

**THE AGGREGATION OF SUSTAINABILITY
PERFORMANCE MEASURING AT COMPANY LEVEL**

A CASE STUDY

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ABSTRACT

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Abstract <p>Industrial companies face constant scrutiny about their sustainability performance development and comprehensive sustainability performance measuring is demanded from them. Companies are measuring their sustainability performance with various and multitude indicators, but it is difficult to look into the overall sustainability performance of companies based on plentiful and variable sustainability measures. There is no universally accepted method to measure the overall sustainability performance of a company, though tools for this purpose are developed.</p> <p>This qualitative case study research aims to shed light on whether the sustainability indicators of a case company could be aggregated in an advantageous way. The theoretical framework forms a basis for the study by looking into the previous research about aggregate indices. Eight semi-structured interviews with the case company's representatives reveal the prerequisites and needs that the case company has for an aggregate sustainability index. Also, the desired functions for an aggregate sustainability index are presented. The data is analyzed with content analysis method. The findings from the interviews are complemented with the previous research by triangulation. Finally the research presents a suggestion for the aggregation of the sustainability performance measuring of the case company.</p> <p>The findings from the interviews show that an aggregate sustainability index is possible to construct for the case company. The research discovers that the case company can approach the aggregation of sustainability indicators in various ways, but in order to produce a clear and operable aggregate sustainability index, precise definitions and decisions about the index are needed. The most common issues that should be considered about an aggregate sustainability index are to do with its contents and understandability. The research suggests that the case company should establish an aggregate environmental index, which would focus only on the environmental performance of the company.</p>	
Keywords corporate sustainability, aggregate sustainability index, sustainability performance, sustainability indicator, sustainability assessment	
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1 INTRODUCTION

Industrial companies face constant scrutiny about their sustainability impacts. Especially heavy industries that utilize raw materials, energy and water, thus producing significant environmental impacts, need to identify and measure their sustainability impacts accurately (Koskela, 2011). Fierce competition in the global market and strict environmental regulations urge companies to implement the sustainable development into their operations (Zhou, Tokos, Krajnc & Yang, 2012). For globally operating companies there are high requirements for committing to sustainable development and reporting their overall sustainability performance (Mikkilä & Toppinen, 2008; Labuschagne, Brent & van Erck, 2005).

Corporate sustainability is also known as corporate citizenship or corporate stewardship. It is a measure of a company's performance in conducting responsible and ethical business. Corporate sustainability covers all the companies' responsibilities from their business activities' impacts on the economy, environment and society. In practice, corporate sustainability has different interpretations and it can be divided into different dimensions of sustainability. (Li, Zhang, Yuan, Liu & Fan, 2012.) The 'triple bottom line' approach to sustainability covers the environmental performance, social responsibility and economic contribution of operations (Krajnc & Glavic, 2005a). Industrial companies' sustainability systems generally take these three dimensions of sustainability into consideration (Sikdar, 2009).

Sustainability reporting has established itself to being an inevitable part of industrial companies' reporting, especially among the internationally operating ones (Mikkilä & Toppinen, 2008). Yet, the sustainability reporting of industries have shortages. Though multiple sustainability issues can be reported with variable methods, it is difficult to evaluate the overall sustainability performance of a company based on a large amount of sustainability indicators (Singh, Murty, Gupta & Dikshit, 2007; Sikdar, 2009). Sustainability is a tremendously complex issue and so is defining its framework (Mendoza & Prabhu, 2003). The complexity of sustainability also adds difficulty in monitoring the overall sustainability performance (Sikdar, 2009). The large

number of sustainability indicators in environmental, social and economic field provide an unwieldy image of sustainability for policy-making (Mayer, 2008). Also decision-making among companies and comparison to industry competitors based on numerous sustainability measurements is challenging (Krajnc & Glavic, 2005a; Tokos, Pintaric & Krajnc, 2012). Therefore there is definitely room for improvements in the sustainability performance measuring in a more holistic manner among companies.

1.1 Motivation for Research

Sustainability reporting among companies is comprehensive nowadays. The amount of different sustainability metrics is plentiful and measures to portray the sustainability performance of products have been developed. Life cycle assessment is a good example of product oriented sustainability performance measuring. (Li et al. 2012.) Yet, there still is no comprehensive way to assess the overall sustainability of a company (Singh et al. 2007; Li et al. 2012). A holistic, aggregate sustainability index could be a way to merge sustainability reporting among companies and provide a new way to portray the sustainability performance development. An aggregate index could assist industrial companies to monitor and improve their operations and communication both internally and externally. There is no universally accepted method for consistent comparison and identification of more sustainable options for industrial companies (Azapagic & Perdan, 2000). More research on the topic is clearly needed. This study attempts to shed light on the possibility to aggregate sustainability performance measuring on a company level with a case study approach. The biggest motivation for this study from the case company's point of view is to present whether an aggregate sustainability index could be possible to construct and to detect what kind of needs the index could potentially fulfill for the company.

Previous research indicates that further scientific support is needed for the development of aggregate sustainability measurement (Cunha Callado & Fensterseifer, 2011). Sustainable development monitoring requires cross-functional aggregation of different sustainability indicators. Also additional metrics are needed in order to enable a more comprehensive multidisciplinary communication and thinking about sustainability. (Tanzil & Beloff, 2006.) Sustainability assessment and reporting are rapidly evolving, so there are possibilities for the industry leaders to develop more innovative approaches (Singh et al. 2007). Subsequently, the case company of this study has potential to develop an entirely new way to portray its overall sustainability performance.

1.2 Research Problem and Objectives of the Study

This research assesses the possibility to aggregate the sustainability performance measuring of an industrial company in a sensible and advantageous way. The research evaluates whether it would be possible to construct an aggregate sustainability index and how this should be done for the case company in question. The hypothetical objective of such aggregate measuring would be to assist in driving, following up and communicating the case company's sustainability performance in a balanced way. The research determines the prerequisites for an aggregate sustainability index and assesses the benefits and challenges related to the index. Motivation for this research has originated from the case company itself. A case company representative also provided guidance for the researcher alongside the university instructor.

The different stakeholders' perspectives about the sensibility of the aggregate index are studied through semi-structured interviews. The objective for aggregating sustainability measurement is to combine the different sustainability metrics of the company in a coherent and readable way. New sustainability measurement indicators are not meant to be generated, but to potentially utilize the case company's existing sustainability indicators. Previous research regarding the aggregate sustainability indices especially among companies is studied and analyzed. The purpose for this is to contemplate the functionality and methodology of aggregate sustainability measurement.

Eight (8) semi-structured interviews were conducted with key people of the case company in order to clarify what are the needs of stakeholders when combining the sustainability measurement of the case company. This will help to shed light on whether it is rational to construct an aggregate sustainability index for the case company and how it could be compiled.

The main research question of the study is:

How can the sustainability performance measures of an industrial company be aggregated?

The sub-questions are:

1. *What are the prerequisites for an aggregate sustainability index on a company level?*
2. *What are the needs of different stakeholders when considering aggregate sustainability measuring?*

The objectives for the research are therefore to outline the prerequisites for aggregating sustainability metrics and present the needs of different stakeholders for an aggregate sustainability performance index. By looking into the needs of case company stakeholders, the functions that are appreciated by the stakeholders are identified.

1.3 The Case Company's Sustainability Metrics and Reporting

Companies publish sustainability reports, which describe their contribution to sustainability development. Generally sustainability reports present the companies' sustainability performance indicators, which portray the sustainability performance measuring of a company. Sustainability indicators are often quantitative metrics about the economic, environmental and social performance of the company. (Azapagic & Perdan, 2000; Azapagic, 2004; Krajnc & Glavic, 2005a.) This chapter is based on the researcher's discussions with the case company's representative and publicly available corporate sustainability materials of the company.

The case company in question monitors its sustainability impacts and development comprehensively and on a regular basis. The sustainability management of the case company is based on their corporate sustainability strategy. The sustainability performance measuring and targets are formed in accordance with the corporate sustainability strategy. Then corporate sustainability strategy divides the sustainability issues into sustainability entities that support the different operations of the company. This approach to manage sustainability differs from the traditional triple bottom line perspective. Regardless of this, all the aspects of the triple bottom line are included in the corporate sustainability strategy and management of the case company, but the strategy is adapted in regards to the case company's operations and operational environments.

The sustainability performance of the case company is monitored with different parameters: the sustainability indicators. The sustainability indicators consist of both single indicators and indices. The type of indicator depends on the issues measured and the type of data that is collected. All indicators have their targets and the progress of each indicator is monitored within the company and also presented publicly in the company's website to enhance the openness of the communication. The case company reports its sustainability performance in accordance with the Global Reporting Initiative. The case company measures its sustainability extensively and operates in a highly sustainability oriented manner. The sustainability reporting of the case company has been constantly developed and the reporting has been introduced to the quarterly reporting as well. Also the coherence between the interim reports and sustainability reporting has been developed.

The sustainability target setting of the case company is a combination of bottom-up and top-down approaches. Targets are set and performance is followed on all the three levels of operations: unit, division and corporation levels. The units determine their own targets and relevant metrics while taking into consideration the global responsibility strategy and the unit specific aspects. The division level sustainability targets and measures are aimed to communicate and follow-up the performance and support resource allocation. In the corporation level the sustainability targets are mainly communicational. The operational sustainability performance is more relevant in the unit level, and com-

municational aspect accentuates its significance in the division and corporation levels. Ultimately, the overall sustainability performance of the case company is formed based on the unit level results.

2 METHODOLOGICAL CHOICES

This chapter discusses the methodological choices conducted in this research. The methodological choices were made in order to answer the research questions most appropriately and comprehensively while focusing on the case company of the research.

2.1 Research Design

The present research is a qualitative research, which looks into the possibility to aggregate a case company's sustainability measuring. Qualitative research is an evolving and transforming process (Eskola & Suoranta, 1998; Eriksson & Kovalainen, 2008), in which the objective is to present facts about a phenomenon by portraying real life events in a comprehensive manner (Hirsjärvi, Remes & Sajavaara, 2009). In qualitative research the scholars themselves can shape the research methods into their own use (Eriksson & Kovalainen, 2008). An open research plan, which evolves with the research process, is typical for qualitative research. It emphasizes the connection between the different stages of the research: data collection, analysis, interpretation and results reporting. (Eskola & Suoranta, 1998.) The three stages were highly interconnected in the present research and the stages overlapped during the study.

Qualitative research method strives usually to provide comprehensive understanding of the research phenomenon at hand. The results are linked to the context of the study and they are not to be statistically generalized. (Tuomi & Sarajärvi, 2002; Hirsjärvi, Remes & Sajavaara, 2009.) In qualitative research the researcher is the most essential tool in the process and affects the reliability of the research. The researcher's subjectivity needs to be acknowledged and it affects the reliability of the research. (Eskola & Suoranta, 1998.) It is stated that a qualitative research cannot provide completely objective research findings (Tuomi & Sarajärvi, 2002). Qualitative research form was chosen since the study

was to focus on the particular case study and its needs, and not to make any statistical generalizations. Also, the initial glance to the previous research revealed that much studies with similar scope as the present research did not occur. Therefore the researcher could ensure that relevant issues with a large range could be discovered by relying on a qualitative research method. Many aspects of the research were developed during the research process and the qualitative method made this possible for the researcher.

The research method applied is case study, which is an approach of qualitative research (Eriksson & Kovalainen, 2008). A case study does not follow any particular routine procedures (Yin, 2012). It is an empirical inquiry that investigates a complex phenomenon within its real life context. The contextual conditions have an important role in the research process. (Yin, 2002.) The case study research is designed for the assessment of a single situation, or as in this case a single company, in its natural context. It is common for case study's data to consist of different sources. (Hirsjärvi et al. 2009.) In this study the data was both from primary and secondary sources. Case study research is complex and avoids too simplistic research designs (Eriksson & Kovalainen, 2008). The goal in case studies is usually to make analytic generalizations and therefore to expand and generalize theories (Yin, 2002). The 'case' in this study is an international industrial company and its context is the chosen company division.

Triangulation is essentially the utilization of different data sources, theories and/or methods in the same research. Triangulation is beneficial, since it is difficult to produce comprehensive evidence about a research phenomenon based on a single method. Also the reliability of the findings can be supported by using multiple data sources to justify the results. (Eskola & Suoranta, 1998.) There are different types of triangulation: data triangulation, investigator triangulation, theory triangulation and methodological triangulation. This research applies data triangulation, which means that different data sources are utilized in the same research. (Denzin, 1970.) The primary data is retrieved from the semi-structured interviews. The secondary data used in triangulation is the previous research about aggregate indices, the theoretical framework of this study, which is discussed in chapter 3. The emphasis is on the interview data, but with the previous researches' findings the results from the interviews could be validated.

2.2 Data Collection: Semi-Structured Interviews

A qualitative interview aims to approach the research topic with the point of view of the interviewees. The goal is to comprehend, why the interviewees look at the topic with their particular perspectives. Common characteristics of a qualitative research interview are a flexible interview structure, open questions being dominant in the interview process and also that specific issues are looked for in the interviewees' statements. (Cassell, 2004.) These common characteristics apply to the present research as well.

The most common data sources in case studies are direct observations, interviews, archival records, documents, participant-observations and physical artifacts. Case study can apply either qualitative or quantitative data or both simultaneously. (Yin, 2012.) When acquiring data through interviews, the perspectives and voices of the participants are brought forward (Hirsjärvi, Remes & Sajavaara, 2009). For this research the data was collected through semi-structured interviews. This data collection method was chosen in order to enable open dialogue and this way to find out the perceptions of the interviewees about the research phenomenon in comprehensive manner. The semi-structured interviews made it possible to gain information with a broad perspective and this way to take into the account the different types of relationships that the interviewees have with sustainability measuring.

