Evaluating the Implementation of Sustainability Management Systems in Green-tech Companies

A case study at Northvolt AB

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Industrial and Management Engineering, master's level
2021

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Preface

This thesis is the final effort of the five years of studying M.Sc. Industrial Engineering and Management with a master's in Quality Management at Luleå University of Technology. It has been a rewarding and inspiring time working with Northvolt Labs in Västerås. Certain people have made this thesis special and we would first and foremost like to express our gratitude to Ben Kuhn, our supervisor at Northvolt, who immensely supported us throughout the entire process. We would also like to thank our supervisor Helena Ranängen, who helped us tremendously with valuable insights when we needed guidance to move further. Ranängen is a prominent researcher in the research field and her contribution has made a huge difference for this thesis. Furthermore, a sincere thank you to our opponents Martin Berg, Oscar Blombäck, Mathias Lindkvist, and Mani Mostafaee who have contributed by reviewing our report drafts on several occasions. A special thank you to everyone at Northvolt for agreeing to be interviewed and for your interest in our work. We appreciate your commitment to helping us and we would not have been able to reach our result without your aid.

As this thesis is the concluding result of our time at Luleå University of Technology, we would like to thank our professors and teachers. Thanks to you, we are now prepared for the next chapter of our lives.

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Västerås 2021-06-03

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Västerås 2021-06-03

Abstract

In recent times, sustainability has become a top management priority as well as a competitive advantage for organizations. Green-tech companies that develop and commercialize innovations and technology, that protect the environment by alleviating environmental market failures while preserving natural resources, have increased as a result. Additionally, more companies pursue corporate sustainability (CS), which is a comprehensive term that includes CSR and the long-term effects of corporate actions to maximize the organization's contribution to SD. Management systems can help companies to achieve certain dimensions of CS, however, no single management system is comprehensive enough to capture the entire scope of CS. The most commonly used management systems related to CS are the quality management system ISO 9001:2015, environmental management system ISO 14001:2015, energy management system ISO 50001:2018, and occupational health and safety management system ISO 45001:2018. However, the adoption of multiple, separate MSs can lead to counterproductivity and difficulties in managing them. This issue is often solved by creating an integrated management system (IMS), defined as a fusion of two or more MSs. IMSs can enable the operationalization and implementation of CS into business processes and an IMS augmented with CS principles is defined as a sustainability management system (SMS). In literature, there are conceptual frameworks for the development of SMSs, but they lack empirical evidence in multiple industries and countries, especially in green-tech companies.

The study aimed to develop a framework for how green-tech companies can achieve an SMS. The aim was realized by studying state-of-the-art literature, testing the applicability of an SMS framework in a case study, evaluating the applicability, and suggesting improvements. The case study was done at a battery cell manufacturer, which was chosen because this industry faces a number of sustainability threats and is emerging rapidly parallel to the automotive industry's electrification. The originality of the work lies in testing the applicability of the current frameworks in practice at a green-tech company.

The main contribution of this study is the development of an updated framework for the implementation of an SMS in green-tech companies, based on the literature and empirical findings. The framework provides managers with an understanding of the path towards incorporating CS and working towards a sustainable development. Another contribution is the compliance analysis which can be used to evaluate the implementation of an SMS. The authors consider the findings to be applicable to other green-tech companies and battery cell manufacturers with a sustainability-focus. The framework adapted to the case study's circumstances shows how to apply the solution in practice.

Keywords: *sustainability management system, green-tech, corporate sustainability, integrated management system*

Sammanfattning

På senare tid har hållbarhet blivit högsta prioritet i företagsledningar eftersom det många gånger innebär konkurrensfördelar för organisationer. Så kallade green-tech-företag har utvecklats i takt med nutidens hållbarhetsutmaningar, i syfte att utveckla och kommersialisera innovationer och teknik som skyddar miljön och lindrar miljömässiga marknadsmisslyckanden, samtidigt som naturresurser bevaras. Allt fler organisationer arbetar numera också med *företags hållbarhetsarbete* (corporate sustainability, CS) vilket är ett omfattande begrepp som innefattar, utöver alla aspekter av socialt ansvarstagande (CSR), även ett långsiktigt perspektiv till hållbar utveckling. Arbetet med CS kan underlättas med ledningssystem specialiserade i varje dimension av CS, men enbart ensamma ledningssystem kan inte åstadkomma CS. De vanligaste ledningssystemen relaterade till CS är kvalitetsledningssystemet ISO 9001:2015, miljöledningssystemet ISO 14001:2015, energiledningssystemet ISO 50001:2018 och arbetsmiljöledningssystemet ISO 45001:2018. Företag som innehar flera olika ledningssystem upptäcker dock snart att det kan leda till kontraproduktivitet och svårigheter att hantera de olika systemen. Detta löses ofta genom att skapa ett integrerat ledningssystem (IMS) som definieras som en sammanslagning av två eller fler ledningssystem. Ett IMS kan möjliggöra integrering av CS in i ett företags processer och ett IMS kompletterat med CS definieras som ett hållbarhetsledningssystem (SMS). Det finns konceptuella ramverk för SMS i litteraturen, men de saknar empiri i många olika typer av industrier, företag och länder, inte minst inom green-tech.

Studien syftade till att utveckla ett ramverk för hur green-tech-företag kan uppnå ett SMS. Syftet kunde åstadkommas genom att studera aktuell SMS-litteratur, testa tillämpbarheten av ett SMS-ramverk genom en fallstudie, utvärdera tillämpbarheten och därefter föreslå förbättringsförslag gällande de studerade ramverken. Fallstudien utfördes på en battericellstillverkare eftersom denna industri står inför hållbarhetsutmaningar och växer parallellt med elektrifieringen av bilindustrin. Originaliteten i arbetet ligger i att testa tillämpbarheten för nuvarande ramverk i praktiken på ett green-tech-företag.

Studiens huvudsakliga bidrag är ett uppdaterat ramverk för implementeringen av ett SMS i green-tech-företag, baserat på litteratur och empiri. Ramverket kan bidra till att öka förståelsen i företagsledningar gällande den praktiska implementeringen av operativt hållbarhetsarbete. Ett annat bidrag är verktyget *compliance analysis*, som utvecklades i studien för att utvärdera implementationen av ett SMS. Författarna anser att studiens resultat är tillämpbart för andra green-tech-företag men även battericellstillverkare med hållbarhetsfokus. Det anpassade ramverket visar även hur studiens resultat kan tillämpas i praktiken.

Nyckelord: *hållbarhetsledningssystem,   green-tech,   hållbarhetsarbete,   integrerade ledningssystem*

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Nomenclature

Abbreviation	Stands for	Explanation
CS	Corporate sustainability	The augmented view of CSR that goes beyond legal requirements and includes all dimensions of sustainability and the long-term perspective of businesses.
CSR	Corporate social responsibility	Practices that companies do to act socially responsible, transparent, and meet their stakeholders' requirements
EMS	Environmental management system	Often defined as utilizing the MS standard ISO 14001:2015
EnMS	Energy management system	Often defined as utilizing the MS standard ISO 50001:2018
IMS	Integrated management system	Two or more management systems combined into one
MS	Management system	Used for managing an organization's interrelated parts of its business in order to achieve its objectives
OHSMS	Occupational health and safety management system	Often defined as utilizing the MS standard ISO 45001:2018 (replacing the old standard OHSAS 18001)
QMS	Quality management system	Often defined as utilizing the MS standard ISO 9001:2015
SD	Sustainable development	Development that ensures the needs of present generations without compromising the future generations
SDG	Sustainable development goals	The 17 goals acknowledged in Agenda 2030
SMS	Sustainability management system	An IMS with CS(R) aspects included

1. Introduction

This part gives the reader a brief introduction to the literature on sustainable development, management systems, and sustainability management systems. Thereafter, the problem description, aim, delimitations of the study, and an exhibit of the logical disposition of the report is presented.

1.1 Background

Sustainable development (SD) is defined as a development that ensures the needs of present generations without compromising the future generations (Brundtland, 1987). There are 17 sustainable development goals (SDG) and number 12, responsible consumption and production, has made sustainability a top management priority as well as a competitive advantage for organizations (Engert et al., 2016; United Nations, 2015). SDG number 7, affordable and clean energy, urges radical changes in technology to enable the usage of clean energy while also reducing energy consumption (United Nations, n.d.). The SDG are policy instruments aimed at influencing companies and industries to stay within the planetary boundaries, i.e., the earth's thresholds which must not be exceeded (Rockström et al., 2009). As a result of this new focus in society, more ventures and green-tech companies have emerged as well as a plethora of research on the subject. The term green-tech has many synonyms including sustainable entrepreneurship, environmental entrepreneurship, corporate greening, to mention a few (Cohen & Winn, 2007; Dean & McMullen, 2007; Schaltegger & Wagner, 2011). Nonetheless, the consensus and definition used in this report is, as described by Meyskens and Carsrud (2013), that green-tech companies develop and commercialize innovations and technology that protect the environment by alleviating environmental market failures while preserving natural resources. However, being a green-tech company does not guarantee that the company is sustainable, instead, the business case for sustainability must be actively managed (Schaltegger & Wagner, 2008). Regular and green-tech corporations alike can, in addition to their business case, also pursue Corporate Sustainability (CS), which is the contemporary definition of organizational sustainability practices (Sarkar & Searcy, 2016). In the past, Corporate Social Responsibility (CSR) has been a focal point for companies wanting to assume social responsibility (Elkington, 1997), but in recent years it has undergone a substantial evolution and, likewise CS, it now accounts for ethical, economic, stakeholder, and sustainability dimensions (Sarkar & Searcy, 2016). However, the discrepancy between the two is that CS incorporates all aspects of CSR (Ashrafi et al., 2018) and, most importantly, also the long-term effects of corporate actions (Bansal & DesJardine, 2014; Schwartz & Carroll, 2008). CS thus goes beyond complying with minimum levels of legislature, regulations, and stakeholder requirements in the aim to maximize an organization's contribution to SD (Sarkar & Searcy, 2016; Sroufe, 2017; Van Marrewijk, 2003). Notwithstanding being a green-tech company, it is widely known that the successful implementation of CS remains a difficult task for many companies. Scholars mean that specific dimensions of CS can be addressed through the implementation of

management systems (MSs) specialized in that dimension (Asif et al., 2013; Wagner, 2007). An MS is defined as *"the way in which an organization manages the interrelated parts of its business in order to achieve its objectives"* (the International Organization for Standardization [ISO], n.d.).

Besides being beneficial for CS, an MS can also improve a company's customer value, resource utilization, efficiency, and strategic alignment (Asif et al., 2013; ISO, n.d.; Ranängen & Zobel, 2014). The most used MSs related to CS are Quality MSs (QMS), Environmental MSs (EMS), Energy MS, and Occupational Health and Safety MSs (OHSMS) (Naden, 2018; Poltronieri et al., 2019). For companies acting in highly regulated sectors, such as electric power and transmission, healthcare, and defense, several MSs may be required to properly document and control all operations in the organization (ISO, n.d.). However, organizations that have multiple, separate MSs can experience their counterproductivity and the difficulty to manage them (Oliveira, 2013). The issue is often solved by creating an integrated management system (IMS), defined as a fusion of two or more MSs (Poltronieri et al., 2019). The most common ISO MS standards to integrate, because of their similarities, are ISO 9001 (QMS), ISO 14001 (EMS), and OHSAS 18001 (as of 2018 replaced by ISO 45001) (OHSMS) (Jørgensen, 2008; Karapetrovic, 2003; Oliveira, 2013; Wilkinson & Dale, 2000). Through a single set of interconnected processes, meaning the same human, financial, informational, and material resources, an IMS can meet the requirements of all stakeholders with fewer resources and, thus, generate higher organizational efficiency than isolated MSs (Karapetrovic, 2003; Nadae et al., 2020). Regarding CS, the integration of MSs has proven to be an enabler of the successful implementation and operationalization of CS (Asif et al., 2013; Nawaz & Koç, 2018; Rebelo et al., 2016). Scholars define an IMS consisting of, for example, a QMS, an EMS, and an OHSMS, augmented with CS principles as a Sustainability Management System (SMS) (Asif et al. 2013; Ranängen & Lindman, 2020; Ranängen & Zobel, 2014) and SMSs are believed to be one way to contribute to SD (Esquer-Peralta et al., 2008). An SMS in this report has CS integrated horizontally and vertically across the organization (Asif et al., 2013; Rocha et al., 2007; Sroufe, 2017).

1.2 Problem Description

Previous studies have developed conceptual models and frameworks for integrating CS into a company's business processes (Asif et al., 2013; Castka et al., 2004; Nawaz & Koç, 2018; Rocha et al., 2007). Multiple scholars also provide frameworks and models for how an IMS, an important part of an SMS, should occur (Oliviera, 2013; Rebelo et al., 2016; Rocha et al., 2007). However, there is a scarcity of empirical evidence for both the applicability of the conceptual SMS frameworks and models and the integration of CS into strategic management (Asif et al., 2013; Engert et al., 2016; Gianni et al., 2017; Nawaz & Koç, 2018). In the finite amount of empirical evidence that does exist, the countries and industries in which it has been carried out pose a limitation to the generalization of the results because a significant part of CS, as well as MSs, revolves around governmental laws and industry requirements (ISO, n.d.). This entails that the SMS frameworks and models need to be further tested in other countries and industries.

Additionally, many companies, especially in the manufacturing industry, have begun transitioning towards Industry 4.0 (Ghobakhloo, 2018) and this paradigm shift might entail new aspects that a sustainable company, and an SMS, likewise, must consider (Lopes de Sousa Jabbour et al., 2018; Rojko, 2017). Finally, Meyskens and Carsrud (2013) argue that there is a scarcity of empirical studies on nascent green-tech companies which, together with the general lack of empirical evidence on SMS frameworks, comprise a major research gap in the literature. An industry that is of special interest to SMS models within the green-tech industry is the battery cell industry, firstly because it faces several sustainability threats, for instance, the sourcing of raw materials (OECD, 2016), and secondly because it is emerging rapidly parallel to SDG 7 and the automotive industry's electrification and high demands of sustainable batteries (World Economic Forum, 2019). A study covering the applicability of SMS frameworks in this industry will contribute to the literature in two ways: through acquiring empirical evidence of SMS frameworks' applicability and through new insights into the research gap of SMS frameworks for green-tech companies.

1.3 Aim and Objectives

The aim of this study is to *develop a framework for how green-tech companies can achieve an SMS.*

To realize the aim, the following objectives were developed:
1. Study state-of-the-art literature in the research field of SMS implementation.
2. Test the applicability of a framework for SMS implementation in a case study.
3. Evaluate the applicability of the framework in practice and suggest improvements.

1.4 Delimitations

The thesis will be limited to 20 weeks of time during spring 2021. Therefore, one important delimitation has been acknowledged to fulfill the aim in the limited time frame: this study will not implement any MSs, merely recommend actions for implementing an SMS.

1.5 Disposition

The remainder of the report is organized into four sections. First, an overview of the relevant literature is provided. Thereafter, an outline of the methodology used in this report is described. The empirical findings and analysis are presented in chapter 4, followed by the conclusions in chapter 5. A final discussion, implications, and suggestions for future research are found in chapter 6.

2. Theoretical Framework

This chapter presents literature on corporate sustainability, integrated management systems, benefits of and barriers for implementation of such a system, and sustainability management systems. Different models and frameworks for the implementation of IMSs and SMSs are introduced.

2.1 Corporate Sustainability

As already stated in the introduction, CSR and CS are converging terms, and although some scholars mean that there is a significant difference (Ashrafi et al., 2018; Bansal & DesJardine, 2014; Schwartz & Carroll, 2008), they are often treated as more or less the same. Therefore, both terms will be used in this literature review and termed as by the reference. With that said, Gianni et al. (2017) argue that in the business context, sustainable development (SD) is labeled corporate sustainability (CS). According to Vermeulen and Witjes (2016), CS has three dimensions, *issues*, *place,* and *time*, where the latter builds on the principle of generational equity, in line with Brundtland (1987). The authors further argue that companies' contribution in this dimension is to identify CS trends in their market and pursue radical changes to create positive long-term impacts on society and ecology (Vermeulen & Witjes, 2016). Rocha et al. (2007) state that an organization aiming at integrating CS into the business must not only consider today's stakeholders, but also future generations of stakeholders. A firm's measurable contribution to SD is termed 'CS performance' and is defined as meeting and balancing present and future stakeholder's needs in the economic, environmental, and social pillars while assuring the short-term and long-term perspective (Artiach et al., 2010).

Earlier research has focused on CSR and shown that implementing CSR principles and practices has the potential to make corporate practices more transparent and socially responsible (Asif et al., 2013). Since 2010, ISO 26000 serves as a guideline for social responsibility aspects within a company (ISO, 2010). In ISO 26000 it is described that social responsibility became a solicitude for organizations when they realized that they have an important role to play in achieving SD (ISO, 2010). Jørgensen (2008) describes the concept of CSR as having a strong focus on suppliers and other stakeholders in matters concerning human rights, child labor, forced labor, work hours, health and safety, among else, which is congruent with ISO 26000 (ISO, 2010). CSR is said to be practiced by companies that knowingly do not harm their stakeholders, and if harm is discovered and brought to their attention, they rectify it (Campbell, 2007). As long as corporations meet the expectations of key stakeholders, such as investors, employees, consumers, suppliers, or the local community in which it operates, it is regarded as socially responsible (Campbell, 2007). However, Parmar et al. (2010) state that the concept of CSR only concerns the value a company creates if it is affecting society negatively. Notwithstanding the foregoing, the more comprehensive term CS incorporates all aspects of CSR (Ashrafi et al., 2018) as well as the long-term effects and positive

influences on society, which goes beyond complying with minimum levels of legislature, regulations, and stakeholder requirements (Sarkar & Searcy, 2016; Van Marrewijk, 2003). CS and CSR are commonly referred to in the context of integration with MSs (Castka et al., 2004; Nawaz & Koç, 2018; Rocha et al., 2007) and more specifically how MSs can ease the operationalization of CS or CSR into business processes (Asif et al., 2013; Castka et al., 2004).

2.2 Integrated Management Systems

ISO (n.d.) defines an MS as *"the way in which an organization manages the interrelated parts of its business in order to achieve its objectives."* According to ISO (n.d.), effective MSs can generate more efficient use of resources, improved financial performance, improved risk management, and protection of people and the environment. The incentive to implement an MS might be triggered by a company's stakeholders or regulatory requirements (Asif et al., 2010; Asif et al., 2013). However, which MSs an organization chooses to implement depends on the unique circumstances in that organization (Rocha et al., 2007). Accordingly, MSs are commonly used to enhance a business' performance connected to that specific MS (Qi et al., 2013), and the most well-known and used MS standards globally relating to CS performance are ISO 9001, ISO 14001, ISO 50001, and OHSAS 18001 (as of 2018 replaced by ISO 45001) (Jørgensen, 2008; Naden, 2018; Poltronieri et al., 2019). These relate to the QMS, EMS, EnMS, and OHSMS, respectively. An organization may certify their MS standards by demonstrating to a third-party auditor that they have developed and implemented management processes in line with the requirements of these standards (Qi et al., 2013). Certification might be necessary to meet customer and investor requirements or to gain a competitive advantage (Qi et al., 2013). Incentives to certify MSs could stem from the need to disclose information about a company's sustainability practices to shareholders or the government. Qi et al. (2013) further allege that this pressure made companies, especially publicly listed, more likely to acquire ISO 14001 and 45000 certifications.

Naturally, a company may have several MS standards in place, which is often the case for large multinational companies in highly regulated sectors (ISO, n.d.). However, multiple isolated MSs strain organizational resources and are insufficient in terms of needed time, money, and personnel to handle the systems (Salomone, 2008; Zutshi & Sohal, 2005). This is often solved by creating an integrated management system (IMS), defined as a fusion of two or more MSs (Poltronieri et al., 2019). To enhance the compatibility and ease the joint implementation and integration, the structure and content of these standards have become very similar (Karapetrovic, 2002; López-Fresno, 2010; Mustapha et al., 2017; Rebelo et al., 2016). The Plan-Do-Check-Act (PDCA) improvement cycle (Deming, 2018) has become the foundation for many of these standards which further increases their compatibility (Labodová, 2004, López-Fresno, 2010; Panagiotakopoulos et al., 2015). The most common ISO MS standards to integrate, due to their similarities, are ISO 9001, ISO 14001, and ISO 45001 (Jørgensen, 2008; Karapetrovic, 2003; Oliveira, 2013; Wilkinson & Dale, 2000). These standards as well as ISO 26000 are explained in table 1 below.

Table 1. Description of the QMS, EMS, OHSMS MS standards, and the social responsibility guidelines

ISO standard (corresponding MS)	Focus	Benefits from implementation
ISO 9001:2015 (QMS)	Customer satisfaction, creating products that satisfy customer expectations with a process-oriented perspective (Qi et al., 2013).	• Provide a basis for initiatives related to SD (ISO, 2015b). • Improve competitive advantage through enhanced processes and products (Oliveira, 2013).
ISO 14001:2015 (EMS)	Addressing immediate and long-term environmental impacts from the company's products, processes, or services (ISO, 2015a; Qi et al., 2013).	• Comply with countries' environmental legislation, • Increase customer satisfaction, • Access to domestic and international markets, • Waste reduction, • Improve brand image, • Compliance with pressure from external groups, • Increase environmental awareness, and • Improve environmental performance overall (Oliveira, 2013).
ISO 45001:2018 (OHSMS)	Managing occupational health and safety risks, prevention of work-related injuries, ill health, and continued improvement of a firm's OHS performance (ISO, 2018).	• Eliminate hazards, risks and take preventive and protective measures related to these (ISO, 2018). • Fulfill health and safety legislation and other requirements connected to an organization's employees (ISO, 2018). • Enhance company image (Salomone, 2008). • Continuous improvement in these aspects (Salomone, 2008).
ISO 26000:2010 (guidance on social responsibility)	Guidelines on social responsibility principles and how to integrate socially responsible behavior into an organization, however, it is not a certifiable MS standard (ISO, 2010).	• Manage CSR aspects (Ranängen & Zobel, 2014). • Guidance on ways to engage with stakeholders, integrate socially responsible behavior into the organization and assist organizations in contributing to SD (ISO, 2010).

