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A Balanced Scorecard Approach for Measuring a R&D Organization

A case study in collaboration with the R&D intensive company Swegon

Swegon

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Abstract

In today's rapidly and ever-changing competitive landscape, companies are racing to develop and commercialize innovative products and services. Successful organizations have realized that Research & Development (R&D) can be leveraged to achieve sustainable competitive advantage. However, there are several problems associated with measuring R&D: difficulties in identifying a tangible output, the high degree of uncertainty of the activities and its lagging outcome. Moreover, it is also challenging to get buy-in from the organization and it is not possible to measure the overall performance through a single metric, in fact, you need several ones to get an overall picture. However, prior studies have shown that the Balanced Scorecard (BSC) is an appropriate model for measuring R&D performance in an organization in order to get a comprehensive overview. Additionally, firms can tailor the model for their specific needs which facilitate an alignment between the strategy and the measurement. In this paper, the authors discover how the R&D intensive case company Swegon currently is measuring their R&D organization and which obstacles they face in doing this. Furthermore, the study aims to develop a BSC customized for Swegon's needs, in order to steer their R&D organization towards their strategic goals.

The research builds on an extensive literature review about the BSC and the difficulties of measuring R&D, resulting in a solid foundation to build upon. Additionally, a qualitative research strategy was adopted where semi-structured interviews were conducted with respondents involved in the R&D at Swegon. This was done in order to construct a status quo analysis of the R&D organization. Moreover, a self-completion questionnaire was sent out to respondents at Swegon working in different departments to rank appropriate KPIs to measure their R&D organization.

One of the main finding is that Swegon is only measuring time, budget and project objectives related to their R&D organization. However, the study shows that there is a clear need and desire to improve and extend the current measurement framework. There are several obstacles that needs to be overcome in order to succeed with this. First, there is a lack of communication throughout the organization. Second, there is no clear alignment between strategy and the R&D activities. Third, it does not exist a standardized feedback culture in the R&D organization. Forth, it is difficult to measure the R&D organization due to its complex character. Furthermore, the study resulted in a customized BSC including 34 KPIs which were perceived as relatively more important. Conclusively, a recommended final BSC is provided with 12 selected KPIs which are argued to be relevant and feasible to implement. The final BSC can be utilized to steer the R&D organization towards the strategic goals, taking different perspectives into account. Although all KPIs may not be directly linked to each strategic goal, they provide the R&D organization with the prerequisites necessary to fulfill their part.

Keywords: *Balanced Scorecard ● Measure R&D ● Obstacles in measuring R&D ● Performance Measurement ● Key Performance Indicators ● R&D Performance*

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1. Introduction

In this chapter, the reader will be introduced to the research field and a review of associated problems. It will also provide a presentation of the case company together with the aim of the study. Lastly, there will be a demonstration of the disposition.

1.1 Background

Prior studies have shown that the Balanced Scorecard (BSC) is an appropriate model for measuring Research and Development (R&D) performance in an organization (Bigliardi & Dormio 2010; Bremser & Barsky, 2004; Kressens van Drongelen & Bilderbeek, 1999; Kaplan & Norton 1992). Additionally, firms can tailor it for their specific needs and it can facilitate an alignment between the strategy and the measurement (Le, 2018; Kaplan & Norton, 1992). In this paper, the authors discover how the case company Swegon currently is measuring their R&D organization and associated obstacles which they encounter. Furthermore, a customized BSC is developed for their R&D organization in order to steer it towards their strategic goals.

In today's rapidly and ever-changing competitive landscape, companies are racing to develop and commercialize innovative products and services. Successful organizations have realized that R&D can be leveraged to achieve sustainable competitive advantage (Tripathy, Sahu, & Ray, 2013; Karlsson, Trygg, & Elfström, 2004; Werner & Souder, 1997). R&D is about creative work that is conducted in a structured and systematic way with the goal of enhancing human knowledge and to come up with innovative solutions (OECD, 2020). It has been proven that long-term growth for companies is not about investing more than their competitors in R&D, but to be the most efficient one with their R&D investments (Chiesa & Masella, 1996). The main goal for investing in R&D is to gain financial return, which is why shareholders, board of directors and executives want to track the progress. Yet, most companies do not know what they actually receive from their R&D organization (Bassani, Lazzarotti, Manzini, Pellegrini, & Santomauro, 2010). Failure rates are high, and even successful companies can't sustain their performance (Pisano, 2015). Moreover, R&D is uncertain, unpredictable and an unstructured process which is almost impossible to manage (Chiesa, Frattini, Lazzarotti, & Manzini, 2009).

Thus, to keep up with this increasing change, companies need the right measurements, which is why Key Performance Indicators (KPIs) are of the utmost importance. KPIs measure business health and ensure that all departments are working for the same goal and by the same strategies. Hence, KPIs align all levels of a business with clearly defined targets and track progress. (Bauer, 2004) In addition to traditional measuring and monitoring functions, control systems are used by top managers to communicate new strategic agendas; establish implementation timetables and targets; and ensure continuing attention on new strategic initiatives (Simons, 1994). A central challenge though, is for companies to design a performance measurement system (PMS) that is suitable for their own organization (Suomala, Kanniainen, & Lönnqvist, 2012; Osama, 2006). Choosing performance measures is context

dependent and therefore needs to be customized to an organization's business and goals of improvements (Goffin & Mitchell, 2017).

"Creating effective KPIs is challenging; it is more art than science" (Eckerson, 2006, p.27).

1.2 Problematization

In a study conducted by the Industrial Research Institute between 1993 and 1995 that included 200 respondents, they ranked "measuring and improving R&D productivity/effectiveness" as the problem with the highest priority (Ellis, 1997, *see:* Karlsson et al, 2004). To overcome this problem, it is crucial to measure the R&D performance.

"*You can't manage what you do not measure*" (Compton, 2015, p.14).

Thus, to improve R&D, the first step is to measure current performance to find out if it has gotten worse or better (Goffin & Mitchell, 2017). Also, Kaplan and Norton emphasize the requirement of measuring, *"What you measure is what you get"* (1992, p.71), to get a successful R&D organization. However, according to Chiesa and Masella (1996), measuring R&D performance has always been associated with great problems because of the nature of R&D activities and the difficulties in identifying a tangible output. They also argue that the degree of uncertainty in R&D activities is high, the R&D output is often highly fuzzy, not definable and therefore not measurable, and the end result of R&D activities is only seen after some years.

Moreover, choosing the right R&D metrics is also connected to problems. Two of the more essential ones are knowing what to measure and getting buy-in from the whole organization. R&D efforts are often weakly, if at all, connected to the strategy of the company. Consequently, money and resources are put into less optimal use. A good R&D metric should therefore be clearly connected to the corporate strategy and cover improvement initiatives. (Osama, 2006; Lassenius, Nissinen, Rautiainen, & Sulonen, 1998) Metrics that combine both qualitative and quantitative measures have been found to be most effective, but also the most complex, costly to develop and most difficult to use in practice (Thamhain, 2014; Werner & Souder, 1997). Thus, the choice of R&D measurement depends on the user's needs for comprehensiveness, the type of R&D, available data and their resources. It is also important to consider that some metrics are more important for specific industries and innovation strategies than others (Schwartz, Miller, Plummer, & Fusfeld, 2011).

According to Osama (2006), it is not possible to measure the overall performance through a single metric, in fact, you need several ones to get an overall picture. Likewise, Mendigorri, Valderrama and Cornejo (2016) are arguing for an integrated measuring model but they also claim that a model like this does not exist. Many R&D managers also claim that they are uncertain about how to select the most valuable metrics and measuring methods for their situation (Kerssens-Van Drongelen, 1999). However, the Balanced Scorecard (BSC) is a model that has been widely spread but is under-utilized within R&D (Kerssens-Van Drongelen, 1999).

Many authors argue that the BSC is the most appropriate model when measuring R&D (Bigliardi & Dormio, 2010; Bremser & Barsky, 2004; Kressens-Van Drongelen & Bilderbeek, 1999; Kaplan & Norton, 1992). However, studies focusing on identifying indicators for the BSC to evaluate R&D performance have been sparse. The case company, Swegon, has never investigated what kind of metrics that could be valuable to assess their R&D organization. Since the design of the performance measurement should be developed by the users themselves to meet their specific needs (Kressens-Van Drongelen & Cooke, 1997), it becomes evident that companies cannot completely rely on the result of previous research. Hence, there is a need to strengthen this research field with insight from R&D practitioners.

1.3 Case Company - Swegon

Swegon is a leading global company that develops, manufactures, and sells energy efficient products and solutions in the indoor climate industry. It is wholly owned by the Swedish investment company Latour Group and has 16 production plants spread out over the world, covering three continents. The company employs 2,400 people and has an annual turnover of €500 million. (Swegon, 2020) Some of the most recent industry changes concern reduction of energy consumption, environmental impact as well as health issues (Formas, 2004). According to Swegon representatives, incumbents from other technological industries are now entering the market through acquisitions which is intensifying the competition. Therefore, companies within this industry have been pushed to pursue heavy investments in R&D, to develop the next generation ventilation system to fulfill the demands of the market (Avalon Innovation, 2016). Swegon's R&D investments have led to several new innovations such as environmentally friendly and energy efficient systems that create value for their customers. Today, there are around 100 employees working with R&D, spread out over five different business units. Swegon has four main strategic goals: *Indoor Environmental Quality*, *Superior Customer Experience, System Approach* and *Strongholds,* see figure 1. The ultimate goal is to deliver an indoor climate that has an excellent environmental quality. In order to achieve this, they need to deliver a systems approach and superior customer experience, whereas these rely on selected strongholds to achieve a high market penetration.

Figure 1 – Overview of Swegon's Strategic Goals

Until today, Swegon has invested substantially to develop advanced market leading products. However, they see a shift in customer preferences towards a more user friendly and digitalized system solution. Therefore, their R&D activities are now predominantly focusing on developing digital solutions in order to achieve a system approach. Yet, Swegon does not have an appropriate way of measuring their R&D performance to reach the aforementioned goals. For Swegon's ability to deploy their corporate strategy, investments in R&D is key for their success. When setting up the controlling environment for the various functions of the company, R&D is one of the most difficult areas to steer. However, as mentioned by one of Swegon's representatives working in the management: "*When adopting a measurement framework, it is important to 'manage walking before you can run, and crawling before you can walk' in order to utilize it successfully*" (Swegon representative, personal communication, February 4th, 2020). Thus, in the start, it is important to not adopt a too demanding and extensive framework. Different functions in their organization are controlled by different measurements based on their specific characteristics. Therefore, Swegon wants a holistic model that provides the management with an overview of the company's R&D performance which also can be adjusted for a more local level, i.e. for a production site. Moreover, they want to know how their R&D organization performs today and the obstacles they encounter.

1.4 Purpose and Research Questions

After the problematization discussion above, it can be concluded that there is a need for further research about the adoption of a BSC when measuring R&D. Considering Swegon's lack of a uniform measurement model, this study aims to develop a BSC to evaluate R&D performance based on insights from R&D practitioners at Swegon as well as previous research. It will provide them with an overarching picture of their R&D performance and enable them to steer their R&D organization towards their strategic goals. This is necessary for Swegon in order to stay competitive in an industry characterized by increased competition. However, in order to fulfill this purpose, the study also aims to discover how the R&D department is being measured today and which obstacles they encounter. Hence, knowing the current situation can foster a smooth transition to a more comprehensive measurement framework. Thus, a sub-question has been developed to facilitate answering the formulated main research question:

Research question
How can Swegon use the BSC to measure the R&D organization in order to steer it towards their strategic goals?

Sub-question
How is Swegon measuring their R&D organization today and what are the obstacles they face?

1.5 Delimitations

1. This research investigated a suitable model and KPIs from Swegon's perspective and thus, might not be as appropriate for other industries than the indoor climate industry. Hence, the result will not be representative or necessarily applicable for other companies.

2. It does not cover the practical implementation of the proposed model; it should rather be used as a recommendation on how to start to measure R&D and which issues that might occur.

3. The study aimed to provide a BSC customized for Swegon to measure and steer their R&D. However, the presented framework and accompanying KPIs does not result in single numeric score. Instead, it consists of both financial and non-financial KPIs, which provides both numerical and subjective result respectively.

4. Although the study exposes some obstacles to measure R&D, it does not provide a guide of solutions on how to overcome them. Instead, it aimed to create awareness in order to get a seamless start in the adoption of a more extensive measurement framework.

5. The report will provide the case company with a structured recommendation on how they should measure their R&D organization through a BSC. However, the authors will not create a benchmark on the chosen KPIs in the BSC nor compare Swegon to other companies within the industry.

6. The report developed a BSC with accompanying KPIs for the overall R&D organization. Hence, the BSC in this report is intended for management level but can be used as a foundation for subdivisions own customized BSC.

1.6 Disposition

The thesis is divided into six chapters and will follow the structured seen in figure 2 below.

Introduction
- Background and Problematization
- Case Company - Swegon
- Purpose, Research Questions and Delimitations

Literature Review
- Performance Measurement
- The Balanced Scorecard (BSC)
- Adopting the BSC to measure R&D

Methodology
- Research Strategy, Design and Method
- Data Analysis and Quality

Empirical Findings
- Findings from interviews and self-completion questionnaire with the case company

Analysis
- Analysis of theoretical framework and empirical findings

Conclusion
- Answers to the Research Questions
- Recommendation For Swegon
- Theoretical Contribution and Future Research

Figure 2 – Disposition

2. Literature Review

In this chapter, a literature review will be presented which have been used as a foundation in this study to answer the stated research questions. It includes a description of performance measurements and prerequisites for a successful R&D organization. Further on, it will present problems associated with measuring R&D and which frameworks that exist to overcome these problems. Finally, a comprehensive examination of the Balanced Scorecard and its applicability on R&D.

2.1 Performance measurement

Performance measurement (PM) is the process of analyzing the efficiency and effectiveness of actions (Neely, Adams, & Kennerley, 2002). Measurement drives behavior and, even more importantly, behavior change (Kerssens-Van Drongelen & Cooke, 1997). Management strategies need an integrated performance measurement which captures both financial and non-financial changes. An integrated PM system aims at aligning the organizational processes, like R&D, with the corporate strategy, employing both performance drivers and outcome measures. Further, this provides managers at different levels with a clear overview of which actions they should execute to effectively implement a strategy. (García-Valderrama, Mulero-Mendigorri, & Revuelta-Bordoy, 2008; Bremser & Barsky, 2004)

According to Kerssens-Van Drongelen and Cooke (1997), there are some fundamental criteria that must be fulfilled for a PM system to work. It should enable the right information to be collected at the right time and in a cost-efficient and reliable way. Otherwise, the risk is that it does not match the business structure or activities. Also, if the organization changes, so must the PM. It should be designed with a holistic perspective where all relevant variables are considered (e.g. costs and time) and all stakeholders requirements must also be met. For instance, the employees who are subject to the evaluations need to have a positive attitude towards it - so they are willing to cooperate in the assessment. These requirements will differ from different users in the organizational hierarchy. Moreover, Packer (1983) argues that a PM system must provide information that is understandable, interpretable, relevant and reliable.

Furthermore, the metrics must align with the purpose of the measurement as well as reflect the objectives and responsibilities of the employees and activities which are being evaluated. There are plenty of metrics that are used to measure performance. Most of the metrics that have been identified in literature can be grouped into five top level measures: cost, quality, time, innovativeness and contribution to profits. (Kerssens-Van Drongelen & Cooke, 1997) These five top level metrics are also similar to Kaplan and Norton's (1992) four perspectives in the BSC.

2.1.1 Key Performance Indicators

When an organization has worked out a framework which they are using to evaluate progress, it is of utmost importance to decide upon a certain amount of metrics which will measure what they want to measure. Through KPIs, organizations focus employee's attention towards the tasks and processes that are of higher importance and in this way, managers can steer their employees in the right direction (Velimirović, Velimirović, & Stanković, 2011; Shahin & Mahbod, 2007; Eckerson, 2006).

Eckerson (2006) argues that KPIs are one of the most powerful and effective tools for executives to continuously steer an organization in the right direction. Therefore, a decent amount of time needs to be spent on choosing the right ones for a certain goal in order to end up with desirable results. Otherwise, employees will work suboptimal and hence not contribute in the way which could be possible. KPIs can be of different character, a common way of classifying them are *leading* and *lagging*. Leading KPIs are measuring activities that have a significant effect on future performance. These ones are of high importance when making decisions about the future. However, they are usually more challenging to define. For instance, a leading KPI could be "number of incoming orders today". On the other hand, lagging KPIs are focusing on the output in the past, which is something that most financial KPIs measure. For instance, comparing the output with the input. Since lagging KPIs are focusing on the past, it reduces its relevance for decision concerning the future and becomes a follow-up measurement. (Eckerson, 2006; Beatham, Anumba, Thorpe, & Hedges, 2004)

Another common classification of KPIs, is to divide them into financial and non-financial. According to Kaplan and Norton (1996), the non-financial is of higher importance since they measure the future performance, which has a clear relation to an organization's accomplishment of long-term success. However, financial KPIs reflect past performance and have a short-term focus. Therefore, it is critical for companies to use several KPIs to be able to capture the full picture of the company. (Velimirović et al, 2011; Kaplan & Norton, 1996)

As argued above, creating the right KPIs for an organization is crucial, but not the easiest task (Goffin & Mitchell, 2017). Some of the critical parts include capturing the nuances of a business process and being able to find the right data to use. It is also a challenge to create a KPI that is measuring the progress in an accurate way and taking all influencing variables into account. Another challenge is to understand the lifecycle of a KPI, eventually, the KPI you use might become obsolete and need to be replaced. However, understanding when it is time to replace it is difficult. (Eckerson, 2006; Beatham et al, 2004)

Eckerson (2006) created a checklist for the characteristics of an effective KPIs, which should include the following:

1. There needs to be an alignment between the company strategy and the objectives in a KPI.
2. There needs to be a clear ownership taken by the employees/groups responsible for the KPI.
3. The KPI needs to be predictive.
4. The KPI needs to be actionable and be possible to act accordingly.
5. The KPIs should be simple, to enhance feasibility.
6. The KPI needs to be easy to understand and straight forward.
7. The KPI needs to be balanced and not sub-optimizing processes.
8. The KPI needs to trigger changes in the organization.
9. The KPI needs to be standardized with a clear definition of how the KPI is working.
10. The KPI needs to be context driven.
11. The KPI needs to be reinforced with incentives, to motivate the organization.
12. The KPI needs to be relevant for the organization in its current state and continuously needs to be refreshed.