Semi-structured interview is also known as thematic interview. Essential for this method is that the interviews are formed around certain themes, which poses the structure for the interview process. The themes are chosen to support the research objectives and research questions. The interview questions and their order may vary, but the central themes are same for all the interviews. Because the questions are not fixed, the interviewees are able to express their ideas about the research topic more freely. (Tuomi & Sarajärvi, 2006; Hirsjärvi & Hurme, 2010.) By utilizing the semi-structured interviews, the data collection and analysis process could benefit from both the light structural form and openness of the interviews, as presented by Cassell (2004). It is beneficial for the purpose of this research that the interviewees can speak freely. This enables new issues to surface, even if the researcher had not anticipated them. By proceeding with the planned themes, the researcher could ensure that data was collected from all the areas that the research task demands. Also, this way the researcher could make sure that all the important aspects of the research phenomena were discussed. For the research, open dialogue and perceptions of the interviewees were desired in order to receive a broad and comprehensive understanding about the research phenomenon.

Eight semi-structured interviews were carried out during January-February 2015. All the interviews were individual, so only the researcher and each interviewee were present in each session. Since qualitative research strives to provide a theoretically meaningful interpretation of the studied phenomena, it is important that the chosen interviewees have proper knowledge and experience about the researched issue. Hence, the interviewees need to be chosen carefully and in accordance to the purpose of the study. (Tuomi & Sarajärvi, 2002.) The interviewees of this research were chosen with the help of the case company's supervisor for the research, since the supervisor possessed more precise information about the responsibilities of different employees of the case company. All the interviewees work in relation to sustainability performance measuring, and therefore they could provide outlooks and opinions about the research subject. The interviewees utilize the case company's sustainability indicators in their work. The interviewees were internal key people of the case company and their answers portray the voices of different stakeholder groups

of the case company. The interviewees have different positions in the case company and they operate in various functions of the company. This way it could be ensured that the most important stakeholder groups of the company were taken into consideration indirectly through the interviews. Table 1 lists the main stakeholder groups, which the interviewees work with.

Interview	Position in the Case Company	Main Stakeholder Groups
1	Unit management	Unit level employees, customers, local community, suppliers, authorities*
2	Corporation management	Corporation & division management, customers, NGOs, industry partners
3	Corporation management	Investors
4	Division management	Corporation & division management & employees, federations, industry associations, NGOs, other stakeholders interested in sustainability
5	Division management	Division & unit management & employees, institutions, research partners
6	Corporation management	Corporation management, investors, other various stakeholders
7	Division management	Division & unit level employees, customers, suppliers, authorities
8	Division management	Customers, indirectly also NGOs*

Table 1 The most significant stakeholders for to the interviewees¹

Some of participants were approached initially by the case company's supervisor alongside with other discussions. The researcher herself contacted all the participants via email or phone and briefly presented the research topic and objectives. Also, the researcher presented all the participants with a paper introducing the research and its background before the interviews took place. The reason for this was to make sure that the interviewees' answers were based on their actual experiences and opinions, but with the proper knowledge about the purpose and aim of the research. At the beginning of each interview the researcher inquired each participant about their understanding of the purpose of the interview and presented additional information about the topic or the

¹ *) These stakeholder groups were identified and added by the researcher after the interviews, since the interests of these stakeholder groups should also be reflected in the interview discussions. The other stakeholder groups were identified by the interviewees themselves.

interviews if needed. These steps were done in order to make sure that the interviewees were able to give their best contribution to the study, without preparing to the interviews too much.

Seven out of eight interviews were conducted face-to-face. One interview was performed via audio conference and the interview was recorded. Seven interviews were carried out in English and one in Finnish. Altogether, seven out of eight interviews were recorded with the consent of the people interviewed. Also additional notes were made by the researcher during the interviews. After the interviews the recordings were lettered. One interview was left unrecorded due to the interviewees wish. This interview was lettered from the interviewer's memory relying on the notes written during the interview. All the other interviews were transcribed from the recordings using the interviews notes as assistance.

It is common to find themes in the process of collecting and analyzing empirical material. The themes can be identified before, during and after the data collection. (Denzin & Lincoln, 2000.) In this study, the researcher had constructed semi-structured interviews based on the following themes: 1) background information, 2) the current sustainability measuring of the case company and 3) aggregating the sustainability measuring of the case company. Table 2 presents the interview themes and their focus points. The themes were chosen so that the case company's specific needs regarding the possibility to aggregate the sustainability performance measuring would be discussed and the research objectives would be met comprehensively. Therefore the researched did not rely heavily on the theoretical framework when assessing the themes to be chosen. Both the current sustainability indicators and the possible aggregate index were discussed in order for the researcher to dig deep into the benefits, challenges and needs regarding sustainability performance measuring. This led to the revealing of some benefits and needs for improvements of the current sustainability performance measuring of the case company, though this is not the main purpose of this research. The themes were chosen before the data collection, but also focused and elaborated during the data collection process. The chosen themes supported one another and made the transition to different areas of interest smooth. Also by proceeding in the chosen order with the themes, the interviewees also got the opportunity to display their perceptions about the discussed issue without too much focus restricting them. By beginning with the background information questions, the interviewees were able to get an 'introduction' the topic through their own perceptions with the issues discussed.

Theme	Main focus points within theme
1. Background information	<ol style="list-style-type: none"> 1. How the interviewees work with sustainability? 2. Relevant stakeholder groups and their connections to sustainability?
2. The current sustainability measuring of the case company	<ol style="list-style-type: none"> 1. How do the current sustainability indicators meet the needs of the interviewees and relevant stakeholders?
3. Aggregating the sustainability measuring of the case company	<ol style="list-style-type: none"> 1. How would a potential aggregate sustainability index meet the needs of interviewees and relevant stakeholders? 2. What possibilities and challenges does the index have?

Table 2 Structure of the interviews

The interviews were founded on the prepared semi-structured interview questions. Depending on the interview situation, e.g. the knowledge, enthusiasm and confidence of the interviewee, the prepared questions were followed with other, more specific questions related to the structured themes. The additional questions were not designed beforehand, but surfaced spontaneously during the discussions with the interviewees. Some additional questions came from the knowledge and issues that occurred in the previous interview sessions. The additional questions made it possible to map the interviewees' knowledge on the research issues more carefully. Also issues that the interviewees were the most eager to talk about, were discussed with more depth.

2.3 Data Analysis

Qualitative data can be analyzed in various ways and the chosen method depends on the research phenomena, the research problem and the extensity of data. The data analysis of this research is of inductive form, so the analysis focuses on the research data and makes implications based on it. The data analysis method chosen for this particular research was content analysis, which can be applied to all kinds of qualitative researches. (Hirsjärvi & Hurme, 1993.) The reason for doing inductive analysis through content analysis method is the nature of the research and the desire to focus on the case company relevant issues. In content analysis the researcher establishes categories and finds systematic

linkages between them (Silverman, 1993 & 2000). Using content analysis as the basis for data analysis is applicable e.g. when substantial amount of information is produced in the research. This happens for example when relying on open questions in interviews. (Hirsjärvi & Hurme, 1993.) In the present research, the questions of the semi-structured interviews were indeed open, hence the large amount of versatile data retrieved from them. When applying content analysis to a research, the researcher decides what the focus is going to be in the present study. The irrelevant data can be left out of based on the research scope. (Tuomi & Sarajärvi, 2002.) Hirsjärvi and Hurme (1993) also state that the important concepts and preliminary hypothesis for the research, which were identified prior to the interviews, shape the content analysis process. For this research, the focus on the data was dictated by the initial research problem, which was shaped from the research topic presented by the case company's representative. That is, the data analysis focuses on the issues that help to answer the research problem as comprehensively as possible. By utilizing content analysis method the most valuable information could be highlighted. The analysis is complemented with the theoretical framework through triangulation. This versatile utilization and processing of information will provide a comprehensive view on the research phenomenon.

After collecting the data and transcribing it, the data was analyzed by the content analysis method. The data analysis was performed by relying on the interview themes. Initially by relying on the previously determined themes of the semi-structured interviews, common issues were looked for in the interviews. The first look analysis based on the interview themes was a cursory examination for the analysis, after which a more in depth analysis was conducted. After the cursory look into the data was performed, the data was divided into initially defined categories based on the research problem. Common ground was sought by utilizing the following categories: 1) prerequisites, 2) stakeholder needs, 3) benefits and 4) challenges of an aggregate sustainability index. Also the findings were divided into themes according to the corporation structure: 1) corporation, 2) division and 3) unit level. This grouping was done in order to find similarities and differences in the perceptions of the interviewees for different stakeholder groups in the different organizational levels. This also helped to map, which stakeholder groups' needs were portrayed in the answers of the interviewees. The backgrounds and knowledge of the interviewees were used to determine which stakeholder group related issues were to be emphasized in the different interviews. Since some of the interviews presented more versatile issues than others, the researcher needed to rely on her own expertise and interpretation of the interviews in order to seek the most relevant findings for the present research.

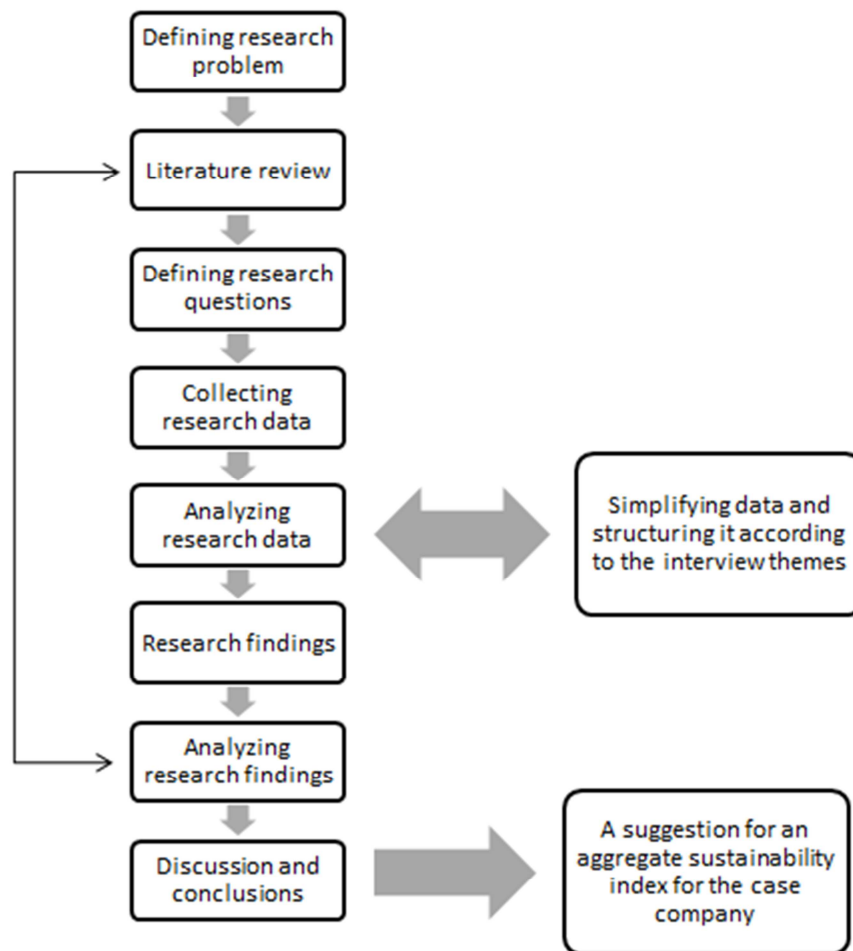


Figure 1 Research process

3 THEORETICAL FRAMEWORK

The theoretical framework of this study concerns aggregate indicators, focus being on aggregate sustainability indicators. Since theoretical understanding about aggregate indices altogether is relevant for the present study, also aggregate indicators and metrics focusing on different areas besides sustainability of companies are looked into. Research on aggregate sustainability indices exists, but it is mostly focused on national performance, not industry or company performance (Krajnc & Glavic, 2005a; Saisana, Saltelli & Tarantola, 2005; Zhou, Ang & Poh, 2006; Böhringer & Jochem, 2007; Saltelli, 2007; Gianetti, Bonilla, Silva & Almeida, 2009). Previous research on aggregating sustainability measuring among industries or companies is scarce and therefore the borderlines of the theoretical framework are extended outside of industrial field and company-specific perspective. The benefits and challenges of aggregate sustainability measurement and aggregate measuring methods are assessed. This chapter also presents the terminology and concepts for the study. The theoretical framework is used to support the findings from the present research through triangulation in chapter 5.

3.1 Terminology

Terminology on sustainability assessment and measuring varies. The most commonly used definition of sustainable development is that it “meets the needs of the present without compromising the ability of future generations to meet their own needs” (The Brundtland Commission, 1987). Sustainability development forms the basis for this research. When referring to sustainability measurement, the terms ‘indicator’ and ‘metrics’ are often used interchangeably. The terms differ though, since ‘indicator’ is commonly used more broadly including both quantitative and narrative descriptions whereas ‘metrics’ is typically used only for quantitative and semi quantitative measurements. (Tanzil & Beloff, 2006.) Indicator can be defined as a simple measure, which

usually is quantitative (Ness, Urbel-Piirsalu, Anderberg & Olsson, 2006), or as an operational representation of a feature of a system (Gasparatos, El-Haram & Horner, 2008). Mendoza and Prabhu (2003) define indicators as variables that can be used to measure the status or condition of a system or process. Indicators can be divided into two groups: the ones that indicate the state of a system, *content indicators*, and the ones that measure the behavior of a system, *performance indicators* (Sikdar 2003; Székely & Knirsch, 2005). Sustainability indicators present the state of economic, social and/or environmental development in a defined region (Ness, et al. 2006).

Index on the other hand is an aggregation of indicators. (Ness et al. 2006.) An index can be simple or weighted, depending on its purpose (Singh et al. 2007). A composite indicator is an aggregation of different indicators (Gasparatos et al. 2008; OECD, 2008). According to OECD Glossary of Statistical Terms, a composite indicator is formed when individual indicators are aggregated into a single index and the aggregation is based on a model of the multi-dimensional concept, which is being measured (OECD, 2008).