Authors point out the need for a unified definition of an IMS (Wilkinson & Dale, 2010), and state that the resulting IMS is dependent on which MSs the organization integrate, which in turn is dependent on the organization's overarching objectives (Nadae et al., 2020; Wilkinson & Dale, 2010). Thus, the IMS is limited to what the company can allocate to the integration in terms of

MSs, resources, and support (Wilkinson & Dale, 2010). The integration may occur at different levels (Poltronieri et al., 2019). Abad et al. (2014) argue for three levels of integration of increasing complexity, the first being document harmonization, followed by partial integration, and lastly full integration. The absence of company culture and climate suitable for the aims and objectives of the integration will solely result in a merge of documentation (Wilkinson & Dale, 2010), i.e., the first level in Abad et al. (2014). This level is driven by the urge to reduce documentation, costs, and the time needed to manage separate MSs (Salomone, 2008) as well as audit costs (Asif et al., 2010). Wilkinson and Dale (2000) further allege that organizations with multiple operational sites can see a benefit of document harmonization as it leads to all entities handling documents in the same way. The partial level of integration is built upon the first level but also includes integrating one or two components that comprise the process map, i.e., one or two of system support processes, strategic processes, or audit processes (Abad et al., 2014). This perspective aligns with the "systems approach", which is an integration on the strategic level, also known as a strategic alignment, cascading downward in the organization to benefit all stakeholders, both internally and externally (Asif et al., 2010). Rocha et al (2007) describe the systems approach as beneficial for integrating CS because it allows integration with the existing business infrastructure. The full integration is achieved when the documentation structure and all three components of the process map are fully integrated (Abad et al., 2014). Jørgensen (2008) argues that the full integration also concerns continuous improvement, identification of synergies between different subject areas, and the creation of a culture for learning. The partial and full integration, therefore, exemplifies the desirable scenario when the company's culture and climate, as argued by Wilkinson and Dale (2010), are in favor of the integration.

2.2.1 Benefits of Integration

Abad et al. (2014) showed that there is a positive relationship between a full integration and corporate benefits, such as better quality of products and/or services. Other scholars emphasize the complete strategic alignment and stakeholder satisfaction that it implies (Asif et al., 2010; Nunhes et al., 2019; Oliveira, 2013). The systems approach is further argued to be beneficial at the operational level because it treats the IMS as part of the organization, rather than a subsystem (Asif et al., 2010; Rocha et al., 2007). Overlapping roles and responsibilities are mitigated in an IMS, which appoints the increased resource efficiency (Oliveira, 2013; Simon et al., 2011). An IMS can provide an opportunity for organizational competitiveness and sustainable business success (Rebelo et al., 2016). Integration also provides an opportunity for change management, which can help define the sustainability initiative and desired culture, practices, and products (Sroufe, 2017). In the study by Zutchi and Sohal (2005), the organizational changes associated with the integration also led to increased awareness of interrelations between different MSs, which was proposed as a success factor for the integration. This awareness and interdisciplinary cooperation are beneficial for sustainability-oriented learning processes when integrating CS into an organization (Siebenhüner & Arnold, 2007). However, the integration is complex, time-consuming, and resource-heavy (Asif et al., 2009; Gianni and Gotzamani, 2015; Santos et al., 2011). A summary of the potential benefits and risks of IMS implementation is presented in Appendix 1.

2.2.2 Barriers for Integration

Several barriers may pose challenges in the integration of MSs. Asif et al. (2010) state that employees' resistance to change, i.e., their behavior and attitudes, was the most important issue to mitigate during the integration process. Furthermore, employees' behavior and attitudes can act as a determining factor for successfully implementing and maintaining an IMS (Zutshi & Sohal, 2005). Zutshi and Sohal (2005) further argue that the individual loss in power might be yet another factor that is detrimental to the integration process. However, this resistance to change can be addressed through communication, education, and training (Asif et al., 2010; Zutshi & Sohal, 2005). Engert et al. (2016) emphasize internal communication as particularly important during the integration process. Similarly, Abad et al. (2016) highlight the importance of communication plans and explaining the expected benefits from the integration to the employees, while clarifying their role in the process. An IMS based on an existing QMS, which is already accepted and practiced within the organization, has been shown to lead to higher acceptance and less resistance among employees (Zutshi & Sohal, 2005). Abad et al. (2014) showed that 80 percent of the companies follow this adoption sequence of starting with ISO 9001, then ISO 14001, and lastly ISO 45001. However, the level of CS integration in an organization may be reduced due to an incongruity between the organization's identified barriers to change and the strategies it applied to overcome these barriers (Lozano, 2013). Lozano (2013) further states that to overcome the resistance to change, a change management process that addresses individuals, groups, the company, and their respective attitudes is effective. Acceptance and understanding among employees as to why the integration is needed and beneficial for the organization is therefore an essential barrier to overcome in the process of the integration (Abad et al., 2016; Asif et al., 2010; Zutshi & Sohal, 2005).

Searcy et al. (2012), who studied barriers for implementing ISO 14001, showed that there is often a lack of a change management process within organizations, although it is seen as a critical component for maintaining an IMS. Organizational change management is defined as moving from a current state towards a more desirable one, through minor or major changes (Lozano, 2013). The higher the level of integration, the bigger the need for structured change management (Searcy et al., 2012). A structured approach to change management is the ADKAR model (Hiatt, 2006), which focuses on people's change adaptation. ADKAR is the result of 14 years of research in over 2600 organizations (Hiatt, 2013). Five building blocks *Awareness, Desire, Knowledge, Ability,* and *Reinforcement* (ADKAR) comprise the model and are used as a tool for creating an understanding of the change and how it should be managed in an organization (Hiatt, 2006). According to Hiatt (2006), all five elements must be in place for change to be realized. Below is each block briefly described as explained by Hiatt (2006):

Awareness recalls the individual's understanding of the change, why it is being made, and what the risks are of not committing to that change.

Desire refers to an individual's willingness and choice regarding how they support and engage in a change. This element therefore includes how an individual is influenced by the nature of the change and thus speaks to intrinsic motivators, unique to every individual.

Knowledge represents the information and educational aspects that are necessary to know how to change. This knowledge includes information about behaviors, processes, tools, systems, job roles, and techniques that are needed to implement a change.

Ability is the action of turning knowledge into change. This element is achieved when a group, or an individual, has demonstrated the capability to implement the change at the required performance level.

Reinforcement is the last step and represents those internal and external factors that sustain a change. External reinforcement includes recognition, rewards, and celebrations that are linked to the realization of the change. Internal reinforcements refer to a person's internal satisfaction in regard to the achieved change on a personal level.

2.3 Sustainability Management Systems

Besides being beneficial for internal resource efficiency, an IMS can provide a stable basis for the integration of sustainability (Asif et al., 2013; Rebelo et al., 2016). Jørgensen (2008) means that an IMS is the first step towards more sustainable MSs and that an IMS can provide the opportunity to improve an organization's CS performance, but not guarantee it. An SMS, often described as an IMS augmented with more CS aspects (Ranängen & Lindman, 2020), could be one way to contribute to SD (Esquer-Peralta et al., 2008). However, the definition of an SMS is rather subjective due to the ambiguity of what is regarded as sustainability and what sustainable practices truly are (Esquer-Peralta et al., 2008). Ranängen and Zobel (2014) mean that congruence with the social responsibility guidelines ISO 26000 along with developing an IMS consisting of QMS, EMS, and OHSMS could be one way to achieve an SMS. This approach of Ranängen and Zobel (2014) manages stakeholders to a higher degree, which is said to be beneficial for businesses since stakeholders may provide an organization with essential means of support but could withdraw their support if their needs are not met, hence causing the organization damage (Garvare & Johansson, 2010). With support in that CS is the contemporary definition of a company's contribution to SD (Sarkar & Searcy, 2016), the definition of an SMS that will be used is an IMS with CS aspects incorporated horizontally and vertically into the organization, in line with the approaches found in the literature (Asif et al., 2013; Rocha et al., 2007; Sroufe, 2017), see figure 1.
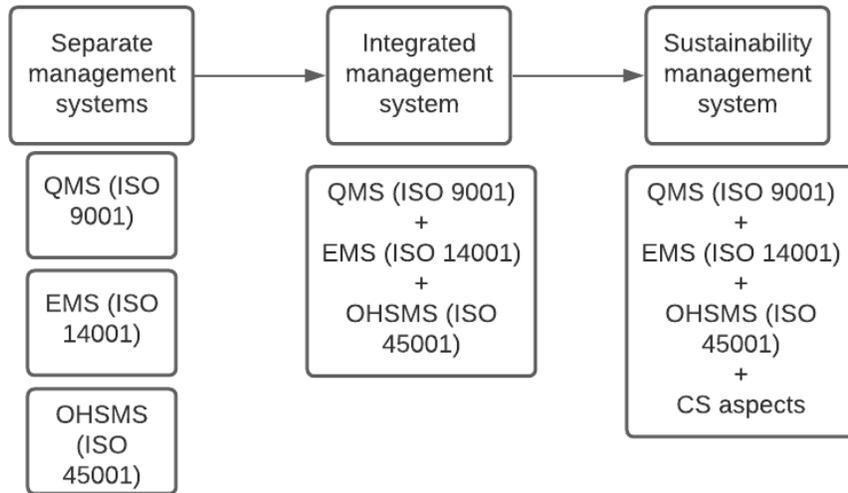
Figure 1. Relationship between single MSs, IMS, and SMS

When integrating CS into organizational processes, fundamental changes in processes, products, systems, and communication occur (Siebenhüner & Arnold, 2007). Internal communication becomes a key enabler for sustainability-oriented learning within organizations and could be realized through internal networks or internal communication platforms (Siebenhüner & Arnold, 2007). The authors claim that the organization's CS strategies, objectives, and measures must be transparent and communicated internally, and Engert et al. (2016) state that transparency can be increased by internal and external communication regarding sustainability issues. Firms that integrate multiple MSs and CS concerns, i.e., implement an SMS, may satisfy a variety of stakeholders' needs and expectations (Gianni et al., 2017). Since both CS and IMS share a stakeholder orientation, the combination of these into an SMS can lead to positive synergies in terms of CS performance (Gianni et al., 2017). Nevertheless, it is important to remark that the actual CS performance depends on internal commitment and capability of continuously improving (Jørgensen, 2008). Furthermore, the implementation of CS is complex, and deficiencies in MSs, organizational structure, culture, leadership, and employee behavior can often act as barriers to implementation (Engert et al., 2016). Rocha et al. (2007) emphasize leadership and top management commitment in the integration of CS and stress that a sound business case for SD is one key to gain top management commitment.

2.4 Frameworks and Models for IMS and SMS

Frameworks and models for both IMS and SMS have been studied, since an IMS can provide a foundation for CS (Asif et al., 2013; Jørgensen, 2008), and an IMS augmented with CS is defined as an SMS. As can be noted, different scholars refer to their work as either frameworks, models, or guidelines, but for this study the label is irrelevant, and they are treated as equally important. To fulfill the first objective in this study, a table consisting of prominent authors in the field and their frameworks' key features has been assembled, see table 2.

Table 2. Key features of SMS and IMS frameworks and models

Author(s)	Framework/ Model	Key features	IMS/SMS
Asif et al. (2013)	Framework	Combines top-down and bottom-up stakeholder approaches to integrate CSR into business processes, following the PDCA cycle.	SMS
Castka et al. (2004)	Framework	Framework for a CSR MS that is compatible with a QMS. Transformation of stakeholder's expectations into operations and the monitoring of it.	SMS
Karapetrovic (2003)	Framework	The first to establish the overarching process of integration. Introduced the systems approach to an IMS.	IMS
Nawaz and Koç (2018)	Framework	Framework for an SMS at the organizational level and clear connections between the required processes for systematically managing sustainability.	SMS
Oliveira (2013)	Guidelines	Guidelines for integrating the QMS, EMS, and OHSMS customized for the manufacturing environment, divided into three phases: 1) planning, 2) development, and 3) control and improvement. Highlights the importance of special teams in customizing the IMS to generate less resistance.	IMS
Rebelo et al. (2014); Rebelo et al. (2016)	Model	A flexible model with four main steps (PDCA) supported on the Vision, Mission, Culture, Business objectives, Organizational roles, responsibilities and authorities, and Management commitment and leadership.	IMS
Rocha et al. (2007)	Model	An IMS model built on seven elements: stakeholders, resources, leadership, set of processes, values, objectives, and results, where CS is integrated into these elements.	SMS
Rößler and Schlieter (2015)	Model	A model-based approach for the operational integration of an IMS consisting of QMS, EMS, EnMS, and OHSMS.	IMS
Zeng et al. (2007)	Model	Three-level integration: 1) strategic synergies, 2) organizational structure, resources, and cultural synergy, 3) documentation synergy.	IMS
Wilkinson and Dale (2010)	Framework/ guidelines	An aligned approach and total quality (TQ) approach. The alignment is a merging of documentation and the TQ approach is creating a philosophy and aims for the system.	IMS

A well-cited work in the SMS field is made by Asif et al. (2013) who suggest a framework of how to integrate CSR[1] into business processes, using the definition that CSR is *"an approach by an organization for voluntarily addressing multiple and dynamic bottom-line issues through the development of an organization-wide infrastructure"* (Asif et al., 2013, p. 8). The framework provides a list of specific activities connected to the framework's different stages, following the PDCA cycle. The study distinguishes itself because of the list, but also because it consolidates different stakeholder theories through a bottom-up and top-down perspective, see figure 2. The top-down perspective includes conducting an environmental scan, identifying potential and existing stakeholders' requirements, and finalizing the organization's strategic direction (Asif et al., 2013). The scanning process entails the development of a corporate mission, values, culture, and desired business behavior. The stakeholder identification should be guided by important criteria such as power, legitimacy, and urgency, as described by Mitchell et al. (1997). The other perspective, bottom-up, emphasizes that the external, community stakeholders, have a significant part in a company's CSR work (Asif et al., 2013). This approach incorporates the community stakeholders, their needs and values, and focuses on how the organization can contribute to improving their quality of life and living standards. According to Asif et al. (2013), the two approaches are equally important, but the authors emphasize the need for further empirical testing when the two approaches are used concurrently.

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[1] The traditional interpretation of CSR, which lacks the long-term perspective
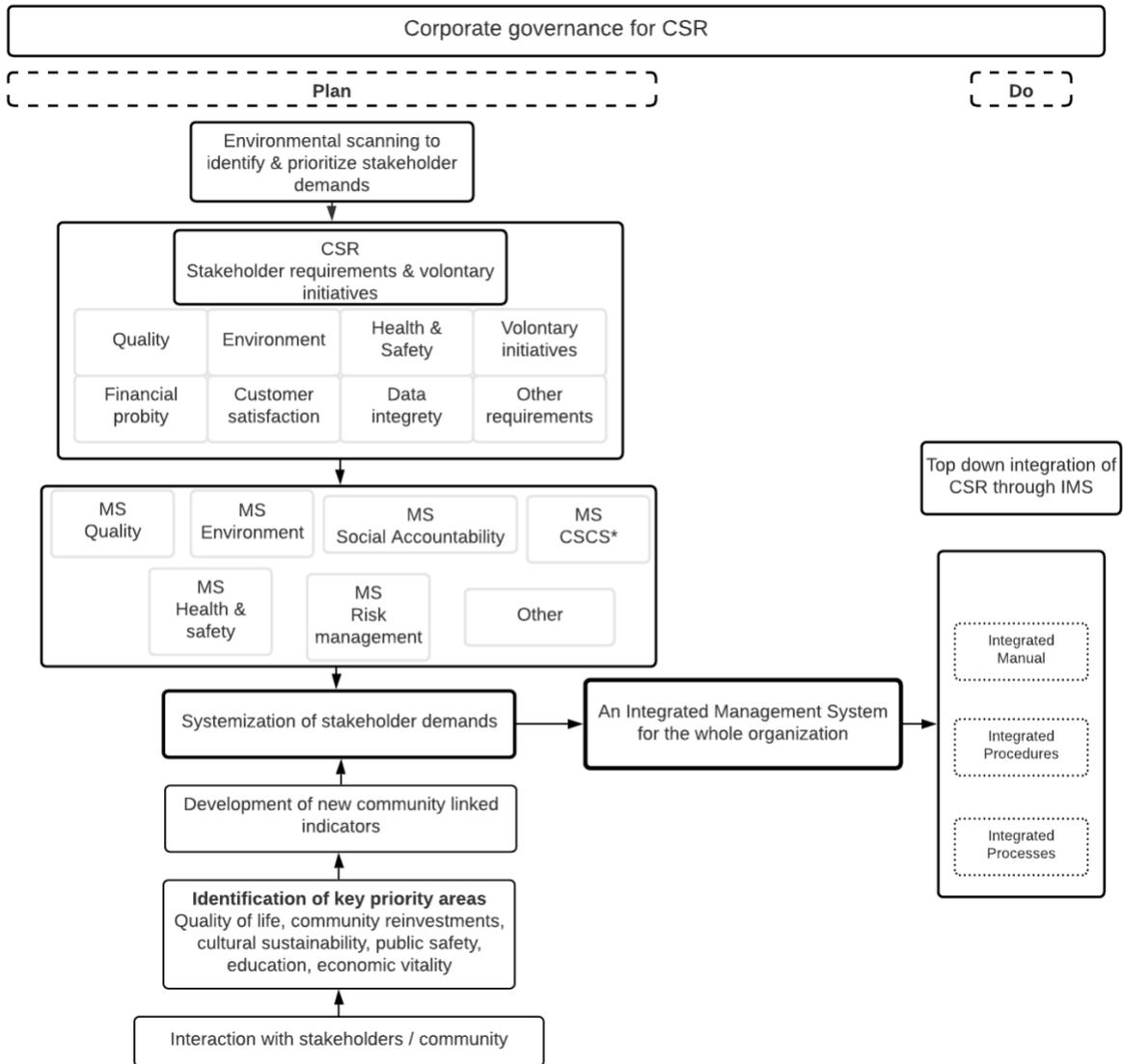
Figure 2. The framework by Asif et al. (2013) of an integrated approach to incorporate CSR in business processes, adapted to this study's delimitations (used with permission)

Another prominent study in the SMS field is the comprehensive literature review by Nawaz and Koç (2018) resulting in their own SMS framework. The framework, as seen in figure 3, is similar to that of Asif et al. (2013) and the ISO standards as it revolves around the PDCA cycle (Deming, 2018). However, it differs from the former as it explicitly begins with the CS vision, scope, and principles, instead of simultaneously identifying stakeholders and finalizing the corporate mission (Nawaz & Koç, 2018). Noteworthy is also that the methods for 'identification of stakeholders' or 'analysis of stakeholders' needs' do not lie in the scope of their work. This framework is therefore different from Asif et al. (2013), whose framework revolves around the top-down and bottom-up approach. In contrast, Nawaz and Koç (2018) rely on the CS vision, scope, and principles to be dismantled into meaningful sustainability objectives and goals in the following steps of the framework. The authors further argue that the vision and principles operate as a reference to find

an organization's stakeholders. Unlike Asif et al. (2013), the authors urge that stakeholders are a combination of a specific location and time, and thus a relative term, subjective to change (Nawaz & Koç, 2018). Likewise, ISO 26000 also describes that social responsibility will be decided by the society's expectations at a given time, relative to change (ISO, 2010). In addition, Garvare and Johansson (2010) explain that stakeholders vary over time and are depending on the type of market, culture, and government system in which the company operates. The most distinguishing fact between Asif et al. (2013) and Nawaz and Koç (2018) is however that the latter authors argue that there must be a "system initiator" labeled 'Organization/Decision-maker' in figure 3. In line with Schaltegger et al. (2012), the authors mean that this element must be built on the voluntary desire to form an SMS, which is owned and envisioned by all stakeholders. Nawaz and Koç (2018) express that this part of the process requires bold leadership, characterized by the ability to convince, govern, and communicate the sustainability vision. In contrast to Asif et al. (2013) and the ISO standards (ISO, n.d.), the vision is consequently established before identifying stakeholders.
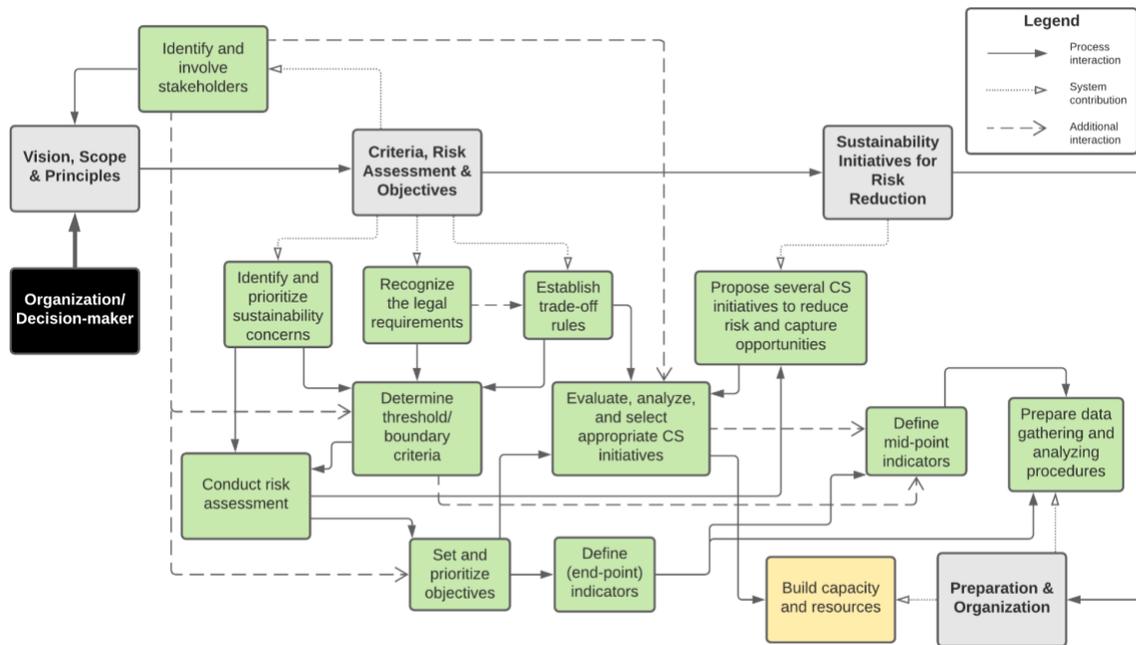
Figure 3. Part of the sustainability management framework by Nawaz and Koç (2018), adapted to this study's delimitations (used with permission)

One purpose of the literature review was to find a state-of-the-art SMS framework or model to be tested in practice as the study's second objective infers. Because Asif et al. (2013) is prominent, meaning well-cited in the researched field, and provides a list of activities, it was used as the basis for this study. This framework was then evaluated against other scholars to see if they concurred with the elements in the framework. Table 3 summarizes the activities in Asif et al. (2013) and the references that have stressed the same or similar elements as important in the context of

IMSs/SMSs. The decision to not use Nawaz and Koç (2018) as a basis for table 3 was because they did not provide descriptive activities for each element that could be tested empirically. However, their framework is state-of-the-art and the discrepancy between it and that of Asif et al. (2013) provides an opportunity to analyze potential shortcomings in Asif et al. (2013), and subsequently, make suggestions for improvement in line with the third objective.

