Zoetis Inc	60,96
KLBF,JK	Kalbe Farma Tbk PT	59,58
1789,TW	ScinoPharm Taiwan Ltd	58,55
4519,T	Chugai Pharmaceutical Co Ltd	58,41
000538,SZ	Yunnan Baiyao Group Co Ltd	58,15
BTG,L	BTG PLC	57,80
MYL,OQ	Mylan NV	56,55
PXS,AX	Pharmaxis Ltd	56,29
AGN,N	Allergan plc	56,18
PCR,OO	Pacira Biosciences Inc	55,76
2877,HK	China Shineway Pharmaceutical Group Ltd	55,35
ORNBV,HE	Orion Oyj	54,66
SOBIV,ST	Swedish Orphan Biovitrum AB (publ)	54,41
600332,SS	Guangzhou Baiyunshan Pharmaceutical Holdings Co Ltd	54,33
3320,HK	China Resources Pharmaceutical Group Ltd	53,35
ABCA,L	Abcam PLC	52,53
002422,SZ	Sichuan Kelun Pharmaceutical Co Ltd	52,48
CBM,N	Cambrex Corp	51,98
DPH,L	Dechra Pharmaceuticals PLC	51,91
4151,T	Kyowa Hakko Kirin Co Ltd	51,58
ARBN,NS	Aurobindo Pharma Ltd	50,90
AMAG,OQ	AMAG Pharmaceuticals Inc	49,80
0460,HK	Sihuan Pharmaceutical Holdings Group Ltd	49,42
ALXN,OQ	Alexion Pharmaceuticals Inc	49,02
CORT,OQ	Corcept Therapeutics Inc	48,95
LUN,CO	H Lundbeck A/S	48,31
2269,HK	Wuxi Biologics Cayman Inc	47,43
GDRB,BU	Richter Gedeon Vegyeszeti Gyar Nyrt	47,07
000423,SZ	Dong-E-E-Jiao Co Ltd	46,22
600085,SS	Beijing Tongrentang Co Ltd	45,45
000999,SZ	China Resources Sanjiu Medical & Pharmaceutical Co Ltd	45,34
VCEL,OQ	Vericel Corp	44,98
0570,HK	China Traditional Chinese Medicine Holdings Co Ltd	44,64
BMRN,OQ	Biomarin Pharmaceutical Inc	43,39
1177,HK	Sino Biopharmaceutical Ltd	42,70
EGRX,OQ	Eagle Pharmaceuticals Inc	41,90
STAGn,D	STADA Arzneimittel AG	41,87
BHC,TO	Bausch Health Companies Inc	41,74
CTLT,N	Catalent Inc	41,61
600518,SS	Kangmei Pharmaceutical Co Ltd	41,50
AMRX,N	Amneal Pharmaceuticals Inc	41,32
HYPE3,SA	Hypera SA	40,73

1093, HK	CSPC Pharmaceutical Group Ltd	40,26
OPK, OQ	OPKO Health Inc	39,78
VEC, L	Vectura Group PLC	39,76
ENDP, OQ	Endo International PLC	39,68
PAHC, OQ	Phibro Animal Health Corp	38,19
ADVZ, TO	Advanz Pharma Corp	37,61
JAZZ, OQ	Jazz Pharmaceuticals PLC	37,41
002294, SZ	Shenzhen Salubris Pharmaceuticals Co Ltd	36,97
ACR, AX	Acrux Ltd	36,86
TARO, N	Taro Pharmaceutical Industries Ltd	36,82
ANIK, OQ	Anika Therapeutics Inc	36,11
WEED, TO	Canopy Growth Corp	35,86
TLGT, OQ	Teligent Inc	35,60
TBPH, OQ	Theravance Biopharma Inc	34,99
600436, SS	Zhangzhou Pientzehuang Pharmaceutical Ltd	34,81
LCI, N	Lannett Company Inc	34,78
HZNP, OQ	Horizon Therapeutics PLC	34,44
2186, HK	Luye Pharma Group Ltd	34,03
AMPH, OQ	Amphastar Pharmaceuticals Inc	33,83
068760, KQ	Celltrion Pharm Inc	33,11
600535, SS	Tasly Pharmaceutical Group Co Ltd	32,96
AKRX, OQ	Akorn Inc	32,72
ASRT, OQ	Assertio Therapeutics Inc	32,03
000100, KS	Yuhan Corp	31,32
APHA, TO	Aphria Inc	29,89
PLI, TO	Prometic Life Sciences Inc	29,66
TXMD, OQ	TherapeuticsMD Inc	29,46
GUD, TO	Knight Therapeutics Inc	29,29
FAE, MC	Faes Farma SA	28,64
603858, SS	Shandong Buchang Pharmaceuticals Co Ltd	28,11
COLL, OQ	Collegium Pharmaceutical Inc	27,84
AKCA, OQ	Akcea Therapeutics Inc	25,98
600276, SS	Jiangsu Hengrui Medicine Co Ltd	24,83
SUPN, OQ	Supernus Pharmaceuticals Inc	24,70
128940, KS	Hanmi Pharm Co Ltd	23,35
MDCO, OQ	Medicines Co	23,00
RMTI, OQ	Rockwell Medical Inc	21,84
KDMN, N	Kadmon Holdings Inc	19,48