Concept	Definition			
<i>Indicator</i>	Variable, can measure the status or condition of a system or process (Mendoza & Prabhu, 2003)	Either quantitative or narrative measure (Tanzil & Beloff, 2006)	Simple measure, most often quantitative (Ness et al. 2006)	Operational representation of a feature of a system (Gasparatos et al. 2008)
<i>Metrics</i>	A quantitative or semi quantitative measure (Tanzil & Beloff, 2006)			
<i>Sustainability indicator</i>	Indicator of the state of economic, social and/or environmental development in a defined region (Ness et al. 2006)			
<i>Index</i>	Weighted or simple, depending on the purpose of use (Sikdar, 2003)	Aggregation of indicators (Ness et al. 2006)		
<i>Composite Indicator</i>	An aggregation of different indicators under a well-developed and pre-determined methodology (Gasparatos et al. 2008)	A mathematical aggregation of indicators with different measurement units (OECD, 2008)		

Table 3 Sustainability measuring related terminology

Previous researches reveal that a coherent and universally accepted terminology about sustainability measuring does not exist. This study is forced

to define its own terms for the issues. Concepts such as 'aggregate sustainability index', 'composite sustainability indicators', 'composite sustainability index', 'composite sustainability development index' and 'composite sustainability performance index' are used in the literature regarding aggregate sustainability measurement (Nardo, Saisana, Saltelli, Tarantola, Hoffman & Giovannini, 2005; Nardo, Saisana, Saltelli & Tarantola, 2005; Saisana et al. 2005; Singh et al. 2007; Mayer, 2008; OECD, 2008; Li et al. 2012; Zhou et al. 2012). This study uses the term 'aggregate index', when referring to cumulative, composite or aggregated way to merge different metrics. 'Aggregate sustainability index' is used when discussing an aggregate index for sustainability issues. The term 'sub-indicator' defines the indicators, which are aggregated into an index. The case company's own sustainability indicators are referred to as sustainability indicators. Term 'sustainability indicator' is also used when discussing the sustainability indicators in a general context. When discussing the potential aggregation of the sustainability indicators of the case company, 'aggregate sustainability index' is used.

3.2 Sustainability Assessment

Sustainability assessment addresses the variable issues that affect stakeholders on both spatial and temporal scales (Gasparatos et al. 2008). Assessing sustainability is extremely complex by nature and it is difficult to develop a framework that has universal applicability (Keeble, Topiol & Berkeley, 2003; Mendoza & Prabhu, 2003). A functioning framework for assessing sustainability should be holistic and that way it would enable analyzing issues of an entire system. A sustainability analysis needs to be comprehensive and interactive. (Mendoza & Prabhu, 2003.) Measuring sustainability performance has to be simplified in order for it to be practically useful. Subsequently, an aggregate index should take into consideration the various spectrums of issues and provided the information in a condensed form. (Hubbard, 2009.)

Sustainability indicator systems have various purposes of uses. They are increasingly recognized as useful tools for measuring, evaluating, tracking and improving sustainable performance of companies (Al-Sharrah, Elkamel & Almansoor, 2010; Tokos, Pintaric & Krajnc, 2012). Sustainability indicators and metrics have been identified and developed at community, corporate, business unit or even process or technology levels (Tanzil & Beloff, 2006). Sustainability indicators can be used as tools for assessing and predicting operational conditions and trends, providing information to prevent economic, social or environmental damage, generating strategies, communicating ideas and supporting decision-making (Singh, Murty, Gupta & Dikshit, 2009). Sustainability indicators should present the business realities, values and culture of the organization. Therefore the indicators should not be constrained to prescribed methodologies or standards. (Keeble et al. 2003.) Though, internationally recognized standards, such as Global Reporting Initiative (GRI), can assist in the determining of the

chosen indicators (Keeble et al. 2003; Krajnc & Glavic, 2005a; Li et al. 2012). With international standards, such as the GRI, it might be possible to select universally accepted indicators and metrics, which can therefore be combined into an aggregate sustainability performance index. This would then enable the index for comparison purposes within industry competitors.

Indicators are often interlinked and therefore they impact sustainability directly or indirectly through other indicators (Mendoza & Prabhu, 2003). Hence the motivation for aggregate index gains greater endorsement, since it could reflect the overall development of sustainability while taking the linkages between different indicators into consideration. The interlinkages within different indicators pose challenges for the aggregation though. If indicators affect each other, it is difficult to be certain which issues have affected certain indicators and to what extent. Mendoza and Prabhu (2003) utilize a soft qualitative methodology to examine the interactions and linkages between different indicators. This estimation allows a more holistic approach to sustainability indicators, since it takes into consideration the different linkages between indicators. (Mendoza & Prabhu, 2003.) This sort of interactions and linkages evaluation may be needed in order to produce an aggregate sustainability index. The linkages between different sustainability indicators for the case company are not a primary focus of this research though, so this issue is left for further research to look into.

The metrics of the three domains of sustainability: economic, environmental and social, most likely will have some interlinkages of their own. The improvement in a metric of one domain can have an unfavorable effect on another domain's metric. On the other hand, the effect to another domain's metric can be neutral or positive as well. (Sikdar, 2009.) This variation on the effects on different sustainability domains needs to be taken into consideration when contemplating the aggregation of different sustainability indicators. Sikdar (2009) emphasizes the central question in aggregating multiple sustainability metrics: "How does one identify overall improvement (or relative sustainability) when some metrics show improvement and others decline?"

In order to get a more comprehensive and realistic view on sustainability issues, sustainability indicators should be presented either in a conceptual framework, or they should be quantitatively aggregated into indices (Mayer, 2008). An aggregate index should ideally measure multidimensional issues, which cannot be portrayed with a single index. Sustainability is an example of such an issue. (Li et al. 2012.) In order to make proper conclusions based on the changes and status of an aggregate index, one must understand the strengths, weaknesses, biases and scale-dependence of it (Mayer, 2008). This on the other hand can be challenging for the index provider, since the contents and characteristics of the index need to be communicated extremely efficiently in order to dispense the proper information for the index readers and hence guarantee the necessary understanding for them. Table 4 summarizes the common characteristics of assessing sustainability.

Characteristic	Source
Analyzing sustainability issues of an entire system	Mendoza & Prabhu, 2003
Taking into account the different levels of a system	Singh et al. 2007
Assessing diverse issues	Gasparatos et al. 2008; Li et al. 2012
Interlinkages between indicators and different domains of sustainability	Mendoza & Prabhu, 2003; Sikdar, 2009

Table 4 Characteristics of assessing sustainability

3.3 Previous research on Aggregate Measuring

Previous research about developing aggregate indicators mainly aims to conduct cross-national comparisons of triple bottom line issues' progress in a quantitative manner (Krajnc & Glavic, 2005a). Also, as mentioned before, the previous research regarding aggregate sustainability performance measuring is highly focused on national or regional level operations, not company level (Krajnc & Glavic, 2005a; Krajnc & Glavic, 2005b; Saisana, Saltelli & Tarantola, 2005; Zhou et al. 2006; Böhringer & Jochem, 2007; Saltelli, 2007; Gianetti et al. 2009). Regardless of the developed aggregate indicators, there is still a lack of a useful method for integrated sustainability assessment on a company level. According to Kranjc and Glavic (2005a) issues regarding aggregation of sustainability indicators have been that the methods for aggregation are either insufficient, under development or unavailable to all the sustainability aspects. Hence, more research on the aggregation methods and comprehensive assessments is needed. The researcher of the present study predicts that the reasons behind the lack of previous research about aggregate sustainability indices on the company level is due to the fact that the issue of aggregate sustainability measuring is still a relatively new issue among companies. Legislation or NGOs are not demanding aggregate sustainability indices from companies and therefore the scarcity of such instruments among companies is not surprising. Also, if company-specific aggregate sustainability indices are being used, it is likely that the information regarding the metrics is confidential, and therefore not publicly available. The researcher contacted a representative from a company that was known to have conducted a study that handled a similar topic than the present research. It turned out that the research was not published in public and therefore the information retrieved from it could not be used in this research. This indicates that studies from the present topic do exist,

but they may not be available for the public eye. The case company of this research is highly sustainability oriented and working with a wide range of projects related to sustainability, and therefore it might be among forerunners in exploring aggregate sustainability performance metrics. Since the existing and publicly available studies are not plentiful, this research also relies on studies about aggregate sustainability performance indicators on another level, for example at the national level. The research also looks into researches about aggregate indices with other scopes than sustainability in order to receive much needed knowledge about the functionality of aggregate indices altogether.

A study by Singh et al. (2007) handles the methodological foundations of constructing a composite sustainability performance index (CSPI) for a steel industry company. Essentially, a CSPI is an aggregate sustainability index, but Singh et al. use different terminology for the index. CSPI is developed by analytical hierarchy process (AHP). The main purpose of the CSPI is to evaluate the overall sustainable performance of steel industry companies. Yet, the authors emphasize that sustainability indicators are only an attempt to get a sense of the complex dynamic phenomena and they should only be analyzed or combined with straightforward methods. The AHP model enables steel industry to identify key sustainability performance indicators and it offers a framework for aggregating the various indicators into the CSPI. The study presents the steps to calculate the CSPI. Figure 2 illustrates the AHP model for a composite sustainability performance index. The model is based four levels, which form the basis for the CSPI. The sub-indicators included into the CSPI are from five different dimensions of the companies' operations: organizational governance, technical aspects, economic performance, environmental performance and societal performance. (Singh et al. 2007.) Here should be noted that the AHP model takes into account two dimensions of operations that are not included into the triple bottom line approach: organizational governance and technical aspects. This way the model taker looks at the companies' sustainability performance in a more extensive perspective that is suitable for steel industry operators.

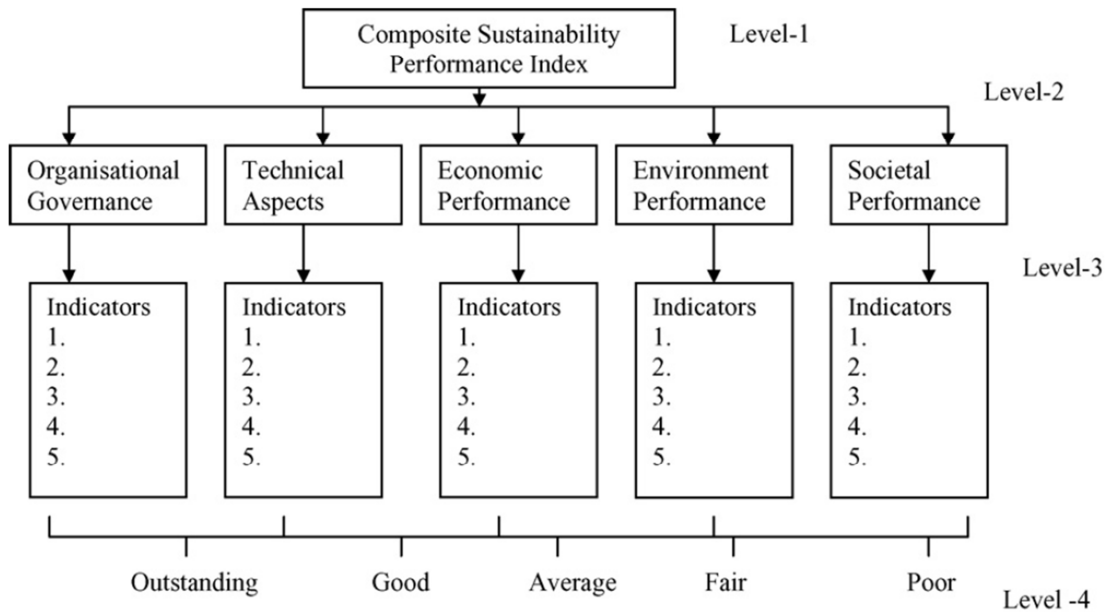


Figure 2 AHP model for composite sustainability performance index (Singh et al. 2007)

Figure 3 presents the generic steps used by Singh et al (2007) in constructing the composite sustainability performance index. CSPI was established for a case study company. Seven experts determined the relative weights of dimensions. Relative weights for the indicators were selected by par-wise comparisons between the indicators in each category. Hence, the weighting was performed in a subjective manner. (Singh et al. 2007.)

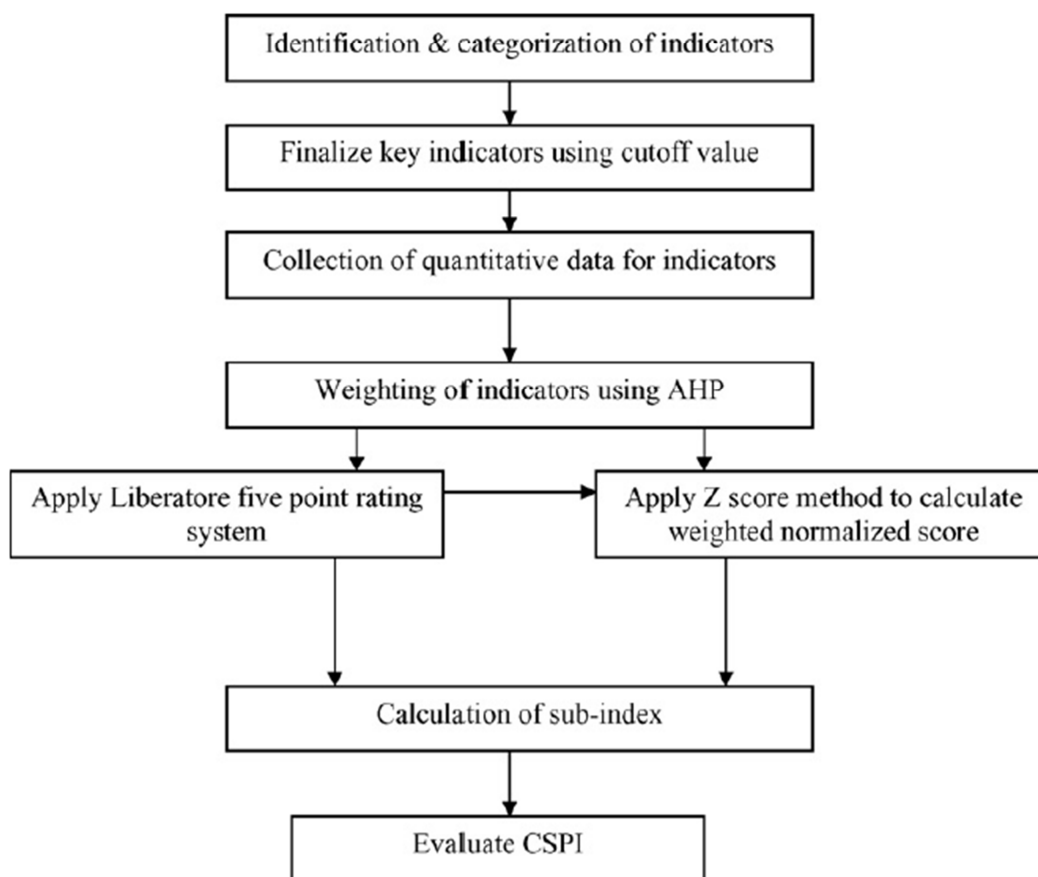


Figure 3 Generic steps for constructing a CSPI (Singh et al. 2007)

Li et al. (2012) develop a method for the construction of an aggregate sustainability index². The index analyzes the sustainability performance of manufacturing companies and benchmarks the company's sustainability performance and identifies the improvement opportunities for sustainability management. The developed method for the index construction is conducted with a methodology based on principal component analysis (PCA), which is a statistical multivariate method. PCA method takes into consideration the correlations between different indicators. The identification of relevant sustainability indicators for the industry is determined based on surveys, which are carried out for industry and academia representatives. The study in question does not focus on a certain industry, but manufacturing industry altogether. (Li et al. 2012.)