Table 3. Activities in the implementation of SMSs

Phase	Activities based on Asif et al. (2013)	References
Plan	Environmental scan	Asif et al. (2013); Rebelo et al. (2016)
	Define stakeholders and their requirements	Asif et al. (2013); Castka et al. (2004); Nawaz and Koç (2018); Rebelo et al. (2016); Rocha et al. (2007)
	Ensure that there are no clashes of interest/ redundancies in different stakeholders' requirements	Asif et al. (2013)
	Ensure different stakeholder's requirements do not pull the organization in different directions	Asif et al. (2013)
	Engage in stakeholder consultation	Asif et al. (2013)
	Define CS(R) in the organizational context	Asif et al. (2013); Castka et al. (2004)
	Define the business case for CS(R)	Asif et al. (2013); Rocha et al. (2007); Schaltegger and Wagner (2008)
	Explore CS(R) competencies	Asif et al. (2013)
	Develop indicators to measure performance	Asif et al. (2013); Castka et al. (2004); Nawaz and Koç (2018); Rocha et al. (2007)
	Develop community indicators	Asif et al. (2013)
	Identify the resources required for CS(R)	Asif et al. (2013)
	Secure top management commitment	Asif et al. (2013); Castka et al. (2004); Rebelo et al. (2016); Rocha et al. (2007)
	Develop business model for CS(R)	Asif et al. (2013)
	Develop organizational charts with clearly defined CS(R) responsibilities	Asif et al. (2013)
Do	Integrate CS(R) vertically	Asif et al. (2013); Rocha et al. (2007); Sroufe (2017)

	Integrate CS(R) horizontally	Asif et al. (2013); Rocha et al. (2007); Sroufe (2017)
	Develop technical structures for CSR such as integrated manuals, procedures, work instructions, and processes	Asif et al. (2013)
	Develop CS(R) social structures, such as teamwork, training, and competencies	Asif et al. (2013); Nawaz and Koç (2018)
	Develop CS(R) routines	Asif et al. (2013)
	Develop a culture conducive for CS(R)	Asif et al. (2013); Sroufe 2017
	Align social and technical structures	Asif et al. (2013)
	Manage CS(R) knowledge	Asif et al. (2013)
	Adhere to strategic plans for the realization of CS(R) long-term objectives	Asif et al. (2013)
	Respond appropriately upon transgression	Asif et al. (2013)
	Ensure transparency in CS(R) integration	Asif et al. (2013)
Check	Evaluation of performance along pre-set indicators	Asif et al. (2013); Nawaz and Koç (2018); Rebelo et al. (2016)
	Assessing the adequacy of CS(R) integration	Asif et al. (2013)
	Assessing the adequacy and functionality of CS(R) structures and the overall infrastructure	Asif et al. (2013)
	Assess the performance of both strategy and operations through, for example, integrated audit, self-assessment, and benchmarking	Asif et al. (2013); Nawaz and Koç (2018)
	Monitoring employees' behavior necessary for CS(R)	Asif et al. (2013)
Act	Determining what to report and how to report	Asif et al. (2013); Nawaz and Koç (2018)
	Reporting of CS(R) results to the stakeholders – such as through annual reports, website updates, letter to shareholders, etc.	Asif et al. (2013); Nawaz and Koç (2018)
	Going beyond conventional CS(R) reporting through personal stories and experiences to strengthen employees' pride and commitment	Asif et al. (2013)

	Integrating new knowledge into organizational processes	Asif et al. (2013)
	Continual improvement along both strategy and operations	Asif et al. (2013); Nawaz and Koç (2018); Rebelo et al. (2016)
	Making process improvement	Asif et al. (2013); Rebelo et al. (2016)

With respect to the delimitations mentioned in chapter 1.4, this study will have a greater emphasis on the Plan and Do stages rather than Check and Act since they require implementation to be assessed. In the Plan stage in Asif et al. (2013), at the end of the environmental scan, measurable indicators in key priority areas connected to identified stakeholders and priorities of the organization should be identified. Subsequently, the organization should implement the MSs that are focused around the key priority areas to effectively and systematically address the requirements of stakeholders (Asif et al., 2013) congruent with Qi et al. (2013). The two approaches, bottom-up and top-down, are linked through "systemization of stakeholder demands" which includes activities that mitigate redundancy and conflicts between different stakeholders. The systemization of stakeholder demands is put to practice by implementing an IMS, which is described as "the backbone for CSR" (Asif et al., 2013, p. 16). This development denotes how the organizational infrastructure must be designed and refined to facilitate the implementation and realization of the CSR integration. Asif et al. (2013) suggest that this process should include an integrated manual (a type of steering document for management to fulfill organizational objectives) which later gives rise to integrated procedures and processes for CSR facilitation. The integrated procedures are described as cross-functional and act as a guide for managers to execute business processes in an integrated manner. Integrated work instructions for the operational level are proposed to inform operators on how to execute tasks in a way that aligns with the organizational objectives (Asif et al., 2013). In this part of the framework, the authors also state that there is a technical and social structure that needs to be aligned to properly facilitate CSR throughout the organization. The former adheres to the top-down approach of integration through implementing structural and/or administrative change throughout the organization, while the latter relates to training employees to develop competencies, routines, and a strong culture for CSR (Asif et al., 2013).

Asif et al. (2013) explain that an IMS has to be developed as a link between the Plan and Do stages but leaves no further details on how to achieve it. Likewise, Nawaz and Koç (2018) leave the implementation of the sustainability initiative to be solved by the practitioner. To get the full scope of what steps are needed to establish an SMS, defined by Asif et al. (2013), the study by Rebelo et al. (2016) was chosen to provide the missing perspective of how to integrate the MSs. A key feature in this IMS model is that it also follows the PDCA cycle (Rebelo et al., 2016), as most of the presented SMS frameworks, which increase their compatibility. In the Plan stage, the company should evaluate the organizational context and develop an integrated policy, while considering the company's mission, vision, strategy, and objectives (Rebelo et al., 2016). It is essential to have top

management approve and communicate the policy and its objectives. During this stage, the planning of the needed actions and resources to address risks and opportunities of the IMS takes place (Rebelo et al., 2016). In the Do stage, the organization should implement the planned activities. The Check stage involves evaluation of the performance of the IMS, integrated internal audits, documentation control, and corrective actions. Lastly, the Act stage regard continuous improvement and innovation of the IMS meanwhile coherently developing the IMS's efficiency. Allocating responsibility and authority, documenting information, and assessing the IMS by internal and external audits, and management reviews are mentioned as important activities in this stage (Rebelo et al., 2016). The authors further express the importance of making the PDCA cycle dynamic regarding continuous assessment, improvement, and innovation.

3. Methodology

This chapter presents the study's purpose, approach, and strategy. Data collection methods are described, as well as the analysis methods. Lastly, the study's research quality relating to validity and reliability are discussed.

3.1 Research Purpose

The research purpose can either be exploratory, descriptive, or explanatory, or a combination of these (Saunders et al., 2012). This study aimed to develop a framework of how green-tech companies can achieve an SMS. The objectives were to study state-of-the-art literature, test an SMS framework in practice and suggest improvements in the framework based on literature and empirical findings. Therefore, it is categorized as both a descriptive study, by basing the study on current literature, and exploratory, as it aims to evaluate the applicability of the framework in practice and suggest identified additions to the SMS. The objective of descriptive research is to gain an understanding in specific situations where it is essential to have a clear picture of the phenomenon before collecting data (Saunders et al., 2012). Exploratory research is about gaining insights into a situation where the precise nature of the issue is unclear (Saunders et al., 2012).

3.2 Research Approach

This study had a deductive approach which Saunders et al. (2012) describe as data is being collected to explore a phenomenon, identify themes, and explain patterns, in order to contribute to new or existing theory which subsequently is tested through additional data collection. Yin (2006) explains that the deductive approach can be used to test an existing theoretical perspective using qualitative procedures, which was the case in this study.

3.3 Research Strategy

Research strategy is described as how the researchers plan to answer the research question (Saunders et al., 2012). In this thesis, the research strategy was a case study. Case studies are relevant if an extensive, in-depth study of a phenomenon is required (Yin, 2006) to gain a richer understanding of its context (Saunders et al., 2012), which might not be achieved with other approaches (Rowley, 2002). The case study strategy was applicable to this research purpose as it would give in-depth empirical insights into the mostly theoretical research field of SMSs. Research methodology refers to the theory of how research should be conducted, meanwhile, a research method is the procedures and techniques utilized to collect and analyze data (Saunders et al., 2012). The research methodology and methods used in this study are presented in table 4 below.

Table 4. The methodologies and methods used in this study

Chapter	Methodology	Method
3.1	Research Purpose	Descriptive and exploratory
3.2	Research Approach	Deductive and qualitative
3.3	Research Strategy	Case study
3.4	Data Collection	Interviews & documentation study
3.4	Data Analysis	Thematic analysis & compliance analysis

3.3.1 The Case Study Company

Because the aim of this study was to develop a framework for how green-tech companies can achieve an SMS, a company categorized as a green-tech company was chosen for the case study. Northvolt was chosen because:

1. They are in the battery cell manufacturing industry, producing lithium-ion batteries aimed to reduce the environmental footprint, hence by definition a green-tech company. In addition, they are sustainability focused.
2. They are in the upscaling phase from being a startup, meaning that they are a nascent green-tech company that do not have all structures in place, which provides a new perspective to the literature, and
3. They have their main operations in Sweden, where this study is taking place.

Northvolt currently operates in Västerås, Sweden, where the R&D center is located. The production sites in Skellefteå, Sweden, and Gdansk, Poland, are expected to commence operations in 2021 and 2022 respectively, with potential annual outputs of 40 and 12 GWh (Northvolt, 2020b, 2021a). Each location is an entity of the parent company Northvolt AB; Northvolt Labs in Västerås, Northvolt Ett in Skellefteå, Northvolt Jeden in Gdansk, and Volthouse (the headquarters) in Stockholm, Sweden (Northvolt, n.d.).

> *Northvolt's approach seeks to minimize the carbon and environmental footprint of batteries at every opportunity. At Northvolt, end-of-life batteries are treated as a valuable resource and recycled to provide raw materials for future batteries. Northvolt's primary manufacturing facility, Northvolt Ett Gigafactory, is powered by 100 percent fossil-free energy in northern Sweden. Meanwhile, Northvolt only sources materials from responsible suppliers, ensuring a supply and distribution chain that is free from conflict, child labor, and human rights abuse. The result: the greenest and most sustainable battery in the market.* (Northvolt, 2021b)

Northvolt has a target to use 50 percent recycled raw materials in their production in 2030, hence a recycling facility will be established next to the production in Skellefteå in 2022. Northvolt will be capable of recycling lithium, cobalt, nickel, manganese, and other metals (Northvolt, 2020b). Furthermore, a joint venture for electric vehicle battery recycling has been established in Norway and will commence operations in 2021 (Northvolt, 2020a).

3.4 Data Collection and Analysis

The focus for data collection was the literature review, interviews, Northvolt's formal documents in Northvolt's intranet, and direct observations at the site in Västerås. In addition to this, an internal survey at Northvolt was used as secondary data (Northvolt, 2020c). By using multiple sources of converging data, coherence in the study could be established (Yin, 2006). The data collection and analysis methods are presented in figure 4. These data collection methods are further explained in-depth below.
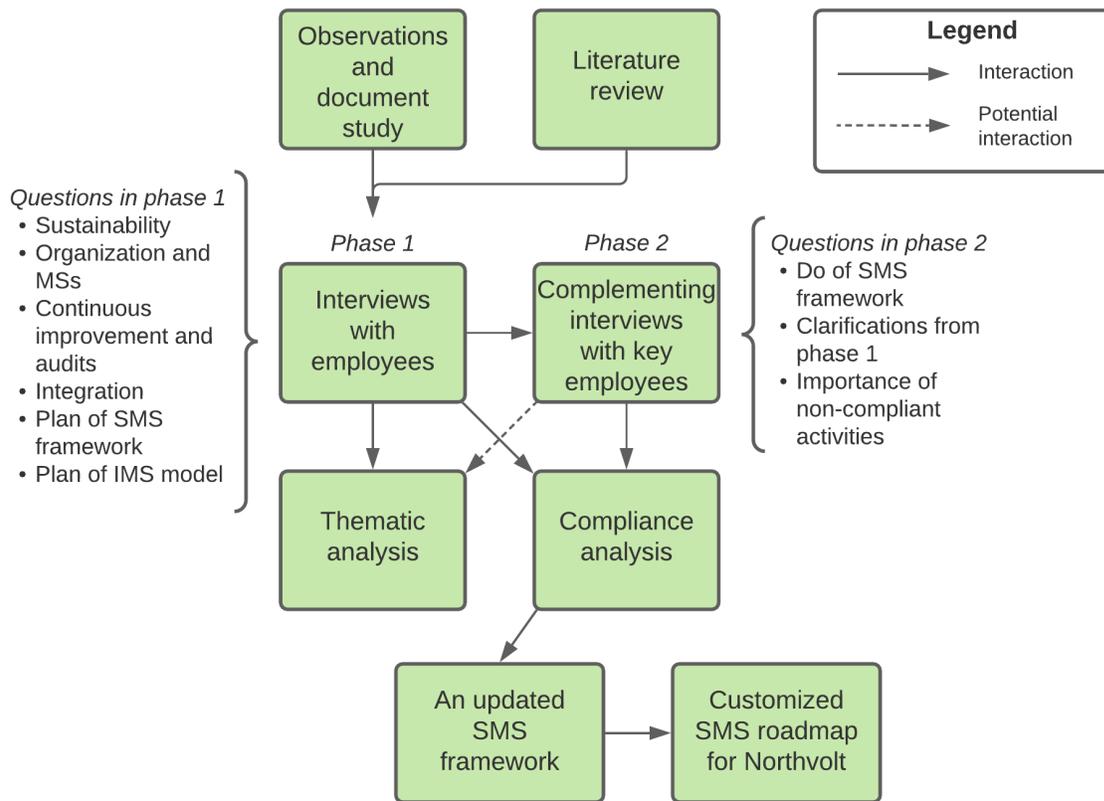

Figure 4. Methods used for data collection and analysis

The literature review and observations hence stood as a basis for the development of the interview guide. The interview responses were analyzed through a thematic analysis and a compliance analysis, which were developed by the authors of this study. The results from these analyzes were thereafter used to develop an updated framework.

3.4.1 Literature Review

The literature review was conducted to get an understanding of the previous research in the field and to realize the first objective of this study. Published and reviewed literature was gathered from Scopus, a database with peer-reviewed scientific journals and conference proceedings. The used search terms were:

- "Sustainability management system*"
- "Sustain* management system"
- "Integrated management system*"
- "Integrating" AND "management system*"
- "CSR" AND "integrate* management system"
- "Corporate sustainability" AND "management"
- "Communication" AND "integrated management system"
- "Green-tech" AND "management systems"

On top of that, the method *snowballing* resulted in more articles from the previously chosen relevant articles' references. Mostly peer-reviewed articles were used, occasionally accompanied by conference proceedings and books relevant to the subject. The SMS and IMS frameworks that were studied are presented in table 2. Based on the literature review, an interview guide and an analysis tool could be developed.

3.4.2 Interviews

Interviews were held to realize the second objective of this study. The most common interview technique in qualitative research is semi-structured interviews (Braun & Clarke, 2013). For semi-structured interviews, the interviewer has prepared an interview guide beforehand, but must not rigidly adhere to it, either in the precise wording or in the order of asking the questions (Braun & Clarke, 2013). The authors further explain that this approach lets the respondents raise issues not anticipated by the researchers, which was relevant due to the explorative purpose of this study. Therefore, an interview guide was prepared with semi-structured questions.

The interview questions were formed from the SMS framework by Asif et al. (2013) and the IMS model by Rebelo et al. (2016) by rephrasing the activities into questions. Braun and Clarke (2013) argue that open-ended questions provide in-depth and detailed responses in the respondents' own words, therefore open-ended questions were formulated when possible. Asif et al. (2013) is a well-cited article in the SMS field (180+ citations on Scopus as of May 2021). In addition, as table 3 shows, a considerable part of the listed activities in Asif et al. (2013) are underlined by other scholars, which emphasize its position in literature. Although the framework was developed in 2013, it lacks empirical testing in multiple different industries and countries. It was assumed that an evaluation of the framework in a nascent green-tech company could provide valuable insights to both the SMS and green-tech literature. Since no distinct list of actions or questions were provided in other SMS frameworks, they were not included in the interview guide. However, some

questions and especially follow-up questions allowed for more thorough answers, which enabled a nuanced analysis of additional practices that was not necessarily in the framework of Asif et al. (2013). An IMS model was included because the framework by Asif et al. (2013) assumes that an IMS should be formed as a link between the Plan and Do phases but leaves this action to be solved by the practitioner without any further guidance. An IMS model by Rebelo et al. (2016) was chosen as it is prominent (60+ citations on Scopus as of May 2021), and because it provides clear steps towards an IMS. In addition, the interview guide was developed by including aspects of the ISO standards related to the QMS, EMS, and OHSMS because an IMS is often based on these in literature, as mentioned in chapter 2.2. Since ISO 26000 is a guideline, it was not studied further. For how to evaluate a company's compliance with ISO 26000 we refer to Ranängen and Zobel (2014). The interview questions (see Appendix 2) were sorted into the categories:

1. Sustainability,
2. Organization and MSs,
3. Continuous improvement and audits,
4. Integration,
5. SMS framework by Asif et al. (2013), and
6. IMS model by Rebelo et al. (2016).

Because the current situation at Northvolt was unknown at the beginning, interviews were conducted in phases, see figure 4. The interview study had an exploratory approach, meaning that phases were added until it was clear which state Northvolt's MSs were in. The different phases had different interview guides, but the same questions adapted to the respondents' knowledge were asked to all respondents throughout the same phase. All interviews were scheduled beforehand with attention to the scope of the interview guide and therefore some interviews were longer than others. The duration of the interviews depended on the time the respondent had available but also how detailed and thorough their responses were. All interviews were held in English because it is the language spoken in the conglomerate of Northvolt, however it was not any of the respondents' native language. The interview respondents are presented in table 5 below.