Finding the right framework, that covers both leading and lagging KPIs, as well as financial and non-financial, might not be the easiest task. However, as argued by Bremser and Barsky (2004), the BSC is a model which covers all these areas and therefore enables organizations to keep a short- as well as long-term perspective and measure the whole organization accurately to ensure a successful future.

2.1.2 How to achieve true R&D performance

The set-up and preconditions for a company's R&D organization is crucial and something that each company needs to consider and work with constantly to end up with successful R&D projects. According to Newman (2009), there are several factors that must be in place, which can be grouped into: customer insight, risk tolerance, entrepreneurship, alignment with strategy, technology excellence, innovation, creative collaboration and execution power.

First, customer insight is important for companies in order to understand where the world is heading. Without the insight of customers preferences, companies will diverge from reality and its inventions will stick as inventions and not get commercialized. (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009) This reasoning is also mentioned in the research by Gupta, Wilemon and Atuahene-Gima (2001), where the "customer understanding" is what distinguishes a successful from an unsuccessful R&D organization. It is all about finding the balance in your organization, between being market as well as technology led, which provides the best conditions for an innovative way of working (Newman, 2009).

Second, organizations need to be tolerant towards risk and have some level of risk appetite. If this requirement is not fulfilled, an organization will miss potential possibilities to create or

discover the next innovation. This means that organizations must be willing to take the chance to explore the unknown and make it acceptable to fail with different projects - the focus must be on the learning and getting experience from each opportunity. This will make the R&D organization more willing to take risks and feel more comfortable with it, due to support from the whole organization. Hence, this will create an organization that is able to make decisions in a fast pace which leads to a competitive advantage. (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009)

Third, the whole organization as well as the R&D organization needs to be characterized by an entrepreneurial spirit and act in the best interest of the company. This will empower employees and make them feel more responsible, which will enable a better outcome from each R&D activity. (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009; Gupta et al, 2001)

Fourth, an R&D organization needs to align its work with the strategy of the overall company. This will create more acceptance from the whole organization and a uniform view of what the R&D organization should focus on. Moreover, this is also increasing the possibility that R&D projects end up with innovations that get commercialized and contribute to the success of a company. (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009) In order for this to become reality, senior management need to work out a clear framework for the whole organization and continuously support the organization towards a united direction (Gupta et al, 2001).

Fifth, having the right technical expertise and being able to attract the most talented employees to an organization is of utmost importance. Even if the structure of an organization is important, without employees that are experts within their area of expertise, it will not be worth anything. (Goffin & Mitchell, 2017; Newman, 2009)

Sixth, an organization needs to take advantage of the new creative ideas that arise throughout the organization and make something out of them. For employees to contribute with these ideas, they need to feel appreciated and be rewarded for their work. However, there needs to be a structured evaluation process based on different criteria to decide if a project should be proceeded with or not, so you do not end up pursuing ideas that are not feasible. (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009)

Seventh, R&D projects need to be accepted throughout the whole organization to avoid a "not invented here" syndrome (Goffin & Mitchell, 2017; Likar, 2013; Gupta et al, 2001). Therefore, a company needs to include their R&D organization into their whole organization. This will prohibit the "not invented here" syndrome and create a higher probability of success in R&D projects (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009). Another positive consequence is that new collaborations might emerge between departments which could strengthen an organization even more and prevent departmental disputes.

Eight, the ultimate goal with investments in R&D projects is that it will contribute to the success of the company. This is done through a commercialization of an invention, which partly depends upon the execution power of the management team. Execution power will ensure that

projects are pursued in the most efficient way and that resources are consumed wisely. (Newman, 2009) Finally, it can be argued that the success in an R&D organization is not about how much money you spend in the end, but rather how efficient a company is in using its resources (Gupta et al, 2001). It has been proven that the amount invested in R&D is weakly correlated with sales growth, since not all the money invested in R&D leads to successful innovations (Goffin & Mitchell, 2017).

2.1.3 Problems related to measuring R&D

Measuring R&D is something that is associated with several challenges and is not an easy task, therefore a considerable amount of time needs to be invested in this process (Kerssens-Van Drongelen, 1994). Companies are often trying to use financial metrics since in the end, that is what's important for most companies. Even if it is desirable to measure R&D based on financial measurements, there are several problems related to it. First, it is challenging to analyze the isolated contribution from a successful R&D organization to the overall organizational performance. Second, there is a time lag with financial measurements. This results in that KPIs are not measuring the current state of the business and is therefore not as relevant for the decision making. Hence, these measurements are losing part of its value as measurements of performance. (Kerssens-Van Drongelen & Cook, 1997) Moreover, one of the common problems that organizations are facing is to align strategy, performance and incentive systems related to R&D within the organization. This is usually because there are several strategic frameworks in place at the same time, which confuses the employees and therefore limiting the success of R&D organizations. (Osama, 2006)

When it comes to R&D, it is difficult to find a measurement that uses past data for making correct decisions concerning the future (Kerssens-Van Drongelen & Cook, 1997). Moreover, a too structured measuring of an R&D organization will limit the creativity and keep employees working in a repetitive way which prohibits R&D organizations from creating successful output (Pappas & Remer, 1985). But, according to Brown and Svenson (1988), it is only the organizations that are using inappropriate KPIs that might experience this issue. One potential solution can be to involve the employees in the process of choosing metrics (Meyer, 1994). But this approach is also linked to other problems, such as getting everyone together and trying to agree upon which measurement method to use (Osama, 2006).

2.1.4 Three frameworks for measuring R&D

García-Valderrama et al (2008) identified the three most utilized integrated PMs when dealing with R&D: Benchmarking, The Technological Value Pyramid (TVP) framework (Tipping, Zeffren, & Fusfeld, 1995), and the Balanced Scorecard (Kaplan & Norton, 1992). Benchmarking refers to the practice of comparing a firm's performance against industry bests, best practices or a set of comparable firms (Bigliardi & Dormio, 2010). Hence, benchmarking R&D performance would involve comparing firms with respect to their R&D efforts and outcomes. Comparing a company to its direct competitors can involve benefits but also be misleading (Goffin & Mitchell, 2017). For instance, if your biggest competitor is investing more in R&D this might raise questions. However, a comparison like this might not be

desirable since your company might need to invest more than the competitor to reach its own goals.

The TVP is a top-down output-focused perspective which demonstrates a hierarchy of managerial factors focusing on R&D management. These factors and accompanying metrics allow the model to be used to track the performance both retrospectively and prospectively to localize weaknesses and use it for improvements in R&D. Thus, the TVP metrics are used as predictors of growth and to make decisions on resource allocation to R&D. These metrics are categorized into five managerial factors which can be used to analyze the performance of a R&D organization; practice of R&D processes to support innovation, asset value of technology, integration with business, portfolio assessment, and value creation. These factors then create three different layers of the pyramid, see figure 3. The TVP model is based on three assumptions: (1) Wealth creation comes from the innovation process and thus, the R&D output is directly connected to value creation of the business, (2) Different stakeholders in R&D will have different interests and therefore some measurements will be more important for some groups than others, and (3) The time scale will differ between stakeholders. Moreover, Tipping et al (1995) study shows that the board, financial community and the CEO will be the stakeholders with the highest interest in value creation. Business management will be most interested in metrics assessing the integration of R&D with business and the balance within the project portfolio. Furthermore, R&D management will be concerned with all layers of the pyramid but will be somewhat more interested in portfolio assessment and asset value of technology. Lastly, the R&D personnel will be more focused on the measurements concerning the practice of R&D processes to support innovation. (Tipping et al, 1995)
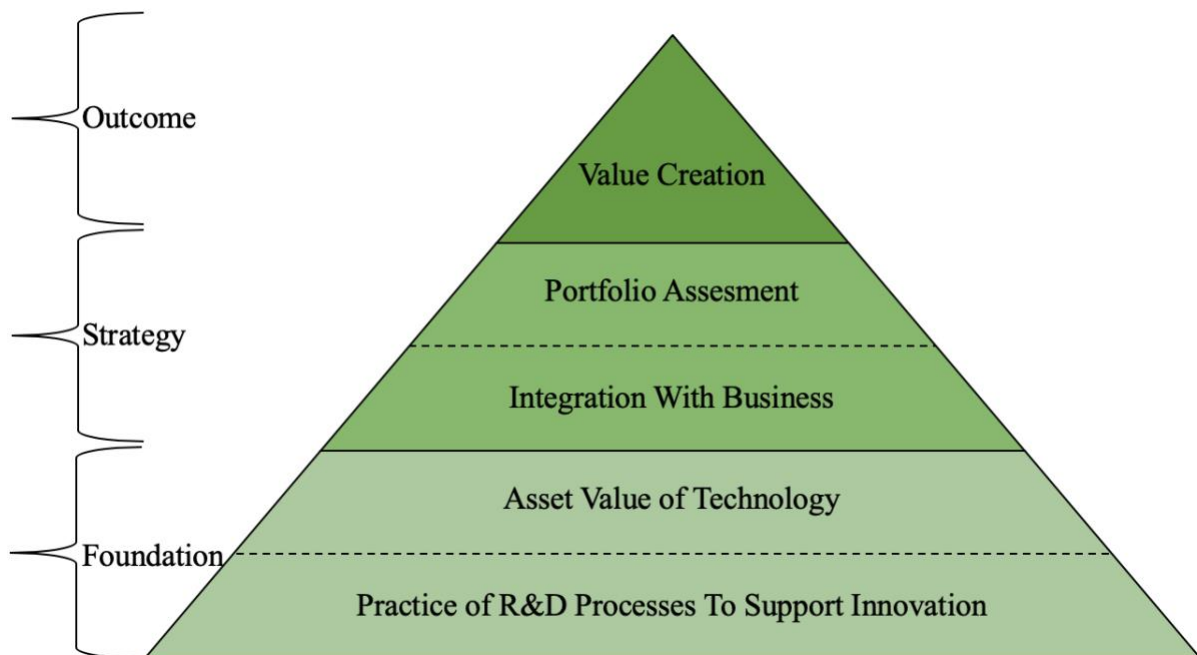
Figure 3 – The Technological Value Pyramid (Tipping et al, 1995)

Among the three different methods mentioned above, this study has focused on the BSC because of several reasons. First, Donnelly (2000) argues that the BSC model is the most useful model because the other models lack an alignment between the measurement and the corporate strategy. Second, he points out the challenge of implementing and using some of the traditional financial metrics. Third, he claims that there is a lack of agreement about which dimensions that should be included for this type of activity. Moreover, many researchers argue that the BSC is an appropriate framework when measuring R&D (Bigliardi & Dormio, 2010; Bremser & Barsky, 2004; Kerssens-Van Drongelen & Bilderbeek, 1999; Kaplan & Norton, 1992). The BSC will therefore be discussed more in detail in the following chapter.

2.2 The Balance Scorecard

Kaplan and Norton (2001a; 1996; 1992) argue that executives know that traditional financial accounting measures, such as return-on-investment, can give misleading signals for continuous improvements and innovation – which has been mentioned earlier to be crucial in today's competitive business environment. Further, they discuss that no single measure can provide a performance target that is comprehensive enough and that managers want a balanced presentation of both financial and operational measures. In their research, they created *The Balanced Scorecard* which consists of four interconnected perspectives with indicators summarizing both the financial and operational drivers, see figure 4. The BSC provides answers to four central questions, see table 1.

BSC Perspectives:	Questions:
Customer Perspective	*How do customers see us?*
Internal Business Perspective	*What must we excel at?*
Innovation and Learning Perspective	*Can we continue to improve and create value?*
Financial Perspective	*How do we look to shareholders?*

Table 1 – Balanced Scorecard Perspectives (Kaplan & Norton, 1992)

The BSC takes the PM systems one step further by moving from a checklist for manager to a strategic performance measurement and management system (Kaplan & Norton, 2001a). By adopting the BSC, managers get a clear overview of the whole organization with a few critical measures and avoid getting an overload of them. The BSC has proven to fulfill several managerial needs: (1) Becoming customer oriented, (2) Shortening response time, (3) Improving quality, (4) Emphasizing teamwork, (5) Reducing new product launch times, and (6) Managing for the long term. Moreover, the BSC provides insight into whether improvements in one area have been achieved at the expense of another. (Kaplan & Norton, 2001a; 1996; 1992)

The four different perspectives included in BSC will now be elaborated for a deeper understanding:

Customer Perspective

Top management has become more concerned with how the company is performing from a customer perspective. Therefore, measures in this perspective reflect what customers value in the business. Thus, they should generate goals and connected measures for the four following categories: time, quality, performance and service, and cost. For instance, the lead time measure concerns the time it takes for the company to fulfill its customer's needs from order to delivery. (García-Valderrama et al, 2008; Kaplan & Norton, 1992)

Internal Business Perspective

Customer satisfaction is driven by internal processes, decisions and actions in the organization. Therefore, managers need measures reflecting internal operations that enable them to meet customer needs. These measures concern factors like cycle time, quality, employee skills and productivity. Moreover, managers should identify and measure their company's core competences and technologies which are crucial for market leadership. These targets need to be communicated through the whole organization in order to get buy-in from employees that can act accordingly. (García-Valderrama et al, 2008; Kaplan & Norton, 1992)

Innovation and Learning Perspective

With today's global competition it is important for companies to strive for continuous improvements to their products, processes and the capability to launch completely new products. This perspective is focusing on the intangible assets of an organization, and long-term growth is the priority at the expense of short-term gains since development of intangible assets will require costs today with a return tomorrow. For instance, a KPI for this perspective can be "core competences of R&D personnel". The ability to innovate, improve and learn is linked to the value of a company and an important part in a company's ability to stay competitive. (García-Valderrama et al, 2008; Kaplan & Norton, 1992)

Financial Perspective

The most common financial measurements concern profitability, growth and shareholder value. They reflect the overall performance of the strategy, implementation and execution. Even though critics argue that financial measures are backward-looking and lack the ability to reflect contemporary value-creation, they can still be useful in controlling the company and ensuring that profitability is achieved. (García-Valderrama et al, 2008; Kaplan & Norton, 1992)
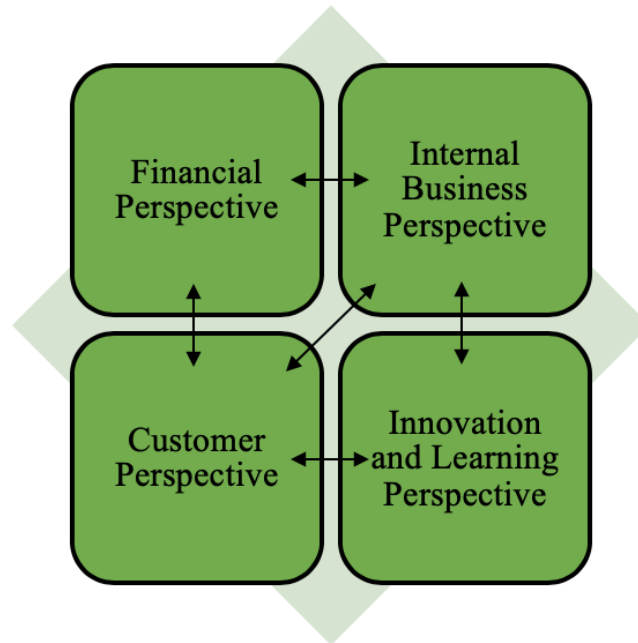
Figure 4 – The Balance Scorecard Links Performance Measures (Kaplan & Norton, 1992)

Moreover, Kaplan and Norton (2001a) mention that there are five fundamental principles for a strategy focused organization to use the BSC: (1) Convert the strategy to operational terms using the BSC and strategy map, (2) Align the organization with the strategy by cascading the highest-level scorecard down the hierarchy, (3) Involve everyone in the strategy to achieve strategic awareness and through personal scorecards connected to rewards, (4) Making strategy a continuous process, and (5) Drive leadership for change to a strategic management system. Moreover, the BSC has a flexible structure and allows for customization with regards to the names of the perspectives, adding dimensions and re-structuring the relationship between perspectives to reflect the reality of the user firm (Kaplan and Norton, 2001b).