Hermann, Kroeze and Jawjit (2007) chose a different approach to the aggregation of environmental performance assessment. The combined three dif-

² Li et al. (2012) use the term 'composite sustainability indicators' for the aggregate sustainability index in their research.

ferent tools for environmental performance assessment: environmental performance indicators (EPIs), life cycle assessment and multi-criteria analysis tool. They utilize this synthesis to assess the overall environmental performance of a company. The combination of the three tools provides an assessment method, which requires less detailed data, time and expert knowledge, while still providing a comprehensive analysis of the environmental performance. (Hermann et al. 2007.) The study presents that sustainability assessing of a company can also be performed by aggregating different tools into one uniform instrument and not just by aggregating indicators. The present study's focus is on aggregating sustainability indicators of the case company, but the study by Hermann et al. (2007) is brought up as an example of the different approach that could be chosen for the aggregation process.

3.4 Characteristics of Aggregate Sustainability Metrics

Sustainability indices can be useful tools when assessing sustainability issues, but only if they are constructed and used appropriately. The methodologies of sustainability indices must be presented honestly and rigorously when introducing the index to stakeholder or other interested parties. (Mayer, 2008³.) Accuracy and uncertainty are issues that both the designer of an aggregate index and also the reader of the index need to take into consideration (Gasparatos et al. 2008). Critical issues in constructing an aggregate indicator are correlation among different sub-indicators and compensability between the sub-indicators. (Singh et al. 2009.)

The appropriate communities of interest should always select the sub-indicators for the aggregate sustainability index. With the participation of significant stakeholders from different fields, the aggregate index can be constructed within a coherent framework with the appropriate information on the issues at hand. (Singh et al. 2007; Singh et al. 2009.) This research too approaches the aggregation with the participation of various stakeholders and their views. This is reflected in the data collection process by choosing the suitable interviewees with variable backgrounds within the case company.

3.4.1 Benefits of Aggregate Sustainability Indices

Aggregate indices have been accepted as methods for performance comparison, communication and supporting decision-making in different fields, such as economic and environment (OECD, 2008). Aggregate indices are valued because of their ability to condense large amounts of information into a simpler

³ Mayer's (2008) research has human-ecological systems oriented approach, not a company level one.

format (Krajnc & Glavic, 2005a; Krajnc & Glavic, 2005b; Singh et al. 2007). Though sometimes it is necessary to provide stakeholders with sustainability information on environmental, social and economic levels, also presenting aggregated sustainability information is beneficial for multiple reasons. This way the different aspects of sustainability can be interrelated and looked into simultaneously. (Azapagic, 2004.) Aggregate sustainability index, which integrates information on economic, environmental and social performance, can be used internally to identify issues that need attention or externally for sustainability reporting and stakeholder engagement (Tokos et al. 2012). An aggregate sustainability index can also be used to improve company's internal operations and assist in company's decision-making regarding sustainability issues (Azapagic, 2004; Krajnc & Glavic, 2005a; Singh et al. 2007). Also Mayer (2008) presented the benefit of an aggregate sustainability index to facilitate decision-making, but amongst policy-makers. An aggregate sustainability index can also potentially provide new policy guidance instruments and public participation on sustainability discussion (Krajnc & Glavic, 2005a). Indices give a static overview of a certain system when calculated periodically. They can indicate whether the system is becoming more or less sustainable and potentially highlight which factors are most responsible for determining the systems direction. (Mayer, 2008.)

Gianetti et al. (2009)⁴ discuss the benefits of a composite environmental index. A composite environmental index condenses information of environmental issues and hence facilitates decision-making, performance monitoring, policy progress assessment and benchmarking comparison. (Gianetti et al. 2009.) A composite environmental index is an example of an aggregate sustainability index, which focuses on a single domain of sustainability: the environment. Aggregating parameters into a single performance index is desirable in order to facilitate effortless comparison. By aggregating metrics into one figure, it might be easy to assess the relative significance of different impacts. This will potentially help with the future sustainability related decisions. (Tanzil & Beloff, 2006.)

⁴ Gianetti et al. (2009) studied the construction of composite environmental index, so the scope of the research is of a more specified dimension of sustainability and not sustainability as a whole. Regardless, the research provides beneficial information for the present research about aggregate indices.

Benefit	Source
Multidimensionality: represent aggregate measures of a complex development phenomenon.	Booyesen, 2002 ⁵ ; Singh et al. 2007; Li et al. 2012
Condensing a large amount of complex information: easier to interpret than finding a trend in multiple indicators.	Krajnc & Glavic, 2005a; Nardo et al. 2005a ⁶ ; Saltelli, 2007; Singh et al. 2007
Presenting the sustainability performance development of a system: detecting the relative significance of factors in the performance development.	Tanzil & Beloff, 2006; Mayer, 2008
Assisting decision-making	OECD, 2008; Gianetti et al. 2009
Performance comparison	OECD, 2008
Performance monitoring	Gianetti et al. 2009
Facilitating communication	Nardo et al. 2005a.; OECD, 2008
Adding to stakeholder engagement	Krajnc & Glavic, 2005a; Tokos et al. 2012
Identify (internal or external) issues that require attention.	Tokos et al. 2012

Table 5 Benefits of aggregate indices

3.4.2 Challenges of Aggregate Sustainability Indices

One of the core challenge related to aggregate sustainability indices is that they can lead to overly simplistic analysis or conclusions (Li et al. 2012). Aggregate indicators can sometimes be misleading, especially when assessing the performance regarding a complex phenomenon (Tokos et al. 2012). Ineffective

⁵ Booyesen's (2002) research focuses on composite indices of development and not particularly sustainability. Yet, the finding from the research about aggregating indicators provides useful information for the present research about aggregating indicators.

⁶ Nardo et al. (2005a.) collected the attractive features and challenges that aggregate indices have received. Their findings are focused on national-level comparisons whereas this research looks at the company-level approach to the matter. Many of the findings of Nardo et al. are applicable with the company-level aggregation of indicators.

or counterproductive decisions can be made based on an aggregate index, if policy-makers do not consider the issues, which affect index behavior. It should be understood how the index is calculated and how the methodological choices influence index behavior. Among influencing issues are for example the scale of data available, choice of system boundaries (e.g. inclusion, transformation and weighting of data) and the aggregation method used. (Mayer, 2008.) Also data errors may cause bias in aggregate index (Booyesen, 2002; Singh et al. 2007).

Data errors (Booyesen, 2002; Singh et al. 2007), method for the including or excluding of sub-indicators, transforming the sub-indicators into a suitable form, normalization, choice of input algorithm, choice of weights of sub-indicators and the choice of aggregation system can hinder the credibility of an aggregate index. (Singh et al. 2009.) It is important to find the best combination for the steps in the aggregation process in order to construct an aggregate index that will effectively measure changes in a company's sustainability performance (Zhou et al. 2012). The researcher notes that errors in data are common challenges related to all kinds of measuring methods and not just an aggregate index. Uncertainties arising from incomplete data, limitations of measurement accuracy or available information are among the common challenges in aggregating sustainability information. These uncertainties can be minimized by improving the quality and quantity of data. Another challenge is the choosing of an appropriate method for the aggregation of indicators into the aggregate index. (Gianetti et al. 2009.)

Aggregate sustainability indices are often accused of being too subjective (Booyesen, 2002; Zhou et al. 2012). The subjectivity occurs because the results of an aggregate index depend on the normalization method, weighting scheme and the aggregation method of sub-indicators. These issues often are decided based on subjective judgements. (Zhou et al. 2012.) As stated before, many sustainability issues also are of subjective nature since several issues cannot be measured with objective metrics, but are determined by subjective assessments. Subjectivity of aggregate indices is often problematic, since choosing the sub-indicators and their weights highly depend on experts' opinions. (Booyesen, 2002; Singh et al. 2009; Li et al. 2012.) The research by Li et al. (2012) discovers that industry and academia representatives' views on sustainability-indicator weighting were not in align and they placed different weights on the same indicators. This was detected by industry and academia surveys, which aimed to discover what sustainability indicators were appreciated by the sustainable manufacturing community. (Li et al. 2012.) Therefore the advocates' opinions about the weights of sub-indicators can have an undetermined amount of variance. Disagreement among different experts' opinions creates uncertainty, which also hinders the reliability of the aggregate index (Gianetti et al. 2009).

Cunha Callado and Fensterseifer (2011) examine different studies on aggregated environmental, social and economic measuring of sustainability. They find a difficulty in analyzing how changes in each sub-indicator affect the others and how they jointly affect the end result of sustainability by the aggregate index. Also Mayer (2008) presents the challenge of interactions between the in-

dicators within an index and their effects to the results of the index altogether. This was stated being one of the most important issues to contemplate when presenting an index (Mayer, 2008).

Székely and Knirsch (2005) assess the best available metrics used by twenty German companies to measure sustainability. The authors summarize that different sustainability assessment methods, including sustainability indices, cannot be used as universal tools among all industries or among all companies within the same industry. Hence they present that aggregate sustainability indices would not be applicable to be used to benchmark industry competitors. Yet the study by Székely and Knirsch (2005) does not discuss aggregate indices with detail, but merely bring out that only one of the twenty target companies has started to study and outline the aggregation of the three levels of sustainability. Li et al. (2012) discover that when looking into the potential improvement targets of a company, attention should be based on each individual sub-indicator and not the aggregate index. Therefore the aggregate index as a whole does not point out the issues that require development, but the reader of the index needs to go deeper into the index and look at the sub-indicators in order to find information that guides towards further improvements.

Despite the increased usage of sustainability indices, they still remain controversial (Zhou et al. 2012). Sustainability is more than just an aggregation of important economic, ecological and social issues; it is about their inter-linkages and the dynamics of the entire system. Aggregate indices may send misleading, non-robust indications about the measured issues. Though, a sensitivity analysis can help to assess the robustness of the index and the reliability of experts' opinions about the index issues. (Singh et al. 2009; Gianetti et al. 2009.) Sensitivity analysis can also help to determine how the included information affects the aggregate sustainability index (Zhou et al. 2012).

Challenge	Issues in the background	Source
Subjectivity	Mechanism for including/excluding data, transforming the indicators, normalization scheme, choice of imputation algorithm, choice of weights, choice of aggregation system	Booyesen, 2002; Singh et al. 2007
May lead to too simplistic or misleading conclusions, especially when assessing a complex phenomenon	Sensitivity analysis can facilitate the robustness and the reliability	Nardo et al. 2005a.; Singh et al. 2009; Gianetti et al. 2009; Li et al. 2012; Tokos et al. 2012; Zhou et al. 2012
Interlinkages between the sub-indicators	The factoring to each other and the entire index altogether	Mayer, 2008; Cunha Calado & Fensterseifer, 2011
An aggregate index cannot be used to compare companies' performance	-	Székely and Knirsch, 2005

Table 6 Challenges of aggregate indices

3.5 Aggregate Index Methodologies

The previous research shows that different methodologies can be applied for the aggregation of indicators. Therefore when aggregating indicators into an index, one must take into consideration methodological issues of the aggregation. Since this research does not focus on the methodological issues, but the overall assessment on the reasonability of indicator aggregation, the methodological issues are only briefly discussed. The quality and reliability of an aggregate index are highly determined based on the methodological choices of the aggregation process. (Zhou et al. 2010.) The methodological assumptions should be well-known in order to assure the transparency of the index (Gasparatos et al. 2008). All aggregation methods have biases, which can influence the final index and its functionality. Therefore anyone trying to utilize the aggregate index should be aware of the chosen methods and how they may affect the index performance. (Mayer, 2008; Tokos et al. 2012.)

Companies' and industries' characteristics affect the methodological issues, such as which sub-indicators should be chosen and how they should be weighted (Li et al. 2012). Depending on the industry and the operational environment of a company, the methodological issues can vary (Mayer, 2008). Mayer (2008) and Tokos et al. (2012) found that the most significant issues affecting the index behavior and functionality are the quantity and/or quality of available data and choice of system boundaries; the inclusion, transformation and weighting of indicators; and the aggregation method used. Table 7 presents methods and steps used in previous studies for constructing aggregate indices.

Source	Method
Krajnc & Glavic, 2005a	Analytical hierarchy process (AHP). Normalized indicators are formed into three sustainability sub-indices and composed into an overall performance index.
Singh et al. 2007	Analytical hierarchy process (AHP): 1) selecting 2) weighting 3) standardizing and 4) aggregating indicators First forming sustainability sub-indices before the aggregation into a composite sustainability performance index.
Hubbard, 2009	1) Developing a sustainable balanced scorecard (SBSC) 2) Choosing indicators 3) Data collection from SBSC 4) Weighting by unweighted average
Cunha Callado & Fensterseifer, 2011	1) Selection of sustainability indicators 2) Calculation of the Partial Sustainability Score (PSS) 3) Calculation of the Corporate Sustainability Score (CSS) 4) Integration of PSSs into a Corporate Sustainability Grid
Li et al. 2012	Principal component analysis (PCA)
Tokos et al. 2012	1) Sustainability indicators are defined: experts' judgment and multi-criteria analysis determine the choosing and weighting 2) Indicators are normalized and transformed into sub-indicators 3) Including sub-indicators into a CSI

Table 7 Methods and steps of constructing aggregate sustainability indices

3.5.1 Steps of the Aggregation Process

Defining criteria for the constructing of the aggregate sustainability index is the primary step before the actual aggregation process can begin. The criteria should meet the issues of sustainable development as accurately as possible. (Singh et al. 2007.) Nardo et al. (2005a) refer to this as developing a theoretical

framework for the aggregation. By choosing the criteria for the aggregation, the scope of the index can be determined.