Table 5. Interview respondents, their role, the date of the interview, and its duration

Respondent	Role and company	Date	Duration
A1	Manager of Sustainability & Compliance, Northvolt	February 10, 2021 March 31, 2021	30 min 30 min
A2	Environmental Manager, Green factories, Northvolt	February 16, 2021	45 min
A3	System Quality Consultant, manufacturing, Northvolt	February 18, 2021	45 min
A4	Management System Lead, Northvolt	February 22, 2021 April 1, 2021	50 min 60 min
A5	HR, OHS & Environmental Manager, Northvolt Poland	February 23, 2021	30 min
A6	Manufacturing Technician, Northvolt	March 1, 2021	50 min
A7	Environment and OHS Manager, manufacturing, Northvolt	March 2, 2021	40 min

Respondents were chosen to highlight the current situation from many different perspectives. For that reason, seven employees at Northvolt from different entities, departments, teams, and levels were interviewed, see the simplified hierarchy tree in figure 5.
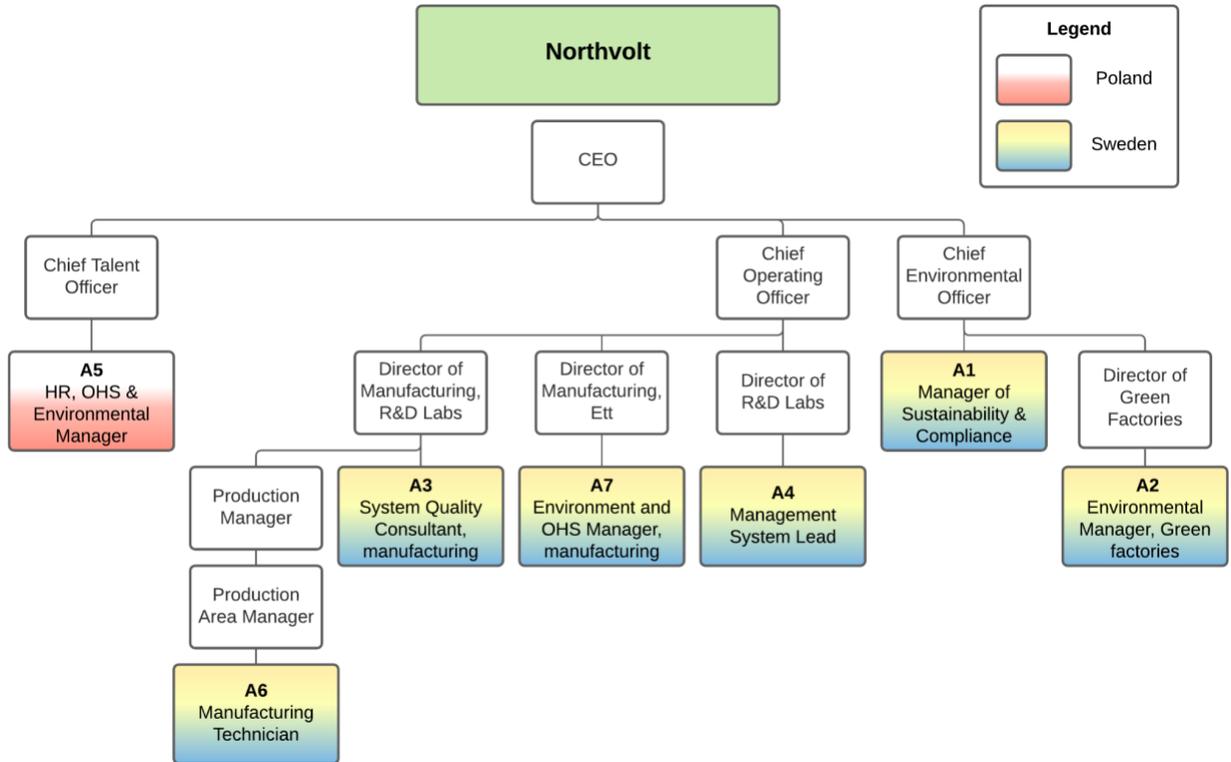
Figure 5. Simplified hierarchy tree of the interview respondents

In the first interview phase, questions were asked to examine how far Northvolt's current MSs are developed, compared to the SMS framework in the literature. Before the interviews were held, the supervisor at Northvolt had explained that the MSs were not yet fully implemented since the company is upscaling from being a startup. For that reason, questions regarding the Plan stage were prioritized in the first phase. After the first interviews were completed, it was evident that some activities in the Do stage were relevant too. Therefore, additional interviews were held with key employees in the second phase of the interview study. Additional questions to clarify a few unclear answers from the first interview phase were also added in the second interview guide to provide enough support for a compliance decision in the compliance analysis. The importance of activities that have not been completed were also asked about. Questions regarding Check and Act were available for use if the respondents indicated that those steps might also be of relevance, however, after phase two of the interview study, it was confirmed that they were irrelevant.

The interviews were virtual face-to-face due to the ongoing pandemic, nevertheless, this method enabled the recording of the interviews, with the authorization of every respondent. The interviews were transcribed through the iterative process of listening, pausing, writing, and then listening again. For transparency and reliability, both authors of this study took turns transcribing. All follow-up questions due to the semi-structured approach made by either the respondent or the interviewer were also documented and added into the transcribed material. The video recordings

were saved on a cloud server connected to the Northvolt intranet and later destroyed upon completion of the report in June 2021.

3.4.3 Document Study

The authors of this study had full access to the entire Northvolt intranet for the duration of the study and through the intranet a document study could be conducted. The main focus of the document study was to get a better understanding of the current situation at Northvolt. The gathered information was used to triangulate data and strengthen the findings as a complement to the interviews. The documentation study followed the method in similar prior studies, such as Ranängen and Zobel (2014), meaning that relevant documents related to the subject were examined, ranging from strategic documents, such as policies, to operational documents, such as audit questionnaires, and internal surveys, see table 6. However, the documents' contents are confidential and will not be enclosed in this report.

Table 6. Examined steering documents from Northvolt

Document	Area	Last update
Anti-corruption policy v2	CS	September 2019
Diversity survey	CS	February 2021
Environmental guidelines for suppliers	CS	October 2019
Environmental policy	EMS	August 2018
Joint audit questionnaire and presentation templates	QMS, EMS, and OHSMS	February 2021
Sourcing and procurement policy	CS	June 2018
Supplier code of conduct	CS	March 2020
Supplier code of conduct v2	CS	February 2021
Sustainability survey	CS	December 2020
Work environment policy	OHSMS	August 2018

3.4.4 Thematic Analysis

A thematic analysis (TA) is a method for identifying themes and patterns in a set of data in relation to a research question (Braun & Clarke, 2013). This method was used to find recurring themes in the transcribed interview data. The phases and their respective activities in Braun and Clarke (2006) can be seen in table 7.

Table 7. The phases of a thematic analysis, adapted from Braun and Clarke (2006)

Phase	Activities in phase
1. Familiarize yourself with your data	Read and re-read data, search for patterns, take notes, and mark ideas for coding. Interviews and similar must be transcribed into written form but do not have to be in the same level of detail as conversation.
2. Generate initial codes	Produce codes, where codes are a feature of the data that appears interesting to the analyst. Identify aspects in the data that may form the basis of repeated patterns (themes) across the data set.
3. Search for themes	Sort the different codes into potential themes and collate all relevant coded data extracts within the identified themes. Analyze the codes and the relationship between different levels of themes to combine and form overarching themes.
4. Review the themes	Check if some themes might need to collapse into each other or be broken down into separate themes, or they might not even be themes if there is not enough data to support them, or too diverse data.
5. Define and name the themes	Identify the essence of what each theme is about, and the themes overall to generate clear definitions and names for each theme.
6. Produce the report	It is the final analysis where vivid examples or extracts are presented to tell the complicated story of the data in a convincing way. The analytic narrative needs to go beyond a mere description of the data and make an argument in relation to the research question.

Quotes that stood out as initial ideas were highlighted in the transcribed interview material and to increase the confidence in this process it was done by each author. Every highlighted quote was put on a post-it note in the web-based tool Lucidchart. From there, quotes concerning the same issue/aspect were sorted into categories amidst constant discussion. In the categories, the quotes were further sorted to discover if they said similar or different things. The overarching themes and subthemes could subsequently be formed. Eventually, a thematic map was created with codes, subthemes, and overarching themes. Each theme was reviewed in relation to the entire dataset to make sure that each theme represented the core meaning of the complete dataset (Braun & Clarke, 2006). Finally, the themes could be defined and named, and the TA was finished. Many respondents gave similar answers but through different perspectives which enabled interrelations between different codes, subthemes, or themes to be identified in the TA. These interrelations were analyzed and explained in 4.1.6 to show how one solution to an issue would solve another issue.

3.4.5 Compliance Analysis

The compliance analysis was used to evaluate if Northvolt currently has done or planned to do what the frameworks in the literature suggested. The compliance analysis was developed from the activities listed in Asif et al. (2013) (see Appendix 3) and Rebelo et al. (2016) (see Appendix 4),

using the same method as Ranängen and Zobel (2014). Ranängen and Zobel (2014) used the activities in ISO 26000 as a framework for analyzing current practices at a case study company. The authors excluded certain core subjects in the standard from the analysis because they were deemed excessive, granted that the case study company had certain preconditions. Adapting that method, activities in the Plan and Do stages of the frameworks formed the basis for evaluating the compliance by using the interview responses to mark if Northvolt was compliant, partly compliant, or not compliant to the activities. The evaluation was based on what Asif et al. (2013) and Rebelo et al. (2016) had explained regarding each activity. The assessment also considered how in-depth answers were and if more than one respondent expressed the same thing. If contradicting answers were expressed during the interviews, the compliance assessment was made considering where the respondent worked, as the entities work differently, and in comparison to other respondents' answers. Quotes from the interviews were used and attached in a column as support to the decision to enhance the transparency of the analysis.

After the initial interview phase, a compliance level could be established. However, activities that were marked as partly compliant or not compliant had to be assessed in-depth to conclude whether it was an important activity, and thus was planned to be completed, or if it was regarded as unnecessary. That way, the company's immature, upscaling situation did not influence the result and analysis of the framework's applicability. As a result, an additional "Important activity" column was added to the compliance analysis before the second interview phase, to assess the importance of each activity. Second interviews with key Northvolt respondents contributed to making the assessment in the "important" column. The applicability of each activity was determined by:
- "No" compliant + important = applicable
- "Partly" compliant + important = applicable
- "Yes" compliant = applicable

By assessing both the compliance level from the first interview phase, in correlation with the importance of each activity from the second phase, the frameworks' overall applicability could be determined. The conclusion from this analysis fulfilled and contributed to the second and third objectives.

3.4.6 PDCA Cycle

The PDCA cycle was used to develop the updated SMS framework because the frameworks in literature as well as the ISO standards (ISO, 2015a, 2015b; 2018) have adopted it. The cycle enables organizations to manage their processes and find areas of improvement (Deming, 2018). The steps of the PDCA cycle are described as (ISO, 2015a, 2015b; 2018):
- **Plan:** identify risks and opportunities, establish objectives of the MS and its processes, organize resources needed to deliver results that are satisfying stakeholder requirements and the organization's policies.
- **Do:** implement the processes as planned.

- **Check:** monitor and measure the performance of activities, processes, and outputs (products/services) compared to the organization's policies, objectives, requirements, and planned activities, and report the results.
- **Act:** take actions to continually improve performance.

3.4.7 Developing an Updated Framework

The updated framework was developed based on the previously mentioned frameworks in the compliance analysis but excluding activities that were marked as not compliant and not important, i.e., not applicable in practice. Gaps found in the studied frameworks were complemented by other studies. Other practices that were expressed as important at Northvolt in their development of an SMS, and also found in other frameworks in literature, were added to the updated framework. The updated framework adapted to Northvolt's current situation resulted in a customized roadmap with solutions to their remaining activities based on the literature and respondents' answers.

3.5 Research Quality

In quantitative research, validity and reliability are commonly used to determine a study's quality. Rowley (2002) and Yin (2006) define four criteria for evaluating the quality of the research: construct validity, internal validity, external validity, and reliability. Internal validity is excluded since it is merely used for explanatory studies. External validity, or generalizability (Greener, 2008), is discussed in chapter 6.1.

The validity, more specifically construct validity, is determined by whether the method actually measures what is intended to measure or not (Greener, 2008). The data collection methods and analysis tools were used to realize the objectives and thereby the aim. Since the interview questions were derived from literature, they are assumed to be adequate to the objectives to test and evaluate the frameworks in practice. To improve the construct validity, another researcher in the field could have read through and provided feedback on the questions before the interviews were conducted and to ensure that they measure what they were intended to. The supervisor at Luleå University of Technology is an expert in the field of SMS and guided the study's proceedings via weekly discussions. The guidance could therefore be assumed enough for ensuring relevant steps were taken in this study.

To further improve construct validity, in what Rowley (2002) defines as reducing subjectivity and establishing correct measures for the concepts, respondents from multiple departments, entities, and levels at Northvolt were interviewed. It was expected to give a holistic and representative view of the true situation at the company and would assess whether a concept is described in an analogous way throughout the organization. If contradictory information was brought up, further questions were asked from another perspective to allow the respondent to explain further and sort out the discrepancy. The second interview phase was used to receive confirming answers from the

key respondents to reduce the chance of misinterpretations or misunderstandings by the interviewers.

Reliability in a study is the ability to demonstrate that the method and the data collection can be repeated by another researcher and lead to the same results and conclusions (Rowley, 2002; Saunders et al., 2012; Yin, 2006). A transparent and clear method can provide reliability (Greener, 2008), which can be achieved by documenting the procedures taken and appropriate record-keeping (Rowley, 2002). Literature searches, documents, interview guides, transcripts, and the analyzes were documented in a case study database to provide transparency. Triangulation can also improve reliability (Greener, 2008), which is why different sources of data (interviews, documentation study, and observations) were used simultaneously throughout the analysis. When the TA was made, biases could be prevailing as the authors had made the literature review beforehand and hence had previous knowledge of the subject. However, theoretical bias can be used to sort out themes in the TA (Braun & Clarke, 2006), which also occurred to some extent as the interview questions were based on the literature. To make the results more reliable, both authors marked initial ideas for codes individually and thereafter looked through the other's markings and when a disagreement occurred, a discussion of each point of view was held. All responses were treated as equally important, even if only one person mentioned it, as described in Braun and Clarke (2006), which could lead to more reliable results.

4. Empirical Findings and Analysis

In this chapter, the results of the semi-structured interview study and document study are presented. The findings from the interviews are analyzed in a thematic analysis and a compliance analysis and these results are described. Theoretical views and interpretations in regard to the findings are constantly employed.

4.1 Empirical Findings

The interview responses were analyzed through a TA, and these results are explained throughout 4.1. The TA was divided into the main themes: *current situation* and *future situation*, where the current situation covers five themes (blue), 16 subthemes (red), and 18 codes (green), see figure 6 below. The *current situation* describes how Northvolt currently works with their MSs and CS. The second part of the TA, *future situation*, is explained in chapter 4.1.7 and 4.1.8. The dotted lines between the blue boxes indicate that there is an interrelation, meaning that the themes are affecting each other. The interrelations are described in detail in chapter 4.1.6 and the interview respondents are coded as presented in table 5 (see chapter 3.4.2).

Figure 6. Thematic analysis map of the current situation

4.1.1 Corporate Sustainability

At the specific point in time, *Lack of transparency* is one of the main issues with regard to CS. When asked to specify what kind of CSR work Northvolt does, A6 said:

"I have never heard of it because I have so much work so I don't have time to listen to all the CEO updates."

Several answers to the same question all touch upon environmental sustainability, but leave out the other dimensions of CS. This issue was also confirmed in the document study, in the sustainability survey, where statements such as *"Northvolt is tackling climate change"* was among the highest scoring, meaning respondents concurred with the statement. This particular issue was already known by A1 who argued that there is a lack of training internally and also a lack of transparency regarding what CS work Northvolt is performing. A1 explained that sustainability related KPIs connected to each team are currently not developed, which altogether forms the code *Silo working* due to the sustainability department's detachment from other parts of the organization. All respondents acknowledged that Northvolt's *Business model* embodies CS and the code *Cradle to the grave* represents the latter subtheme. Respondent A1 stated:

"We are in a company where everyone is interested in working at Northvolt because it's a sustainable business idea."

The meaning of A1's statement is that Northvolt's products are regarded as sustainable and that every employee contributes to the product in one way or another. This finding aligns with the result from the document study and the sustainability survey. However, the fact remains that *Lack of transparency* and the daily sustainability concerns at the operational level are isolated and must be improved, a finding that is also apparent in the document study. A3, A4, and A6 expressed the same opinion as A1. Although A2, A5, and A7 also agree, they add that there is still a long way to go in terms of total sustainability. This was a recurring theme in the sustainability survey through comments such as *"...we [Northvolt] are not a sustainable company yet."* What is regarded as sustainability is yet again rather ambiguous even within Northvolt, however, A2, A5, and A7 all concluded that Northvolt is improving in this sense and believe Northvolt must install recycling procedures to become completely sustainable. In terms of *Engaging with the community*, respondents explained that there are many channels already in place to solve important aspects related to the location, building the factories, as well as employee housing. A7 states that the location of Ett was made while considering the availability of green energy. Northvolt has acknowledged communities, neighboring cities, and local cultural groups as important stakeholders (A1, A4, A7) which is a part of the code *Several indicators*. A7 stressed that noise from the factories, especially during the building phase, has been the main concern to not affect community stakeholders negatively. Meanwhile, A4 and A7 mean that Northvolt creates more jobs

in the region, which A7 saw as a positive contribution to this stakeholder group. An important recognition in Northvolt's sustainability work is the acknowledgment by A1:

"CSR is an old definition. Sustainability has to do with being accountable to stakeholders and to yourself."

The community-related concerns as explained in the code *Several indicators* and other interview responses conclude the same thing: that this statement is true at Northvolt. This statement together with the contemporary definition of CS in literature (Sarkar & Searcy, 2016), provides enough reason to use CS instead of CSR from hereon throughout the report.

4.1.2 Organizational Structure

The state of Northvolt's MSs was known to be rather insufficient even before the interviews, a result of discussions before the start of the study, and all the interview respondents confirmed the situation. A1, A3, and A4 mean that a rigid organizational structure is not yet established because Northvolt is still a rather young company and in the upscaling phase. Regarding the MS structure, Northvolt is certified according to ISO 9001 at Labs and the headquarters and they aim to certify the ISO 14001 standard at all Northvolt entities within one year (A1, A2, A4, A5, A7). According to A1, the EMS will be developed into the "wheel of quality." The plan for 2022 and onward is to certify the ISO 45001 (A4, A5), the ISO 50001 (EnMS) (A2, A4, A7), and perhaps other MS standards such as ISO 31000 (risk management) (A4). This conclusion aligns with the study by Abad et al. (2014) who showed that 80 percent of companies start with ISO 9001, thereafter ISO 14001, and lastly ISO 45001. According to A4, MS standard certifications are a pressured requirement from Northvolt's investors because *"if you have it, it proves something, but only on paper,"* which aligns with many scholars who stated that stakeholders might incentivize companies to implement MSs (Asif et al., 2010; Asif et al., 2013; Qi et al., 2013). In summary, answers regarding certifications and the current MSs stipulate the core of the theme *Organizational structure*, but the important takeaway is that the standards are seen as a bureaucratic requirement (A4, A5) and that there are currently more issues in the MS structure than there are benefits. A subtheme that exemplifies the major challenges in the current situation is *Lack of awareness* which refers to awareness of MSs, parallel processes, projects, and overlapping tasks and roles. According to A3, this is due to constant time pressure and a lack of knowledge about what an MS is. As highlighted by A4 and A2:

"When you ask around 'what is a management system?' they always refer to documentation. [...] We need to do a lot more communication about what it really is." (A4)
"I think general awareness of what the MS is and how the individual operator, engineer, etc. contribute to the successful implementation and continuation of the MS is the biggest challenge." (A2)

On that note, A2 phrases the employees' *Lack of awareness* as the employees' knowledge regarding how they should communicate, store information, and work in the systems. Much of this issue could be explained by the subtheme *In progress* and the code *Unused and unassembled MS*. However, the subtheme *Mentality of a startup* is, according to A4, the most prominent issue when it comes to structural inefficiencies:

> *"The startup culture needs to change in order to get more structure."*

A5 also said that this is because there are so many simultaneous projects which hinders them from planning and documenting changes in a structured manner. The overarching time pressure due to upscaling the entire business is also evident. This simultaneous development of processes, people, and products without following a structure has created a *Conflict of aims in development* that arguably has a compounding effect on the development of an appropriate organizational structure. Several inefficiencies connected to the organization and MSs were apparent, as mentioned in this chapter. The SMS was intended to be the solution to these deficiencies, whilst increasing the employees' knowledge and awareness of what the MSs are.

4.1.3 Improvements

The interviews asserted that there was no process for change management or continuous improvement. Respondents testified that there was nothing to improve because they are amidst developing everything. A common denominator regarding Northvolt's current process for continuous improvement is the subtheme *Too early* and code *Still developing*, meaning that there are other processes that need to be established first. Currently, a *Learning by doing* culture is preeminent, meaning that there is an openness to "*fail fast and learn fas*t" as expressed by A4. The subtheme *Open mindset* was derived from answers implicating that employees were welcomed to cultivate their ways of working. Respondent A6 argued that managers are open to operators experimenting and A5 emphasized employees' contribution to improvements through suggestion boxes.

4.1.4 Documentation

The current situation strongly denotes the need for structure and a unified method of working through the subthemes *Lack of structure* and *Different channels*. A4 testified that there is a documented guideline, but it is not being used, which was confirmed by A3 who also expressed that there is confusion about where to store information. Altogether, the subtheme *Different Channels* was formed, under which one code is *Critical information gets lost*. This phenomenon permeates the whole organization and A6 asserts the issue on operational level through another subtheme, *Barriers to information,* by expressing:

> *"We have so many group messages in [Microsoft] Teams and documents everywhere but if it's not organized it's going to be so hard to find it."*

A6 also pressed on the need for accessible information around the clock and not just during office hours when managers and engineers are on site.

4.1.5 Cooperation

The respondents indicated both positive and negative perspectives regarding the cooperation between different departments at Northvolt. The negative aspects form the subtheme *Segregation across Northvolt*, which is a result of answers that implied working in silos and a clear distinction between different teams. In addition to this, A4 stated that different teams do not get in contact with each other which aligns with the code *Structural barriers*. This is partly due to differences in regulations between countries and entities, but A5 expressed a desire for more transparency and cross-border collaboration. An important insight from A5 is the fact that different circumstances in different countries oppose collaboration. The positive aspects of cooperation were that there are a few forums and certain occasions where *Cross-functional* teamwork does happen, for example the project group assigned to create the SMS. Another example is the problem-solving process, as described by A6:

> *"I can go directly to the person that I think could solve the problem."*

This phenomenon also speaks to the flat hierarchy at Northvolt and many respondents testified that this has enabled a climate accentuated by helpfulness. A4 argued that cross-functional teamwork is currently advancing parallel to the development of different sites that face similar problems. A4 and A6 both appoint the positive synergies that can be gained through cooperation but remark that it does not happen enough. The subtheme *Collective intelligence* and its code *Learn from each other* are both derived from these thoughts.