2.2.1 How the BSC can be used at different organizational levels

Managers at all levels in an organization needs to get a clear statement of what strategies and actions that should be implemented (Bremser & Barsky, 2004). Through a translation of strategic goals into relevant measures of performance, the BSC is providing organizations at all levels, with a solution for aligning strategic performance and KPIs for different departments (Osama, 2006; Bremser & Barsky, 2004). Even if the highest-level of BSC is ideally at the corporate level, it can be implemented at each division and department. Some organizations do not adopt a formal BSC but use the structure of the BSC to help implement strategies through the development of an integrated set of KPIs for each department. (Bremser & Barsky, 2004)

It is effective to cascade the top-level R&D goals down the organization, to every employee. High-level goals like revenue from your products can be connected to project team goals, which consequently can be linked to goals of each member in a team. When cascading goals, it is central to make sure that the goals at each level are specific, measurable, achievable, relevant and timed. The different goals need to be aligned throughout the hierarchy to promote

teamwork. This is especially true for fast-track breakthrough projects, that require high commitment. (Goffin & Mitchell, 2017) The BSC is an appropriate model to spread an organization's strategy through the whole organization and adjust it for each department. The top management group sees the organizational objectives and strategies through the lens of a BSC and formulate strategies for the whole organization. Then, through the cascading method, specialized strategies for each department are formulated, together with performance targets. Thus, through multiple scorecards, the goals of each department as well as the goals of the overall organization is achieved. (Osama, 2006)

In order to implement a BSC framework throughout the whole organization, there are some steps that need to be followed according to Bremser and Barsky (2004):

1. First, you need to translate the organizational strategy into operational terms in a BSC and create a strategy map.
2. Second, the strategy of an organization needs to be cascaded through the whole organization, to business unit levels as well as external partners, to align all of them. This process starts with a statement of strategic indicators at firm level. How these measurements are related to strategy implementation are communicated through business units, divisions and departments. Depending on the organizational structure, each division needs to prepare a BSC for their department and cascade it down in each sub department.
3. Third, initiatives to create awareness needs to be made into everyone's job, through personal scorecards for each employee.
4. Fourth, the strategy work must be a continuous process by linking budget and strategy together.
5. Fifth, leadership needs to be mobilized for change and aligned to a strategic management system.

2.2.3 Criticisms of BSC

Implementing a BSC in an organization is not trouble free and like all frameworks it has its flaws. According to Rompho (2011) these problems are concerning the design of the BSC as well as the process of it. When it comes to a poorly designed BSC, it means that too few KPIs are used and therefore an unbalanced BSC is created, which results in an inaccurate picture of the firm. However, the opposite might also be a problem, too many KPIs can result in counteracting signals and waste management time. (Goffin & Mitchell, 2017; Rompho, 2011) This might cause confusion regarding the organizational strategy. Another drawback regarding the design of a BSC is when organizations fail to turn organizational goals into KPIs, that represent all perspectives of the BSC framework (Awadallah & Allam, 2015; Rompho, 2011).

However, the drawback of the BSC concerning the process of the framework is usually the most common source of failure. These failures refer to problems such as lack of commitment from senior management, too few employees involved, seeing the BSC as a one-time measurement framework, or keeping the BSC in the top management. (Rompho, 2011) Another

drawback with the BSC is that it needs to be modified according to changes in market conditions, which once again might create confusions and uncertainty for an organization and its employees. Therefore, the whole organization needs to be onboard with the BSC and a clear communication needs to be in place for organizations to succeed with the implementation of a BSC. Hence, the BSC should be perceived as a flexible framework which involves a continuous process and should be a part of the daily work in order to engage the whole organization. (Awadallah & Allam, 2015; Rompho, 2011) Moreover, Osama (2006) argues that it takes a great amount of time for an organization to implement a BSC, which is why communication and structure is of utmost importance.

Awadallah and Allam (2015) argue that the BSC misses out important stakeholders such as suppliers, the government and the environment aspect. Therefore, it results in an unbalanced scorecard, since crucial actors are overlooked. Moreover, they argue that even though it might be possible to modify the BSC, the way to include these stakeholders in the model as well as the linkage between the cause and effect is not clear. Neither do the BSC in a clear way explain how employees can be engaged in the model, or how to translate organizational strategies into KPIs. This is instead something that needs to be done by companies themselves. (Awadallah & Allam, 2015; Osama, 2006) In addition, a BSC does not give managers a final score on the overall performance of an organization which they can use in decision making, instead they get a multi-facilitated score that includes trade-offs which decreases its feasibility (Sundin, Granlund & Brown, 2010).

Furthermore, to some extent the BSC is limiting the creativity of organizations, since it pushes them to only focus on creating KPIs that will fit into one of the four perspectives. This might lead to an exclusion of other KPIs that might be crucial for measuring the performance of an organization. (Awadallah & Allam, 2015)

2.3 Adopting the BSC to measure R&D

A company can formulate an appealing R&D strategy which strives for competitive advantage and growth, but implementing it is a managerial challenge. The BSC is a suitable framework to use as an integrated performance measure for R&D (Bremser & Barsky, 2004; Kerssens-Van Drongelen & Bilderbeek, 1999). The BSC can be implemented both on corporate level and divisional or department level. The purpose of adopting the BSC for the R&D function is to achieve integration of technology planning with business strategy. One of the main problems with R&D PMs concerns integrating past-oriented cost data with prospective long-term strategic and financial objectives. When a company is using the BSC framework to implement strategy, it will emphasize most non-financial metrics directly or indirectly related to R&D in the internal business process perspective. The reason behind this is that being efficient, effective, and timely in the innovation process is crucial to implement a strategy. The advantages of using BSC for R&D is the balanced mix of strategic and financial indicators that the framework provides. (Bremser & Barsky, 2004)

Bigliardi and Dormio (2010) did a case study with the aim to develop a BSC to measure R&D performance and ensure the frameworks applicability to a firm which has a significant R&D activity. Their study started with an extensive literature review to identify indicators relevant for R&D. Then, a panel of experts gave their opinion to validate them. This BSC resulted in 54 indicators which were categorized in five perspectives, compared to the original BSC (Kaplan & Norton, 1992) with four perspectives. Further, this BSC was proposed to the R&D manager of an Italian automotive company which then ranked each indicator on a Linkert scale 1-6. After clearing the BSC from indicators with a score lower than 4, only 29 indicators were remaining and became the final proposed BSC. Moreover, their result shows that the traditional financial measures (financial perspective) remain because it represents the tangible indicators of corporate wealth. However, it shows that companies must measure central factors of their business strategy, like for instance quality, customer satisfaction and employee motivation. Moreover, they also concluded that the innovation and learning perspective resulted in being most important when dealing with R&D activity. Among all indicators, only the following five got the highest rank: motivation and involvement, R&D oriented culture, adoption of selection and skills development plans, evaluation of R&D personnel performance, and turnover from and to R&D unit. (Bigliardi & Dormio, 2010)

Another similar case study was conducted by Le (2018) who was inspired by the research mentioned above. He developed a BSC to evaluate R&D performance based on data from interviews with participants with a minimum of five years of experience in R&D. The results were corresponding with the results of Bigliardi and Dormio (2010). The study resulted in 35 indicators, whereas 22 of them correspond with the ones from Bigliardi and Dormio (2010). Thus, the relevance of a majority of the indicators has been confirmed.

In Osama's (2006) BSC focusing on R&D, there are five renamed perspectives of performance, although they have clear similarities with the original four. He considers the following dimensions to be the most important ones which can be generalized across a range of different R&D organizations. The first one is called *Employee morale and creativity dimension* and is motivated by the fact that employees may be the most valuable asset of any organization. This is argued to be especially true for R&D organizations, where their morale and creativity drives output and performance. Thus, measuring systems like hiring systems, reward and recognition systems, and career progression models are crucial for the overall health of an R&D organization. Next, the *Innovation management dimension* reflects the internal business process perspective of the traditional BSC. Further, *Organizational learning, dissemination, and knowledge management dimension* focuses on measuring how businesses learn and employ their knowledgebase as a central performance perspective for R&D. Next, the *Financial control and performance dimension* constitutes the financial perspective in the original BSC. This dimension is important because R&D managers have to raise money for R&D and ensure efficient allocation of their resources to justify their existence to the corporate sponsors. Thus, measuring financial performance is crucial to evaluate the overall performance of an R&D organization. Finally, the *Customer satisfaction dimension* focuses on the same as Customer perspective in the original BSC.

Although there are some similar studies in this area, they seem to have different approaches and levels of specification regarding the content of the BSC. Some have developed a BSC containing indicators of areas to assess (Bigliardi & Dormio, 2010), while other authors have developed a BSC with indicators and accompanying KPIs with definitions and clear calculative formulas (García-Valderrama et al, 2008). Thus, organizations need to select measures that help determine whether the R&D capability of the firm is increasing, which requires not only measures but also an assessment of the actions being taken to build a long-term capability (Goffin & Mitchell, 2017).

3. Methodology

In this chapter, the chosen research strategy, design and methodology for investigating and answering the stated research questions will be elaborated. Further on, the data analysis will be presented and the most common quality aspects.

3.1 Research Strategy

To answer the stated research questions, a qualitative research strategy was chosen. A qualitative research strategy is more focused on a contextual understanding to provide the research with more depth rather than breadth and help to uncover different perspectives of the subject (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders, Lewis & Thornhill, 2009). The aim of this research is not to generate generalizable theory associated with a quantitative strategy, but rather theory tailored around the needs of Swegon. Thus, it will provide a more comprehensive understanding of how the employees working in different departments related to R&D perceive the way Swegon is measuring R&D today. Although, the main research method is qualitative, it will also be complemented with a quantitative method to extract suitable KPIs for Swegon. This provides a triangulated approach which enables a more complete picture and improves confidence in the findings (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009).

Based on the qualitative strategy, an inductive approach is the most suitable option (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). The research has an exploratory character since it is about examining how Swegon should measure their R&D performance in an accurate way in order to motivate and steer their R&D organization. It should also map how it is done today and which obstacles they face. Thus, the study does not aim to test earlier studies. However, the researchers have used the BSC as a framework to structure the study like the previous studies presented in the literature review.

3.2 Research Design

Since this research solely focuses on a single company, a case study design has been adopted to facilitate structuring of the data and enables a more complex analysis (Bryman & Bell, 2011; Saunders et al, 2009). Swegon is an R&D intensive company, which makes it well suited for a case study to examine how you can measure R&D with a BSC. It allows a deeper and more detailed understanding of the situation at Swegon and hence a more accurate answer to the stated research questions.

3.3 Research Method

The research method describes the used techniques to gather the primary and secondary data. This should guide the execution of the research strategy while also monitoring the analysis of the collected data (Bryman & Bell, 2011).

3.3.1 Primary Data

To answer the sub-question of this research, primary data was collected through eleven semi-structured interviews with employees at different hierarchical levels which were connected to the R&D organization at the case company, Swegon. Semi-structured interviews enable some deviations from the subject, if it is found beneficial for the study (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). Therefore, this structure ensured that the interviews became structured to some extent, but still left room for flexibility in terms of follow-up questions during the interviews. Semi-structured interviews also made it possible to do a comparison between the interviews, which facilitated a nuanced answer to the research's sub-question. Conclusively, it provided a good balance between structure and flexibility.

An interview guide divided into two parts was created before the interviews were held, see Appendix 8.1. The first part concerned a *Status Quo Analysis* of Swegon's R&D setup today and the second concerned the respondent's views of each perspective in the *BSC*. This guide made the interviews more consistent, which created an identifiable structure to extract the data from. The order of the interview questions sometimes changed between the interviews, and different sub-questions were asked during the interviews depending on the outcome of the answers from each respondent. According to Bryman and Bell (2011), an interview guide should consist of clearly formulated questions, do not take too much time and be asked in a simple way to mitigate confusion. This was taken into consideration when developing the guide and a pilot test was also conducted with the representatives from Swegon, to ensure its quality and that it provided relevant data.

The authors gave the respondents a brief introduction about the research purpose and why they had been selected, to make them aware of their contribution. The authors also gave a short description of the BSC framework to facilitate the respondent's interpretation of the questions in part two of the interview guide. The interviews were then recorded after approval from the respondents, to facilitate the transcription afterwards. One of the authors was responsible for asking the questions while the other one took summarizing notes. This enabled one of the authors to fully focus on the answers from each respondent and the other one to ask suitable follow-up questions. Later, the interviews were transcribed to ensure that important points not were missed, which enhanced the quality of the analysis (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). The first round of interviews was held face-to-face on site in Kvänum, Sweden, to provide the best conditions for a successful interview. They were conducted in Swedish to make the respondents more comfortable and ensure exhaustive answers. The authors believed that seeing the respondents, their facial expression and body language was helpful for the interpretation of the answers. However, although the second round of interviews were planned to take place in Kaarina, Finland, they had to be conducted through Skype because of Covid-19. These interviews were conducted without video, due to the respondent's desires, and in both Swedish and English depending on their preferences. To ensure confidentiality and anonymity, names will not be disclosed. The same goes for quotes in the empirical findings, they will not be linked to any specific respondent.

As a complement to the semi-structured interviews, a self-completion questionnaire was developed to help answer the main research question, see appendix 8.2. It was sent out to 42 employees working in different departments with a connection to the R&D organization or an interest in their activities, e.g. R&D, finance and management, see section 3.3.2 for more details about the respondents. Due to time constraints, the survey was closed after two reminders which resulted in 30 responses. Unlike the semi-structured interviews, the questionnaire consisted of closed questions with a Linkert scale where the respondents had to rank different KPIs from 1-6, based on their importance and relevance to measure Swegon's R&D performance. These indicators were taken from the compilation of R&D related indicators done by Bigliardi & Dormio (2010) which were divided into the four perspectives of the BSC. They did a literature review to identify indicators appropriate for R&D performance measurement, which was validated and narrowed down by a panel of experts (both academics and members from different industries involved in R&D). A BSC was developed, composed of 54 R&D measurement indicators divided into five perspectives, compared to the original four. The fifth category was a result from a split of the *Innovation and* Learning *perspective* into *Innovation perspective* and *Growth and Learning perspective.* However, the researchers of this study decided to follow the original four perspectives of Kaplan and Norton (1992), thus, the fifth perspective was merged back into the *Innovation and Learning perspective.* These 54 indicators were the basis for the self-completion questionnaire, and thus, the foundation of the recommended KPIs for Swegon.

A self-completion questionnaire decreases the risk that the respondents fail to answer the questions. However, it needs to have an easy-to-follow design to minimize the risk of "respondent fatigue" (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). Moreover, it was a cheap and fast way of collecting data and it offered convenience for the respondents. Another reason for using a self-completion questionnaire was that it removed the interviewer influence, which neutralized the potential subjectivity from the interviews and therefore increased the quality of the research. A pilot study was also conducted with representatives at Swegon to ensure the suitability and quality of the questionnaire.

3.3.2 Respondents

To choose the right interview respondents, the contact person in the management of Swegon pointed out two relevant managers with responsibility for R&D activities in their respective business area. These managers then selected personnel working close to their R&D operations at different organizational levels, see table 2. Respondents with different positions and at different locations were chosen, because as mentioned in the literature review; requirements and interests of the measurement framework will differ between users in the organizational hierarchy. It is therefore beneficial to seek respondents who are differing slightly from each other to ensure some variety, which is called stratification (Bryman & Bell, 2011; Saunders et al, 2009). Thus, the sample of respondents were selected in a strategic way based on their experience, knowledge and ability to contribute to the research. This is called a purposive sampling method, which is a non-random selection which consequently provides a result of low generalizability (Bryman & Bell, 2011; Saunders et al, 2009).

However, this research is not aiming to come up with general conclusions, instead it intends to analyze a single case and come up with an answer for its specific situation and conditions. Out of the eleven initially chosen interview respondents, respondent number three was replaced with the R&D manager in Kvänum due to illness.

Respondent	Title	Date	Duration	Place
1	System Development Applications Manager	2020-03-03	50 min	Swegon Kvänum, Sweden
2	Technical Calculation and Testing Manager	2020-03-03	45 min	Swegon Kvänum, Sweden
3	Calculation Engineer	2020-03-03	47 min	Swegon Kvänum, Sweden
4	Project Leader	2020-03-03	45 min	Swegon Kvänum, Sweden
5	Mechanical Construction Manager	2020-03-03	43 min	Swegon Kvänum, Sweden
6	R&D Manager	2020-03-24	37 min	Skype
7	Site Manager	2020-03-24	44 min	Skype
8	Director - Product Management and Business Development	2020-03-25	45 min	Skype
9	VP - Business Area Home Solutions	2020-03-25	43 min	Skype
10	Product Designer	2020-03-25	36 min	Skype
11	Embeded System Specialist	2020-03-25	41 min	Skype

Table 2 – Interview Respondents

Furthermore, the respondents for the self-completion questionnaire were also pointed out by the same contact person at Swegon. Based on the arguments above regarding the selection of respondents, the recipients of the questionnaire also included employees working in management and with sales, to also engage people indirectly linked to R&D through decision making, see figure 5. Moreover, Kaplan and Norton (1992) found that senior managers who have a more complete picture about the company should be included to achieve a successful implementation of a BSC.
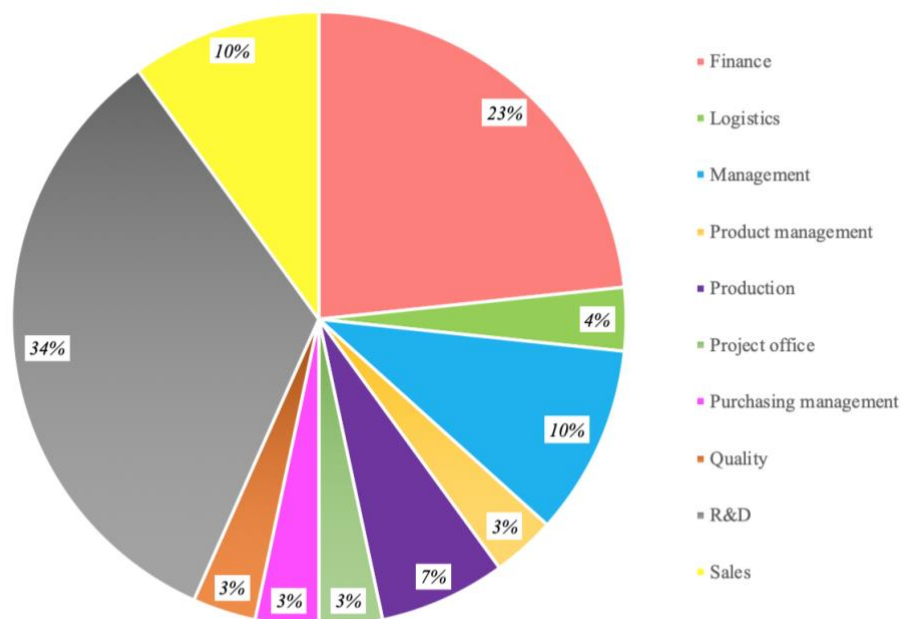
Figure 5 – Respondents - Self-completion Questionnaire

3.3.3 Transcription of Interviews

All interviews were recorded, and notes of the most important highlights were taken simultaneously by one of the authors. In this way, the authors made sure that the crucial points were emphasized and that it was time efficient. However, after each round of interviews, a more complete transcription was written while relistening to the recordings. This ensured that nothing relevant was left out which strengthened the result and consequently the analysis. Thus, this is not to consider a word-by-word transcription, but rather a partial transcription which is presenting key insights and provides enough transparency to create reliability (Bryman & Bell, 2011; Saunders et al, 2009). Since the interviews were conducted in both Swedish and English, the transcription was made in the same language as each interview. This was done to ensure that the content of the transcript would not differentiate from the actual interviews. However, when conducting the data analysis, the result was translated to English.