4. Correlation Matrix

Correlation Matrix							
	ESG Score	Resource Use Score	Innovation Score	Gross Margin, %	R&D Expenses	R&D, %	Intangibles, Gross
ESG Score	1						
Resource Use Score	0,86476594	1					
Innovation Score	0,28867675	0,15011443	1				
Gross Margin, %	0,18703607	0,17723062	-0,0528812	1			
R&D Expenses	0,63417363	0,55561216	0,09923797	0,25802525	1		
R&D, %	-0,1579956	-0,077664	-0,2760173	0,18800815	0,0342409	1	
Intangibles, Gross	0,50590894	0,49243441	0,06762967	0,20482043	0,78618365	-0,0167296	1

5. Regression Results on the Real Estate Industry

a. Hypothesis 1: Resource Use Score

Regression Statistics	
Multiple R	0,801
R Square	0,642
Adjusted R Square	0,640
Standard Error	10,461
Observations	174

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	33791,494	33791,494	308,774	0,000
Residual	172	18823,248	109,437		
Total	173	52614,741			

Linear Regression						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	23,694	1,692	14,000	0,000	20,353	27,034
Resource Use Score	0,488	0,028	17,572	0,000	0,434	0,543

b. Hypothesis 2: Innovation Score

Regression Statistics	
Multiple R	0,594
R Square	0,353
Adjusted R Square	0,349
Standard Error	14,071
Observations	174

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	18558,772	18558,772	93,731	0,000
Residual	172	34055,969	198,000		
Total	173	52614,741			

Regression Analysis						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	31,094	2,222	13,993	0,000	26,708	35,480
Innovation Score	0,365	0,038	9,681	0,000	0,290	0,439

c. Hypothesis 3: Gross Margin %

Regression Statistics	
Multiple R	0,044
R Square	0,002
Adjusted R Square	-0,004
Standard Error	17,418
Observations	169

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	96,818	96,818	0,319	0,573
Residual	167	50667,482	303,398		
Total	168	50764,300			

Regression Results						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	48,777	3,031	16,095	0,000	42,794	54,760
Gross Margin, Percent	3,197	5,660	0,565	0,573	-7,977	14,372

6. Data Parameter Definitions

Parameter	Definition
Non-financial Data	
ESG Score	Thomson Reuters ESG Score is an overall company score based on the self-reported information in the environmental, social and corporate governance pillars.
Environment Pillar Score	The environmental pillar measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long term shareholder value.
Social Pillar Score	The social pillar measures a company's capacity to generate trust and loyalty with its workforce, customers and society, through its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long term shareholder value.
Governance Pillar Score	The corporate governance pillar measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long term shareholder value.
Resource Use Score	Resource use category score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.
Emissions Score	Emission category score measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.
Innovation Score	Environmental innovation category score reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new