4.1.6 Analysis of Interrelations in Current Situation

The analogy of the interrelations between the themes (blue) of the *current situation*, is that a line has been drawn where the subthemes or codes under each of the themes align on some level. Many respondents expressed the same thing but through different perspectives, hence this analysis. An interrelation could be where a solution to one subtheme solves another subtheme, or where a subtheme enhances another subtheme.
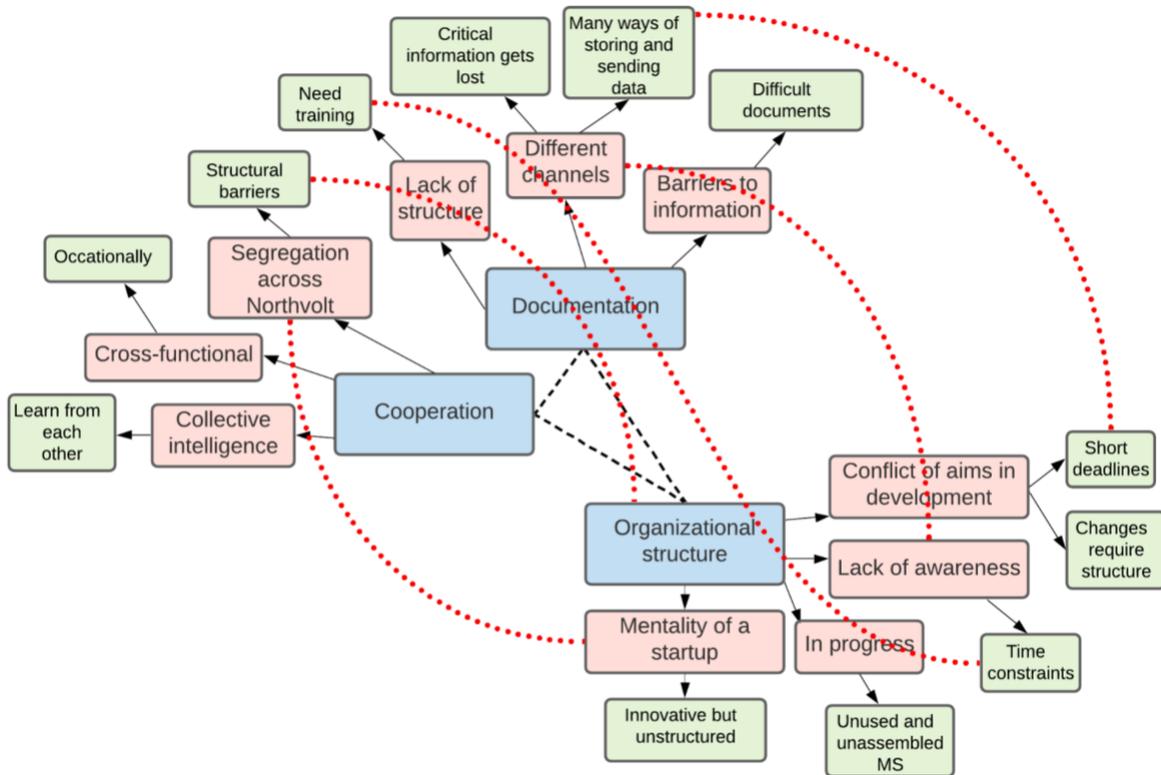
Figure 7. Interrelation between Documentation and Cooperation, a cutout from figure 6

As seen in figure 7, the theme *Documentation* is connected to *Cooperation* by an interrelation because of the positive synergies between proper document control, sharing of information, and collaboration. The code *Learn from each other* is strongly enhanced if the subtheme *Barriers to information* could be solved through more transparency and collaboration. The *Segregation across Northvolt* can enhance the subtheme *Different channels* leading to more issues because the latter creates barriers that prevent seamless collaboration and transparency between different entities and teams, as discussed by the respondents.

Figure 8. Interrelation between Improvements, CS and Organizational structure, a cutout from figure 6

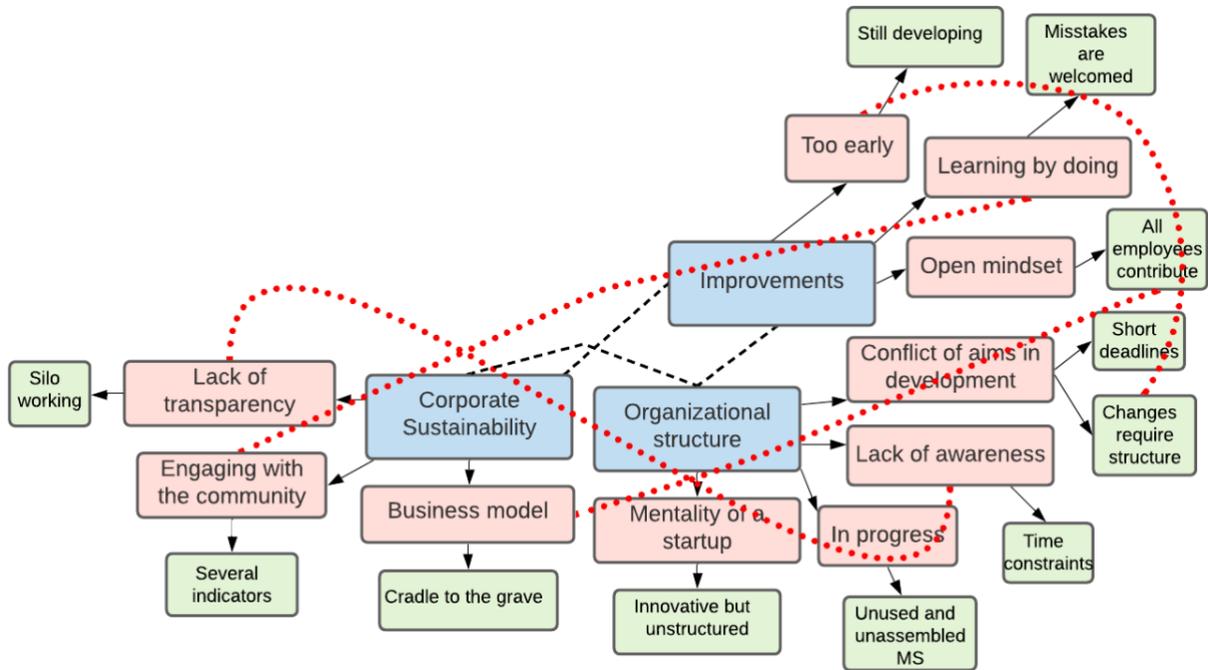In figure 8, *Improvements* is interrelated with *Corporate Sustainability* which, as explained by Jørgensen (2008), is because there is a need to have structures that enable continuous improvement to enhance a company's CS work. This interrelation is rather natural at Northvolt as the connection between the code *All employees contribute* and the subtheme *Business model*, see figure 8, was expressed numerous times throughout the document and interview study (see 4.1.1). As an example, A1 said *"we are all working with sustainability,"* supporting this connection. Furthermore, respondents stated that Northvolt's CS community indicators (subtheme *Engaging with the community*) are strongly emphasized by the motto *Learning by doing* as the process of identifying requirements is continuous and stakeholders are a relative term, in line with Nawaz and Koç (2018) and Garvare and Johansson (2010). *Improvements* is invariably a theme that enhances all other themes, however, the authors of this study refrained from making any interrelations other than what had been outspoken by respondents or scholars. *Organizational Structure* and *Corporate Sustainability* are connected by an interrelation because of the synergies between *Lack of transparency* and *Lack of awareness*. The transparency issue was the most appointed improvement aspect regarding the CS work, but A1 was confident that this could be solved by establishing an adequate organizational structure and through more training, hence the connection. Increased awareness and interdisciplinary cooperation have been shown to be beneficial for sustainability-oriented learning processes (Siebenhüner & Arnold, 2007), which indicates that A1's thought is reasonable. A remark in this context was the respondents' explicit wish to not create only a CS department, but rather integrate CS as a philosophy that permeates every department and team. Therefore, the silo working in the CS department is an important element to mitigate when developing an SMS.
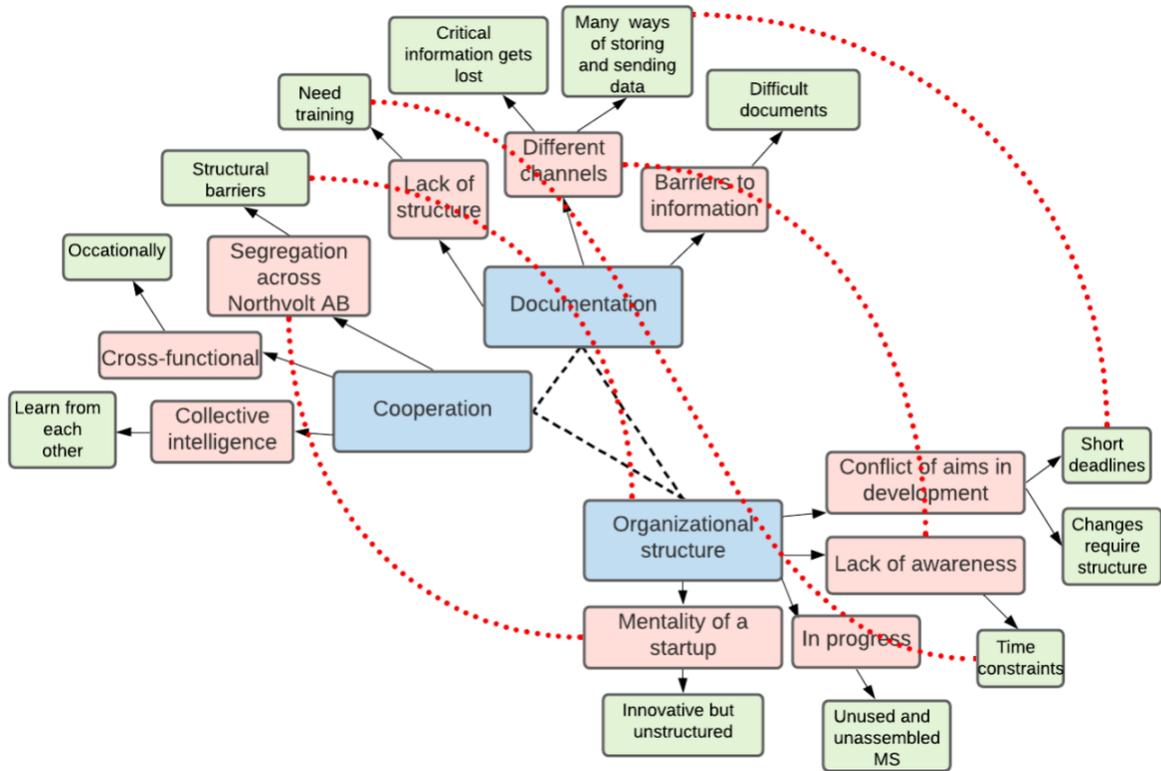
Figure 9. Connections between Documentation, Cooperation and Organizational structure, a cutout from figure 6

As shown in figure 9, *Organizational Structure* connects to both *Documentation* and *Cooperation*. *Organizational structure*, therefore, has four interrelations with other themes, see figure 6, and by the analogy of this analysis, that means that it has the most influence on the overall current situation. A prominent connection between this theme and *Documentation* is the relationship between the codes *Many ways of storing and sending data* and *Short deadlines,* which have already been mentioned by A5 in 4.1.2. In addition, respondents who worked with, or had knowledge about, the MSs made the connection between *Different Channels* and *Lack of awareness* numerous times and emphasized it as the inevitably largest problem to solve. The overarching subject in both themes can be summoned to a time-pressured expansion. This is especially evident when looking at how the *Mentality of a startup*, signified by less required structure, proceeds as the company grows at the expense of the attempts to establish a proper structure.

4.1.7 Barriers for the SMS

The second part of the TA, *future situation*, regarding the theme (blue) *Barriers for the SMS* has five subthemes (red) and six codes (green), see figure 10 below. These subthemes and codes must be considered when implementing the SMS at Northvolt.
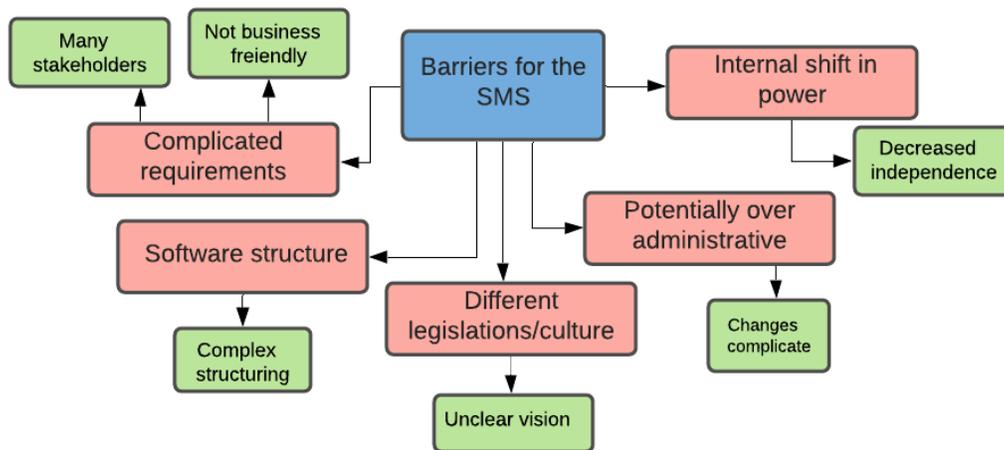
Future Situation

Figure 10. Barriers for the SMS

The respondents were asked if an SMS could pose any disadvantages and this theme is the compilation of those answers. A barrier that most respondents agreed upon was that it is complicated to arrange documentation and insert proper structure in a simple manner and that this complexity needs to be outweighed by usability. One of the more concerning codes in this theme however is *Unclear vision* which points to the differences in how to accomplish the SMS. As an example, the concept of an SMS was not known beforehand by the respondents, however, upon being introduced to the notion, the IMS management expressed that it was essentially what they intended for the IMS. Another one is the subtheme *Internal shift in power* which was described as a limitation to individuals' personal power and mandate because of the integration. If not handled correctly, this issue could hamper an aligned vision, amplify *Unclear vision*, and subsequently risk the success of the integration as a result of sub-optimization. Another factor that must be considered, according to A5, is that ISO standards often complicate internal operations and that they are not business-friendly. The collective opinion throughout the interview study was that the ISO standards are there to satisfy external stakeholders and that Northvolt strives for what A2 describes as excellence and best in class. And a common belief at Northvolt is therefore that the standards are merely one step towards that and should automatically be complied with by aiming at excellence. The subtheme *Complicated requirements* is compiled from these concerns and the concerns about the vast quantity of stakeholder requirements that Northvolt must oblige. An answer that connects all these different stakeholders and barriers was said by A6, who thought the success of the SMS strongly depends on overcoming the barrier of sufficient leadership for the SMS.

4.1.8 Employees' Requirements on the SMS

The other theme *Vision for the SMS* (blue), in the *future situation*, has eight subthemes (red) and ten codes (green), and describes employees' requirements on the SMS, see figure 11 below.
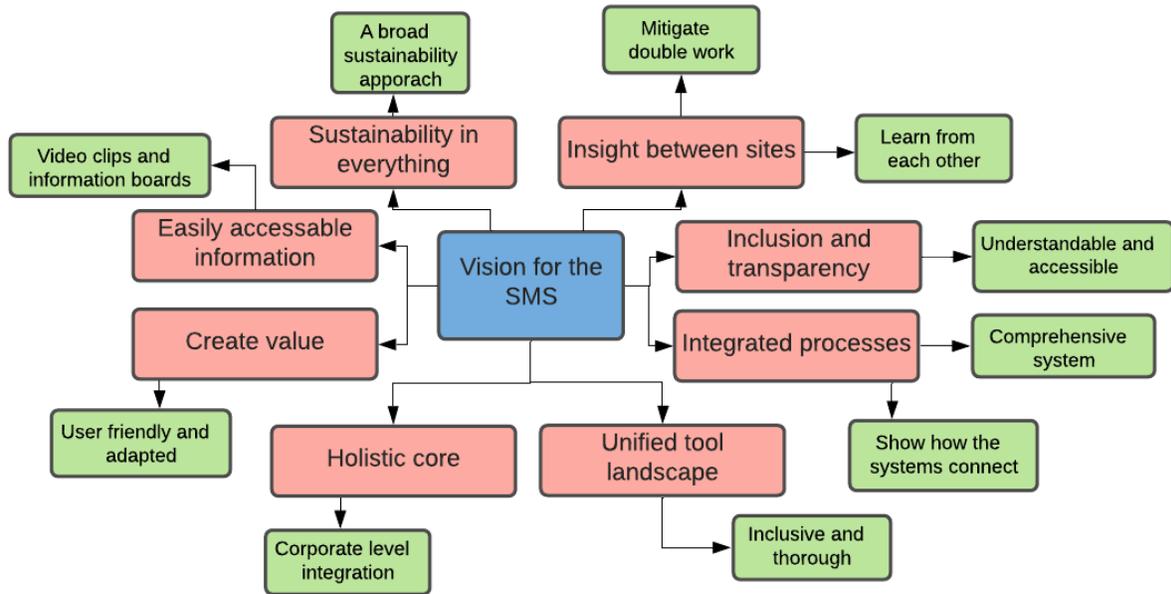
Future Situation

Figure 11. Employees' requirements on an SMS

The subthemes conclude the need for transparency, integration, and user-friendliness. A major vision for the SMS is that sustainability is integrated ubiquitously. This is coded as *A broad sustainability approach* and it is derived from several responses on the management level. It was A1 who first expressed this idea about having sustainability integrated into all different departments. However, as the interview study proceeded and more respondents aligned with this, it became evident that the idea of an IMS highly influenced by CS, i.e., an SMS, was the general wish. Additional internal requirements for the SMS were found in the codes *Understandable and accessible, User friendly and adapted* and *Mitigate double work,* which translates to the subthemes *Inclusion and transparency, Create value* and *Insight between sites*. As can be seen, the overarching answer in this theme, irrelevant to the code and subtheme, is simplicity. Another subtheme that speaks to this subject is *Holistic core,* which is a sum of answers wanting comparability between all sites to increase cooperation and transparency, although they must certify MSs individually. A *Unified tool landscape* is something that respondent A2 thinks could increase comparability between different sites and units. Lastly, the *Integrated processes* are of course a big part of the vision for the SMS. A7 embodied this subtheme by stating that Northvolt aims to integrate QMS, EMS, OHSMS, as well as the production system, meaning the integration of the Industry 4.0 manufacturing. The sharing of information with other organizations in the supply chain was something that A5 expressed in the interview study which correlates to *Integrated processes*. According to respondents A1 and A5, information sharing between suppliers and Northvolt would benefit both parties especially regarding improved measuring of the product's environmental footprint.

4.2 Compliance Analysis

In accordance with the second objective, the SMS framework and the IMS framework were tested in practice through the compliance analysis. The full compliance analysis can be seen in <u>Appendix 3</u> (SMS framework) and <u>Appendix 4</u> (IMS framework).

4.2.1 SMS Framework by Asif et al. (2013)

As visualized in figure 12, results from the interview study and compliance analysis show that Northvolt is at the end of the Plan stage and at the beginning of the Do stage in the framework by Asif et al. (2013). With that said, further analyzes of Check and Act stages in the framework were refrained from because it was evident that they did not have an SMS in place.
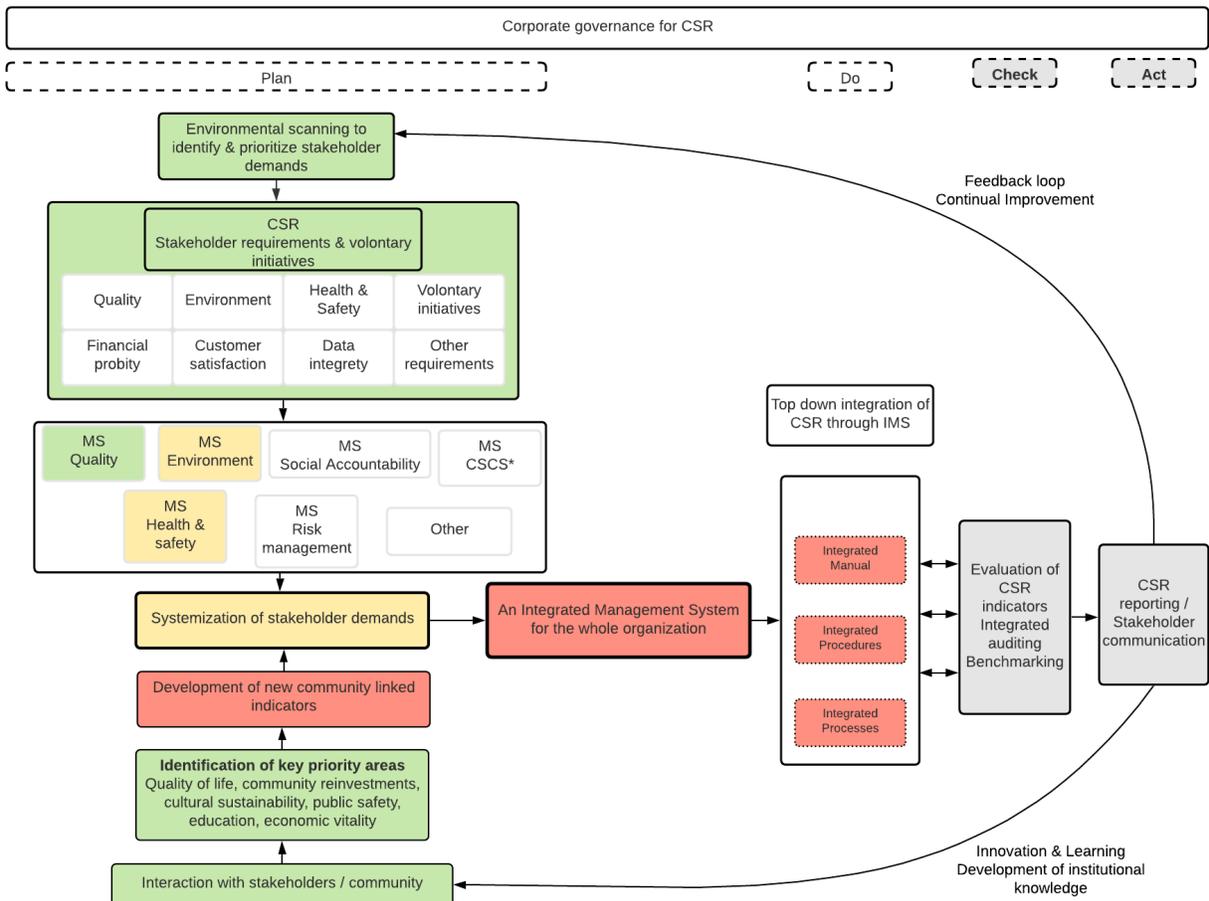

Figure 12. Northvolt's compliance with the steps in Asif et al. (2013). Green equals compliance, yellow partly, and red no compliance. Grey boxes were not investigated.