3.3.4 Secondary Data

The theoretical framework chapter is based on a structured literature review, which ensures that relevant previous research with valuable insights were gathered within the research field of this thesis. The authors chose the BSC as a framework because it enabled them to visualize important indicators which easily can be connected to an organizational strategy and objectives. Moreover, previous research has argued that BSC is an appropriate framework for measuring R&D (Bigliardi & Dormio, 2010; Bremser & Barsky, 2004; Kressens van Drongelen & Bilderbeek, 1999; Kaplan & Norton, 1992).

When searching for relevant literature for this study, the following databases and search engines were used: GUPEA, GUNDA, Business Source Premier, ScienceDirect and Google Scholar. Moreover, the inclusion and exclusion criteria, found below, have been used:

Inclusion criteria:
- Since the report aimed to create a BSC, literature covering BSC on a general level has been included.
- Since the report aimed to understand how companies can measure their R&D organization, literature covering different ways to measure R&D has been included.
- Since the report aimed to measure R&D, literature concerning what R&D performance means has been included.

Exclusion criteria:
- Since the report aimed to create a BSC for a case company, literature focusing only on one perspective of the BSC has been excluded.
- In this report, earlier research focusing on the BSC within the public sector has been excluded, since this case study is based on a private company and this may implicate contrasting goals.

3.4 Data Analysis

In this study, a thematic analysis has been used for the data from the interviews because it is one of the most common ways of processing qualitative data (Nowell, Norris, White & Moules, 2017; Bell & Bryman, 2011). It is also a relatively tangible, flexible and simplistic way of approaching data (Javadi & Zarea, 2016). The first step was to recognize different key points from the interviews that could be classified into different themes in relation to the research's sub-question. The collected data was divided into two parts; (1) *Status Quo Analysis* which was based on the interviews and (2) *Customized BSC* with KPIs to measure R&D which was based on the questionnaire. In terms of the Status Quo Analysis, it included a presentation of the present R&D setup and how it is measured today, what is missing and which obstacles they face. Since there was a gap between the interview rounds, a pilot data analysis was conducted to get familiar with the data and determine if relevant data had been collected to answer the research's sub-question. As this was confirmed, the second round could be executed without any changes.

Part one of the interview guide transcripts was color-coded based on the theory and interview questions, to find initial codes. These codes were then sorted into common themes and some of them were later merged into aggregated themes due of similarities, see figures 6-9. Part two of the interview guide transcripts was color-coded based on positive and negative aspects of each perspective in the BSC, see figures 10-13. Moreover, some potential KPIs and other insights that was brought up in the interviews were also coded. Some subjectivity is unavoidable in the interpretation and execution of a thematic analysis (Bell & Bryman, 2011). However, to minimize this risk, there were continuous discussions about the coding and analysis with the different supervisors of this research. Moreover, the coding process was thoroughly documented to increase transparency.

Moreover, regarding the creation of a customized BSC for Swegon, the quantitative data from the self-completion questionnaire was structured and analyzed. It followed a similar methodology as Bigliardi & Dormio (2010) adopted in their study, presented in the literature review. First, the indicators that received an average score lower than 4 were removed. This resulted in a new list of 34 indicators that were considered relatively more important to measure and steer R&D. After filtering the KPIs, they were compared to the result of Bigliardi & Dormio (2010), to see how many that were corresponding, see table 3. This was done to support the legitimacy of the findings of this study, since both case companies are within heavy manufacturing. Finally, when formulating the recommendation to Swegon, an additional selection of KPIs from the customized BSC was done in collaboration with Swegon representatives. This was done to find the most feasible and core KPIs to start with, see figure 15.

3.5 Data Quality

Data quality refers to the features and characteristics of data and the degree to which it can satisfy its given purpose. Two of the most prominent evaluation criteria are validity and reliability which will be discussed in detail below. (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009)

3.5.1 Validity

In general, validity is a measurement of how correct the choice of method is for conducting research and if it is observing, identifying and measuring what you say you are (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). The external validity for this research is limited since it is based on a single case study and therefore the finding might not be generalizable. However, this research is argued to have a high internal validity since established research methods have been followed and triangulation accomplished through multiple sources of data. Face validity was also established by asking people with experience in the field whether the measures seemed to be appropriate for the scope of this study. This was achieved through continuous discussions with Swegon representatives.

3.5.2 Reliability

Reliability refers to the ability to produce similar results under consistent conditions (Bryman & Bell, 2011; Patel & Davidson, 2011; Saunders et al, 2009). This research is argued to have a high internal reliability since the authors share an understanding of the issues concerning measuring R&D in businesses. Moreover, external reliability is often low in qualitative studies due to the challenge of replicating the study because of constantly changing conditions. Thus, in this research, the external reliability can be questioned, considering that all companies have different preconditions and are acting in different contexts. However, the authors tried to mitigate this issue by being transparent and thoroughly describing the procedure of this study, to enable future researchers to replicate it.

4. Empirical Findings

This chapter include the empirical findings from the interviews with respondents from the case company, Swegon. The first part will present a Status Quo Analysis as well as a presentation of the respondent's thoughts about the Balanced Scorecard perspectives. In the second part of the empirical findings, a customized Balanced Scorecard for Swegon will be presented in combination with a comparison of the one provided by Bigliardi and Dormio (2010).

4.1 Part One

In the Status Quo Analysis, the four figures are constructed in the way that the first column consists of summarized statements and quotes from the interviews which have been merged into different themes. These themes have then been merged into an overall aggregated theme. In the next section, Perception of the BSC perspectives, the figures consist of summarized statements and quotes from the interviews regarding the thoughts of the different perspectives in the BSC framework.

4.1.1 Status Quo Analysis

When asking the respondents about how they are being measured today and how they know if they are performing well or not, three themes were frequently mentioned, see figure 6. They can be summarized with the following quote:

"We measure that project objectives are fulfilled at all, within time and budget. It is being done today but can be improved".

However, there were no distinct overarching KPIs that measured the R&D organization on a regular basis. Instead, the three mentioned indicators were only measured on a project level. Regarding the time and budget objectives, these were estimated based on the character of each project rather than on data or comparisons of previous projects. Nonetheless, when it comes to the project specific goals, all projects followed a stage-gate model which consisted of predetermined tasks that needed to be fulfilled in every gate to proceed in the process. It is of a standardized character and nothing that was customized and adjusted in a great extent based on the project in question.
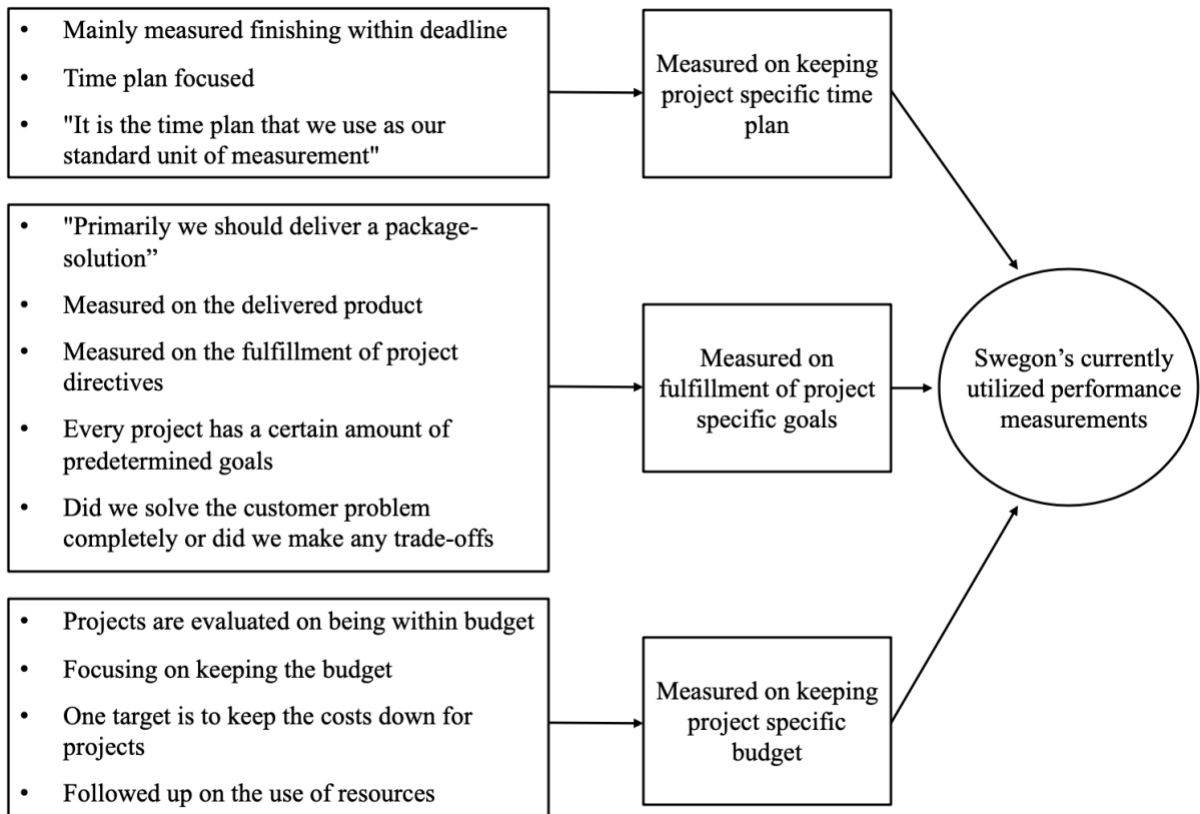
Figure 6 – Swegon's currently utilized performance measurements

A majority of the respondents wanted more measures, to know if they were doing the right things and to get more feedback on their work, as indicated by the quote below:

"I would prefer that you steer the process more and link KPIs to measure what assignments everyone has and how they are performing them. Today we have the prerequisites for it, but do not do it".

Some also argued that it could motivate and lead to more self-development for the R&D personnel. Moreover, there was a recurring opinion from the respondents, when it comes to developing and facilitating measurement of R&D; that the market study must be improved and more backed-up by data rather than subjective estimates. One of the respondents expressed it in this way:

"We need a clearer prestudy and maybe be more transparent with what kind of prestudy that has been made, who is the customer and which segment are we targeting for this specific product".

This was considered important in order to provide a clearer understanding of the customer needs and thus prevent expensive failures. As of today, the R&D organizations activities are dependent on the market study, and if that is deficient, their ability to be measured in a fair way decreases since changes might be necessary due to incorrect assessments.

The majority of the respondents argued that they were only being measured on the three objectives mentioned above, but there was still a consistent perception about the lack of clear measures and a belief that it could be done more comprehensively. Moreover, the respondents also argued that even though they are using three objectives today, the results on these measures are not evaluated in an explicit way to reflect and come up with improvements. As one of the respondents answered:

"We are basically not measuring anything today, so there is a lot missing".
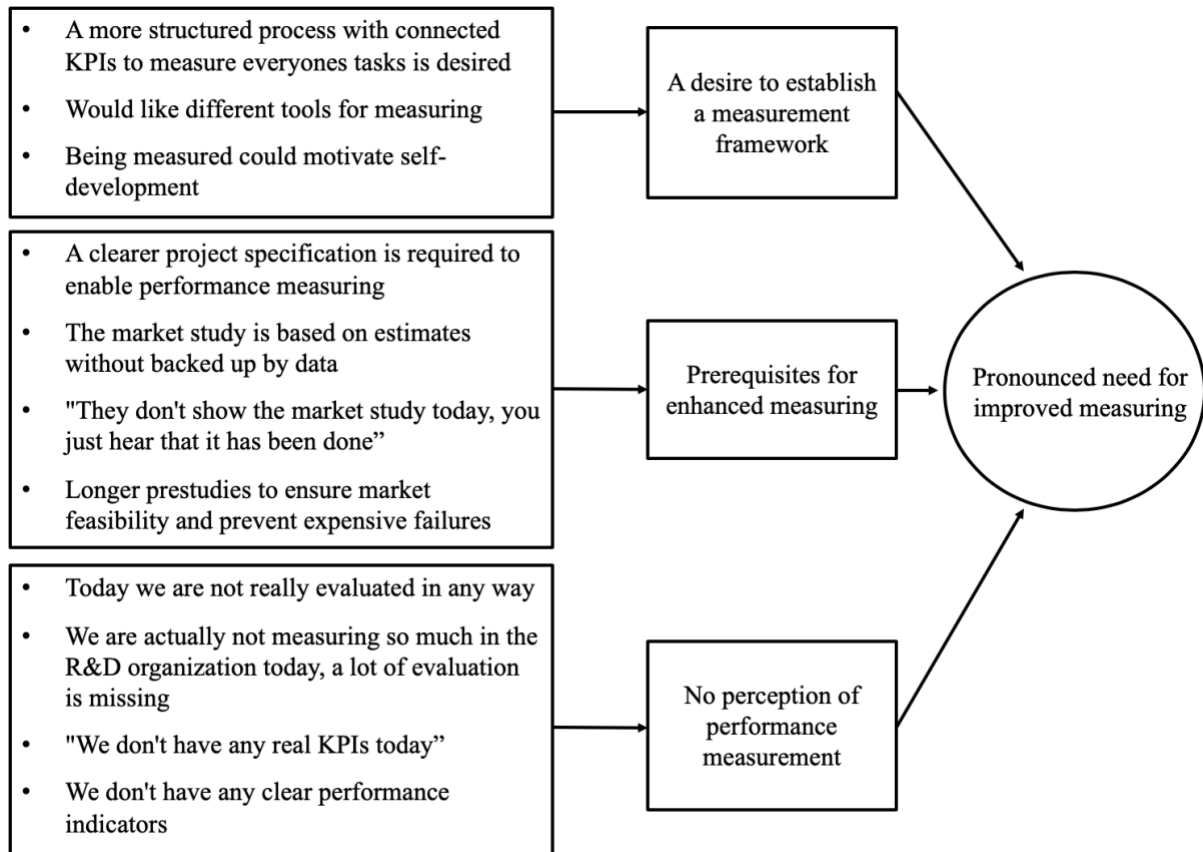
Figure 7 – Pronounced need for improved measuring

As presented in figure 8 below, there was a coherent attitude towards the need for mutual communication between management and the R&D organization. There were some different views on whether the R&D should focus on radical innovation and strive to develop more advanced products or if they should follow the directions from the product managers and focus more on user friendliness and incremental innovation. One of the respondents expressed his point of view in the following way:

"The company wants to focus more on how we can sell it and market ourselves. But I see it differently and want to focus on becoming the best ventilation manufacturer with the best performance and engineering ".

This confusion was also seen as a consequence of the inadequate communication regarding the long-term strategic goals and how to fulfill them. Most of the respondents argued that they were familiar with the goals, but not how they could be used in the daily business and how to interpret the goals. Therefore, they argued, that there is a need to break down the long-term strategic goals into milestones to steer the R&D organization towards them:

"We have big and nice goals but how do we reach them? We need milestone targets. That is where it fails, because we do not know if we should break down the goals, and someone needs to approve it".