The construction of an aggregate index consists of different steps. Previous researches have stated these steps to include e.g. the development of theoretical framework, variable selection, imputation of missing data, multivariate analysis, normalization, weighting and aggregation, robustness and sensitivity analysis. (OECD, 2008.) The steps can be adjusted during the process, before the index is finalized. For example the amount of chosen sub-indicators can be altered. (Booyesen, 2002.) The most common steps in the previous research are: 1) selecting the sub-indicators and data inclusion, 2) standardization and/or normalization of sub-indicators, 3) weighting the sub-indicators and 4) aggregating sub-indicators into an index (Booyesen, 2002; Krajnc & Glavic, 2005a; Nardo et al. 2005a; Mayer, 2008; OECD, 2008; Li et al. 2012; Tokos et al. 2012). Figure 4 illustrates the steps of the process in aggregating sustainability indicators by Tokos et al. (2012) They utilized the Global Reporting Initiative for the selection of sub-indicators for the aggregate index. The weighting was conducted based on subjective opinions of experts. Three sustainability sub-indices were formed, based on the triple bottom line and the sub-indices were eventually aggregated into an aggregate index. (Tokos et al. 2012.)

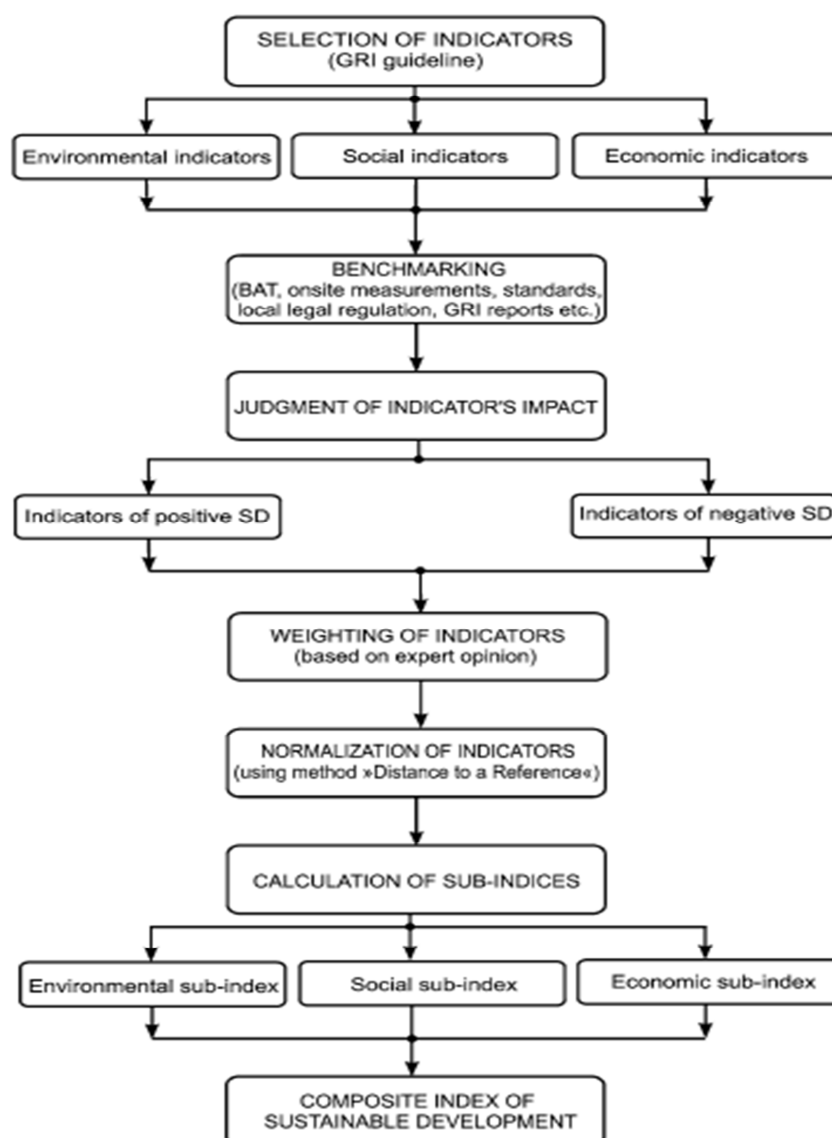


Figure 4 Methodology for integrated sustainability performance assessment and benchmarking breweries (Tokos et al. 2012)

3.5.1.1 Selecting Sub-indicators and Data Inclusion

The initial step in the process of aggregating sustainability indicators is to choose the relevant sub-indicators to be included into the index (Nardo et al. 2005a; Gasparatos et al. 2008; Mayer, 2008; Gianetti et al. 2009; Li et al. 2012; Zhou et al. 2012 & Tokos et al. 2012.). An aggregate index is greatly influenced by the indicators chosen to include into it (Gasparatos et al. 2008; Zhou et al. 2012). The final selections of sub-indicators should always be conducted in close cooperation of the company in question (Zhou et al. 2012). The selection is highly recommended to be done by various experts from different fields, such as environmental sciences, business and the academic sector. Also references to the science and literature in sustainability should be made when choosing the sub-indicators. Since experts' opinions are the basis for the chosen indicators,

the possible inconsistencies in the opinions create challenges for the choosing of appropriate indicators. It is extremely difficult to determine which indicators to choose, if the experts have remarkable different opinions about the matter. (Gianetti et al. 2009.) Selection of the sub-indicators for an aggregate sustainability index can be based on theory, empirical analysis, pragmatism or intuitive appeal or some combination of the above (Singh et al. 2007).

Though industries measure and monitor their sustainability performance with variable metrics, not all the sustainability indicators are necessary relevant to an aggregate sustainability index (Singh et al. 2007). An example of the choosing of sub-indicators is to consult industry expert or other stakeholders about their views on the indicators. Singh et al. (2007) conducted a survey for 15 experts a steel company in order to map the relevant stakeholders and key sustainability issues within the industry.

It is difficult to choose only a few indicators to portray the performance of a company, especially if the company operates in a geographically or functionally multiform environment. Hubbard introduces two approaches to the choosing of indicators. One can either aim to portray the performance in a manner that is best in accordance of the company's business strategy or to seek to cover the entire field as appropriately as possibly. (Hubbard, 2009.)

3.5.1.2 Standardization and Normalization

Indicators included into a sustainability index need to be standardized. The indicators are formed from a variety of data, so the values and units of the indicators differ. Standardization via suitable aggregation methods makes the range of the indicators constant. Standardization itself is method of weighting that assumes that the indicators have equal variability ranges. Also, weighting the indicators equally assumes that they have equal influence over sustainability. If all the indicators are weighted similarly, but there are more indicators for a specific aspect (e.g. the environment), the more noted aspect is given more influence over the final index value. (Mayer, 2008.) Some researches approached the index forming by normalizing the sub-indicators (Krajnc & Glavic 2005a; Gianetti et al. 2009; Tokos et al. 2012). For example Tokos et al. (2012) normalize the chosen indicators by the corresponding benchmarks and transform them into dimensionless sub-indices.

3.5.1.3 Weighting

The weighting of included sub-indicators can be done based on expert opinions. Inconsistencies in opinions are troubling in the weighting of the sub-indicators. Also the experts' knowledge and definitions of sustainability issues produces uncertainty in the process of weighting the sub-indicators. (Gianetti et al. 2009.) The weighting of sub-indicators is not founded on a reliable basis, if the knowledge and definitions vary between different evaluators. As mentioned, Li et al. (2012) find that the views about indicator weighting vary depending on the backgrounds of the evaluators. Since the weighting is based on subjective

outlooks about the measured issues, it can be assumed that the weighting of different indicators depends on the person you are inquiring and their background and knowledge. Hubbard (2009) presents an approach to the weighting, which too is of a subjective sort. The scale of the weighting comes from portraying the performance into the expectations that the company has and asking the question: "Are we performing better or worse than expected?" The scale can be then combined to a weighted or un-weighted basis, depending on the importance of the issue has for the company. (Hubbard, 2009.)

3.5.1.4 Aggregating the Indicators

Essentially, the final step in forming an aggregate index is aggregating the data with the chosen method (Gianetti et al. 2009). Zhou et al. (2012) apply methodology that gradually aggregates sustainability development indicators into sustainability sub-indices and finally, to an aggregate sustainability index. Tokos et al. (2012) also present a methodology that gradually aggregates sustainability indicators into sustainability sub-indices and eventually to an aggregate sustainability index. The methodology for aggregation needs to be thoroughly considered so that the aggregation model will be credible (Singh et al. 2007).

3.6 Stakeholder Needs

Sustainability reporting has established its significance in different fields of business. Customers, suppliers and other stakeholders are constantly demanding excellent sustainability performance from companies and they expect appropriate reporting about sustainability issues (Mikkilä & Toppinen, 2008.) The demands and needs from different stakeholders vary. Keeble et al. (2003) present the needs of different stakeholder groups with the following classification:

- Investors seek for evidence of good corporate governance, business strategy and management of risk.
- Customers demand information of the origin and contents of the products.
- Employees assume social and environmental responsibility from their employer.
- Governments and civil societies urge businesses to report on their social and environmental performance. (Keeble et al. 2003.)

Certain interest groups should be consulted when evaluating the need and potential to create an aggregate sustainability index. The perceptions of the stakeholders who are going to be utilizing the aggregate index are important to

take into consideration. (Singh et al 2008; Li et al. 2012.) Constant dialogue with different stakeholder groups is of major significance with sustainability issues. When developing sustainability indicators for a company, it is important to involve all the parties to whom the company is accountable. Stakeholder expectations are important in developing indicators. Different stakeholder groups' expectations vary, especially between the internal and external stakeholders. Therefore the final combination of indicators should be balanced accordingly to reflect the stakeholders' needs. (Keeble et al. 2003.)

Since the needs of different stakeholder group differ, it is not realistic to assume that an aggregate sustainability index could meet the needs of all the various stakeholder groups. It might be impossible to involve all the stakeholder groups of the company when developing an aggregate sustainability index. Singh et al. (2012) stated that it is highly difficult to aggregate the preferences of multiple stakeholders in this context. Yet, the authors identified the relevant stakeholders in the respect of creating an aggregate sustainability index in their research. They evaluated all the stakeholders and their preferences as individual entities. Based on the importance of needs and expectations of the stakeholders, the relevant stakeholders were chosen. These included employees, shareholders, government, regulatory bodies, customers, suppliers and community. (Singh et al. 2012.)

The set of sustainability indicators should measure company's performance on different levels of the organization so that a multiple range of stakeholders will be up to date on how the company is performing. (Keeble et al. 2003.) Here an aggregate sustainability index has great potential, since it could provide information on a general scale for various stakeholder groups about the overall sustainability performance of the company.

3.7 Conclusions of the Theoretical Framework

The theoretical framework presents that there is no uniform way to aggregate sustainability performance measuring, especially on a company or industry level. Aggregate indices do exist, but they have no universal terminology, structure or methodology. Regardless, similarities in the previous researches occur too. The researchers have recognized some common benefits and challenges of aggregate indices. The previous research, especially with the scope of company-approached aggregate sustainability indices, is limited and more research on the issue is definitely needed. Especially case studies would provide important contribution for the research topic. Therefore the present research has significant relevance in both academic and business understanding about aggregate sustainability indices.

The theoretical framework presents the benefits and challenges that the case company may deal with if forming an aggregate sustainability index. Also by discussing aggregate indices in a more broad scope, it was possible to bring forward some methodological issues that all types of aggregate indices deal

with. The methodological foundation for an aggregate sustainability index for the case company was not meant to be generated based on this research. A brief overview for the methodological aspects of an aggregate index was made in order to present the most common methodological issues that the case company might deal with if eventually forming an aggregate index. Stakeholders needs and their variation was also shortly discussed, since the present research is looking into the stakeholder needs of the case company. The theoretical framework forms the basis for the research interviews and their contents. Since the interviews were aimed to focus on the case company specific issues about aggregate sustainability measuring, the theoretical review had only a minor role in the interview questions forming, when the researcher contemplated on what kinds of issues might surface in the interviews.

4 FINDINGS

The aim of this research was to look into how the sustainability performance measuring of an industrial company could be aggregated. Prerequisites for an aggregate sustainability index and needs of different stakeholders for the aggregate index were to be explored. In the process of looking into these issues, the challenges related to an aggregate sustainability index for the case company were revealed. It was also discovered, what functions the interviewees saw beneficial for the aggregate index. This chapter discusses the findings from the primary data collected with the semi-structured interviews.

The recurrent issues of the interviews handled mostly about the contents and transparency of the potential aggregate sustainability index and the difficulty of choosing and weighting of the sub-indicators to be included into it. The findings from the interviews are divided into three main themes in order to meet the research problem in a coherent manner. The themes are 1) prerequisites for an aggregate sustainability index, 2) needs of stakeholders and 3) functions of an aggregate sustainability index.

4.1 Prerequisites for an Aggregate Sustainability Index

This chapter presents the most common and critical prerequisites for an aggregate sustainability index based on the interviews. The most crucial prerequisites handle outlining sustainability and the understandability and the contents of an aggregate sustainability index.

4.1.1 Outlining Sustainability

The first and foremost prerequisite for an aggregate sustainability index is outlining sustainability and what it features in the aggregate sustainability index. The interviewees agreed that sustainability is a complex issue and it can

be defined in multiple ways. They also stated that the aggregate sustainability index could be approached with different definitions of sustainability. All the interviews established that it is crucial to outline the definition of sustainability as an initial step in the aggregate sustainability index construction. Clear and unambiguous definitions for sustainability are needed. This forms the basis for making interpretations based on the aggregate index. The case company works with versatile sustainability related issues and these issues vary among different units. So it is significant to determine which issues are included in the aggregate sustainability index and how they are connected to the operations of the case company.