Table 8. Number of compliant activities with the steps in Asif et al. (2013)

Stage in Asif et al. (2013)	Yes	Partly	No	Total number of activities
Plan	11	2	1	14
Do	4	2	5	11

Northvolt has completed eleven out of the 14 activities in the Plan stage, and partly two more, see table 8. The activity *Development of community indicators*, marked as red, is the only non-compliant activity and has not been completed due to lack of time. However, respondents stated that they regard this as an important activity to address all stakeholder needs. A quote from A7 describes this further:

"We have done the stakeholder analysis in order to map out who the stakeholders are and where we get in contact with them. As far as I know, at Northvolt, we haven't done the last part of seeing what kind of demands they have on us and what kind of demands we can have on them."

This respondent works at Northvolt Ett where the factory is not built yet which means that the processes are currently developing, hence the stakeholder analysis has not been fully completed at Ett. At Labs and the headquarters, the stakeholder analysis was regarded as complete by respondents because they were certified according to ISO 9001. As a result, due to the nascent state at Ett, the activity was marked as compliant after all. Moreover, Northvolt has recently begun the horizontal integration of CS across departments, which means that they have begun the 16th step, as shown in Appendix 3, of Asif et al. (2013). However, they have not fully integrated CS across the whole supply chain and there is also a clear distinction between teams, which contradicts the completion of this step. In line with the 18th activity, they have bought a system for training employees in CS but have not yet enrolled it. Therefore, these two activities were marked as partly compliant, however, the respondents evidently regarded the activities as important and stated that they will be fully completed as soon as possible. The five activities in the Do stage that are marked as not compliant in table 8 are important but they have not had time at Northvolt – a common theme expressed throughout the interviews.

4.2.2 IMS Model by Rebelo et al. (2016)

Table 9. Number of compliant activities with the steps in Rebelo et al. (2016)

Stage in Rebelo et al. (2016)	Yes	Partly	No	Total number of activities
Plan	4	4	6	14
Do	-	-	-	5

Northvolt has come further in their CS work, i.e., the SMS framework, compared to the IMS implementation. Only four out of the 14 activities in the Plan stage in the model by Rebelo et al. (2016) have been completed and partly four others, see table 9. This result implies that the Plan stage in Asif et al. (2013) is a precursor to develop an IMS. Since Northvolt is clearly in the Plan stage, the five activities in the Do stage (Rebelo et al., 2016) – that are based on the planning activities – were not investigated and nor were the Check and Act stages. Two activities that have been completed, which are essential to certify the ISO 9001 and 14001, are: *Better knowledge of the organization including its context, through a diagnosis to characterize, accurately the situation*, and *Identify the needs, and expectations of Interested Parties, both internal and external* (Rebelo et al., 2016, p. 108). The other two compliant activities are: 1) Northvolt has defined a multidisciplinary team for implementing the IMS and 2) set up a steering committee. As previously mentioned, a common denominator in most activities that have not yet been completed is that they are important but not prioritized, due to lack of time. However, discernible are the two activities that are marked as not completed and not important. These are to *Conduct an evaluation of the MS standards' requirements and its compatibilities* and *Conduct an evaluation of existing integration models and select the one that to be adopted to support the IMS* (Rebelo et al., 2016, p. 108). Regarding the former, A2 argued that Northvolt wants to excel in everything and be the best in class and that the standards are secondary and are expected to automatically be complied with. In terms of the latter activity, the project leader was unaware of the existence of different models and approaches for integrating MSs, which yet again appoints Northvolt's preferred way of working, namely, to develop their own systems. The reasoning, according to Northvolt, is that these activities are not necessary nor important since they are rather based on experience. The six activities that are marked as not completed underpin that Northvolt is still in the Plan stage.

4.3 Additional SMS Practices

The framework by Asif et al. (2013) was not comprehensive enough to capture the full scope of Northvolt's SMS practices. In figure 13, the identified gaps in the framework are visualized, based on the case study and literature. The interview study showed that the framework by Nawaz and Koç (2018) was applicable for some practices and could complement the framework by Asif et al. (2013), especially in the beginning stages of the SMS implementation.
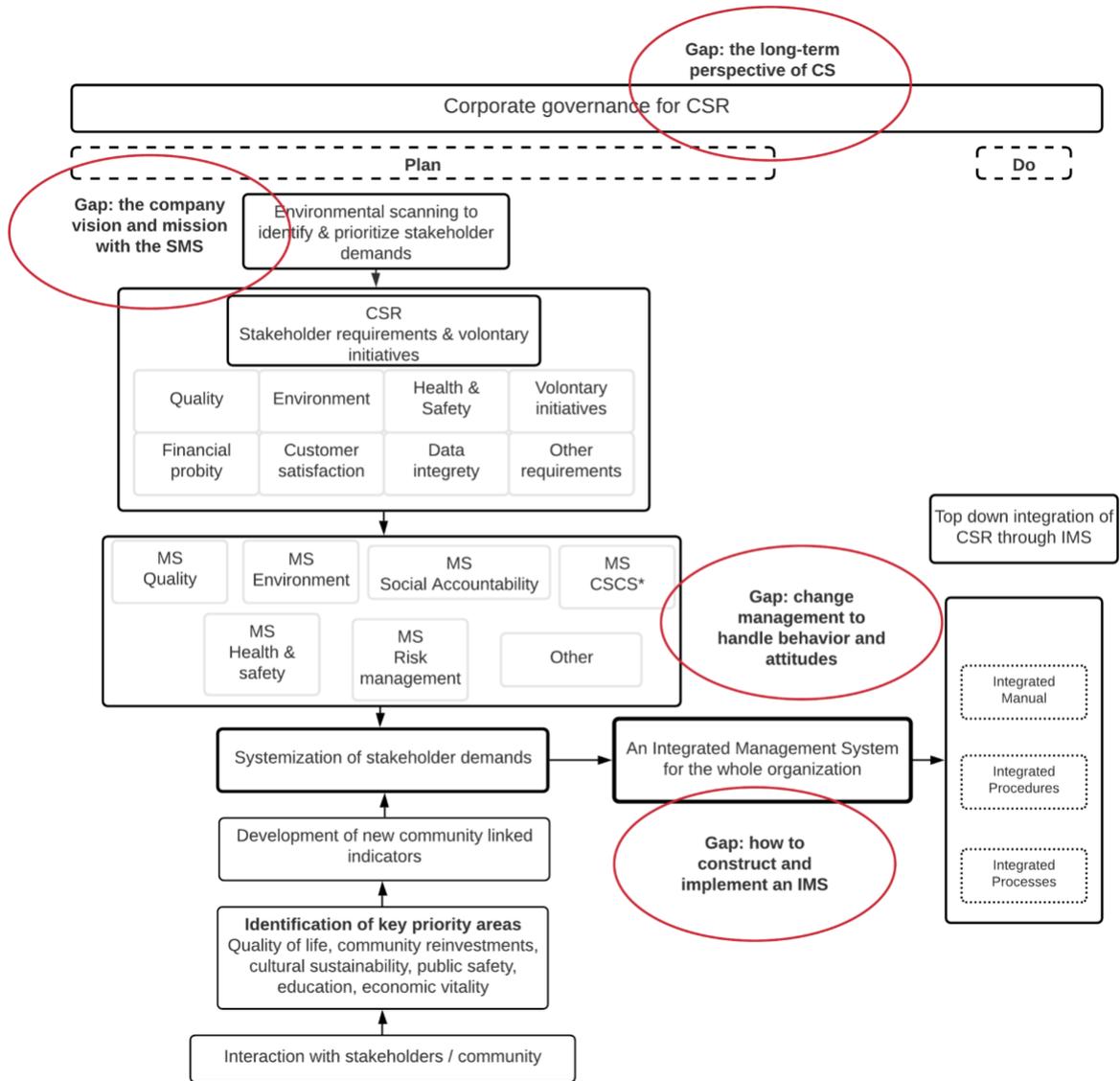
Figure 13. Gaps in the framework by Asif et al. (2013)

An element that Northvolt did exhibit but was not included in Asif et al. (2013) is the *system initiator* (Nawaz & Koç, 2018) and is best described through this quote by A4:

"The management committed itself to sustainability by creating the business case they have. If that is not enough commitment I don't know."

This quote not only emphasizes the top management's commitment to CS, an important factor according to Rocha et al. (2007), but also that the business model is the reason behind the SMS ambition, which underpins this element. Because Northvolt exhibits this trait and emphasized its importance to create engagement around CS, it should be highlighted regarding the objectives of

this study. Alongside this element, bold leadership was explained by Nawaz and Koç (2018) as an essential addition to facilitate sustainability, throughout the whole organization. During the interview study, document study, and observations at Northvolt, it was evident that all employees, no matter the position, were guided by Northvolt's values: bold, passionate, and excellent. The bold leadership that Nawaz and Koç (2018) describe is, therefore, another descriptive element for Northvolt's practices and is best described through A6's quote:

"Yes, sometimes we need to make bold decisions that come from experience."

Northvolt is arguably viewing this from a slightly different angle as this bold leadership is instituted in the form of self-leadership and not as one specific leader or management group as described by Nawaz and Koç (2018). On the other hand, the authors emphasized the need for bold leadership with the purpose to convince and communicate the sustainability vision, and this part is an integral part of every Northvolt employee, see 4.1.1. Another perspective that complies with other frameworks than Asif et al. (2013) was the importance of involving everyone regarding major changes, as said by A4:

"That is actually the plan for the management system when changing a process, that every participant in the process, everyone who has an impact on these processes, are being informed and those who get the results of it, they need to get the approval first as well."

This is in line with the system contribution that Nawaz and Koç (2018) described as dependent on broad participation throughout the organization. Northvolt is evidently focusing on change management at the individual level which is also in line with the ADKAR model by Hiatt (2006), in particular *Awareness*, *Desire*, and *Knowledge*. Respondent A3 concurs with the need to be transparent and information to be accessible for everybody, and that an integrated system could support this. However, as mentioned in chapter 4.1.3, a process for change management is not yet established.

4.4 Conclusions About the Applicability of the Frameworks

In summary, Northvolt currently is compliant to 11/14 activities, in the Plan stage in Asif et al. (2013) and they are in the midst of transitioning into the Do stage of the framework since they are only compliant to 4/11 activities in that stage. In total, current practices in the Plan and Do stages of Asif et al. (2013) account for 15/25. In phase two of the interview study, all of the activities in the Plan and Do stages were assessed as both compliant and important by respondents, which meant that the total applicability equals perfect correspondence with the case study company's practices. However, the empirical data implied that the framework was not comprehensive enough to capture the full scope of Northvolt's SMS practices. Instead, the framework by Nawaz and Koç (2018) proved to be a good complement to Asif et al. (2013), especially in the beginning stages of the SMS implementation. Since the CSR perspective in Asif et al. (2013) lacks the long-term

perspective (Sarkar & Searcy, 2016; Van Marrewijk, 2003), and Northvolt has adopted the CS approach, the results indicate that the framework by Asif et al. (2013) could be more comprehensive if substituting CSR with CS. The results also show that when changing from CSR to CS, stakeholders and the corporate mission need to be evaluated on a more frequent basis as part of the time dimension of CS (Lozano et al., 2015; Vermeulen & Witjes, 2016), which is congruent with the definition of stakeholders by Nawaz and Koç (2018) and Northvolt's view:

"We are aware and we implement new interested parties when they come up." (A4)

Both the bottom-up and top-down perspectives were complied with, which appoints a combination of both Nawaz and Koç (2018) and Asif et al. (2013) regarding the stakeholder identification. In addition, the authors of this study acknowledged a few more gaps in the framework of Asif et al. (2013), one of which was the IMS creation. The literature concurs that an IMS can enable the integration of CS practices (Asif et al., 2013; Jørgensen, 2008; Rebelo et al., 2016), and therefore the compliance level with an IMS model (Rebelo et al., 2016) was investigated to correctly map out the current practices at Northvolt. Out of the 14 activities in the Plan stage, two were deemed unnecessary and non-compliant. The applicability level of Rebelo et al. (2016) in practice is therefore only 12/14, with four of those completed.

4.5 Updated Framework

To fulfill the third and last objective of this study, an updated SMS framework was developed, see table 10. The framework is based on the empirical results from the studied frameworks' applicability in practice as well as the identified gaps presented in chapter 4.3.

Table 10. Updated SMS framework, inspired by Asif et al. (2013) and Rebelo et al., (2016)

Phase	Activities to integrate CS	Parallel activities to integrate CS
Prerequisite	1. System initiator 2. Establish a strong leadership	A. Create a process for change management
Plan	3. Environmental scan 4. Define stakeholders and their requirements 5. Ensure that there are no clashes of interest/redundancies in different stakeholders' requirements 6. Ensure different stakeholder's requirements do not pull the organization in different directions 7. Engage in stakeholder consultation 8. Define CS in the organizational context 9. Define the business case for CS 10. Explore CS competencies 11. Develop indicators to measure performance 12. Develop community indicators 13. Identify resources required for CS 14. Secure top management commitment 15. Develop a business model for CS 16. Develop organizational charts with clearly defined CS responsibilities	B. Define a multidisciplinary team for the implementation C. Set up a "Steering Committee" D. Increase knowledge of the organization including its context E. Identify the needs, and expectations of interested parties, both internal and external F. Determine and document the scope of the SMS G. Identify legal and other applicable requirements, as well as all potential risks, and critical success factors H. Define and receive approval of the SMS policy by top management I. Address and assess the significance of risks and impact (positive or negative) on the business and environment J. Define the management program of the SMS consistent with the policy K. Discuss and receive consequent approval of the management program by the "Steering Committee" L. Define a specific plan of information and training for all collaborators and other relevant interested parties M. Structure an SMS manual including the needed processes KPIs, process owners, etc.
Do	17. Integrate CS vertically 18. Integrate CS horizontally 19. Develop CS technical structures, such as manuals, procedures, work instructions, and processes 20. Develop CS social structures, such as	N. Communicate/publish the SMS to all collaborators and other interested parties O. Implement the management program of the SMS P. Define, structure, and test the needed contingency plans Q. Define, structure, and implement the

	teamwork, training, and competencies	needed operational instructions, including the outsourced processes
	21. Develop CS routines	R. Retain the required documented information to demonstrate the compliance of the SMS
	22. Develop a culture conducive for CS	
	23. Align social and technical structures	
	24. Manage CS knowledge	
	25. Adhere to strategic plans for realization of CS long-term objectives	
	26. Respond appropriately upon transgression	
	27. Ensure transparency in CS integration	

First and foremost, the case study implied that CSR is an old definition, and that CS is more appropriate, therefore this framework aims to integrate CS throughout the organization. The addition of the first activity in table 10 was made due to empirical evidence that the case study company exhibits bold leadership and is committed to SD through creating a sustainability-driven business case. This activity had a major impact on the approach to sustainability in the case study company, a result in line with Nawaz and Koç's (2018) argument. Change management is a prerequisite in table 10 as it is seen as a critical component to maintain an IMS (Searcy et al., 2012), or an SMS in our case. The 12 activities in the Plan stage of Rebelo et al. (2016) that were seen as applicable (see 4.2.2) were included in the framework to overcome the gap to achieve an IMS. These specific IMS activities, therefore, run parallel to the CS activities in the same PDCA cycle. Activities 17-27 focus on integrating CS, while activities A-R focus on creating the IMS that enables CS (Asif et al., 2013; Nawaz & Koç, 2018; Rebelo et al., 2016; Rocha et al., 2007; Sroufe, 2017). Activities N-R are included in table 10 because they are built on the activities in the Plan stage which were applicable at the case study company. The applicability of those indicates that N-R should also be applicable in practice since they are built on the former stage. The aim of this study cannot be fulfilled without these activities, which is why they are included.

It is believed that this approach, the step-by-step development of CS and an IMS concurrently, will entail success factors such as sustainability-oriented learning (Siebenhüner & Arnold, 2007). Empirical evidence revealed major shortcomings in the organizational structure, documentation, and cooperation of the case study company (see 4.1), despite being compliant to two-thirds of the activities in the Plan stage (Asif et al., 2013). The shortcomings and the compliance level are however inequitable because the study by Asif et al. (2013) entrusts companies to already have some MSs and structures in place. The findings in this study show that the same assumption does not hold for nascent green-tech companies. Therefore activity 2 in table 10 was added as a

reinforcement and it regards both leadership for CS as well as the IMS, in line with Rocha et al. (2007) and Nawaz and Koç (2018). A strong leadership should convince, direct, and motivate employees to work in an aligned way, even if the appropriate structures are not yet established, and thereby secure the successful SMS implementation as argued in 4.1.7. Since this activity is performed before the IMS development takes place it is believed to imprint on the latter processes as well.

4.5.1 Roadmap for Northvolt

From the compliance analysis, it can be concluded that Northvolt has developed a large portion of the Plan and Do stages of the frameworks. However, in order to accomplish the desired SMS, partly compliant and non-compliant parts of the framework in table 10 will have to be completed. The remaining activities are presented in figure 14, where green boxes are suggested steps to achieve the activities in the black (Prerequisite), darker gray (Plan) and lighter gray (Do) boxes. The activities must not be completed in the order visualized in the figure, it is merely a visual representation of how change management should be incorporated throughout the process and how the theoretical framework can solve Northvolt's issues.
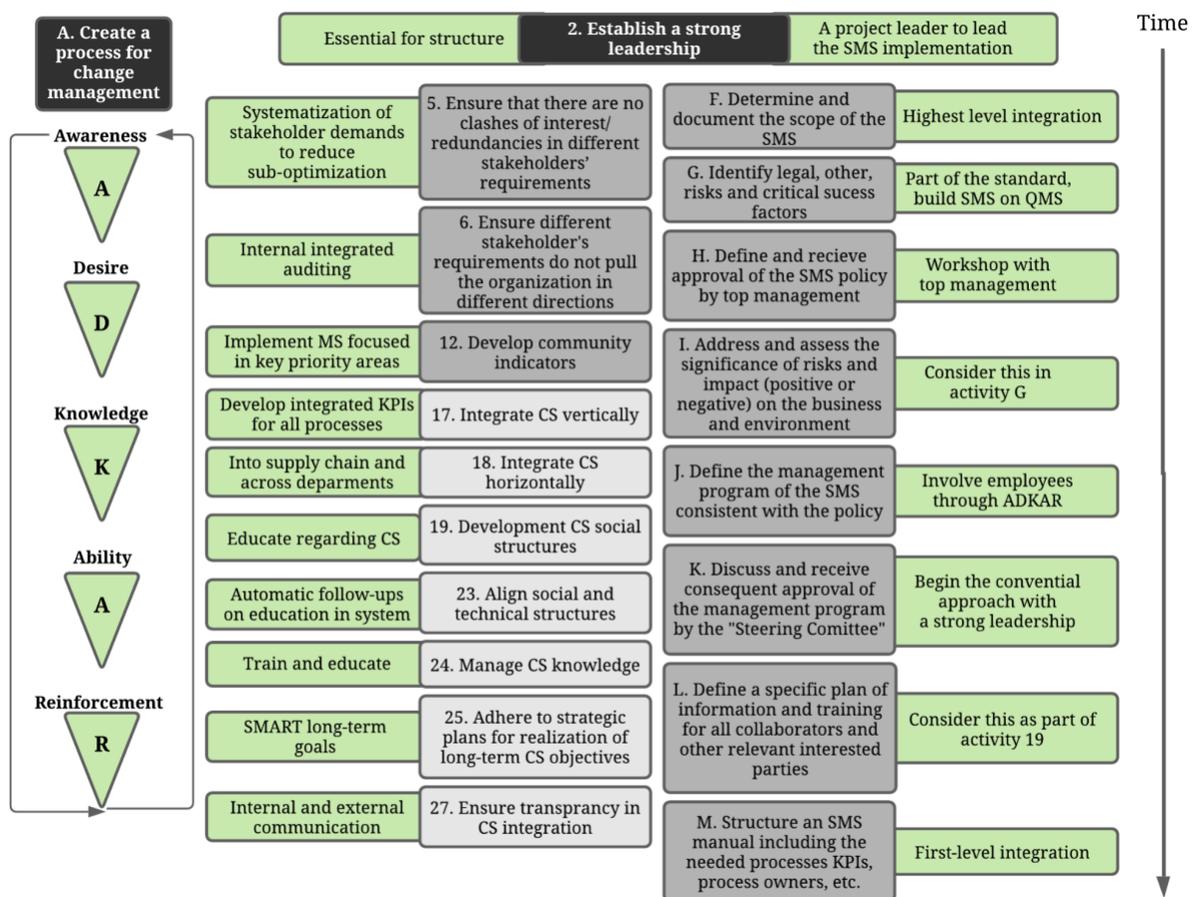

Figure 14. A visualized roadmap for Northvolt's remaining activities of the updated framework

The activities N-R in table 10 are not represented in figure 14 because they were not studied in the compliance analysis and Northvolt must first complete the Plan activities F-M before N-R can be implemented. Like any other framework or model, table 10 needs individualization and company specific details to be successfully applied at the company (Rocha et al., 2007). Different MSs are integrated depending on a company's specific circumstances (Rocha et al., 2007), and Northvolt's wish for the SMS was *Integrated processes* consisting of a QMS, EMS, OHSMS and the production system. In table 10, activity F is important to individualize to the company's circumstances and the issues *Mentality of a Startup* and *Segregation across Northvolt* point to a full integration (Abad et al., 2014) because these issues require top management engagement and strategic alignment. This also implies the systems approach (Asif et al., 2010), which was Northvolt's expressed wish as this will help operationalize the CS (Rocha et al., 2007), i.e., achieve the wish *Sustainability in everything*. *Lack of transparency* and *Silo working* can also be solved through this framework, see activity 27. Transparency can be increased by internal and external communication (Engert et al., 2016) and with the SMS structure in place, CS will seep through the organization, eliminating the *Silo working*. Because the full integration builds upon the first and partial, it is important to acknowledge how these should occur too. Northvolt has the most issues in the triangle interrelation *Documentation, Cooperation,* and *Organizational structure* which could be solved by a first-level integration (see activity M) as argued by Wilkinson and Dale (2000). This will help all Northvolt entities to handle documents in the same way and solve the subthemes *Different channels, Barriers to information,* and *Lack of awareness* as shown in chapter 4.1.6. According to researchers (Asif et al., 2010; Salomone, 2008), Northvolt will save time and money through this integration allowing more time for educating employees on document management, which is expected to mitigate the *Lack of structure*.