Moreover, although some attempts had been made, but due to the top-down structure of the organization and the lack of communication it didn't result in any actions. Thus, a majority wanted the goals to be cascaded down to department and individual level to facilitate decision making in the daily business. One of the respondents also mentioned that they do not know if they should be part of this process or not:

"Goals mostly come from above, I'm not sure if I should be involved in making these targets, but I want to know more specifically how to achieve these goals".
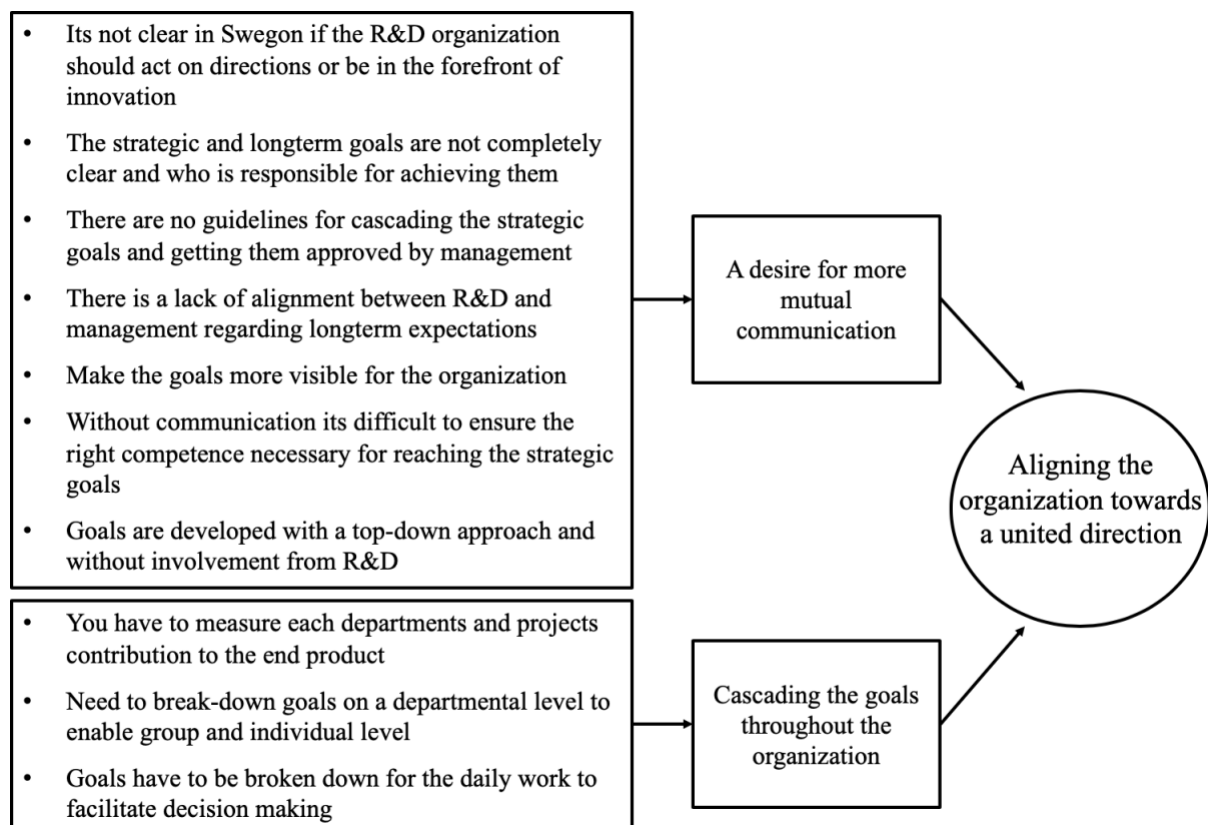
Figure 8 – Aligning the organization towards a united direction

The respondents also mentioned some obstacles for measuring their R&D organization, see figure 9. The first problem was the lack of a standardized feedback culture, where the only evaluation of their work was based on potential complaints from the customers. As indicated by the quote:

"It feels like if nobody complains, then we have succeeded; that is the normal thing".

Thus, they do not follow up on successful projects. Furthermore, one respondent mentioned that they do not get information about the value of the products they develop and thus their performance is assessed based on estimates rather than facts:

"We do not know enough about the market potential for the products we develop, if we develop something revolutionary, it is more about gut feeling that determines if the product is good or not".

However, corrections of complaints from customers are being followed up in a structured way. Most of the respondents brought up different difficulties with measuring a R&D organization, for instance, that too much measuring and steering can hamper creativity:

"R&D personnel differ from other employees; they want more support instead of being steered. There needs to be room for creative thinking and sometimes more time to learn things during the process. At too controlled approach can impede the organization".

Moreover, it is hard to isolate the R&D organizations contribution to the final product, since it is dependent on the work from sales and marketing for instance. When it comes to the R&D organization at Swegon, many of its employees have specialized knowledge and skills and thus work independently, which makes measuring and comparing more difficult.

- We don't evaluate if a product is used as it was intended to
- If something is not working, we will hear it from the customer
- Corrections are being followed up, but successful project are not
- No concrete routines for follow up on projects
- "It feels that if nobody complains, then we have succeeded; that´s the normal thing"
- The value of a product for customers are not evaluated

- Working in an innovative setting, can't be associated with a too structured way of working
- Its difficult to measure the isolated contribution from R&D in the final product
- Its hard to measure R&D projects
- Since our R&D personnel has expert knowledge within different areas it is difficult to measure and compare
- Some products can't be financially motiveted but are crucial for customers engagement
- "Then we have the problem how to define a new product (...) we both make incremantal improvements and bigger launches of the same products"
- To enable creative thinking, R&D needs to be supported rather than managed

Lack of a standardized feedback culture in the R&D organization

Issues related to creating a R&D organization steered by measurements

There are difficulties to measure an R&D organization

Figure 9 – Issues related to creating a R&D organization steered by measurements

4.1.2 Perceptions of the BSC perspectives

When it comes to the first perspective in the BSC framework, which is the financial perspective, most of the respondents had positive opinions regarding the perspective and think that it is a clear and important one when measuring R&D, see figure 10. However, one of the respondents also stated that it is hard value innovation:

"At the end of the day it is all about making money but putting a price tag on innovation is really difficult".

It was also mentioned in some interviews that indicators for this perspective could be motivating and lead to a cost awareness among R&D personnel:

"We should have a careful cost control, personnel in product development constantly need to feel the push of costs".

Although, there seems to be potential drawbacks as well for the R&D if there is a too strong focus on financial indicators:

"Budget and financial measures can hamper because R&D is about testing and experimenting to see what is happening".

However, some of the problems mentioned in the previous section apply to this perspective, for instance, that it is hard to isolate R&D contribution to the result and hard to quantify KPIs in this perspective:

"R&D has some responsibility to develop a sustainable, good, smart, qualitative solution. However, it becomes complex when you look at sales since it becomes difficult to link it to R&Ds contribution".

One potential way to assess this perspective mentioned in the interviews is time to money, which is about evaluating projects based on their payback period. Another one is how much of the sales that comes from new products, but as mentioned in the status quo analysis result, some products are necessary to have in the assortment but are not sold in high volumes. Therefore, this way of measuring R&D might provide a false picture of the reality in some cases.
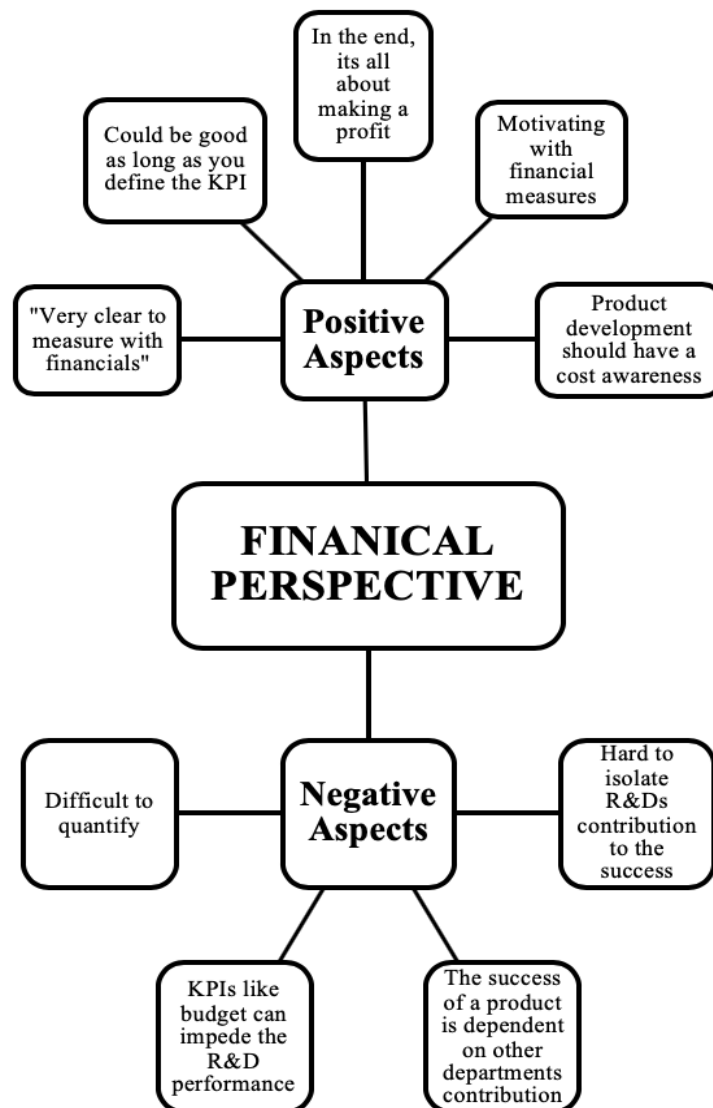
Figure 10 – Financial Perspective

Regarding the customer perspective, some respondents were very positive and thought that it was a perspective that are quite easy to follow up and evaluate, see figure 11. Besides that, it is a concrete perspective which enhances customer relations. The importance of this perspective can be shown by the following quote:

"*The most important one for analyzing the performance of the R&D group*".

However, some respondents also mentioned the fact that it is a more subjective perspective compared to financial indicators. The same goes for the satisfaction of different customers, two different markets might have different opinions and preferences. This can be summarized in the following quote:

"Customer satisfaction is a good measurement, but every person values a product differently and therefore their satisfaction becomes more subjective than financials".

Therefore, there are always trade-offs and they need to decide which market they are developing a product for. Thus, one market might not be as satisfied with a product as another, because the preferences of the more important market was considered more in the product development phase. Similarly, it is often the overall picture of a product that is evaluated and not each part of it, thus, it is difficult to derive which R&D activity that is responsible for the level of satisfaction, which can be seen in the following quote:

"It is difficult to measure satisfaction with a certain product; it is often the big picture that is evaluated and not every function or solution".

Hence, it can show a skewed result in customer satisfaction. During the interviews, some potential assessment areas came up such as constructing a customer satisfaction index, measuring the number of reclamations made or to conduct customers surveys to get regular feedback, to reconnect both successful and less successful projects.
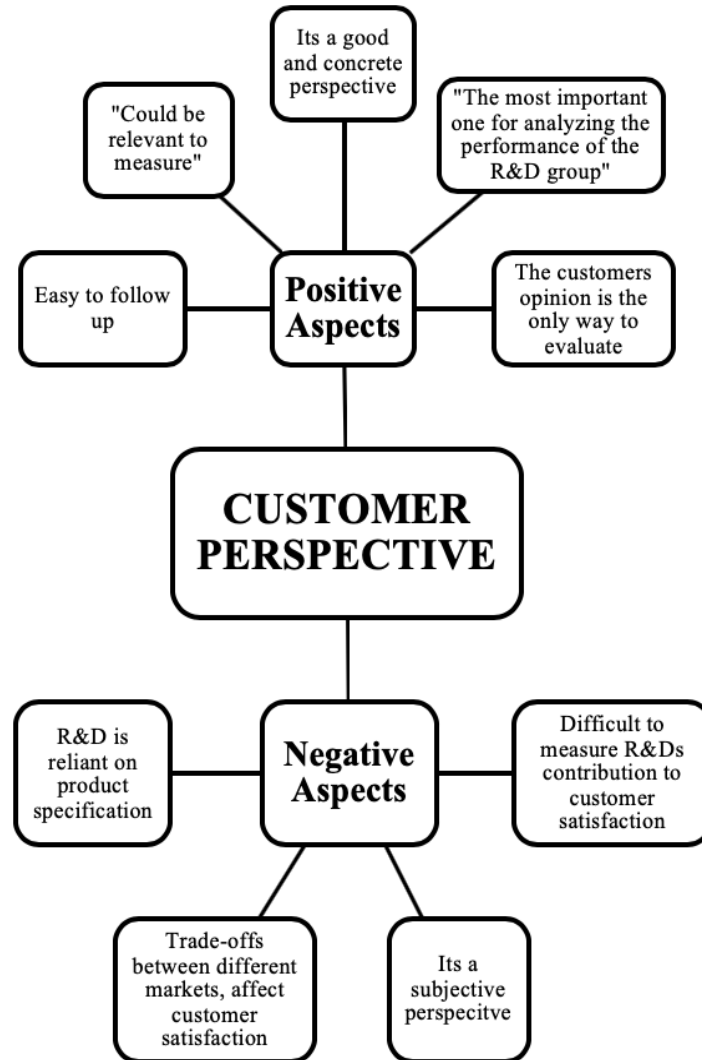
Figure 11 – Customer Perspective

In the internal business perspective, the most common positive argument concerned the importance of measuring time objectives, see figure 12. However, most respondents did not go further than that. Instead, there was a more skeptical perception of this perspective since it could harm the creativity, create stress and result in too early production of non-finished products that often had to be changed which consequently increased costs:

"A problem with R&D is that when you push deadlines and costs, the products are moved to production too early".

There was also a perception from the respondents that it might be difficult to come up with concrete KPIs connected to this perspective as well as comparing projects with each other due to their different scopes. However, the network within Swegon could help to overcome this problem by sharing information in an effective way:

"Something I think about is the network within the organization, where we could look at retrieving and sharing information. Are we doing it effectively? There might be similarities between projects".

Meaning that it might be hard to come up with some sort of a standard measurement and a certain procedure of doing things, since some projects might be about incremental improvements while others are about creating a completely new product. Moreover, there was a fear that this perspective could lead to a negative risk aversion and keeping the R&D personnel in their comfort zone:

"You need to be able to take risks and not be afraid of failing, otherwise it can deter creativity and learning".
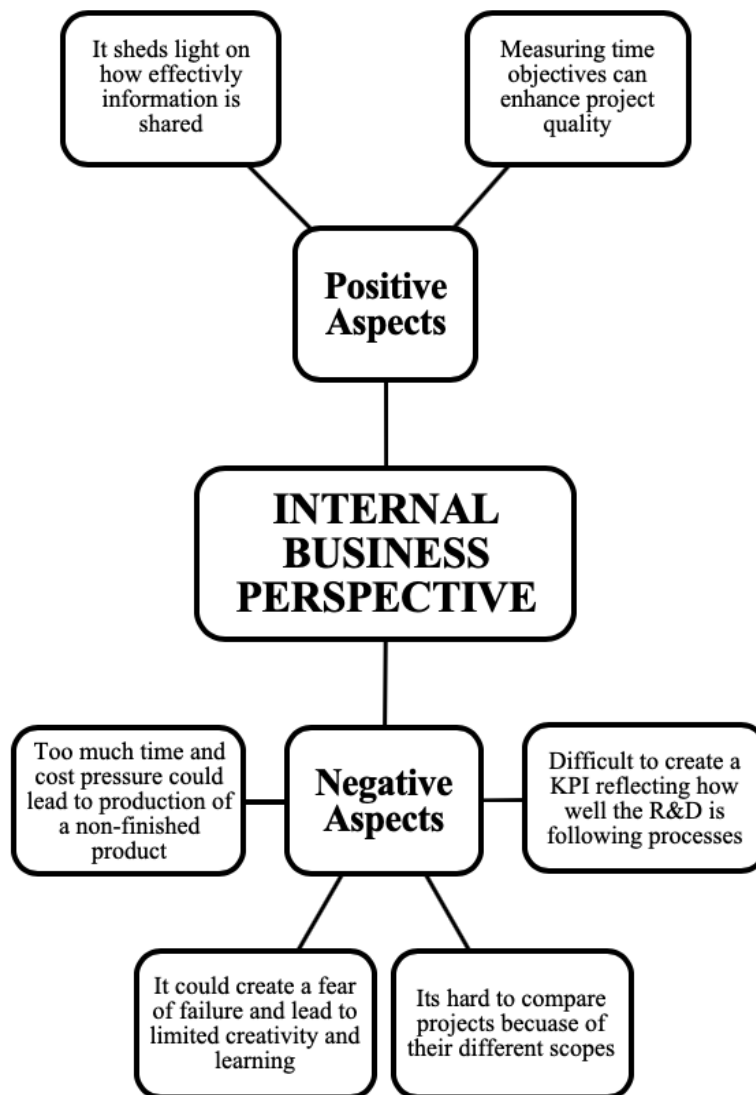
Figure 12 – Internal Business Perspective

Unlike the previous perspective, innovation and learning received relatively more positive attitudes, see figure 13, and that there is a desire to put more focus on this area:

"It is something that we are missing in the moment, so we should concentrate more on it".

Most respondents argued that this perspective is important to measure in order to drive innovation and to make sure that they were appropriately equipped for the future:

"Absolutely, evaluate what competence we have compared to what we need".

However, some respondents argued that it might be difficult to measure. One of the potential KPIs and important insights that was brought up in the interviews, was that you can map competence towards the strategy to ensure that you have the right knowledge to achieving the strategic goals. Another one was to make sure that there is a culture that accepts failures in the organization, which can strengthen employee self-confidence in trying out new activities that might lead to important insights even if it does not turn out in new innovations.
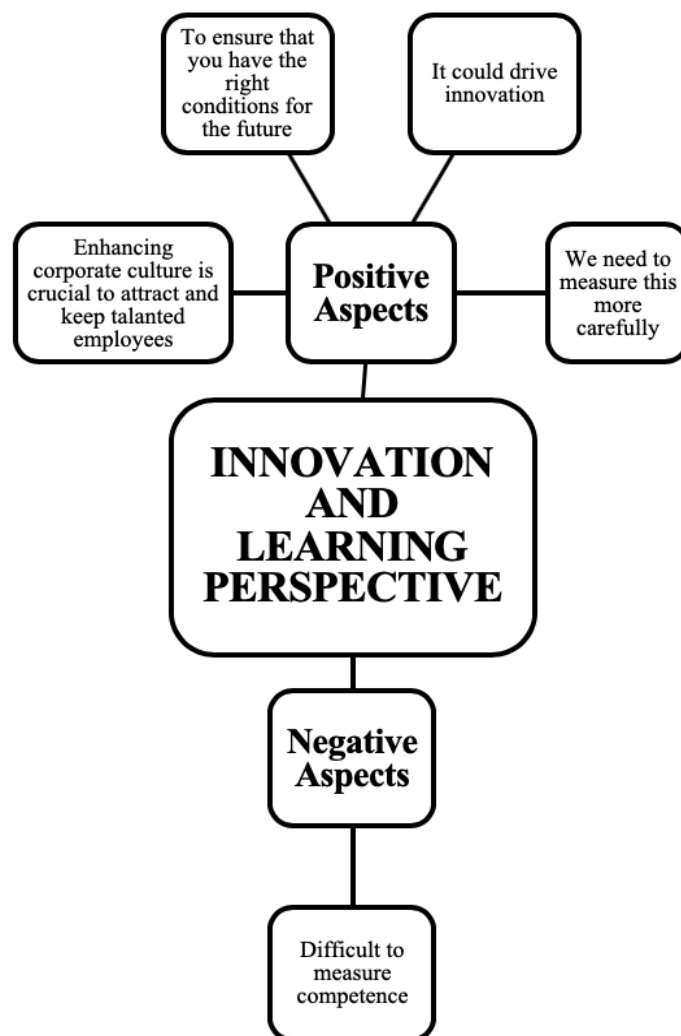
Figure 13 – Innovation and Learning Perspective

4.2 Part Two

In this part, a customized BSC for Swegon will be presented with KPIs derived from the self-completion questionnaire which were considered more important than others. Later on, a comparison of the KPIs from this study that were found to be more important with the KPIs that Bigliardi and Dormio (2010) found to be more important in their study.