A recurrent opinion among the interviewees was that when referring to an aggregate sustainability index, the index should cumulate information about a wide range of sustainability issues. An interviewee stated that all the aspects of sustainability should be taken into consideration by the index, but not too many sub-indicators should be included. Suggestion was that the most significant indicators from each sustainability aspect should be chosen into the aggregate index. The researcher discovers from the interviews that there is a contradiction to aggregating sustainability issues into an aggregate sustainability index: a broad perspective to sustainability should be chosen, but simultaneously leaving out the less significant sustainability issues. The underlying question here is how should the case company determine, which sustainability issues are the most important. This issue will be discussed further on in the research. The following chapters 4.1.1.1–4.1.1.3 discuss the different approaches to outlining sustainability, which were discovered from the interviews.

4.1.1.1 Environmental Performance Aggregation

A common suggestion from the interviewees was that the aggregate sustainability index should focus only on the environmental performance of the case company. This would therefore frame the defining of sustainability and what to include into the aggregate index. Most interviewees seemed to agree that focusing on an aggregate environmental index could be the most advantageous and practicable way to approach the aggregation of sustainability indicators. The interviewees felt that it is difficult to aggregate indicators from different fields of sustainability, such as combining social and environmental indicators. Here, the suitable weighting for each indicator would be extremely complex as well, since it is hard to compare the significance of such different issues. A recurrent opinion among the interviewees was that environmental issues are clearly a more uniform area, compared to for example social issues. Therefore the benefits from an aggregate social sustainability index for the case company should be assessed separately.

In fact, some interviewees suggested that after establishing an environmental performance index, the possibility to construct an aggregate social sustainability index could be assessed. The researcher states that social sustainability measuring is often difficult, since one cannot easily and objectively measure the status or changes of social issues. The effects that a company has on social

sustainability are often based on subjective insights. An interviewee presented that the issues behind social sustainability are commonly much more complex by nature. When assessing social sustainability, there may often be multiple viewpoints that need to be contemplated before one can form an opinion about the status of social sustainability. For example, when discussing children's rights, it should be noted that a child has the right for a parent-child relationship and parental solicitude. In some cases this can be jeopardized by employment, if the parents are separated from their children because their employments are located somewhere else. Here the case company's responsibility may extend much further than just providing a safe working environment for the parents. With these kinds of social sustainability issues the case company needs to have multiple points of views under consideration.

4.1.1.1 Aggregate Corporate Sustainability Focus Areas

One approach to the aggregation was also that the case company should consider producing different aggregate indices for focus areas of corporate sustainability. These focus areas are determined in the case company's corporate sustainability strategy and the sustainability indicators are divided according the focus areas. Once the separate sustainability focus areas' indicators have been aggregated, these focus area indices could be cumulated together in order to produce a single aggregate sustainability index. This could be a beneficial approach, since it would enable the following up of individual focus area indices while also having an aggregate index for the entire field of sustainability. The focus area specific aggregate indices could possible provide additional benefits for the sustainability performance related tasks. On the other hand, few interviewees felt that if the case company was to present an aggregate sustainability index, then the index should take into consideration all the different aspects of sustainability, not just one focus area. Hence, the aggregate indices for different focus areas would be futile, if they were not combined together. The researcher notes here that the focus areas approach faces the difficulty of aggregating variable sustainability indicators, as was discovered problematic in the previous chapter 4.1.1.1.

4.1.1.2 Focusing on a Certain Aspect of Sustainability

Some interviewees discussed that the case company could choose a certain sustainability aspect to focus on. Examples of such aspects would be for example water or air related issues. For instance, an aggregate water sustainability index could be constructed to portray the performance in water related matters. This approach poses both possibilities and challenges for the performance monitoring. Focusing on a single aspect of sustainability may give a comprehensive look on the overall sustainability performance of a certain aspect in the corporation, division or unit level. For example external communication to local communities or perhaps even to customers could be a benefit from an index of this sort.

With this approach to outline sustainability the researcher sees challenges related to the borderlines of the chosen aspects. Since issues such as water management are an ensemble of a large amount of different parameters, it may be difficult to determine which indicators are allocated under which aspect. For example waste water related issues could be allocated either under water issues or waste management issues. Some interviewees also state that this kind of an approach to the index is questionable. They believe that an aggregate sustainability index should take into consideration the different aspects of sustainability performance altogether and not just to focus on specific matters.

The researcher points out that no aspect of sustainability related to social issues were presented by the interviewees in this context. The researcher herself does not find any specific social aspect that could be utilized in outlining sustainability for an aggregate index. Table 8 summarizes the different approaches, which were presented in chapters 4.1.1.1- 4.1.1.3, to outlining sustainability in an aggregate sustainability index.

Outlining sustainability		
<i>Environmental performance</i>	<i>Corporate sustainability focus areas</i>	<i>Aspect of sustainability</i>
Focus only on environmental performance	1. Cumulating each corporate sustainability focus areas 2. Eventually the focus area indices can be cumulated thus producing an index for overall sustainability performance	E.g. water, air or waste related performance

Table 8 Different approaches to outlining sustainability in an aggregate sustainability index

4.1.2 Understandability and Transparency

Understandability and transparency of the aggregate sustainability index were seen as a major prerequisite for the index. Certain interviewees stated that it would be advantageous to see the sustainability trends based on an aggregate index, but this must be communicated in an appropriate manner. An aggregate sustainability index was perceived as a highly complex tool by the interviewees. Interviewees contemplated whether the index readers will be able to understand the index and make appropriate conclusions based on it. When presenting an aggregate index, it needs to be clearly stated how it has been constructed. The readers of the index have to be able to see the sub-indicators and the changes in them. This way the readers can make the most accurate interpretations on what issues have actually affected the index development and to what extent. If the sub-indicators are not visible for the readers of the index, the index does not appropriately present how the sustainability performance has been developing. The proper understanding of the

sustainability indicators by index readers is also needed in order to comprehend the aggregate index. Some interviewees questioned the current understanding of the existing sustainability indicators by e.g. customers and personnel working close to customers. Some interviewees presented that stakeholder training is most likely necessary in order to guarantee the appropriate index understanding of the different stakeholders relevant to the index. Training and educating different stakeholders was presented as a solution and even a requirement when discussing the issue of index understandability. The researcher believes that the internal stakeholders of the case company are more likely to have a better understanding of the case company's sustainability indicators and also that their knowledge about the indicators is easier to improve compared to external stakeholders, such as customers.

Some interviewees discuss the fluctuating understanding and knowledge for sustainability indicators among different stakeholders. Especially customers of the case company were said to lack the appropriate knowledge of the indicators. An interviewee stated that the internal customer interface personnel find it difficult to understand the sustainability indicators of the case company as well. The current list of sustainability indicators was stated to be too lengthy by multiple interviewees. On the other hand, most interviewees perceived the indicator listing being comprehensive enough for the company's needs. Therefore the opinions for the current sustainability metrics of the case company were conflicting.

The issues behind the sustainability indicators are complicated. The interviewees agreed that interrelations between different sustainability indicators exist, but most of them felt uncertain about where the actual interrelations lie. Also the extent and importance of the interrelations could not properly be estimated. Therefore when presenting any figures of sustainability, proper and understandable explanations of the agents behind the figures need to be presented. An indicator or index of sustainability has a limited ability to portray the tangible changes that have occurred behind the figures, since the measures only present a change in a static number. Further explanations about the sustainability metrics or the performance change are needed especially, if some significant event has affected the sustainability performance development. Many interviewees stated that an aggregate sustainability index could potentially be usable, if the performance evolves positively and accordingly to plans. On the other hand, if something noteworthy happens and changes the positive direction of the sustainability performance development, the index is not enough to communicate this. The researcher notes that even when relying on an individual sustainability indicator about a single matter, additional explanations should be done if a sustainability performance relevant event occurs.

Understandability was seen as a big threat by the interviewees. Few participants stated that the value of the index is hindered if too much explanation is needed about the contents of it. Thus, it would not be reasonable to have such an aggregate index, if additional explanations are constantly needed. Table 9

presents the basis for the understandability of an aggregate sustainability index discovered in the interviews.

Understandability		
<i>Precondition</i>	<i>Hindering factors</i>	<i>Supporting factors</i>
Knowledge of the contents of the aggregate sustainability index and its sub-indicators	Interrelations of Different sub-indicators	Stakeholder training & communication

Table 9 Basis for the understandability of an aggregate sustainability index

4.1.3 Inclusion and Weighting of Sub-indicators

All of the interviewees discussed the issue of what parameters to choose into the aggregate index. Also the amount of sub-indicators to include into the aggregate sustainability index was debated. The choosing of sub-indicators was seen problematic, since sustainability can be approached with very versatile perspectives and also because of the versatile operational environments of different units. As the case company is a heavy industry operator, it has sustainability impacts in various matters. The amount of the company's sustainability indicators is substantial and therefore choosing the included sub-indicators is not simple. Also the amount of the sub-indicators needs to be considered accordingly as well. A common opinion among the interviewees was that too many indicators should not be attempted to put into the single index.

The interviews reveal that weighting of the sub-indicators poses challenges for the index construction. Few interviewees discussed the potential changing of the weights accordingly to the present operational situation. Changes in the operational environments, which affect certain sustainability issues becoming more or less important, could be a reason for altering the weights of the sub-indicators. The changing of weights of the sub-indicators is difficult since alterations in the weights leads to the hindering of the comparability of the index. The weights of the sub-indicators need to be set to a certain level, if the index is to be used for performance comparison. On the other hand, if the operational environment or company strategy changes, the weights should potentially be altered, since different issues need to have more emphasis than before. A few interviewees presented that in order to monitor the sustainability performance development the index needs to be fixed. This would also ensure that the information maintains its value in comparability. Few participants stated that if the index is not fixed, then it has no reliability or use value, since the development monitoring and comparability to earlier performance is hindered.

The researcher wants to emphasize the importance of the sub-indicators weights in the context of corporate sustainability and especially in the industrial field. The sustainability index needs to be weighted since the different aspects of sustainability have different importance depending on the nature of the op-

erations of the units. The case company's sustainability indicators are not constant, but they are set according to the company's strategy. Therefore new indicators may arise or existing indicators are taken out of use. This was discussed by a few interviewees and this was seen challenging in relation to the aggregate index construction. If the sub-indicators are changing, then the aggregate index is not permanent either. In fact, an interviewee stated that the case company should monitor, if there are some new sustainability parameters gaining importance. The interviewee, who operates closely with sustainability issues, presented that if new significant sustainability indicators occur, the possible adding new parameters to the aggregate index should be considered. Here the comparability of the index would be disturbed though.

The researcher summarizes that the desired purpose of use of the aggregate index is what determines the fixing or altering of the included sub-indicators and their weights. If comparability is highly appreciated, then the index should be fixed and the weights of sub-indicators should not be changed. If the most realistic reflection of the current sustainability situation is wanted to be portrayed, then the alteration of the sub-indicator and their weights is acceptable.

4.2 Needs of Stakeholders

This research started with the objective to determine what kind of needs of different stakeholders have for aggregate sustainability measuring. Mapping the needs for an aggregate sustainability index is extremely important when contemplating the potential development of an aggregate sustainability index. The two essential findings about stakeholder needs from the interviews were that the needs for an aggregate sustainability index differ within stakeholder groups and that an aggregate sustainability index has a limited ability to meet the stakeholder needs for sustainability performance measuring of the case company.

4.2.1 Differences in Needs

Many interviewees presented that the interests for sustainability measuring vary based on stakeholders' duties and responsibilities within the case company. Some of the stakeholders are looking to know the entire sustainability performance development and some are just interested in one or a few performance metrics. People who are continuously working with detailed sustainability issues need rigorous sustainability measuring. An example of this type of stakeholder group is the corporate and division personnel responsible for managing sustainability performance on different levels of the case company. Therefore they cannot rely on an aggregate index, but they need to utilize the sustainability indicators. On the other hand, they could potentially use an aggregate index for communicational purposes and to present an overall

picture of the performance status or development. The communicational need for an aggregate sustainability index was especially seen relevant for the corporation and division management personnel.

The interviewees emphasized that the needs for an aggregate sustainability index differ highly between stakeholders and organizational levels. Especially close to the operations, at the unit level, the needs differ greatly from the ones of division and corporation levels. The process operators require more detailed sustainability metrics to follow-up the performance and set targets accordingly. The process operators need sustainability information, which is relevant and close to the actual production process. In the unit level operations it is essential to know the development and status of the operational sustainability issues. A general, overall view to sustainability measuring is not needed among the process operators. Hence, in the unit level, an aggregate sustainability index does not have much potential in offering any assistance for the target setting and follow-up, since it provides a more general picture of the performance development.

An interviewee working closely with customers stated that the good sustainability performance of the company could and should be used in the marketing of the company as well. Hence, an aggregate sustainability index was seen as potentially beneficial in marketing and customer interface related matters. Though customers and potential customers demand highly detailed sustainability performance data from the case company, they need more universal and understandable information about the case company's sustainability performance too. An interviewee working with customers stated that if an easier and more transparent way to present the sustainability performance information would be available, time and resources could be saved in customer interface. An aggregate sustainability index could therefore save time and resources in presenting a uniform picture of the performance.

An interviewee working in close cooperation with the case company's investors described that the investors follow the sustainability performance information of the company. They demand more detailed sustainability information, especially if there has been some significant event that affects the case company's performance or image. Usually the investors demand more elaborate information only if something noteworthy has happened. The interviewee presented that if the sustainability performance develops as expected, more general information may be enough for the investors. In this case, the investors could potentially accept the aggregate sustainability index as an overall index for the performance.

4.2.2 Limitations of an Aggregate Sustainability Index

According to the interviewees, too much conclusions should not be based on the final figure of an aggregate index. As presented earlier, a reader of the index should properly understand the composition of it so that implications can be made. This is important even when presenting an overall glance to the sustainability performance merely for communicational purposes. The readers

must be able to see what are really factoring the changes within the index. This is especially important for the different management levels of the case company. Many interviewees also stated that when aggregating sustainability performance metrics into a single index there is a danger of the index becoming too complex. Here the risk of drawing the wrong conclusions from the index is considerable. One of the biggest challenges related to an aggregate sustainability index is therefore losing the information behind the index number. Especially in the operational level at the units, the aggregate index may not provide detailed enough information for the employees about the sustainability performance development. It was commonly criticized by the interviewees that it is difficult to make plans and operational actions based on an aggregate sustainability index. In internal follow-up, the sustainability indicators are needed so that the suitable actions can be implemented in the right operational areas.