Although the integration will solve some issues, a cultural issue like the *Mentality of a Startup* is deeply rooted in the corporate culture and therefore needs direct attention and a broad participation across the organization to be solved. Therefore, activity 2 in figure 14 "Establish a strong leadership" is critical for Northvolt. The findings show that a bold leadership for sustainability, as argued by Nawaz and Koç (2018), is integral at Northvolt but that strong leadership for the SMS implementation and organizational structure is missing. An adequate leadership will help achieve the objective of the third-level integration, namely, to secure a culture and climate that can facilitate the SMS in an effective way (Wilkinson & Dale, 2000) and find areas of improvement (Jørgensen, 2008). An entailing element to activity 2 that needs individualization in figure 14 is "A. Create a process for change management." The empirical findings show that many issues in figure 6 are interrelated, which means that a change in one area will have an impact on the overall situation. Therefore, management should begin the first step of integration by utilizing the change management opportunity that integration provides (Sroufe, 2017), which is an essential tool to successfully overcome resistance to change (Asif et al., 2010; Zutshi & Sohal, 2015). Drawing upon the results in chapter 4.3 and the characteristics of the change required in the SMS integration,

i.e. people's adaptation to change, the ADKAR model (Hiatt, 2006) is considered suitable for Northvolt. Due to the interrelated issues, the change management process should be constantly employed, parallel to the activities in figure 14. ADKAR will also help mitigate the barrier *Internal shift in power* and the code *Unclear vision*. Activity G is another activity that will depend on the specific circumstances in a company. Northvolt testified that identifying success factors was important but they were unaware that it should be done, see <u>Appendix 4</u>. However, an identified success factor for the overall integration at Northvolt is that the MSs are created into "the wheel of quality," which should lead to less resistance to change (Zutshi & Sohal, 2005). The development of MSs into "wheel of quality" will enable increased awareness of interrelations between different MSs, and when the highest level of integration is completed through efficient change management and strong leadership, interdisciplinary cooperation can be achieved (Zutshi & Sohal, 2005).

Complicated requirements posed as a barrier to the integration according to respondents. However, the benefits of MSs in an integrated system with a strategic alignment is that it satisfies stakeholder demands (Asif et al., 2010; Nunhes et al., 2019; Oliveira, 2013), reduces documentation, costs, the time needed to manage separate MSs (Salomone, 2008), and treats the system as part of the organization rather than a subsystem (Asif et al., 2010; Rocha et al., 2007). It can also optimize the use of resources, enhance process understanding, and reduce duplication of tasks, as shown in <u>Appendix 1</u>. These benefits correspond to the employees' requirements of an *User friendly and adapted* and *Understandable and accessible* system that *Mitigate double work*.

5. Conclusions

This chapter contains conclusions derived from the findings and the analyzes. Recommendations to practitioners are also provided.

The study aimed to develop a framework for how green-tech companies can achieve an SMS. Several researchers have developed conceptual frameworks for SMSs over the last two decades (Asif et al., 2013; Castka et al., 2004; Nawaz & Koç, 2018; Rocha et al., 2007), but the question of their applicability in practice remains a critical challenge for practitioners. This study integrated the literature on SMS and IMS frameworks and models while considering perspectives of a nascent green-tech company. A battery cell manufacturer was chosen as this industry faces several sustainability threats (OECD, 2016) and is emerging rapidly parallel to SDG 7 and the electrification of the automotive industry (World Economic Forum, 2019). The aim was realized by testing an SMS framework's and IMS model's applicability in a case study, evaluating the results, and presenting suggested improvements based on the empirical findings in an updated framework. It was concluded that the Plan and Do stages in the SMS framework by Asif et al. (2013) are applicable in a nascent green-tech company. The IMS model by Rebelo et al. (2016) was applicable regarding 12 out of the 14 activities investigated in this study. Moreover, the top-down and bottom-up approach for stakeholder identification were empirically investigated and the approaches were proven to be used concurrently at Northvolt, which therefore fills a research gap as expressed by Asif et al. (2013).

The updated framework corroborates with the study by Asif et al. (2013) complemented by the studies by Nawaz and Koç (2018), Rebelo et al. (2016) and the ADKAR model (Hiatt, 2006). It therefore became a more encompassing framework that can be used to achieve an SMS in green-tech companies. The developed compliance analysis in this study can also be used to evaluate the SMS development in any company Asif et al. (2013) describe as appropriate. The updated framework focuses on CS since it is the contemporary interpretation of companies' work towards SD. The framework also accounted for the nascent case study company's absence of adequate structure by suggesting activities to mitigate symptoms of it during the implementation.

To practitioners that aims to implement an SMS, defined as an IMS with CS aspects integrated horizontally and vertically, we recommend the following:
- A change management process should be a prerequisite to develop an SMS as it is helpful in overcoming barriers connected to the implementation.
- The organizational structure can be restrained by a startup culture and mentality. In order to establish proper MS structures, an appropriate company culture and climate is essential. Establishing a strong and bold leadership that can address such sub-optimizations, behaviors and attitudes, and spread the CS vision, is therefore of highest priority in companies that lack structure.

- Barriers for the implementation of an SMS is important to investigate in the early phases of the implementation. This gives management a chance to mitigate their effect and work with change management regarding barriers from employees' resistance to change.
- The first-level integration can lead to a leaner document system, which is desired as MS standards were seen as bureaucratic requirements in the case study company. This integration is beneficial for companies with various operational sites that seek transparency and cross-border cooperation. However, the full integration is recommended as it should help operationalize CS through the mitigation of silo working within the CS department.

A company will have achieved an SMS when fulfilling all activities in table 10, according to our study. The updated framework is expected to be applicable and adaptable in practice, as was shown in the customized roadmap adapted to Northvolt's circumstances. Northvolt found the updated framework to be helpful, comprehensive, and useful regarding many different aspects. Most importantly, they were thankful for the step-by-step roadmap in 4.5.1. The authors consider the findings to be applicable to other green-tech companies and sustainability-focused battery cell manufacturers that intend to work with CS in a structured way to contribute to SD.

6. Discussion

In this chapter is a discussion regarding the trustworthiness of results presented. Thereafter, the theoretical and practical implications of the results, the limitations of the study, and suggestions for future research are provided.

6.1 Discussion

As only one company was studied, certain limitations in the result are expected. For one, the result will not necessarily be applicable to *all* other green-tech companies because this is a relatively broad term. Secondly, the location of the company entails regulatory and legislative requirements that plausibly will limit the study from being applicable to other countries. Thirdly, a majority of battery cell manufacturers are located in Asia which, if studied, may have imprinted differently on the results. In addition, this industry is diverse and there may be large differences between countries in sustainability engagement and CS endeavors.

It is plausible to argue that the compliance analysis, as well as the resulting framework, were distorted to only highlight Asif et al. (2013) because it had the most prevalence in the interview study. However, the open-ended questions and the relaxed interview atmosphere allowed respondents to expand their reasoning which gave the answers depth. That depth along with the sequence of phases in the interview study is believed to have mitigated such a biased view and results. The open-ended questions and follow-up questions also allowed interviewers to discover possible additional practices, which were later presented in 4.3. In addition, the literature review of SMS frameworks and the resulting table 3 was made using an array of prominent SMS frameworks and models which all confirmed a considerable part of the activities in Asif et al. (2013).

The gaps found in the framework of Asif et al. (2013) would possibly be different if another company was studied. However, aside from the system initiator and the CS gap, the remaining gaps should be of general character independent of the company. This entails that the gaps in the framework by Asif et al. (2013) for how to create an IMS and how to use change management to overcome barriers connected to SMS implementation and development is consistent. On the contrary, the system initiator and the CS gap is dependent on the case study company's mission and beliefs which will probably differ between different companies.

The length of the interviews with respondents ranged from 30 minutes to 60 minutes which gave some respondents higher prevalence in the transcribed material. However, when the TA was made, all codes and quotes were sorted under each of the respondents and we concluded that each respondent contributed equally to this part of the analysis. Therefore, it is expected that the

distribution of the quotes and findings in the empirical findings are equitable and that there should be no biases portrayed.

A different choice of research method could have been surveys. This method would allow for both a quantitative and a qualitative analysis and avoid the time-consuming task of transcribing interviews. During this thesis, the authors were employed at Northvolt and a similar study could have been done without being employed which may mitigate possible biased analyzes that could occur if the interviewers know the respondent or vice versa. However, in this study, the authors did not meet any interview respondents other than the supervisor before the interviews were conducted. Therefore, no such bias should be inflicted in the result. Being completely disconnected from the company would not have given the same insight and observation opportunities and since the objective of this study was to gather empirical evidence in nascent green-tech companies, a company like Northvolt was desirable. The authors also reason that the measured data and the analyzes match the aim and objectives. Repeating the study in another green-tech company is assumed to reach similar results, but can not be guaranteed.

6.2 Contributions and Implications

6.2.1 Contributions to Research

The originality of the work lies in testing the applicability of the current frameworks in practice. The resulting updated framework contributes to research by an enlightened view on the SMS development and how to assess a company's implementation of an SMS. We argue that the updated framework includes the most important aspects that should be included in an SMS framework as it is based on state-of-the-art research. A major contribution to research is the compliance analyzes in Appendix 3 and 4 which give examples of practices that should result in compliance with the conceptual frameworks. This gives researchers an in-depth insight into how the actual operationalization of CS and IMSs occur in a green-tech company, which ultimately addresses the scarcity of empirical studies in research.

6.2.1 Contributions to Northvolt

For the specific case study company, the results and value of this study is found in chapter 4.5.1, where the updated framework is explicitly described in correlation to the empirical findings. In addition, the detailed analysis of the framework's application at Northvolt is expected to fast-track Northvolt's process of achieving an SMS. If the suggestions are adopted, Northvolt could have an SMS implemented in the near future which will help overcome the barriers of upscaling. The updated framework enables certification of MSs, in line with Asif et al. (2013), which, if executed, will help Northvolt disclose important information about their CS work to stakeholders (Qi et al., 2013). This step is vital for profitability and survivability (Asif et al., 2013), and therefore important given Northvolt's uncertain upscaling phase. However, as noted, for the SMS to be

complete, Northvolt also needs to implement the Check and Act stages of Asif et al. (2013) in which stakeholder communication will also be an integral part.

The SMS suggested in this study incorporates QMS, EMS, OHSMS, and CS aspects, however it might as well incorporate more or fewer MS standards. If Northvolt would like to certify with additional MS standards, these can be adopted into the SMS by iterating the Plan and Do steps. Moreover, the suggestions of steps to take to achieve an SMS in chapter 4.5.1 are beneficial for all Northvolt entities since the SMS is a company-wide solution. It is possible that the cross-border collaborations can massively improve by such an overall MS.

6.2.3 Contributions to Other Green-tech Companies

The main contribution of this study to other green-tech companies is the updated SMS framework for evaluating their endeavors towards SMSs, which provides an understanding to managers of the path towards incorporating CS into the organization. This framework can be utilized to efficiently operationalize CS at the operational level, and thereby create the competitive advantage that Engert et al. (2016) speaks of, and contribute to SD. Moreover, this updated framework provides green-tech companies with a tool to go beyond the business case, i.e., actively manage a business case for sustainability (Schaltegger & Wagner, 2008), which will contribute to SDG 7 and 12 while safeguarding the planetary boundaries. The compliance analysis and the "Description of activity at the company"-column gives practitioners in-depth examples of how to accomplish the different activities listed in the framework. Appendix 3 and 4 can also be used as a benchmarking tool for companies that want to assess their IMSs/SMSs.

6.3 Limitations and Future Research

The framework does not include the Check and Act stages since they were not possible to evaluate in the case study company. The lack of activities for continuous improvement of the SMS is therefore a major shortcoming in this study, since the CS performance depends (partly) on the capability of continuously improving (Asif et al., 2013; Jørgensen, 2008). The Do stage of Rebelo et al. (2016) was also not tested in practice due to the current situation of the case study company and hence, the IMS steps in the updated framework are limited. However, the congruence with the Plan stage indicates that the Do stage should be applicable, but this must be tested in future research. A suggestion to researchers is therefore to test all phases in Asif et al. (2013) and to do so in a mature green-tech company that has a proper organizational structure in place. Another shortcoming in this study is that the framework by Asif et al. (2013) has great emphasis on stakeholder management, but our results only reflect Northvolt's perspective on their stakeholders while it should be the other way around. Future research should therefore investigate how the stakeholders perceive this framework and subsequently decide if those views are aligned with the result in this study.

Regarding the validity of the results, the heterogeneity of respondents may provide multiple sources of converging data on the same issues, complemented by the document study. The respondents represent Northvolt, which is defined as a green-tech company due to their products. One limitation of the study is that Northvolt cannot represent all green-tech companies as they are upscaling from a startup, a state that means a lot of immature structures, therefore many suggestions are aimed at the early phases of SMS implementation. However, because the "important" column was added, the impact of Northvolt's immature company structures was negligible. It is, therefore, reasonable to assume that the results also apply to more mature, established green-tech companies. However, a suggestion for future studies is to complement our study by acquiring quantitative data from multiple green-tech companies, in different sizes and maturity degrees, to test this and reach more reliable and extensive results. Moreover, this study did not examine the framework by Nawaz and Koç (2018) in-depth, instead, it was used as a comparative framework due to the differences between it and Asif et al. (2013). Only elements of Nawaz and Koç (2018) that were immediately observed in the case study were examined. Future research should focus on how their study could complement our framework and, more specifically, how their framework should be tested in practice.

References

Abad, J., Cabrera, H. R., & Medina-León, A. (2016). An analysis of the perceived difficulties arising during the process of integrating management systems. *Journal of Industrial Engineering and Management (JIEM), 9*(3), 860-878. http://dx.doi.org/10.3926/jiem.1989

Abad, J., Dalmau, I., & Vilajosana, J. (2014). Taxonomic proposal for integration levels of management systems based on empirical evidence and derived corporate benefits. *Journal of Cleaner Production, 78*, 164-173. https://doi.org/10.1016/j.jclepro.2014.04.084

Artiach, T., Lee, D., Nelson, D., & Walker, J. (2010). The determinants of corporate sustainability performance. *Accounting & Finance, 50*(1), 31-51. https://doi.org/10.1111/j.1467-629X.2009.00315.x

Ashrafi, M., Adams, M., Walker, T. R., & Magnan, G. (2018). How corporate social responsibility can be integrated into corporate sustainability: a theoretical review of their relationships. *International Journal of Sustainable Development & World Ecology*, *25*(8), 672-682. https://doi.org/10.1080/13504509.2018.1471628

Asif, M., de Bruijn, E. J., Fisscher, O. A., Searcy, C., & Steenhuis, H. J. (2009). Process embedded design of integrated management systems. *International Journal of Quality & Reliability Management, 26*(3), 261-282. https://doi.org/10.1108/02656710910936735

Asif, M., Fisscher, O. A., de Bruijn, E. J., & Pagell, M. (2010). Integration of management systems: A methodology for operational excellence and strategic flexibility. *Operations Management Research, 3*(3-4), 146-160. https://doi.org/10.1007/s12063-010-0037-z

Asif, M., Searcy, C., Zutshi, A., & Fisscher, O. A. (2013). An integrated management systems approach to corporate social responsibility. *Journal of Cleaner Production, 56*, 7-17. https://doi.org/10.1016/j.jclepro.2011.10.034

Beckmerhagen, I. A., Berg, H. P., Karapetrovic, S. V., & Willborn, W. O. (2003). Auditing in support of the integration of management systems: a case from the nuclear industry. *Managerial Auditing Journal, 18*(6/7), 560-568. https://doi.org/10.1108/02686900310482696

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Braun, V. & Clarke, V. (2013). *Successful Qualitative Research – a practical guide for beginners.* Sage Publications.

Brundtland, B. G. (1987). *Our Common Future*. The World Commission on Environment and Development. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Campbell, J. L. (2007). Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility. *Academy of Management Review, 32*(3), 946-967. https://doi.org/10.5465/amr.2007.25275684

Castka, P., Bamber, C. J., Bamber, D. J., & Sharp, J. M. (2004). Integrating corporate social responsibility (CSR) into ISO management systems–in search of a feasible CSR management system framework. *The TQM magazine, 16*(3), 216-224. https://doi.org/10.1108/09544780410532954

Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing, 22*(1), 29-49. https://doi.org/10.1016/j.jbusvent.2004.12.001

Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing, 22*(1), 50-76. https://doi.org/10.1016/j.jbusvent.2005.09.003

Deming, W. E. (2018). *The new economics for industry, government, education*. MIT press.

Elkington, J. (1997). *Cannibals with forks – The triple bottom line of 21st century business*. Capstone Publishing Ltd.

Engert, S., Rauter, R., & Baumgartner, R. J. (2016). Exploring the integration of corporate sustainability into strategic management: a literature review. *Journal of Cleaner Production, 112*, 2833-2850. https://doi.org/10.1016/j.jclepro.2015.08.031

Esquer-Peralta, J., Velazquez, L., & Munguia, N. (2008). Perceptions of core elements for sustainability management systems (SMS). *Management Decision, 46*(7), 1027-1038. https://doi.org/10.1108/00251740810890195

Garvare, R., & Johansson, P. (2010). Management for sustainability – a stakeholder theory. *Total Quality Management, 21*(7), 737-744. https://doi.org/10.1080/14783363.2010.483095

Ghobakhloo, M. (2018). The future of manufacturing industry: a strategic roadmap toward Industry 4.0. *Journal of Manufacturing Technology Management, 29*, 910-936. https://doi.org/10.1108/JMTM-02-2018-0057

Gianni, M., & Gotzamani, K. (2015). Management systems integration: lessons from an abandonment case. *Journal of Cleaner Production, 86*, 265-276. https://doi.org/10.1016/j.jclepro.2014.08.023

Gianni, M., Gotzamani, K., & Tsiotras, G. (2017). Multiple perspectives on integrated management systems and corporate sustainability performance. *Journal of Cleaner Production, 168*, 1297-1311. https://doi.org/10.1016/j.jclepro.2017.09.061

Greener, S. (2008). *Business research method*. Ventus Publishing ApS.

Hiatt, J., M. (2006). *ADKAR: a model for change in business, government, and our community*. Prosci Learning Center Publications.

Hiatt, J., M. (2013). *Employees Survival Guide to Change: The Complete Guide To Surviving and Thriving During Organizational Change* (3 uppl.). Prosci Inc.