4.2.1 Customized BSC

Out of the 54 initial indicators, 34 of them received a score of four or above, see figure 14. When it comes to KPIs in the financial perspective, six out of the nine possible were more important by the respondents. Moreover, for the customer perspective, six out of ten KPIs received a score of four or above. For the internal business perspective, there were seven out of twelve that were relatively more important. Lastly, in the innovation and learning perspective 15 out of 23 KPIs got a score of four or above. This means that approximately 60% of the initial number of KPIs in each perspective got a score higher than four.

FINANCIAL
- Budget allocation to R&D activities
- Increased financial profitability
- Cost reduction from innovative projects
- Property right value
- Average cost of each finished project
- Optimization of the use of capital

INTERNAL BUSINESS
- Alignment between R&D activity's objective and firm strategy
- Consistency between the firm as a whole and the R&D unit
- Effect of the external environment on the R&D activity
- Percentage of R&D projects that respect the cost and output plan
- Level of communication and information flow
- Level of coordination among R&D, marketing and production unit
- Achievement of quality and time objectives

Swegon

CUSTOMER
- Market share growth
- Customer satisfaction improvement
- Customer lifetime improvement
- Brand image
- To be the first into new research areas
- Time to market

INNOVATION AND LEARNING
- Innovation contribution to R&D projects in progress
- Capability to take advantage of new technology internally developed
- Time spent to understand the reasons why R&D projects fail
- Time spent in training activities for R&D personnel
- Motivation and involvement of R&D personnel
- R&D oriented culture
- Work environment and relations with co-workers
- Involvement in strategy development process
- Involvement in R&D process
- Teamwork effectiveness
- Identification of skills adequate to the customers' requirement
- Core competences of R&D personnel
- Adoption of skills development plans
- Evaluation of R&D personnel performance
- Adoption of open innovation

Figure 14 – Customized BSC for Swegon

4.2.2 Comparison of KPIs

In the second column in table 3 below, the average score of each indicator that was ranked on a linkert scale of 1-6 is presented. Out of the 34 KPIs that were found to be more important in this study, 21 of them were also seen as more important in the study by Bigliardi and Dormio (2010). This also means that in total, 21 KPIs were only seen as important in one of the two studies. This study has considerably more KPIs in the first three perspective compared to Bigliardi and Dormio (2010). However, the *Innovation and Learning* perspective included relatively less KPIs in this study. The top five indicators in this study was: *customer satisfaction improvement, time to market, involvement in the R&D processes* and *core competences of R&D personnel*. This can be compared to Bigliardi and Dormio's (2010) findings where the following five received the highest rank: *motivation and involvement, R&D oriented culture, adoption of selection and skills development plans, evaluation of R&D personnel performance* and *turnover from and to R&D unit*.

	Ranking Swegon	Included KPI:s by Swegon	Included KPI:s Bigliardi & Dormio (2010)	Ranking above 4 in both studies	Ranking above 4 in only one of the studies
FINANCIAL PERSPECTIVE					
Budget allocation to R&D activities	4.35	X	X	green	
Average expenses for R&D activities	3.87				
Increased financial profitability	4.58	X	X	green	
Cost reduction (derived from innovative projects)	4.84	X			red
Dependence on external funding	2.19				
Property rights value	4.06	X			red
Debt-equity ratios	2.68				
Average cost of each finished project	4.03	X			red
Optimization of the use of capital (human and material)	4.26	X	X	green	
CUSTOMER PERSPECTIVE					
Market share growth	4.9	X	X	green	
Average expenses for market researches	3.0				
Customer satisfaction improvement	5.32	X	X	green	
Enlargement of product variety	3.87				
Customer lifetime improvement	4.06	X			red
Brand image	4.84	X			red
To be the first into new research areas	4.16	X			red
Average expenses for internal and external communication	2.65				
Percentage of project that directly involve the customer	3.77		X		red
Time to market	5.23	X	X	green	
INTERNAL BUSINESS PERSPECTIVE					
Alignment between R&D activity´s objectives and firm´s strategy	5.03	X			red
Consistency between the firm as a whole and the R&D unit	4.94	X			red
Effect of the external environment on R&D activity	4.0	X			red
Percentage of R&D projects abandoned before they are finished	3.26				
Percentage of R&D projects that respect the costs and outputs planned	4.42	X			red
Average cost of R&D projects unfinished	3.52				
Level of communication and information flow	4.74	X	X	green	
Level of coordination among R&D. marketing and production units	4.87	X			red
Achievement of quality and time objectives	4.97	X	X	green	
Level of dependence from external resources	3.74				
Level of collaboration with other companies	3.55				
Cost/benefits ratios from investments in infrastructures	3.94				
INNOVATION & LEARNING PERSPECTIVE					
Innovation contribution to R&D projects in progress	4.39	X	X	green	
Percentage of new patents	3.42				
Improved frequency and quality of scientific papers. workshop etc.	3.03		X		red
Capability to take advantage of new technology internally developed	4.9	X	X	green	
Time spent to understand the reasons why R&D projects fail	4.35	X	X	green	
Increase in the number of the R&D personnel	3.45		X		red
Time spent in training activities for R&D personnel	4.1	X	X	green	
Motivation and involvement of R&D personnel	5.03	X	X	green	
R&D oriented culture	4.65	X	X	green	
Work environment and relations with co-workers	4.94	X	X	green	
Involvement in the strategy development process	4.71	X	X	green	
Involvement in the R&D processes	5.06	X	X	green	
Team work effectiveness	4.61	X	X	green	
Use of survey to improve the R&D human resource management	3.52		X		red
Implementation of new organizational method	3.61		X		red
Identification of skills adequate to the customers´ requirement	4.48	X			red
Percentage of resources dedicated to radical innovation projects	3.94		X		red
Implementation of incentive programs	3.52		X		red
Core competences of R&D personnel	5.1	X	X	green	
Adoption of skills development plans	4.29	X	X	green	
Evaluation of R&D personnel performance	4.13	X	X	green	
Turnover from an R&D unit	3.48		X		red
Adoption of open innovation	4.52	X			red
Sum		*34*	*29*	*21*	*21*

Table 3 – KPI Ranking Comparison

5. Analysis

In this chapter, the empirical findings will be analyzed in relation to the literature presented earlier. This discussion generates insights and create a foundation for future guidance in developing and implementing a Balanced Scorecard.

5.1 Status Quo Analysis

As seen in figure 6 in the result, Swegon's currently utilized performance measurements concern time, project specific objectives and budget which is similar to the ones identified by Kerssens-Van Drongelen and Cooke (1997). However, Swegon lack metrics concerning innovativeness and contribution to profits. Looking at the result, it seems that Swegon's R&D department is only being measured using the internal business perspective out of the four BSC perspectives. Thus, the managers are not getting a clear overview of the whole R&D organization. Therefore, by adopting the BSC, they could expand their currently narrow measuring framework to a more comprehensive one. One can argue that a R&D intensive company like Swegon should have a bigger focus on measuring innovation, since *what you measure is what you get* (Kaplan & Norton, 1992, p.71). In order to stay competitive in an industry that is experiencing new entrants from incumbents in related industries, its crucial to measure and steer the organization proactively to sustain its market leading position in their strongholds.

Although the respondents mentioned the three measurements above, there was still a perception of not being measured, or not in a desired extent. It seems that these measurements work more like a checklist rather than indicators incorporated in their everyday work and decision making. Due to this, the R&D organization might not develop to its full potential, since the incentives are more focused on fulfilling the three measurements rather than exceeding them. The interpretation of this can be that not enough time has been invested into creating the right KPIs for Swegon. Which according to Eckerson (2006) is something crucial for managers to be able to continuously steer the organization in the right direction. Otherwise, as of today, the R&D organization might be working sub optimally and only doing what they must. Moreover, as mentioned in the literature, the employees who are being evaluated must have a positive attitude towards it. The respondents showed great interest in a more extensive measurements framework and one of them even argued that it could enhance self-development. Thus, one can argue that Swegon already have buy-in which is necessary to implement the BSC successfully.

Today, a project is started with a market study including a description of what the customer wants to be developed. This market study has been inadequate with a lack of clear specifications. Consequently, during the development, there has been frequent changes along the project. This results in longer development times and higher costs, thus, negatively affecting two out of the three current measurements. In order to evaluate the R&D organization fairly, this market study needs to be improved. An enhanced market study could also enable a more extensive measurement framework. This is also mentioned as fundamental requirements for a cost-efficient and reliable performance measurement system according to Kerssens-Van

Drongelen and Cooke (1997). Convincingly, there is a pronounced need for improved measuring.

One of the most crucial obstacles seems to be the communication at Swegon, where the management want to pursue a strategy focusing on the customer experience while part of the R&D organization wants to engage in more radical innovation to be in the forefront of technological engineering. Thus, this causes a confusion in the organization about the direction of the company. This becomes an obstacle for measuring the R&D organization since measuring the customer experience and level of innovation are two separate objectives and requires different KPIs. Hence, more communication is necessary to set a united direction for the company and create related KPIs. Newman (2009) confirms this and argue that it is crucial to find the balance in an organization between being market as well as technology led, to provide the best conditions for an innovative way of working. Thus, the long-term goals must be clarified in order to align the organization and ensure access to the competences necessary to reach the goals. Otherwise, it might lead to confusion in the organization. Moreover, having several strategic frameworks simultaneously can also cause confusion among the employees and limit the success of the R&D organization (Osama, 2006). Furthermore, the employees need to know who is responsible for achieving these goals. If the R&D organization is not informed about their part, then it is difficult to know what is required of them and the KPIs won't be accurate. This can be a result of the top-down approach at Swegon in the goal development process. With a higher involvement of the R&D organization in this process, they can achieve a enhanced awareness of their content, responsibilities and activities to fulfill them. One can also argue that a higher involvement could lead to a more entrepreneurial spirit among the employees (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009; Gupta et al, 2001).

As mentioned above, the R&D organization needs to align its activities with the strategic goals of the company. As stressed by the respondents, there is a lack of directions on how to cascade the top-level strategic goals down to milestone goals for specific departments and project teams. Thus, there is a need to make the strategic goals more visible in the organization and create guidelines for how to break them down, in order to facilitate daily decision making. Aligning strategy and the daily work is also supported by literature (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009). To achieve this, senior management need to set a clear guideline for how the whole organization should apply the BSC in their daily work in order to utilize the framework efficiently. This is also mentioned by Gupta et al (2001), who argues that this is the way to get an organization to work towards a united direction. Moreover, keeping the BSC in the top management or not getting enough commitment to it, might cause failure of its implementation (Rompho, 2011). It is therefore crucial to have an open communication about the BSC and ensure that the managers take responsibility for adopting it throughout the whole organization.

Another obstacle in the pursuit of measuring the R&D organization, is the lack of feedback. It is most evident when it comes to evaluating whether they have succeeded or not and to what extent. Currently, the R&D organization only get feedback when something is not working appropriately. Thus, it is difficult to measure the level of success of a project if they do not get

a standardized feedback on both successful and less successful projects. Continuous feedback could enable a more fast-moving decision making and ensure development in the right direction - in line with what the customer wants. Moreover, one can argue that receiving positive feedback can enhance motivation and create appreciation among the employees - stimulating the R&D culture. Without the insight about customers preferences, Swegon risk to develop products which does not correlate with customer demands. Thus, if the R&D do not get the right information about what the customers want, they risk getting a bad recommendation even though the project was considered a success in accordance to the project specification. Hence, the evaluation of the R&D organizations performance will be inaccurate due to incorrect preconditions. As mentioned in the research by Gupta et al (2001), customer understanding is what distinguishes a successful R&D organization from a weak one and therefore should be considered carefully.

Despite the benefits of a more extensive measuring framework, one must consider its possible hampering effect on creativity, of a too structured and controlled measuring of the R&D organization. Since a R&D organization is dependent on taking advantage of creative ideas, this could have devastating consequences. This is mentioned in the literature as well as in the interviews as an obstacle for a measurement framework. To overcome this obstacle, involving the employees can be one solution to find a good balance in level of control. Therefore, employees from different departments and hierarchical levels should be involved in the development of the KPIs. This was done in this study through the self-completion questionnaire when selecting KPIs for the customized BSC for Swegon. Involving employees in the process already from the beginning will also facilitate its adoption.

Furthermore, Kerssens-Van Drongelen and Cooke (1997) mentioned that it is challenging to analyze the isolated contribution from a successful R&D organization to the overall organizational performance which was also a recurring comment from the respondents. The success of a product depends on so many different departments and activities outside of the R&D organization and therefore it is troublesome to measure their contribution. It has been proven that the amount invested in R&D is weakly correlated with sales growth since not all the money invested in R&D leads to successful innovations (Goffin & Mitchell, 2017). Thus, it becomes an obstacle for measuring the R&D organization at Swegon and whether they are using the resources efficiently. Another consequence of not being able to isolate the contribution from a R&D organization, is that it is easier to point the fingers at other departments and blame them for failures to justify your own work.

Another discovered obstacle is that some products are not financially motivated but necessary to have in the product portfolio in order to offer a complete solution to customers. Thus, measuring these kinds of products and associated project would show a skewed perspective of the R&D organizations performance. This aspect must be considered when measuring the R&D organization to understand the underlying reason why these projects are pursued. Moreover, there is a lack of understanding of what is a "new product", which creates confusion when measuring their success. For instance, is an old product with minor updates considered new or

not? There needs to be a clear definition of this to enable measuring of the R&D organization in an accurate way.

5.2 Perceptions of the BSC perspectives

Looking at the BSC, the financial perspective has gotten some critique in the literature because of its lagging character and Kaplan and Norton (1996) argue that non-financial KPIs are of higher importance. However, the result of this study shows that there is still a high interest in keeping the perspective, as it is a clear and none-subjective indicator of performance. Although some financial measures can hamper the creativity of a R&D organization, an interesting insight was that it has the potential to affect self-motivation and cost awareness positively. Thus, one can argue that the measure itself is not the obstacle, but a too strict control over it. As mentioned previously, it is difficult to isolate the contribution of the R&D organization to the financial success of the company or single products. But, by spending enough time on choosing the right KPIs as argued by Eckerson (2006), Swegon can take advantage of the positive aspects and capture the short-term evaluation. The importance of this perspective is further confirmed by the amount of KPIs in figure 14.

The customer perspective receives good recommendations from both literature and practitioners at Swegon. As mentioned above, Kaplan and Norton (1996) argues that the non-financial perspectives are of higher importance which is also confirmed by the result of this study. Some respondents communicated that the customer perspective is the most important one. Customer insights, about their opinions and preferences are crucial in order to invent and commercialize attractive products as well as keeping up with the market changes (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009). However, similar to the financial perspective, there are difficulties in deriving the R&D organizations contribution to the satisfaction of customers. The reason behind this, is that they get insights from other departments about customer needs and are dependent on the market study delivered to them. Thus, if it is insufficient or does not reflect reality, the customers will not be satisfied, although the R&D group delivered on the information they had available. Another obstacle with measuring the R&D organization through this perspective, is that there are often trade-offs between different market preferences, and it might not be possible to satisfy both. Hence, customer preferences in one market might come at the expense of another, leading to a lower average score in related KPIs. To overcome this obstacle, Swegon needs to clearly specify the KPIs, how the they are measured and how they are tracked in order to provide a true picture of reality (Bauer, 2004).

The internal business perspective is the one which corresponds mostly to Swegon's current measurement framework, focusing on time, cost and project goals. One interesting problem reflected in the result, was the occurrence of too early production because of deadline and cost pressure. This shows, once again, that a too controlled measuring actually can have sub optimizing consequences and increase costs rather than keeping them down. Moreover, this tight control might also limit the risk taking that employees are willing to take in their work and some risk is necessary in order to take advantage of different opportunities that arise and the next innovation (Goffin & Mitchell, 2017; Likar, 2013; Newman, 2009).

To overcome this obstacle, there needs to be an acceptance of failure in Swegon, that can provide opportunities for learning and acquiring experiences. Although there were limited positive responses about this perspective, one useful aspect was its ability to focus on information sharing within the organization and between sites. This is important in order to gather everyone behind the same goals and a united direction as well as taking advantage of internal knowledge.

Bigliardi and Dormio (2010) concluded that the innovation and learning perspective is the most important one when dealing with R&D organizations. This seems to correspond well with the results of this study, where only one negative aspect was expressed. Based on this, one can argue that it should be taken more into consideration at Swegon and be measured carefully. One interesting aspect that was brought up in the interviews was that this perspective measures the company's abilities to stay competitive in a changing industry. This becomes especially important for an R&D intensive company in a competitive industry - to ensure that they have the right conditions for the future. Goffin and Mitchell (2017) as well as Newman (2009) stress the importance of attracting the right competences for a company in order to secure its success. Likewise, the respondents of this study showed a similar opinion and expressed the importance for Swegon to do this in order to create an attractive culture and inspire future employees to join the company.