The case company's units operate in variable environments, e.g. from social and environmental points of view. Also the national requirements pose sustainability preconditions and even the local environments of the units form the sustainability scope for each unit. The different units have therefore different sustainability aspects to put emphasis on. Also the operational requirements and limitations vary depending on the production processes that the units have. Not all the units are required or even able to deliver the same sustainability performance. The units should focus on the sustainability issues that are important to their operations. It is difficult to construct an overall sustainability index, when the requirements for sustainability performance vary between the units. Regardless, it is necessary to follow-up the overall sustainability performance of the units and therefore detect whether they are moving to the right direction with their sustainability performance, even when not all the units are supposed to deliver the same contribution to corporate sustainability. Table 10 summarizes the most significant limitations of an aggregate sustainability index based on the interviews.

Limitations	
<i>Complexity</i>	<i>Differences in the operational environments of the units</i>
Not providing detailed enough information to guide operational activities	Only a simplified image of the units' performance can be provided

Table 10 The most significant limitations of an aggregate sustainability index

4.3 Functions of an Aggregate Sustainability Index

By discussing the interviewees' perceptions about the stakeholder needs for an aggregate sustainability index, the desired functions of the aggregate index could be discovered. This chapter displays the functions and the needs behind them discovered from the semi-structured interviews. At the end of the day, the stakeholder needs determine the functions and basis for an aggregate sustainability index. Numerous functions for an aggregate sustainability index and sustainability measuring altogether were identified from the interviews. All the functions are related to communication and/or management. Table 11 presents the identified and most significant functions, which the aggregate sustainability index can offer for the case company. The identified functions are displayed according to the stakeholders, which can utilize these functions.

Function Stakeholder group	Communication & Management				
	<i>Performance comparison</i>	<i>Performance follow-up</i>	<i>Summarizing performance</i>	<i>Decision-making & target setting</i>	<i>Motivation tool</i>
Corporation management	x	x	x	x	x
Division management	x	x	x	x	x
Unit management	x	x	x	x	x
White collar workers	(x)	(x)	x		x
Process operators			(x)		x
Customers	x	x	x		
Investors			x		
Other external stakeholders			x		

Table 11 The functions identified based on the interviews

4.3.1 Expectations for the Aggregate Sustainability Index

All in all, most of the interviewees welcomed the research about an aggregate sustainability index, but their expectations for the tool differed. Few participants were convinced that the index should be able to guide the sustainability performance related operational decision making. The ability for the aggregate sustainability index to assist in decision-making was discussed in a broad context, thus these discussions covered different management related functions of the case company. Some interviewees stated that there is no use for an aggregate index, if the company's sustainability performance cannot be influenced based on it. On the other hand, many participants found it beneficial to utilize the index for internal and/or external communications as a signpost for the sustainability performance development, but not for actual decision making. Thus, they did not see the need or in some cases even the possibility to utilize an aggregate index for operational improving.

The interviews presented a contradiction on the stakeholders' views about an aggregate sustainability index. Some interviewees stated that stakeholders

would appreciate an aggregate sustainability index because it would provide a simple way to understand and compare performance. At the same time interviewees also stated that stakeholders will not possibly be satisfied with the aggregate index, since it does not provide detailed enough information about its contents. Despite this contradiction, the expectations for the aggregate index discovered from the interviews could be divided into communicational functions and managerial functions.

4.3.2 Internal and External Communication

All in all, the most useful function that the interviewees acknowledged for an aggregate sustainability index was communication. The index was perceived to be potentially useful for both internal and external communication. Internally an aggregate index was seen most useful for corporate and division level communication. Also unit level communication could potentially be supported with the index, but the existing sustainability indicators were seen as more relevant at the unit level. The corporate and division management could be identified as potential users of the aggregate sustainability index based on the interviews.

As presented earlier, the interviewees notified that the process operators cannot utilize an aggregate sustainability index in their work. Yet, the aggregate sustainability index was seen as a motivation tool by an interviewee. By presenting the sustainability trend in the case company's operations, the employees of the company could be proved that their sustainability work provides improvements in the performance and therefore the sustainability work has value in all the levels of performance. Therefore, the aggregate sustainability index could be utilized for communication, which is targeted to the unit level as well.

The external communication based on the aggregate sustainability index was seen beneficial, because of its ability to condense complicated and plentiful sustainability information. An aggregate sustainability index would offer a more simplistic and easily communicated way to portray the sustainability performance development of the case company. An interviewee presented that by utilizing the aggregate sustainability index for external communication, the relative sustainability performance development could be communicated without giving away anything confidential. The index could also help to save time with communication, when the sustainability information would be presented in a compact form. This was especially noted when referring to customer contact.

Even though an aggregate index has potential in providing communicational benefits, many interviewees felt that the individual sustainability indicators need to be provided simultaneously when communicating sustainability information with the aggregate index. The audience may potentially question or misunderstand the content of the aggregate index, if the sub-indicators are not visible.

4.3.3 Sustainability Performance Follow-up

The interviewees presented that the ability to monitor sustainability performance development was clearly desirable by different stakeholders of the case company. Especially the corporation and division management need sustainability information in order to monitor the sustainability performance and its development. Majority of the interviewees presented that the sustainability indicators fulfill this need for monitoring and follow-up. Therefore many interviewees stated that they do not necessarily see a need for an aggregate sustainability index for the performance follow-up. Yet, the opinions about the needs for performance development monitoring were highly heterogeneous and some interviewees said that they could utilize the aggregate index for the overall sustainability performance follow-up.

The possibility for the index to sketch an overall performance trend was seen beneficial, even though many interviewees determined that in order for more precise follow-up, the individual indicators are needed. The communication of the case company could be enhanced both internally and externally by forming a sustainability performance trend with the aggregate index, stated the interviewees. This would clearly simplify the performance follow-up. The process operators at the units need to monitor the sustainability performance too, but as mentioned this is done with metrics closer to the actual operations. Hence, the interviewees agreed that the operational level would not benefit from the aggregate sustainability index as a sustainability performance follow-up tool.

4.3.4 Performance Comparison

The interviewees saw it beneficial to utilize an aggregate sustainability index for sustainability performance comparison. One interviewee even stated that this would be the only significant purpose of use for the aggregate index. Nearly all the interviewees discussed the prospective function of the aggregate sustainability index to benchmark the different units of the case company. A simplified method for comparison could sometimes be necessary, for example when corporation or division management needs to assess the overall performance of different units. Yet, if wanting to make more fundamentally accurate benchmarking of the units, the comparison should be done based on more precise performance measuring metrics.

Since the operational environments differ, an aggregate sustainability index offers limited opportunities for comparing the different units. Despite this, few interviewees presented that utilizing the aggregate index for comparing units is doable. An aggregate index could present a simplified indication about the units' sustainability performance. The units could therefore be ranked based on the index. An index merely portrays a simplification though, as it does not present an entirely reliable benchmark of the units. The interviewees were concerned about the fact that the operational environment in which the case company and its units operate in changes constantly. Different sustainability issues

may increase their importance due to events that are cannot be controlled by the case company. This may falsify the benchmarking of different units, if the importance of sustainability issue changes in some units.

Interviews show that the sub-indicators chosen into an aggregate sustainability index have a significant influence in the ranking order, if using the aggregate index to benchmark the case company's units. As determined before in this research, not all the units are expected to deliver the same contribution concerning all indicators of sustainability. This might be affected by varying technical possibilities, asset age or production technology in the production units. The units need to focus on the sustainability aspects that are significant for their operations and their sustainability targets. Therefore some units may not rank high according to the aggregate index, because the valued sustainability sub-indicators are not fully compatible with their local sustainability targets. For example some units may have better operational ability to be highly material efficient compared to other units in different locations.

According to the interviews, company management needs to have a clear understanding about what impacts the performance development of units. This is highly important particularly if some unit performs worse compared to others or the unit's performance does not develop according to plan. If the performance of a certain unit is questionable, the detailed sustainability performance information from the sustainability indicators should be presented to the management. The ranking of units can be done based on an aggregate sustainability index, but at the end of the day, the true performance development can only be seen from the single sustainability measures. To summarize: if the sustainability performance of units is in accordance with the targets, then the aggregate index can be used to benchmark the units. At the same time, if the performance is not meeting expectations, then a closer look into the sustainability indicators is needed.

Interviewees also reflected the possibility to benchmark the case company to competitors based on the aggregate index. Here the index was seen as a desired tool because of the commercial value that could be gained from the sustainability performance benchmarking. An interviewee reflected that the commercial benefit from the aggregate sustainability index could be compared to the benefits from an eco-label or a certificate issued by an independent 3rd party. The identified potential benefit was the assurance of a certain level of sustainability performance in the case company's operations.

Certain standards in the sustainability measuring among the industry are needed, if comparisons are wanted to be done between industry competitors. In order for industry-level comparisons to be prospective, the same prerequisites need to be in place for all the compared companies so that accuracy of comparisons could be ensured. That is, the same calculation routines and boundary setting are required behind the measures. This would best be achieved by applying internationally set standards. It is possible that the companies themselves are not the only ones using the sustainability metrics for comparison. Different stakeholders, such as clients, potential clients or NGOs, may potentially base

the comparison on the aggregate index too. Especially in these cases, when external stakeholders compare the different companies and their performance, it is important that the comparisons can be based on reliable measurements and that the same procedures are applied by different companies. External stakeholders have a high risk of making wrong conclusions, if they do not know how the measurements are constructed. Obviously, the competing companies should have the aggregate index in place in order to make any comparisons between the case company and its competitors. The interviewees agreed that if an aggregate index would gain popularity among the industry, then the case company should most definitely integrate it into its sustainability measuring.

4.3.5 External Verification

An interviewee stated that an aggregate sustainability index could be utilized with the external audiences in order to support the legitimacy of the company's sustainability impacts. Hereby the aggregate sustainability index could be utilized for external communication to legitimate the case company's performance. The researcher points out that it is difficult to use the aggregate sustainability index to verify the case company's sustainability position compared to competitors, if the competing companies do not have the same index in place.

In customer interface an aggregate sustainability index could be helpful to bring a clear and straightforward way to present the sustainability performance. Sustainability performance related information and data was stated to being difficult to present in a comprehensible and compact way. Thus, an aggregate index could benefit the sales with presenting more simplistic and condensed information about the sustainability performance for clientele.

4.3.6 Management Decision-making

Some interviewees saw that the aggregate sustainability index has potential in guiding the corporation or division level management with their decision-making. The aggregate sustainability index was seen potential to support the case company's annual target setting process. This way the aggregate index could be incorporated into the long-term planning of the organizational management. Also, the index could possibly be used as a basis for incentives. Many interviewees also doubted the possibility to base management decisions on the aggregate sustainability index.

4.4 Summary of the Findings

The prerequisites, needs of stakeholders and functions of an aggregate sustainability index discovered from the interviews are highly connected to each other. The interviewees had both similar and differing perceptions about

the aggregation of the case company's sustainability performance measuring. Most common issues were to do with the contents and understandability of the index. Though the interviews reveal many challenges with an aggregate sustainability index, also many benefits and possibilities were found from using the index. The benefits of an aggregate sustainability index were mostly related to communication at corporation and division management levels, though also customers were seen as important in this relevance. The challenges about an aggregate sustainability index largely arise from the differences in the operational environments of units and the understandability of the index. The needs of different stakeholders for an aggregate sustainability index vary, especially between the unit and higher management levels. Various functions for the aggregate sustainability index were identified from the interviews. Table 12 summarizes the main findings discovered from the interviews: the prerequisites for the index, needs of stakeholders and functions for the index.

Prerequisites	Needs of stakeholders	Functions
<ul style="list-style-type: none"> • Outlining sustainability • Understandability and transparency • Inclusion and weighting of sub-indicators 	<ul style="list-style-type: none"> • Differ between stakeholder groups • Acknowledging the limitations 	<ul style="list-style-type: none"> • Communication • Performance follow-up • Performance comparison • External verification • Management decision-making

Table 12 Summary of the main findings from the interviews

Altogether, there was a clear controversy about the understandability and usability of the aggregate sustainability index. Interviewees felt that too much information cannot be aggregated, but if not enough information is condensed then an aggregate sustainability index loses its attributes as a cumulative instrument. Regardless, an aggregate sustainability index is possible to produce for the case company, but there are different approaches to do this. All in all, the interviews reveal that if one wants to monitor the true sustainability performance of the case company, one must look at the individual sustainability indicators and their backgrounds.

5 DISCUSSION

This chapter discusses the findings from the research data and elaborates them with the theoretical framework of the study. A suggestion is given about the case company's sustainability performance aggregation. The interviews revealed that an aggregate sustainability index for the case company is potential, but it meets a lot of challenges and uncertainties. The case company can strive to avoid any misunderstandings and negative perceptions about the index and focus on getting the maximal benefits from it, by being aware of the limitations and challenges that the index has. The aggregate sustainability index would provide features that other instruments, such as the sustainability indicators, fail to offer. The greatest example of this is to portray a condensed, overall outlook about the case company's sustainability performance. Previous research too supports this claim that an aggregate sustainability index could portray the variable sustainability performance in a summarized way (Azapagic, 2004 & Li et al. 2012).

All in all, the aspect that the case company chooses to focus on with the aggregate index highly determines the functionality of the index. The aspect also determines the contents that should be included into the aggregate index. Both the theoretical framework and the interviews reveal that there are multiple approaches that could be chosen for an aggregate sustainability index. As Singh et al. (2007 & 2009) present, the relevant stakeholder groups should be taken into consideration when constructing an aggregate sustainability index. Also, as the previous researches reveal, aggregate indices can be formed based on rather subjective insights, at least when determining the sub-indicators and their weights (Booyesen, 2002; Singh et al. 2007; Singh et al. 2009; Li et al. 2012). With the interviewees of the present research, the views of different stakeholder groups were looked into. Communication and corporation and/or division management related needs were discovered. Hence the researcher suggests that the case company could utilize an aggregate sustainability index for these kinds of tasks. Especially the communicational functionality of an aggregate index was appreciated by the interviewees, so the aggregate index could focus on providing communicational value. Therefore the researcher suggests that the

scope of the aggregate sustainability index should be clearly defined, and not too variable aims should be based on the aggregate index.