	market opportunities through new environmental technologies and processes or eco-designed products.
Workforce Score	Workforce category score measures a company's effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.
Human Rights Score	Human rights category score measures a company's effectiveness towards respecting the fundamental human rights conventions.
Community Score	Community category score measures the company's commitment towards being a good citizen, protecting public health and respecting business ethics.
Product Responsibility Score	Product responsibility category score reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy.
Management Score	Management category score measures a company's commitment and effectiveness towards following best practice corporate governance principles.
Shareholders Score	Shareholders category score measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.
CSR Strategy Score	CSR strategy category score reflects a company's practices to communicate that it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes.
Financial Data	
Revenue	Is used for industrial and utility companies. It consists of revenue from the sale of merchandise, manufactured goods and services, and the distribution of regulated energy resources, depending on a specific company's industry.
Gross Profit	Represents a measure of a company's operating performance. Gross Profit states the profits earned directly from a company's revenues and direct costs.
Normalized EBITDA	Represents the sum of: Operating Income; Interest Expense (Income), Net Operating; Unusual Expense (Income); Loss (Gain) on Sale of Assets & Operating; Depreciation, Supplemental; Amortization of Acquisition Costs, Supplemental and Amortization of Intangibles, Supplemental.

Gross Margin, Percent	Represents Gross Profit divided by Revenue. Gross Margin is not available if either Gross Profit or Revenue is missing or if Revenue is negative.
Operating Income	Represents the sum of: Total Revenue and Total Operating Expense.
Research & Development	Represents expenses for research and development of new products and services by a company in order to obtain a competitive advantage.
R&D Expenses to Total Revenue, %	This ratio is calculated as the Research and Development Expenses divided by Total Revenue for the same period and is expressed as percentage.
Net Profit Margin, (%)	Represents Income Available to Common Excluding Extraordinary Items divided by Total Revenue. Net Profit Margin is not available if either Income Available to Common Excluding Extraordinary Items or Total Revenue is missing or if Total Revenue is negative.
Operating Margin, Percent	Represents Operating Income divided by Total Revenue.
Operating Profit - SmartEstimate Growth (Next Yr/This Yr)	The growth rate of Operating Profit SmartEstimate from this fiscal year to next fiscal year. The rate is displayed as a percent; for example, a growth rate of 17% is displayed as 17. If there is no current fiscal year SmartEstimate, or if the next fiscal year SmartEstimate is unavailable, this analytic is not generated.
Operating Profit - SmartEstimate Growth (This Yr/Last Yr)	The growth rate of Operating Profit SmartEstimate from actual value a year ago (FY0) to current fiscal year SmartEstimate (FY1). The rate is displayed as a percent; for example, a growth rate of 17% is displayed as 17. If there is no actual value, or if the current fiscal year SmartEstimate is unavailable, this analytic is not generated.
Revenue - SmartEstimate Growth (Next Yr/This Yr)	The growth rate of Revenue SmartEstimate from current fiscal year (FY1) to next fiscal year (FY2). The rate is displayed as a percent; for example, a growth rate of 17% is displayed as 17. If there is no current fiscal year SmartEstimate, or if the next fiscal year SmartEstimate is unavailable, this analytic is not generated.
Revenue - SmartEstimate Growth (This Yr/Last Yr)	The growth rate of Revenue SmartEstimate from actual value a year ago (FY0) to current fiscal year SmartEstimate (FY1). The rate is displayed as a percent; for example, a growth rate of 17% is displayed as 17. If there is no actual

	value, or if the current fiscal year SmartEstimate is unavailable, this analytic is not generated.
Intangibles, Gross	Consists of patents, copyrights, franchises, goodwill, trademarks, trade names, secret processes, and organization costs. Intangibles, Gross represents the gross amount of intangibles before being reduced by Accumulated Intangible Amortization.
Credit SmartRatios Intangibles / Assets (%)	Goodwill & Intangibles as a percentage of Total Assets.
Cash Flow, 3 Yr CAGR	This is the compound annual growth rate of Cash Flow over 3 consistent years. Cash Flow is the sum of Net Income After Taxes minus Preferred Dividends and General Partner Distributions plus Depreciation and Amortization of Intangibles. NOTE: If the value for either the most recent year or the oldest year is zero or negative, the growth rate cannot be calculated, a 'NA' (Not Available) code will be used.
Intangibles, Net/Tot Assets, %	This ratio of the Intangibles, Net for the fiscal period divided by the Total Assets for same period and expressed as percent.
Others	
Product Responsibility Score	Product responsibility category score reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy.
Eco-Design Products	Does the company report on specific products which are designed for reuse, recycling or the reduction of environmental impacts?
Environmental Products	Does the company report on at least one product line or service that is designed to have positive effects on the environment, or which is environmentally labeled and marketed?
Organic Products Initiatives	Does the company report or show initiatives to produce or promote organic food or other products?
Product Impact Minimization	Does the company report about take-back procedures and recycling programs to reduce the potential risks of products entering the environment or does the company report about product features or services that will promote responsible and environmentally preferable use?