5.3 Customized BSC

An interesting insight is that all perspectives kept around 60% of their initial KPIs in the customized BSC for Swegon, confirming the importance of keeping a good balance between financial and non-financial KPI as well as short- and long-term focus, which Kaplan and Norton (1996) and Velimirović et al (2011) argue for as well. As shown in the results of this study, the respondents want to be measured in a more extensive way compared to today, which the new customized BSC can provide them with. Moreover, the results of this study support the findings of Bigliardi and Dormio's (2010) research, regarding the importance of the innovation and learning perspective when dealing with R&D organizations. Almost half of the chosen 34 indicators belong to this perspective, stressing its relevance. Some of the suggestions and requested evaluation areas mentioned in the interviews can also be found in the customized BSC. This indicate that there is a broad agreement about which KPIs that are important for the R&D organization. For instance, the following KPIs were mentioned in both the interviews and received an average score above four: *Customer satisfaction improvement*, *Involvement in strategy development process* and *Alignment between R&D activity's objectives and firm strategy.* As Kerssens-Van Drongelen and Cooke (1997) argue, requirements may differ from different users in the organization. However, since the customized BSC is based on preferences of employees from several different departments, thus, one can argue that it covers the majority's requirements. This could facilitate new collaborations and strengthen the organization to work in a united direction. It may also prevent departmental disputes, since everyone has been involved in the development of KPIs and therefore has a stronger buy-in. This is also a requirement for a successful implementation of the BSC. However, another precondition is clear communication (Awadallah & Allam, 2015; Rompho, 2011).

This study shows that the communication of goals and strategies are insufficient at Swegon and therefore needs to be enhanced in order to succeed with the adoption of the BSC. The same goes for the importance of keeping the BSC as a part of the daily business, and continuously use it to communicate which actions and strategies that needs to be implemented, which is in line with the findings of Bremse and Barsky (2004). Otherwise, this will only be seen as "another project" that fails and do not achieve acceptance.

Another important aspect that must be considered, is to utilize a limited amount of KPIs to avoid contracting signals (Goffin & Mitchell, 2017; Rompho, 2011) and overwhelming efforts to achieve a wide range of KPIs. However, the customized BSC presented in this study, is rather extensive and might therefore need to be narrowed down to the most crucial ones, see 6.1 Recommendation for Swegon. One solution can be to filter the KPIs based on a higher score than four or, to go through the 34 KPIs and filter them manually based on their feasibility and simplicity, which was done in this study. Moreover, time need to be dedicated to clearly define the KPIs which are to be implemented (Eckerson, 2006). As of today, it has been a challenge for Swegon to break down the strategic goals into milestones and align KPIs to the strategies of the overall organization. To simplify the implementation of the BSC, it is therefore of importance for Swegon to evolve their ability to do this and work hard to clearly anchor the strategic goals within the whole organization. Another crucial aspect to consider, is the fact that the customized BSC will not provide Swegon with a final score on the overall performance of the R&D organization. Instead it will consist of both scores as well as assessment areas that need to be handled in different ways. The pure financial KPIs such as *Increased financial profitability* or *market share growth*, will provide a score on a regular basis which is easier to follow up. This can be compared to the nonfinancial KPIs which are based on subjective assessment such as *R&D oriented culture* or *Core competences of R&D personnel,* which frequently needs to be evaluated. One must remember that this might decrease the feasibility of the measurement framework, which Sundin et al (2010) argues. Moreover, this customized BSC is not to consider final, since KPIs can become obsolete over time as markets changes and might have to be replaced in the future (Eckerson, 2006; Beatham et al, 2004). This is a procedure that is missing at Swegon today, and which they need to adopt in order to measure their organization's current state through relevant KPIs.

As previously mentioned by one of Swegon's representatives working in management: "*When adopting a measurement framework, it is important to 'manage walking before you can run and crawling before you can walk' in order to utilize it successfully".* Thus, figure 14 and its 34 KPIs can be considered overwhelming to start with. Hence, before they adopt this extensive set of KPIs, they might want to start with a smaller version of the customized BSC with the most feasible KPIs, to ensure a successful implementation. Otherwise, they risk ending up with KPIs that creates counteracting signals and waste management time. Referring back to the quote, when they manage crawling, they can start walking by including more KPIs. Some KPIs can be more difficult to interpret and to use in practices, for instance *Adoption of open innovation,* and might therefore be less feasible to implement. Thus, a final selection of KPIs has been completed from the customized BSC, based on their feasibility to be implemented, insights from the interviews and support from literature. Additionally, some KPIs in figure 14

have a similar character and have therefore been merged, to simplify and make the measuring more efficient, for instance: *Core competences of R&D personnel* now includes both*, Identification of skills adequate to the customers' requirements* and *Adaption of skill development plan*. The final BSC can be found in figure 15 in the conclusion. One should not forget the difficulties in creating KPIs with a clear link to strategic goals, since these tend to be overarching for a whole organization, while some KPIs can be designed for certain departments. As for this study's final BSC and accompanying KPIs, they are chosen based on their relevance in steering a R&D department. Thus, all KPIs may not have a direct connection to all the strategic goals, see figure 1. All departments in an organization contribute in different extents in achieving their strategic goals. For instance, one can argue that a sales department would have a clearer connection to the strategic goal *strongholds* and *superior customer experience* since they work closer to clients, compared to R&D, which focuses more on creating innovative products. Hence, the R&D would be more connected to the strategic goal *indoor environmental quality*. However, the R&D organization may have an indirect link since excellent products with a *system approach* would lead to *superior customer experience,* which in turn enables the creation of *strongholds*. Conclusively, by measuring the KPIs in the final BSC, the R&D organization will be put into optimal use and contribute to achieving all the strategic goals.

5.4 Comparison of KPIs

In the comparison of this study's customized BSC and the one in Bigliardi and Dormio (2010), there are some clear similarities. 21 of the 54 initial KPIs were considered highly important and relevant in both studies, which create legitimacy for the findings. One reason behind this could be that they were both based on rankings by personnel working in the heavy manufacturing industry. Thus, there might be similarities between their core competences and therefore also their preferences, resulting in common view of relevant KPIs for this industry. However, the distribution of KPIs differ slightly between the two studies, where this study sustains the proportion per perspective while Bigliardi and Dormio (2010) is more unproportionally skewed towards the innovation and learning perspective. One can argue that this can be a consequence of the fact that the indoor climate industry is lagging behind the automotive industry when it comes to innovation and the development of the industry. Furthermore, Swegon is serving the real estate market, which is characterized by conservatism and slow adoption of innovation. The automotive industry on the other hand, is an industry associated with a lot of innovation and it has been in the forefront for a long time, which can be a reason why the study of Bigliardi and Dormio (2010) has more KPIs in this perspective. The uneven distribution between the studies is further confirmed in the other three perspectives which received a seemingly higher amount of KPIs in this study. This can be interpreted as that Swegon is relatively more focused on traditional measures even though one can argue that maybe they should be more focused on measures concerning R&D more directly, such as the innovation and learning perspective, to stay ahead of competition. Conclusively, to continue as a competitive player in the indoor climate industry, Swegon should follow the automotive industry and strive to be in the forefront of innovation. Thus, with both the customized or final

BSC, Swegon has a foundation in which they should emphasize the innovation and learning perspective to steer the organization towards their strategic goals.

6. Conclusions

In the final chapter of this study, the answers to the research questions are presented together with a final recommendation for Swegon. Lastly, it defines the theoretical contribution of the study as well as proposals for future research.

This study aimed to develop and provide Swegon with a customized BSC that could be utilized to steer their R&D organization towards their strategic goals. Moreover, it intended to discover how the case company Swegon is currently measuring their R&D organization and which obstacles they face in doing this. Thus, the main research question and sub-question that was formulated were: *How can Swegon use the BSC to measure the R&D organization in order to steer it towards their strategic goals?* and, *How is Swegon measuring their R&D organization today and what are the obstacles?*

In today's fast changing business environment, it is crucial to be in the forefront of innovation in order to capture first-mover advantages. This is especially true for an R&D intensive company which is facing increased competition from incumbents in related industries. As the common proverb goes:

"*What you measure is what you get*" (Kaplan & Norton, 1992, p.71).

Measuring R&D is a prerequisite in order to achieve a successful R&D organization. Currently, Swegon's R&D department lacks a comprehensive measuring framework that incorporates different perspectives. To answer the research's sub-question, qualitative interviews were conducted with employees with R&D related responsibilities. The data from the interviews was analyzed with a thematic analysis, to identify different themes and common insights. Moreover, to help answer the main research question, a self-completion questionnaire was sent out to different departments affected by the R&D activities, in order to rank KPIs for the customized BSC.

Currently, Swegon is only measuring time, project specific objectives and budget which corresponds to a small part of the internal business perspective in the BSC. Thus, managers do not get a comprehensive view of the R&D organization, which is crucial in order to stay competitive. Hence, not measuring the other perspectives in general and *Innovation and Learning* in particular, becomes an obstacle for an R&D intensive company to sustain its market leading position in their strongholds. Swegon is facing several obstacles related to measuring their R&D organization. First, the R&D organization lack a perception of being measured, resulting in suboptimal work performance and not utilizing their full potential. Thus, it becomes difficult to assess whether resources are allocated efficiently. Second, the market study handed to the R&D is currently insufficient, which negatively affect their ability to create successful products, resulting in an unfair evaluation of their effort. Third, the communication is inadequate regarding the long-term strategy of the firm, causing confusion about whether to adopt a market or technology led approach. This becomes a problem for measuring the R&D organization since the two contrasting objectives require different KPIs. Forth, the R&D

organization is not clearly aligned with the strategic goals of Swegon. Thus, breaking down these goals to milestones objectives becomes difficult which hamper the R&D organization in their daily decision making. Fifth, the R&D organization lack a feedback culture, where feedback is only expressed from dissatisfied customers. This impede the potential to measure customer satisfaction, since it will be negatively biased. It also inhibits fast moving decision making and a development in line with customer preferences. Sixth, a too structured and controlled measuring of the R&D organization could have a negative effect on their work, since it requires creativity, experimenting and learning from mistakes. Thus, there needs to be a balance and one must consider the consequences of not allowing testing and failures. Seventh, it is challenging to isolate the contribution from the R&D organization to the overall organizational performance since there are so many different departments and activities involved in launching a product. Finally, some products are not financially justifiable but vital to include in the product portfolio to offer a package solution. Thus, measuring these projects and products are associated with an inaccurate view of the R&D organizational performance. Moreover, a similar problem arises regarding the definition of a "new product" and its contribution to profits.

The financial perspective is the more traditional perspective in the BSC framework and there is mixed view about its relevance. However, the result of this study shows that it is still of interest for Swegon, since it is a clear and non-subjective indicator of performance. Moreover, it has the potential to affect self-motivation and cost awareness positively. However, one should not forget the challenge of isolating the contribution of the R&D organization to the company's financial success. For the customer perspective, both literature and this study confirms its relative importance compared to the financial perspective. This perspective is crucial in order to invent and commercialize attractive product that match customer preferences as well as keeping up with market changes. However, similar to the financial perspective, one has to be aware of the difficulties in deriving the R&D organizations contribution to the customer satisfaction. The internal business perspective is the only perspective that is somewhat utilized today, but it received mixed opinions about its relevance for Swegon's R&D organization. For instance, a too controlled measuring can have sub optimizing consequences and be associated with increased rather than decreased cost. As mentioned previously, it might also inhibit creativity, which is vital for an R&D organization. For the innovation and learning perspective, it has been considered highly relevant in both this study as well as previous literature. The positive aspects can be summarized in its ability to put focus on staying competitive and having the right resources for the future. Comparing the result of this study with the findings of Bigliardi and Dormio (2010), one can argue that the automotive industry is more focused on innovation and learning than Swegon. Thus, to be a competitive player in the indoor climate industry, Swegon must excel at this perspective to steer themselves towards the forefront of innovation like the automotive industry.

All perspectives proved to be relevant to include in the customized BSC, in order to measure the R&D organization at Swegon. Thus, Swegon need to add these perspectives and accompanying KPIs to their current measurement framework. It will provide them with a comprehensive view of the R&D organization's performance and a framework which steers it

towards their strategic goals. This BSC also need to be part of their daily business and continuously be updated to match market changes. Involving employees from different organizational levels and departments in this updating process will increase the buy-in and create consensus about the united direction of the company. Moreover, when Swegon use the customized BSC, they must put attention to the decreasing utility of having too many KPIs. Therefore, an additional selection of KPIs from the provided customized BSC has been done to enhance its feasibility, see figure 15. Finally, the customized BSC should not be considered a numerical scoring model, but rather assessment tool with a mix of numerical as well as subjective evaluations, because of the character of some perspectives and their associated KPIs.

Swegons four strategic goals are objectives concerning the whole organization. Thus, some departments may have stronger connections to a certain goal. For the R&D organization to contribute with their full capacity, the final BSC can be utilized to steer them in the right direction, taking different perspectives into consideration. Although all KPIs may not be directly linked to each strategic goal, they provide the R&D organization with the prerequisites necessary to fulfill their part. One can argue that the strategic goal *indoor environmental quality* and *system approach* are the ones most dependent on the success of the R&D organization. However, achieving them enables a *superior customer experience* which in turn creates and sustains *strongholds*. Thus, whether the KPIs have a direct or indirect connection to the strategic goals, they all contribute to some extent in the fulfillment of them.

6.1 Recommendation for Swegon

Since Swegon currently has a minimal to non-existent and unclear measurement method for their R&D organization, it is crucial to not rush into an overwhelming amount of KPIs which would be very demanding and confusing. Thus, figure 15 below consists of 12 KPIs which were carefully selected together with Swegon representatives and is the final BSC recommended for adoption. It is composed of a relatively manageable amount of feasible KPIs which will provide the managers with a holistic view of the R&D organizations performance and steer it towards their strategic goals, see appendix 8.3 for a more detailed description and potential initiatives. However, once the implementation has been proved successful, the BSC needs to be continuously updated with both new and more KPIs to ensure relevance and comprehensiveness. Additionally, Swegon should address the obstacles presented in order to successfully implement the framework. The next step in the process of implementing this BSC, is to cascade it through the R&D organizations different subdivisions to specify what they should do to achieve each applicable KPI. This will align each subdivision work with the strategic goals. When cascading the goals, it is important that they are specific, measurable, achievable, relevant and timed to ensure a successful implementation. Finally, leadership needs to be mobilized in order to change behavior, create a broad awareness and get buy-in from the employees.
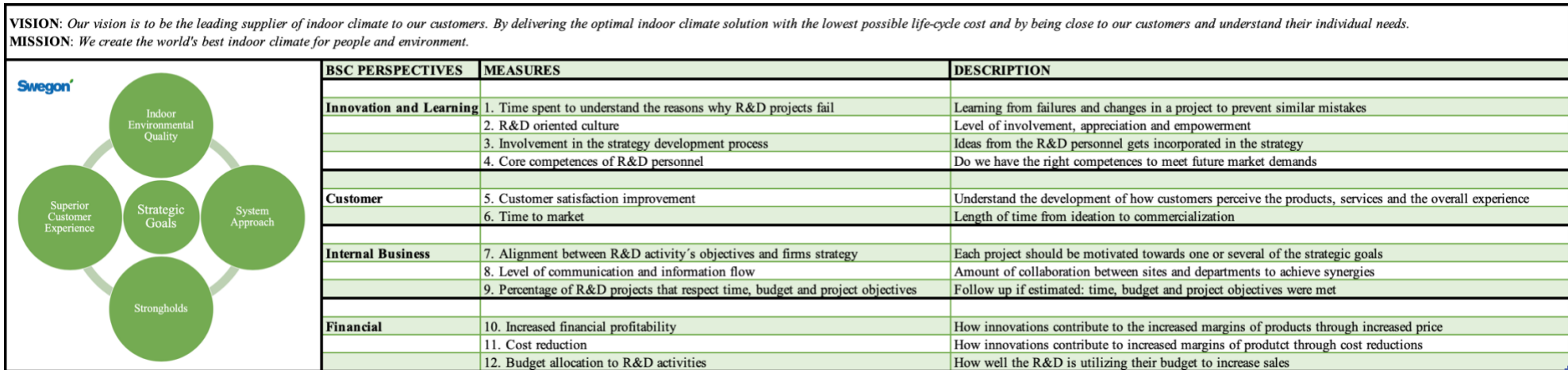
VISION: *Our vision is to be the leading supplier of indoor climate to our customers. By delivering the optimal indoor climate solution with the lowest possible life-cycle cost and by being close to our customers and understand their individual needs.*
MISSION: *We create the world's best indoor climate for people and environment.*

BSC PERSPECTIVES	MEASURES	DESCRIPTION
Innovation and Learning	1. Time spent to understand the reasons why R&D projects fail	Learning from failures and changes in a project to prevent similar mistakes
	2. R&D oriented culture	Level of involvement, appreciation and empowerment
	3. Involvement in the strategy development process	Ideas from the R&D personnel gets incorporated in the strategy
	4. Core competences of R&D personnel	Do we have the right competences to meet future market demands
Customer	5. Customer satisfaction improvement	Understand the development of how customers perceive the products, services and the overall experience
	6. Time to market	Length of time from ideation to commercialization
Internal Business	7. Alignment between R&D activity´s objectives and firms strategy	Each project should be motivated towards one or several of the strategic goals
	8. Level of communication and information flow	Amount of collaboration between sites and departments to achieve synergies
	9. Percentage of R&D projects that respect time, budget and project objectives	Follow up if estimated: time, budget and project objectives were met
Financial	10. Increased financial profitability	How innovations contribute to the increased margins of products through increased price
	11. Cost reduction	How innovations contribute to increased margins of produtct through cost reductions
	12. Budget allocation to R&D activities	How well the R&D is utilizing their budget to increase sales

Figure 15 – Final BSC for Swegon

6.2 Theoretical Contribution and Future Research

This study contributes to the research field of measuring R&D in general and utilizing the BSC in particular. It has also created an academic base for the indoor climate industry which until today, is missing. Moreover, it confirms the findings of earlier research regarding relevant KPIs for R&D in heavy manufacturing industries. This case study also shed light on obstacles associated with measuring R&D that previously mostly have been mentioned in theory. It also demonstrates some of the prerequisites for measuring a R&D organization. Finally, it provides a user friendly and comprehensive framework for companies that do not measure their R&D today, but who are prone to introduce it.