The most important issue in developing an aggregate sustainability index is to ensure that the readers of the index can form accurate and reliable conclusions based on the index. Consistency and transparency are needed in order to enforce the accurate conclusions. Consistency refers to the consistent definitions and outlining of the aggregate index and its sub-indicators. Though operational environments, legislation and other internal or external issues may vary over time, the aggregate index needs to be consistent in order to provide valuable and solid information for the case company. Since the theoretical framework of the study reveals that sustainability can be defined in various ways (Keeble, Topiol & Berkeley, 2003; Mendoza & Prabhu, 2003.), the consistency in the definitions for the case company's aggregate sustainability index is crucial. This was presented by the interviewees too. Transparency on the other hand means that the contents of the aggregate index are clearly visible for the readers. The contents that should be presented with the aggregate index are the chosen sub-indicators, their figures and weights.

The issues related to sustainability are highly complex, as this research frequently mentions. Hence, the stakeholders are always going to need proper explanation about the issues behind any kind of sustainability metrics, whether singular or aggregated. The researcher points out that an underlying issue is also whether the stakeholders have relevant understanding of the sustainability indicators as well. Stakeholders need to be able to understand the changes within the single sub-indicators, so that they are capable of making interpretations based on the aggregate index. The case company's sustainability performance measuring already includes some indices from certain sustainability areas, such as social sustainability. Including these indices into the aggregate sustainability index is complex, since there is a bigger burden of explaining the contents of both the aggregate index and the sub-indices inside it. It will be laborious for the readers too to comprehend what the aggregate index entails, if the sub-indicators are aggregate metrics also. Therefore the researcher suggests that the potential aggregate sustainability index will consist of clear and easily readable sustainability metrics and not complex indices.

Both the interviews and theoretical frame reveal a contradictory issue about an aggregate index: in order to produce a condensed figure, you need to give up the amount of details of the information presented. This contradiction is what determines how the stakeholder needs can be fulfilled. The information produced is not as detailed as in a singular instrument, but the advantages of the aggregate index arise from its ability to simplify the complex issues (Krajnc & Glavic, 2005a; Krajnc & Glavic, 2005b; Nardo et al. 2005a; Saltelli, 2007; Singh et al 2007). The underlying issue here is the audience to which the aggregate sustainability index is designed to provide information. Is the audience going to be satisfied with the aggregate and more universe index or are they going to demand more specific information about the issues? The aggregate index should be transparent and the different layers of the index should be visible for

the index readers. This enables the simplified picture of sustainability performance while providing the more detailed information at the same time. Hence, there is the possibility to look more closely at the detailed issues, if they require more attention.

As presented, an aggregate index may possibly be too complex an instrument. Few interviewees stated that they would especially value simplicity in a potential aggregate sustainability index. One interviewee questioned whether the simplicity will remain if too many sustainability issues are aggregated. Hereby the researcher emphasizes the prior proposal that not too many sub-indicators should be included into the aggregate index. The correct amount of sustainability sub-indicators is a subjective issue though.

The findings and theory (Tanzil & Beloff, 2006; OECD, 2008) show that it is possible to use the aggregate sustainability index to compare the different units' sustainability performance. The operational environments and the restriction that they bring to the units need to be notified when looking at the performance comparison. Here, providing the different layers of the aggregate sustainability index is of assistance, since it provides the opportunity to look into the individual sustainability sub-indicators and therefore detect what causes the units' performance benchmarking in the certain level. The researcher does not perceive it reasonable to utilize of an aggregate sustainability index for comparing the sustainability performance to competitors, because of the reasons determined in the interviews: comparisons cannot be made between industry competitors since there is no commonly accepted aggregate index that the industry companies are using. If companies were to implement a mutual aggregate sustainability index, then surely it could be used for competitor comparison. At least for now it seems that such commonly accepted aggregate index is not being developed by industry, though both some interviewees and previous research (Krajnc & Glavic, 2005a; Krajnc & Glavic, 2005b; Singh et al. 2007; OECD, 2008) present that aggregate indices are gaining popularity and acceptance.

5.1 Suggestion for the Case Company: an Aggregate Environmental Index

Based on the findings from the interviews and the theoretical framework, the researcher suggests a layers approach for the aggregate sustainability index for the case company. This means that the aggregate index is provided in a manner that reveals the contents of the aggregate index, so the different 'layers' of the index are presented. The layers are presented sequentially. The aggregate sustainability index should be based on the case company's existing sustainability indicators and it should be developed as an add-on for the sustainability performance measuring. Hence, no existing sustainability measures should be replaced with the aggregate index. Regardless of the benefits that an aggregate sustainability index may bring for the case company,

the researcher finds that there is a quintessential need for the existing sustainability indicators and therefore the aggregate index cannot in any case replace them. Both the interviews and previous research (Li et al. 2012) support this claim.

The researcher suggests outlining the scope of the aggregate sustainability index into the environmental aspects only, as some of the interviewees suggested. The researcher perceives this as the most reasonable and beneficial way to aggregate the sustainability measuring. The aggregation of all the three dimensions of sustainability is difficult at the least and misleading at the worst. Therefore, the final suggestion for the index is actually an aggregate environmental index. The researcher sees that there is a demand for an aggregate environmental index in the case company, especially in the communication of division and corporation sustainability management and amongst the customer contact personnel. As presented earlier in the research, by defining the borderlines of the aggregate index into environmental issues, more uniform issues are aggregated and therefore the understanding of the aggregate index is enhanced. This also makes the choosing of the sub-indicators easier, when the scope is only on the environmental indicators. Also, the amount of potential indicators to be chosen is significantly smaller, when an environmental approach is chosen. The researcher proposes that not too many sub-indicators are to be aggregated into the index. Also too complex, cumulative sub-indicators should not be chosen in order to support the understandability of the aggregate index.

The contents of the index should be presented in a straightforward way and here the layers approach is of assistance. The layers should include information on 1) the aggregate index figure, 2) the sub-indicators figures (i.e. the sustainability indicators), 3) how the sub-indicators are weighted and possibly 4) how the sub-indicators are measured. Presenting the sustainability indicator calculations with the aggregate environmental index is not obligatory, but the researcher sees that this would improve the transparency of the index and consolidate that the index readers are able to form comprehensive and reliable understanding about the environmental performance. The levels-approach will give the opportunity to also monitor the sub-indicators of the index easily. By presenting the sub-indicator information with the index itself, the readers can make an estimate on what has affected the index developments and to what extent. All in all, the researcher sees a transparent index as the only reasonable suggestion regarding the sustainability performance aggregation. The layers-approach will support the transparency of the index, which is clearly appreciated by the index readers, despite them being internal or external stakeholders of the company. With the levels approach it will be visible for the reader how the index is constructed. As Li et al. (2012) presented, in order to make further improvement actions one must look at the individual sub-indicators to see what issues in particular need to be developed. The layers approach will therefore show how the sub-indicators have been developing. This way the index readers have the ability to go to the source of the potential difficulties in the performance, when the sub-indicators detect how the specific performance in differ-

ent areas has developed. Thus, additional explanations for the entire index development can be given with the information retrieved from the sub-indicators.

The case company itself needs to determine the stakeholders, who are to be addressed with the aggregate environmental index. A clear definition for the chosen stakeholders needs to be made. Not all stakeholders can or should be addressed with the aggregate environmental index. The stakeholders relevant to corporate sustainability communication, customer interface and management are the groups that the researcher recommends to be targeted with the aggregate environmental index. The case company should clearly define the purpose of use of the aggregate environmental index before constructing it. As established before, different needs can be met with the index and therefore it should be strategically defined what the index is to be used for. For instance monitoring purposes and benchmarking are possibilities of use that the researcher sees for the aggregate environmental index.

The challenges of constructing an aggregate environmental index can be answered with effective and thorough communication and transparency. Clear communication about the contents of both the sustainability indicators and the aggregate environmental index is needed to provide stakeholders with the proper and realistic view on the issues that occur in the sustainability performance of the case company. Many interviewees presented that the knowledge base of different stakeholders vary. Therefore the aggregate environmental index needs to be explicit so that different stakeholder groups can interpret it. The researcher assess that the knowledge of internal stakeholders can potentially be controlled better compared to external ones. Here communication and stakeholder training could be applied to enhance the sustainability related knowledge.

6 CONCLUSIONS

The main objective of this research was to examine how the sustainability performance measuring of an industrial company could be aggregated. The prerequisites and functions for an aggregate sustainability index and the needs of stakeholders were used as the basis for estimating the potential to producing an aggregate sustainability index. As the theoretical framework and the interviews show, it is indeed possible to aggregate the sustainability measuring of the case company. Diverse benefits could potentially be generated with an aggregate index, but the aggregation of sustainability metrics is challenging. The challenges of an aggregate sustainability index needs to be taken into consideration when contemplating the construction of an index. Since sustainability covers extremely diverse issues, also an aggregate sustainability index can be generated with different ambitions and outcomes. Therefore it is essential that an aggregate index is generated with a clear perspective about the desired contents and objectives. These will define and guide in the different decisions during the aggregation process. The most significant issues to be determined are the scope of the aggregate sustainability index and the sub-indicators chosen. This research makes a general suggestion of an aggregate environmental index for the case company. More precise suggestions about the targeted stakeholders or the determined weights for the sub-indicators could not be done based on this research. The more precise details of the index are left for the case company to determine. The main contribution of this research is to present that an aggregate sustainability index can be formed for the case company with various objectives and that the environmentally oriented perspective for the index is seen as the most reasonable approach. The presented prerequisites and functions that the case company has for an aggregate sustainability index is also a significant input that this research provides for the case company.

The research presents that the case company should build its aggregate sustainability index based on the company's sustainability indicators. The recommended perspective is the environmental performance of the case company, by forming an aggregate environmental index. In order to meet the needs of the

organization itself or its stakeholders and also to prevent the challenges related to an aggregate index, the aggregate environmental index should be formed in a manner that displays the different layers of the index. Consequently, the index will be transparent and provide also detailed enough information for the index readers. Furthermore, the index readers are able to make appropriate conclusions based on the aggregate index.

6.1 Limitations, Evaluation and Future Research

As most studies, this research contains some limitations, which should be acknowledged. By choosing a case study approach, this study portrays the findings that apply to the case company. As discussed in chapter 2 and the methodological choices of the study, case study approach does not provide universally applicable findings. Because of the case study approach, the interviewees for the semi-structured interviews were chosen from within the company and hence supporting the viewpoint of the case company only. Also, since sustainability issues are highly industry, company and regionally specific, interpretations based on this research cannot be made for companies working with different industries of different countries. Also, depending on company's sustainability strategy and approach, the needs for aggregation of sustainability measuring may be tremendously different. Nevertheless, too general assumptions cannot be made based on the results of this research. Furthermore, the themes for the interviews were chosen in accordance with the case company's interest. In the future, the different aspects of the research subject should be studied through different perspectives. Also, by interviewing eight people in order to collect the data, the number of perceptions about the research issue is limited. This limitation was aimed to be minimized by choosing the interviewees from various operations of the case company. This way the researcher was able to dispense as extensive viewpoints as possible.

The research aimed to look into the opinions of different case company stakeholders, which the interviewees were to represent indirectly through their perceptions. Yet, the interview questions did not possibly reflect this objective enough, and therefore the interviewees were not able to specify their answer according to different stakeholders. The interviews covered more general level discussions with most of the interviewees. This was something that the researcher could have improved by forming more stakeholder-specific questions and this way to enhance the reflection to more specific stakeholders. On the other hand, this was difficult to do, since the stakeholder groups were not determined in advance, but the interviewees were to identify the relevant stakeholders themselves. The more specific outlook to different stakeholders is something that future research could concentrate on. The researcher sees it advantageous, if the case company were to choose the specific stakeholder groups, which are looked into in the future studies. The previous research about aggregate sustainability indices handles stakeholders as a uniform group and does

not specify the stakeholder groups and their different approaches to the index. Consequently a more specific outlook to different stakeholder groups is needed. Since the interviews established that an aggregate sustainability index cannot be utilized by all the various stakeholders of the case company, a more specific assessment of the views of specific stakeholders could be useful for both the case company and academia. The theoretical framework of the study focuses on the aggregation of sustainability performance on a wider perspective, since there is not much hands-on research about the aggregated sustainability performance on an industrial company level. This somewhat undermines the theoretical foundation of the research. The suspected reasons behind the lack of previous research on this level were presented in the theoretical review.

There are multiple approaches that could be chosen when it comes to an aggregate sustainability index and no clear and uniform way to form an aggregate index was revealed with the interviews. Therefore the researcher could not focus on a certain approach for the aggregation and the research did not have the ability to go much into depth about a specific and clearly defined aggregate index. Though, the aim was to look into how the sustainability measuring of the case company could be aggregated and this aim was met. Regardless, no specified inquiries could be made for the interviewees, since the focus was on the overall possibility to aggregate the sustainability indicators. Future research could benefit from a scope that is specified towards a clearly defined aggregate sustainability index and its functionality.

Tuomi and Sarajärvi (2002) emphasize that in qualitative research it is essential that the researcher presents the research process in a detailed and clear manner. This enables the readers to properly evaluate the reliability of the research. Confidential treatment of individual interview responses and the need to protect the confidentiality concerning some details of the case company, caused challenges for the public reporting of this case study. Regardless of this, the researcher aimed to present the research process in a clear and open manner for the readers. Though the interview questions and data could not be provided as appendices, because of the confidentiality, the researcher strived to present the contents of the interviews transparently within the research text. Despite the challenges and above mentioned limitations, this research provides a coherent and comprehensive outlook on the research topic.

All in all, future research on the topic of aggregating sustainability indicators is needed. Since the amount of company and industry oriented research on the topic is so scarce, the researcher depicts the importance of continuing the work that this study has contributed to. Also, the researcher would suggest open participation of industry and companies in the process. If companies would collaborate in participating in this area of research, industry wide applicable information could be produced and this could be used internally and externally to develop the companies' performance. As presented earlier in the research, especially case studies on the topic would provide valuable information about aggregate sustainability indices.

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