Take-back and Recycling Initiatives	Does the company report about take-back procedures and recycling programs to reduce the potential risks of products entering the environment?
Product Environmental Responsible Use	Does the company report about product features and applications or services that will promote responsible, efficient, cost-effective and environmentally preferable use?
GMO Products	Does the company produce or distribute genetically modified organisms (GMO) or seeds?
Agrochemical Products	Does the company produce or distribute agrochemicals like pesticides, fungicides or herbicides?
Animal Testing Reduction	Has the company established a program or an initiative to reduce, phase out or substitute for animal testing?
Renewable/Clean Energy Products	Does the company develop products or technologies for use in the clean, renewable energy (such as wind, solar, hydro and geo-thermal and biomass power)?
Water Technologies	Does the company develop products or technologies that are used for water treatment, purification or that improve water use efficiency?
Sustainable Building Products	Does the company develop products and services that improve the energy efficiency of buildings?
Animal Testing	Is the company directly or indirectly involved in animal testing?
Animal Testing Cosmetics	Is the company directly or indirectly involved in animal testing for cosmetics?
Policy Customer Health & Safety	Does the company have a policy to protect customer health & safety?
Policy Fair Trade	Does the company have a policy on fair trade?
Product Responsibility Monitoring	Does the company monitor the impact of its products or services on consumers or the community more generally?
Healthy Food or Products	Does the company reportedly develop or market products and services that foster specific health and safety benefits for the consumers (healthy, organic or nutritional food, safe cars, etc.)?
Retailing Responsibility	Does the company reportedly promote and support public health by excluding potentially harmful products from its retail offering (fire arms, genetically modified organisms (GMOs), alcohol, tobacco, etc.)?
Obesity Risk	Does the company claim to fight against obesity risk?

Product Quality Controversies	Is the company under the spotlight of the media because of a controversy linked to its products or services quality and responsibility?
Responsible Marketing Controversies	Is the company under the spotlight of the media because of a controversy linked to the company's marketing practices, such as over marketing of unhealthy food to vulnerable consumers?
Consumer Complaints Controversies	Is the company under the spotlight of the media because of consumer complaints or dissatisfaction directly linked to its products or services?
Product Recall	Has the company announced a mass recall of products or has completely withdrawn a product due to defects or safety reasons?
Policy Executive Compensation ESG Performance	Does the company have an extra-financial performance-oriented compensation policy?
Policy Executive Retention	Does the company have a general, all-purpose policy regarding compensation to attract and retain executives?
Sustainability Compensation Incentives	Is the senior executive's compensation linked to CSR/H&S/Sustainability targets?
CSR Sustainability Reporting	Does the company publish a separate CSR/H&S/Sustainability report or publish a section in its annual report on CSR/H&S/Sustainability?
ESG Period Last Update Date	The last update date for one or more ESG metrics for the period.
ESG Reporting Scope	The percentage of the company's activities covered in its Environmental and Social reporting.
GRI Report Guidelines	Is the company's CSR report published in accordance with the GRI guidelines?
CSR Sustainability Committee	Does the company have a CSR committee or team?
Long Term Growth - Mean	The statistical average of all broker estimates determined to be on the majority accounting basis. Long-term growth is an estimate of the compound average rate of EPS growth an analyst expects over a period of three to five years.

Table. Definition of Data Parameters (Thomson Reuters Eikon, 2019)