As mentioned above, this study contributes and confirm some evidence from previous studies about relevant KPIs for measuring R&D. However, some of these KPIs are ambiguous and not practically feasible to implement. Thus, there is a need to further discover usability and feasibility of different KPIs related to measuring a R&D organization. A qualitative research could investigate the implementation of the 12 KPIs the final BSC of this study, to expose the difficulties associated with measuring them.

An insight from this study is that a too controlled measuring and steering can hamper creativity, which is crucial for a R&D organization to function. Thus, another potential future study could be to compare two different companies within in the same industry with widely differing levels of measuring and steering of their R&D, to see if the creativity in their R&D organization differ.

As discovered in this study, breaking down strategic goals into milestone objectives for certain departments and groups is associated with problems. The same goes for linking activities with the strategic goals to achieve an alignment in the organization. Hence, a future study could focus on how to cascade strategic goals down to the R&D organization to ensure that the development of products is in line with the direction of the company.

7. Reference list

Avalon Innovation. (2016). *Next generation indoor climate.*
Retrieved 2020-01-10 from: https://avaloninnovation.com/en/new-wise-en/

Awadallah, E., & Allam, A. (2015). A Critique of the Balanced Scorecard as a Performance Measurement Tool. *International Journal of Business and Social Science. 6.* 91.

Bassani, C., Lazzarotti, V., Manzini, R., Pellegrini, L., & Santomauro, S. (2010). Measuring performance in R&NPD. *European Journal of Innovation Management, 13*(4), 481-506.

Bauer, K. (2004). KPIs - The Metrics That Drive Performance Management. *DM Review, 14*(9), 63.

Beatham, S., Anumba, C., Thorpe, T., & Hedges, I. (2004). KPIs: A critical appraisal of their use in construction. *Benchmarking: An International Journal, 11*(1), 93-117.

Bigliardi, B., & Dormio, A. (2010). A balanced scorecard approach for R&D: Evidence from a case study. *Facilities, 28* (5/6), 278-289.

Bremser, W., & Barsky, N. (2004). Utilizing the balanced scorecard for R&D performance measurement. *R&D Management, 34* (3), 229-238.

Brown, M.G. and Svenson, R. (1988) *Measuring R&D productivity.* Research-Technology Management, July–August.

Chiesa, V., & Masella, C. (1996). Searching for an effective measure of R&D performance. *Management Decision, 34*(7), 49-57.

Chiesa, V., Frattini, F., Lazzarotti, V., & Manzini, R. (2009). Performance measurement of research and development activities. *European Journal of Innovation Management, 12*(1), 25-61.

Compton, J. (2015). Measuring for success: You can't manage what you don't measure, so keeping track of KPIS is vital for assessing shop success. *Auto Body Repair Network, 54*(8), 14.

Donnelly, G. (2000), "A P&L for R&D", *CFO Magazine*, February, pp. 44-50.

Eckerson, W. (2006). Creating Effective KPIs. *DM Review, 16*(6), 15.

Formas. (2004). *Research strategy for sustainable spatial planning report on a government mandate to Formas in collaboration with the Swedish Construction Sector Innovation Center (BIC)* (Rapport (Formas), 2004:3). Stockholm: Swedish Research Council for Environment, Agriculture Sciences and Spatial Planning (Formas).

García-Valderrama, T., Mulero-Mendigorri, E., & Revuelta-Bordoy, D. (2008). A Balanced Scorecard framework for R&D. *European Journal of Innovation Management, 11*(2), 241-281.

Goffin, K., & Mitchell, R. (2017). *Innovation Management: Effective strategy and implementation.* MacMillan Education UK (3rd edition).

Gupta, A., Wilemon, D., & Atuahene-Gima, K. (2001). Excelling in R&D. *The Journal of Product Innovation Management, 18*(2), 123-124.

Javadi, M., Zarea, K. (2016). Understanding Thematic Analysis and its Pitfall. *Journal of Client Care*. 1. 10.15412/J.JCC.02010107.

Karlsson, M., Trygg, L., & Elfström, B. (2004). Measuring R&D productivity: Complementing the picture by focusing on research activities. *Technovation, 24*(3), 179-186.

Kaplan, R., & Norton, D.P. (1992). The Balanced Scorecard - Measures that Drive Performance. *Harvard Business Review*, 1(1), 79.

Kaplan, R., & Norton, D. (1996). Using the balanced scorecard as a strategic management system. *Harvard Business Review, 74*(1), 75-85.

Kaplan, R., & Norton, D. (2001a), "Transforming the Balanced Scorecard from Performance Measurement to Strategic Management", *Accounting Horizons,* 15 (1), pp. 87-104; 15 (2) pp. 147-160

Kaplan, R., & Norton, D. (2001b). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*. Boston, Mass.: Harvard Business School.

Kerssens-Van Drongelen, I., & Cooke, A. (1997). Design principles for the development of measurement systems for research and development processes. *R&D Management, 27*(4), 345-357.

Kerssens-van Drongelen, I. (1999). *Systematic design of R&D performance measurement systems*. Enschede: Universiteit Twente.

Kerssens-van Drongelen, I., & Bilderbeek, J. (1999). R&D performance measurement: More than choosing a set of metrics. *R & D Management, 29*(1), 35-46.

Lassenius, G., Nissinen, M., Rautiainen, K., & Sulonen, R. (1998). The interactive goal panel: A methodology for aligning R&D activities with corporate strategy. *IEMC '98 Proceedings. International Conference on Engineering and Technology Management. Pioneering New Technologies: Management Issues and Challenges in the Third Millennium (Cat. No.98CH36266),* 142-147.

Le, Q. (2018). *Balance Scorecard Integration: An Approach to Measure Overall R&D Performance.* ProQuest Dissertations and Theses.

Likar, B. (2013). *Innovation Management.* Korona plus d.o.o., Institute for Innovation and Technology, Slovenia, 1st edition.

Meyer, C. (1994). How the right measures help teams excel. (includes related articles on the dashboard display format system and on the steps in creating process measures). *Harvard Business Review, 72*(3), 95.

Mowery, D. (1998). The changing structure of the US national innovation system: Implications for international conflict and cooperation in R&D policy. *Research Policy, 27*(6), 639-654.

Neely, A.D., Adams, C. and Kennerley, M. (2002). *The Performance Prism: The Scorecard for Measuring and Managing Stakeholder Relationships*. Financial Times/Prentice Hall, London.

Newman, J. (2009). Building a Creative High-Performance R&D Culture. *Research-Technology Management, 52*(5), 21-31.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods, 16*(1), International Journal of Qualitative Methods, 28 September 2017, Vol.16(1).

Osama, A. (2006). *Multi -attribute Strategy and Performance Architectures in R&D: The Case of the Balanced Scorecard.* ProQuest Dissertations and Theses.

OECD. (2020). *Research and development (R&D).*
Retrieved 2020-01-22 from: https://www.oecd-ilibrary.org/industry-and-services/research-and-development-r-d/indicator-group/english_09614029-en

Packer, M.B. (1983) *Analyzing productivity in R&D organizations.* Research Management, January–February.

Patel, R., & Davidson, B. (2011). *Forskningsmetodikens grunder: Att planera, genomföra och rapportera en undersökning* (4. uppl. ed.).

Pappas, R.A. and Remer D.S. (1985) *Measuring R&D productivity*. Research-Technology Management, May–June.

Pisano, G. (2015). You need an innovation strategy. *Harvard Business Review, 93*(6), 44-54.

Rompho, N. (2011). Why the Balanced Scorecard Fails in SMEs: A Case Study. *International Journal of Business and Management, 6*(11), International Journal of Business and Management, 10/31/2011, Vol.6(11).

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5.th ed.). Harlow: Financial Times Prentice Hall.

Shahin, A., & Mahbod, M. (2007). Prioritization of key performance indicators. *International Journal of Productivity and Performance Management, 56*(3), 226-240.

Simons, R. (1994). How new top managers use control systems as levers of strategic renewal. *Strategic Management Journal, 15*(3), 169-189.

Sundin, H., Granlund, M., & Brown, D. (2010). Balancing Multiple Competing Objectives with a Balanced Scorecard. *European Accounting Review, 19*(2), 203-246.

Schwartz, L., Miller, R., Plummer, D., & Fusfeld, A. (2011). Measuring the Effectiveness of R&D. *Research-Technology Management, 54*(5), 29-36.

Swegon Group. (2020). *About Swegon.*
Retrieved 2020-01-10 from: https://www.swegon.com/about-swegon/

Thamhain, H. (2003). Managing innovative R&D teams. *R&D Management, 33*(3), 297-311.

Thamhain, H. (2014). Assessing the Effectiveness of Quantitative and Qualitative Methods for R&D Project Proposal Evaluations. *Engineering Management Journal, 26*(3), 3-12.

Tipping, J., Zeffren, E., & Fusfeld, A. (1995). Assessing the value of your technology. *Research-Technology Management, 38*(5), 22-39.

Toton, S. (2016). *How to Measure the Effectiveness of R&D Based Innovation.*
Retrieved 2020-01-23 from: https://chemical-materials.elsevier.com/chemical-rd/measure-effectiveness-rd-based-innovation/

Tripathy, S., Sahu, S., & Ray, P. (2013). Interpretive structural modelling for critical success factors of R&D performance in Indian manufacturing firms. *Journal of Modelling in Management, 8*(2), 212-240.

Velimirović, D., Velimirović, M., & Stanković, R. (2011). Role and importance of key performance indicators measurement. *Serbian Journal of Management, 6*(1), 63-72.

Wang, J., & Yang, C. (2012). Flexibility planning for managing R&D projects under risk. *International Journal of Production Economics, 135*(2), 823-831.

Werner, B., & Souder, W. (1997). Measuring R&D performance - State of the art. *Research-Technology Management, 40*(2), 34-42.

8. Appendix

8.1 Interview Guide

Part 1 - Status Quo Analysis

1. Introduction and previous experience in R&D

2. How is your R&D process structured from the ideation phase until commercialization?
   - Pros/cons with this structure?

3. How do you know whether your organization is performing well or not?

4. How do you think R&D performance can be evaluated?
   - Department and firm level?

5. How are you measuring R&D today?
   - Different goals/objectives for different levels?
   - KPIs?

6. Do you think that the R&D goals and strategies are clearly communicated in your organization?
   - R&D goals aligned throughout the different levels/units?

7. What challenges are you facing in the R&D organization today?
   - Problems/something missing with measuring R&D?

8. What potential solutions do you see to these problems?

Part 2 - Balanced Scorecard perspectives

Financial perspective

The financial perspective is associated with how the organization wishes to be
view by its shareholders.

- **E.g.** Budget allocation to R&D activities / Average expenses for R&D activities?
- What do you think about this perspective, is it valuable to evaluate R&D?

Customer Perspective

Customer perspective is associated with how customers perceive
R&D in term of a new product, process, knowledge or technology.

- **E.g.** Market share growth / Customer satisfaction improvement
- What do you think about this perspective, is it valuable to evaluate R&D?

Internal Business Perspective

Internal business process perspective describes the business
processes the company must excel at in order to satisfy its
customers and shareholders.

- **E.g.** Average costs of unfinished R&D projects / Achievement of quality and time
  objectives
- What do you think about this perspective, is it valuable to evaluate R&D?

Innovation and Learning perspective

Innovation and Learning perspective is associated with the capacity of an organization to learn,
adapt and grow.

- **E.g.** % of new patents / Core competences of R&D personnel / Open innovation
- What do you think about this perspective, is it valuable to evaluate R&D?

8.2 Self-completion Questionnaire

KPIs for measuring Swegons´ R&D organization

This survey is a part of the data collection for a Master thesis, in collaboration with Swegon Group. The aim of this survey is to create a set of KPIs that are relevant for Swegons organization to measure R&D performance. All the different KPIs belong to one of the four different perspectives of The Balanced Scorecard (Kaplan & Norton, 1992), which has been proved to be a suitable framework for this purpose.

The four different perspectives:
- Financial perspective
- Customer perspective
- Internal business perspective
- Innovation and learning perspective

Your contribution is valuable for the result of this study and its utility for Swegon. Please rank the following 54 KPIs gathered by Bigliardi and Dormio (2010) below, with a score of 1 to 6 depending on how important You think it is to measure and steer your R&D organization. The survey is expected to take 10 minutes to conduct.

Thank you for your contribution!

Which department do you belong to?	
FINANCIAL PERSPECTIVE	Rank between 1-6
Budget allocation to R&D activities	
Average expenses for R&D activities	
Increased financial profitability	
Cost reduction (derived from innovative projects)	
Dependence on external funding	
Property rights value	
Debt-equity ratios	
Average cost of each finished project	
Optimization of the use of capital (human and material)	
CUSTOMER PERSPECTIVE	
Market share growth	
Average expenses for market researches	
Customer satisfaction improvement	
Enlargement of product variety	
Customer lifetime improvement	
Brand image	
To be the first into new research areas	
Average expenses for internal and external communication	
Percentage of project that directly involve the customer	
Time to market	

INTERNAL BUSINESS PERSPECTIVE	
Alignment between R&D activity´s objectives and firm´s strategy	
Consistency between the firm as a whole and the R&D unit	
Effect of the external environment on R&D activity	
Percentage of R&D projects abandoned before they are finished	
Percentage of R&D projects that respect the costs and outputs planned	
Average cost of R&D projects unfinished	
Level of communication and information flow	
Level of coordination among R&D, marketing and production units	
Achievement of quality and time objectives	
Level of dependence from external resources	
Level of collaboration with other companies	
Cost/benefits ratios from investments in infrastructures	
INNOVATION & LEARNING PERSPECTIVE	
Innovation contribution to R&D projects in progress	
Percentage of new patents	
Improved frequency and quality of scientific papers, workshop etc.	
Capability to take advantage of new technology internally developed	
Time spent to understand the reasons why R&D projects fail	
Increase in the number of the R&D personnel	
Time spent in training activities for R&D personnel	
Motivation and involvement of R&D personnel	
R&D oriented culture	
Work environment and relations with co-workers	
Involvement in the strategy development process	
Involvement in the R&D processes	
Team work effectiveness	
Use of survey to improve the R&D human resource management	
Implementation of new organizational method	
Identification of skills adequate to the customers´ requirement	
Percentage of resources dedicated to radical innovation projects	
Implementation of incentive programs	
Core competences of R&D personnel	
Adoption of skills development plans	
Evaluation of R&D personnel performance	
Turnover from an R&D unit	
Adoption of open innovation	

8.3 Description of the KPIs and Potential Initiatives

A more detailed description of the KPIs in combination with potential initiatives for measuring them:

1. Implement a standardized feedback meeting after each finished project in order to steer the behavior towards action. Measure the percentage of projects that actually were followed up quarterly.

2. Yearly ranking assessment of how R&D personnel experience their job environment (acceptance of failure, what behavior gets reward, entrepreneurial spirit etc.) and put it into an index. Could be a part of the current HR led co-worker satisfaction survey.
   a. This measure was merged with *Motivation and involvement of R&D personnel* and *Work environment and relations with coworkers.*

3. Examine how the R&D personnel *perceive* their involvement in the strategy making process. This can be incorporated in the yearly HR led co-worker satisfaction survey mentioned above (2).

4. Yearly map the competences that Swegon have and what they currently lack to ensure future competitiveness.
   a. This measure was merged with *Identification of skills adequate to the customers' requirements* and *Adaption of skill development plan.*

5. Conduct a survey to get feedback after **every** major sales project. Put into an index to track progress. Partly done today, but not a standardized procedure in our opinion. It seems that the feedback only comes from failures/unsatisfied customers.

6. Measure average time in days/weeks (from identified need to finished product) per project, to create an index in order to avoid organizational inefficiencies and deficient resource allocation.

7. Define each projects connection to one or several of the strategic goals, each project should have a clear motivation to ensure execution in line with strategy. Could be a part of the initial startup meeting and a yearly summary can be composed with number of projects per strategic goal.

8. Yearly follow up and present how many times collaboration have been utilized to boost the organizational performance. Include a "check box" in the feedback delivered in the wrap-up meeting. Alternatively, it could be included in the yearly HR led co-worker satisfaction survey mentioned above (2) to measure perceived collaboration.
    a. Action to enhance collaboration:
        i. Create an R&D forum, where employees can ask for help and share knowledge. Moreover, in the startup meeting of each project, a representative from each relevant department should be involved to ensure feasibility.
        ii. The pre-study must be enhanced with real data (when possible) and be communication in a better way to minimize changes and ensure market interest. The products should also satisfy production requirements.

9. Compare estimated with actual data for each project, to find the percentage of projects that fulfill each of the three measures separately: time, budget and project objectives. This would enhance resource allocation.

10. Focus on how improvements/innovations increase/create value and hence motivate a higher price which increase margins. Analyze the increased average price through [Sales / number of sold products] per product. **

11. Focus on how improvements/innovations reduce costs and hence increase margins. Compare costs of old version of products with new ones to see cost savings derived from this. It can be analyzed through [(Sales – Cost) / Sales] per product. **

12. How much money is allocated to a specific project and how much sales are generated from this project? This can be analyzed through [R&D budget for project X / Sales after project X]. Alternatively, one could measure [Total R&D budget / Total turnover] and [Sales from new products / Total turnover].

** Could potentially be merged into one which only look at increased margin, whether it is achieved through increased price or reduced costs.