ISO. (2010). *Guidance on social responsibility* (ISO 26000:2010). Svenska Institutet för Standarder. https://www.iso.org/standard/42546.html

ISO. (2015a). *Environmental management systems - Requirements with guidance for use* (ISO 14001:2015, 3. ed.). Svenska Institutet för Standarder. https://www.iso.org/standard/60857.html

ISO. (2015b). *Quality management systems - Requirements* (ISO 9001:2015, 4. ed.). Svenska Institutet för Standarder. https://www.iso.org/standard/62085.html

ISO. (2018). *Occupational health and safety management systems — Requirements with guidance for use* (ISO 45001:2018). Svenska Institutet för Standarder. https://www.iso.org/standard/63787.html

ISO. (n.d.). *Management System Standards*. https://www.iso.org/management-system-standards.html

Jørgensen, T. H. (2008). Towards more sustainable management systems: through life cycle management and integration. *Journal of Cleaner Production, 16*(10), 1071-1080. https://doi.org/10.1016/j.jclepro.2007.06.006

Jørgensen, T. H., Remmen, A., & Mellado, M. D. (2006). Integrated management systems – three different levels of integration. *Journal of Cleaner Production, 14*(8), 713-722. https://doi.org/10.1016/j.jclepro.2005.04.005

Karapetrovic, S. (2002). Strategies for the integration of management systems and standards. *The TQM Magazine, 14*(1), 61-67. https://doi.org/10.1108/09544780210414254

Karapetrovic, S. (2003). Musings on integrated management systems. *Measuring business excellence, 7*(1), 4-13. https://doi.org/10.1108/13683040310466681

Labodová, A. (2004). Implementing integrated management systems using a risk analysis based approach. *Journal of Cleaner Production, 12*(6), 571-580. https://doi.org/10.1016/j.jclepro.2003.08.008

Lopes de Sousa Jabbour, A. B. L., Jabbour, C. J. C., Godinho Filho, M., & Roubaud, D. (2018). Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. *Annals of Operations Research*, *270*(1), 273-286. https://doi.org/10.1007/s10479-018-2772-8

López-Fresno, P. (2010). Implementation of an integrated management system in an airline: a case study. *The TQM Journal, 22*(6), 629-647. https://doi.org/10.1108/17542731011085311

Lozano, R. (2013). Are companies planning their organisational changes for corporate sustainability? An analysis of three case studies on resistance to change and their strategies to overcome it. *Corporate Social Responsibility and Environmental Management, 20*(5), 275-295. https://doi.org/10.1002/csr.1290

Lozano, R., Carpenter, A., & Huisingh, D. (2015). A review of 'theories of the firm' and their contributions to Corporate Sustainability. *Journal of Cleaner Production, 106*, 430-442. https://doi.org/10.1016/j.jclepro.2014.05.007

Meyskens, M., & Carsrud, A. L. (2013). Nascent green-technology ventures: a study assessing the role of partnership diversity in firm success. *Small Business Economics, 40(*3), 739-759. https://doi.org/10.1007/s11187-011-9400-1

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853-886. https://doi.org/10.5465/amr.1997.9711022105

Mustapha, M. A., Manan, Z. A., & Alwi, S. R. W. (2017). Sustainable Green Management System (SGMS) – An integrated approach towards organizational sustainability. *Journal of Cleaner Production, 146*, 158-172. https://doi.org/10.1016/j.jclepro.2016.06.033

Muzaimi, H., Chew, B. C., & Hamid, S. R. (2017). Integrated management system: The integration of ISO 9001, ISO 14001, OHSAS 18001 and ISO 31000. In *AIP conference proceedings* (Vol. 1818, No. 1, p. 020034). AIP Publishing LLC. https://doi.org/10.1063/1.4976898

Nadae, J., Carvalho, M. M., & Vieira, D. R. (2020). Integrated management systems as a driver of sustainability performance: exploring evidence from multiple-case studies. *International Journal of Quality & Reliability Management.* Pre-publication online. https://doi.org/10.1108/IJQRM-12-2019-0386

Naden, C. (2018, 15 November). *Guidance on Integrated Management System Standards Just Updated*. ISO. https://www.iso.org/news/ref2347.html

Nawaz, W., & Koç, M. (2018). Development of a systematic framework for sustainability management of organizations. *Journal of Cleaner Production, 171*, 1255-1274. https://doi.org/10.1016/j.jclepro.2017.10.011

Northvolt. (2020a, June 1). *Northvolt and Hydro launch joint venture to enable electric vehicle battery recycling*. https://northvolt.com/newsroom/Announcing-HydroVolt

Northvolt. (2020b, September 29). *Northvolt raises $600 million in equity to invest in capacity expansion, R&D and giga-scale recycling*. https://northvolt.com/newsroom/Northvolt-Sept2020 Northvolt. (2020c). *2020 Sustainability Survey - Results & Comment Themes* [PowerPoint].

Northvolt. (2021a, February 19). *Northvolt expands operations in Poland to establish Europe's largest factory for energy storage solutions*. https://northvolt.com/newsroom/Systems-Poland

Northvolt. (2021b, February 24). *Sustainable battery revolution – TIER and Northvolt start partnership to equip e-scooters with greener batteries*. https://northvolt.com/newsroom/TIER-scooters

Northvolt. (n.d.). *Manufacturing*. https://northvolt.com/manufacturing#manufacturing-locations

Nunhes, T. V., Bernardo, M., & Oliveira, O. J. (2019). Guiding principles of integrated management systems: Towards unifying a starting point for researchers and practitioners. *Journal of Cleaner Production, 210*, 977-993. https://doi.org/10.1016/j.jclepro.2018.11.066

OECD. (2016). *OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas* (Third Edition). OECD Publishing. http://dx.doi.org/10.1787/9789264252479-en

Oliveira, O. J. (2013). Guidelines for the integration of certifiable management systems in industrial companies. *Journal of Cleaner Production, 57*, 124-133. https://doi.org/10.1016/j.jclepro.2013.06.037

Panagiotakopoulos, P., Espinosa, A., & Walker, J. (2015). Integrated sustainability management for organizations. *Kybernetes, 44*(6/7), 984-1004. https://doi.org/10.1108/K-12-2014-0291

Parmar, B. L., Freeman, R. E., Harrison, J. S., Wicks, A. C., Purnell, L., & De Colle, S. (2010). Stakeholder theory: The state of the art. *Academy of Management Annals, 4*(1), 403-445. https://doi.org/10.5465/19416520.2010.495581

Poltronieri, C. F., Ganga, G. M. D., & Gerolamo, M. C. (2019). Maturity in management system integration and its relationship with sustainable performance. *Journal of Cleaner Production, 207*, 236-247. https://doi.org/10.1016/j.jclepro.2018.09.250

Qi, G., Zeng, S., Yin, H., & Lin, H. (2013). ISO and OHSAS certifications. *Management Decision, 51*(10), 1983-2005. https://doi.org/10.1108/MD-11-2011-0431

Rocha, M., Searcy, C., & Karapetrovic, S. (2007). Integrating sustainable development into existing management systems. *Total Quality Management & Business Excellence, 18*(1-2), 83-92. https://doi.org/10.1080/14783360601051594

Rojko, A. (2017). Industry 4.0 Concept: Background and Overview. *International Journal of Interactive Mobile Technologies (iJIM), 11*(5), 77. https://doi.org/10.3991/ijim.v11i5.7072

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1), 16-27. https://doi.org/10.1108/01409170210782990

Rößler, R., & Schlieter, H. (2015). Towards Model-based Integration of Management Systems. Thomas, O. Teuteberg, F. (Hrsg). In *Wirtschaftsinformatik Proceedings 2015* (pp. 31-45). http://aisel.aisnet.org/wi2015/3

Salomone, R. (2008). Integrated management systems: experiences in Italian organizations. *Journal of Cleaner Production, 16*(16), 1786-1806. https://doi.org/10.1016/j.jclepro.2007.12.003

Santos, G., Mendes, F., & Barbosa, J. (2011). Certification and integration of management systems: the experience of Portuguese small and medium enterprises. *Journal of Cleaner Production, 19*(17-18), 1965-1974. https://doi.org/10.1016/j.jclepro.2011.06.017

Sarkar, S., & Searcy, C. (2016). Zeitgeist or chameleon? A quantitative analysis of CSR definitions. *Journal of Cleaner Production*, *135*, 1423-1435. https://doi.org/10.1016/j.jclepro.2016.06.157

Saunders, M., Lewis, P., & Thornhill, A. (2012). *Research methods for business students* (6. ed.). Pearson Education.

Schaltegger, S., & Wagner, M. (2008). Managing the business case for sustainability. In *EMAN-EU 2008 Conference* (pp. 7-9).

Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Business Strategy and the Environment 20.4*, 222-237. https://doi.org/10.1002/bse.682

Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development, 6*(2), 95-119. https://doi.org/10.1504/IJISD.2012.046944

Searcy, C., Morali, O., Karapetrovic, S., Wichuk, K., McCartney, D., McLeod, S., & Fraser, D. (2012). Challenges in implementing a functional ISO 14001 environmental management system. *International Journal of Quality & Reliability Management*, 29(7), 779-796. https://doi.org/10.1108/02656711211258526

Siebenhüner, B., & Arnold, M. (2007). Organizational learning to manage sustainable development. *Business Strategy and the Environment, 16*(5), 339-353. https://doi.org/10.1002/bse.579

Simon, A., Bernardo, M., Karapetrovic, S., & Casadesús, M. (2011). Integration of standardized environmental and quality management systems audits. *Journal of Cleaner Production, 19*(17-18), 2057-2065. https://doi.org/10.1016/j.jclepro.2011.06.028

Siva, V., Gremyr, I., Bergquist, B., Garvare, R., Zobel, T., & Isaksson, R. (2016). The support of Quality Management to sustainable development: A literature review. *Journal of Cleaner Production, 138*, 148-157. https://doi.org/10.1016/j.jclepro.2016.01.020

Sroufe, R. (2017). Integration and organizational change towards sustainability. *Journal of Cleaner Production, 162*, 315-329. https://doi.org/10.1016/j.jclepro.2017.05.180

Ranängen, H., & Lindman, Å. (2020). Walk the Talk—A Sustainability Management System for Social Acceptance in Nordic Mining. *Sustainability, 12*(9), 1-27. https://doi.org/10.3390/su12093508

Ranängen, H., & Zobel, T. (2014). Exploring the path from management systems to stakeholder management in the Swedish mining industry. *Journal of Cleaner Production, 84*, 128-141. https://doi.org/10.1016/j.jclepro.2014.04.025

Rebelo, M., Santos, G., & Silva, R. (2014). Conception of a flexible integrator and lean model for integrated management systems. *Total Quality Management & Business Excellence, 25*(5-6), 683-701. https://doi.org/10.1080/14783363.2013.835616

Rebelo, M. F., Santos, G., & Silva, R. (2016). Integration of management systems: Towards a sustained success and development of organizations. *Journal of Cleaner Production, 127*, 96-111. https://doi.org/10.1016/j.jclepro.2016.04.011

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... & Foley, J. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and society, 14*(2). http://www.ecologyandsociety.org/vol14/iss2/art32/

United Nations. (2015). *Transforming our world: the 2030 agenda for sustainable development* (A/RES/70/1). https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

United Nations. (n.d.). *Ensure access to affordable, reliable, sustainable and modern energy for all.* Department of Economic and Social Affairs Sustainable Development. https://sdgs.un.org/goals/goal7

Vermeulen, W.J., & Witjes, S. (2016). On addressing the dual and embedded nature of business and the route towards corporate sustainability. *Journal of Cleaner Production, 112*, 2822-2832. https://doi.org/10.1016/j.jclepro.2015.09.132

Wagner, M. (2007). Integration of environmental management with other managerial functions of the firm: empirical effects on drivers of economic performance. *Long Range Planning, 40*(6), 611-628. https://doi.org/10.1016/j.lrp.2007.08.001

Wilkinson, G., & Dale, B. G. (2000). Management system standards: the key integration issues. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 214*(9), 771-780. https://doi.org/10.1243%2F0954405001517838

World Economic Forum. (2019). *A Vision for a Sustainable Battery Value Chain in 2030 Unlocking the Full Potential to Power Sustainable Development and Climate Change Mitigation*.http://www3.weforum.org/docs/WEF_A_Vision_for_a_Sustainable_Battery_Value_Chain_in_2030_Report.pdf

Zeng, S. X., Shi, J. J., & Lou, G. X. (2007). A synergetic model for implementing an integrated management system: an empirical study in China. *Journal of Cleaner Production, 15*(18), 1760-1767. https://doi.org/10.1016/j.jclepro.2006.03.007

Zutshi, A., & Sohal, A. S. (2005). Integrated management system. *Journal of Manufacturing Technology Management, 16*(2), 211-232. https://doi.org/10.1108/17410380510576840

Yin, R. K. (2006). *Case Study Research: Design and methods* (4th ed.). Sage Publications.

Appendix 1. Benefits and Risks with IMS

Table A. Benefits and risks with IMS

Potential benefits with integration	References	Potential risk/difficulties with integration	References
Easier management of sustainability aspects	Rebelo et al. (2016);	Incongruities between individual MS standards leading to insufficient integrability	Asif et al. (2009); Asif et al. (2010); Santos et al. (2011); Searcy et al. (2012);
Reduced time/cost of management	Muzaimi et al. (2017); Salomone (2008); Santos et al. (2011); Simon et al. (2011); Wilkinson and Dale (2000);	Developing an overly complex IMS, for example through create lengthy procedures and complex work instructions	Asif et al. (2009); Asif et al. (2010); Santos et al. (2011); Wilkinson and Dale (2000);
Common policy, objectives, goals, manuals, and KPIs	Asif et al. (2010); Muzaimi et al. (2017); Oliveira (2013); Rebelo et al. (2016); Salomone (2008); Santos et al. (2011);	Difficulties when integrating systems	Santos et al. (2011);
Simplification of tasks, development of employees' skills, and enhanced processes understanding	Asif et al. (2010); Muzaimi et al. (2017);	Difficulties associated to changes in the organizational culture and procedures	Santos et al. (2011);
Elimination of conflicts between individual systems	Muzaimi et al. (2017); Rebelo et al. (2016);	Long integration process	Santos et al. (2011);
Resources optimization, especially human and financial resources	Muzaimi et al. (2017); Oliveira (2013); Rebelo et al. (2016); Salomone (2008); Santos et al. (2011); Simon et al. (2011);	Initial higher costs related to an increase in non-conformities	Santos et al. (2011);
Improved company image (internally and externally)	Muzaimi et al. (2017); Rebelo et al. (2016); Salomone (2008); Santos et al. (2011);	Employee resistance to change	Asif et al. (2009); Asif et al. (2010); Wilkinson and Dale (2000);
Continual improvement culture and attitude amongst employees	Asif et al. (2010); Muzaimi et al. (2017);	Lack of knowledge in how to perform integrated audits, leading to	Asif et al. (2010); Beckmerhagen et al. (2003); Searcy et al.

	Rebelo et al. (2016); Salomone (2008);	difficulty in making continuous improvements	(2012); Simon et al. (2011);
Improved partnership with customers and suppliers	Asif et al. (2010); Rebelo et al. (2016);	Increased documentation and bureaucracy initially	Asif et al. (2010);
Increased company competitiveness	Rebelo et al. (2016); Salomone (2008);	Risk of not assigning the right level of importance to different stakeholder requirements/IMS components	Asif et al. (2010); Gianni and Gotzamani (2015); Jørgensen et al. (2006); Salomone (2008); Searcy et al. (2012);
Added value for the business through elimination of waste (especially that of bureaucracy associated with independent MSs and their certifications and duplication of tasks)	Asif et al. (2010); Muzaimi et al. (2017); Rebelo et al. (2016); Salomone (2008); Santos et al. (2011); Simon et al. (2011)	More effort needed to accomplish all the requirements related to internal audits	Simon et al. (2011);
Improved risk management concerning quality, environment, and health and safety at work	Muzaimi et al. (2017); Rebelo et al. (2016);	Lack of support, ownership, and employee training	Gianni and Gotzamani (2015); Wilkinson and Dale (2000);
Reduced number of internal and/or external audits as well as decreased associated time and costs	Asif et al. (2010); Muzaimi et al. (2017); Oliveira (2013); Rebelo et al. (2016); Santos et al. (2011); Simon et al. (2011); Salomone (2008); Wilkinson and Dale (2000);	Lack of financial resources and knowledge to implement an IMS	Asif et al. (2009);
Reduced number of audits of suppliers	Rebelo et al. (2016);	Lack of human resources	Gianni and Gotzamani (2015);
Increased employee training	Asif et al. (2010); Santos et al. (2011);	Stopping at partly integrated MS	Gianni and Gotzamani (2015);
Easier compliance with legislation	Asif et al. (2010); Santos et al. (2011);	Withdrawal of top management commitment	Gianni and Gotzamani (2015);
Better and easier communication system	Asif et al. (2010); Oliveira (2013); Santos et al. (2011);	Some integration approaches are more beneficial than others (systems approach preferred over techno-centric approach)	Asif et al. (2010); Gianni and Gotzamani (2015);

Increased performance and efficiency	Muzaimi et al. (2017); Rebelo et al. (2016); Oliveira (2013); Santos et al. (2011);	Difficulty in organizing an IMS	Salomone (2008);
Streamlined operations	Asif et al. (2010); Oliveira (2013);	Non-integrated audits	Gianni and Gotzamani (2015);

Appendix 2. Interview Guide

Phase 1:

Questions to everyone:
- What is your role at Northvolt?
    - How long have you worked at Northvolt?

Sustainability/CSR:
- Define Corporate Social Responsibility (CSR) in your way? How do you work with it in your operations?
- How is Northvolt currently working with sustainability aspects?
- In what ways does Northvolt affect the environment?

Organization and MSs:
- How are the environmental, quality, health & safety teams organized today?
    - Are they separate or are they working together in some parts?
    - Are they also divided at each of Northvolt's entities or are they the same overall at Northvolt?
- Do you have an organizational chart of the CSR/environmental/quality/health & safety team with clearly defined roles and responsibilities?
- What documents does Northvolt have in place to lead the CSR/environmental/quality/health and safety work? (For example, policy, strategy, objectives, code of conduct, etc.)
    - How do you use them?
- Do you have any indicators or KPIs for each aspect: quality, environment, and health and safety?
    - How did you develop these?
- Is there a CSR/environmental/quality/health and safety MS already in place?
- What are your main struggles/biggest issues with the MS today?
    - Can you think of any solutions to this?
- How can an MS create value according to you?
- What do you wish for in Northvolt's SMS in the future?

Continuous improvement and audits:
- What are your processes for continuously improving?
    - How do you work with sharing learnings and knowledge in the organization?
- How does the communication regarding your MSs work today to get the employees to know about it and work with it?
- How many internal audits ("process coachings", as you call it) do you perform, and how many are you involved with, each year?
    - Related to which MS?
- How do you work with change management today?

Integration:
- How involved are you in the project to integrate MSs at Northvolt?
    - Are you on the steering committee there?

- What benefits do you think that an integration could mean to you in your daily work?
  - Do you think there could be any disadvantages?
- Do you think it is possible to integrate all MSs or do you think that you *have* to have some separate parts in the SMS?
  - Which parts must be separate?
- Which MSs do you intend to integrate?
- Which MS standards do you intend to have certified in the future?
- Which Northvolt entities do you plan to integrate?
- Have you integrated some documents, processes, or policies, etc. yet or are all of them separate?
  - If yes - do you know which ones?

Additional questions to CS responsible:
- How do you manage your stakeholders regarding sustainability?
  - Have you worked with a bottom-up or top-down approach, or both, to manage stakeholders?
- How do you audit your suppliers? Yearly/Quarterly? In-person? What aspects and documents do you look at?

Questions based on the Plan stage in Asif et al. (2013, p. 14):
- Have you done an environmental scan to identify social issues that may impact the organization?
- Have you made an analysis of which stakeholders you have and their requirements?
- Have you ensured that there are no clashes of interest in different stakeholders' requirements?
- Have you defined CSR in the organizational context?
- Have you defined the business case for CSR?
- Have you explored which competencies for CSR you have internally, at the individual level and organizational level?
- Have you developed indicators that can measure performance in CSR activities?
- Have you developed community indicators?
- Have you identified resources required for practicing CSR activities?
- Have you secured top management commitment to CSR?
- Have you developed a business model that incorporates CSR aspects?
- Have you developed an organizational chart that clearly defines CSR responsibilities?

Additional questions to the SMS project leader:
Questions based on the Plan stage in Rebelo et al. (2016, p. 108):
- Have you gathered a multidisciplinary team for planning the integration?
  - Which competencies have you gathered in the team?
- Have you set up a steering committee?
- Have you investigated the organizational context, both externally, such as the surrounding market, competition, legislation, culture, etc., and internally, such as your values, culture, knowledge, performance, etc.?
  - And also evaluated risks and opportunities related to these aspects?
- Have you identified the needs and expectations of interested (internal and external) parties/stakeholders?

- ○ How do you make sure that you are satisfying your customer's wants and needs?
  - ○ How do you continuously work to identify and notice changes in stakeholder requirements?
- Have you determined and documented which MSs to include in the IMS, i.e., the scope of the IMS?
  - ○ If yes - Could you please describe the scope?
- Have you conducted an evaluation of the MS standards requirements and their compatibility (similarities and differences)?
  - ○ If yes -What were your findings?
- Which country in which you operate has the strictest regulations and legislatures? Which should be the foundation of the IMS in that sense?
- Have you identified any critical success factors that will affect your possibility to implement an IMS?
  - ○ If yes - which are these critical success factors?
- Has the top management defined and approved an IMS policy?
  - ○ If yes - have you defined how you will manage the IMS in a way that is consistent with the IMS policy, in terms of objectives and action plans with realistic targets, needed resources, competencies, documented information, and responsibilities?
    - ■ If yes - has the steering committee discussed and approved this?
  - ○ If no - Have you defined any of the objectives, resources, competencies, responsibilities, etc. that are necessary for your IMS?
- Have you done a risk assessment of the risks that *have* or *may have* a significant impact (positive or negative) on the business, including the environment?
- Have you conducted an evaluation of existing integration models and chosen one that will be adopted in your case?
- Have you defined a plan for how you will share information and train employees regarding the IMS? And also other collaborators/stakeholders that may be of interest, for example in the supply chain?
- Have you identified and documented the necessary processes, KPIs, and process owners for the IMS?

Phase 2:
Questions to key respondents:
- Have you listed all your stakeholders?
    - If yes – could you please describe that process?
- How complete would you say that your work regarding defining stakeholders and their requirements?
    - Do you think it is important to do this?
- How have you ensured that you pay equal respect to community stakeholders and top-down stakeholders?
    - Do you think it is important to do this?
- Have you developed indicators that are important for the communities?
    - Do you think it is important?
- How have you ensured that different stakeholders' requirements do not pull the organizational processes in different directions?
    - Do you think it is important to do?
- Do you engage in consultations with your shareholders?
    - If so, how?
- How have you secured top management commitment to sustainability?
    - In what way can you know they are committed?
- Are employees trained in sustainability matters?
    - How often?
    - All employees or some specific departments?
    - How is the training conducted?
    - Do you think this is important?

Additional questions to CS responsible:
- Have you explored your current competencies for corporate sustainability at both the individual and organizational levels?
    - If yes – how did you do that?
- Have you identified all the resources you need for corporate sustainability work?
    - If yes – please describe this process and your findings.

Questions based on the Do stage in Asif et al. (2013, p. 14):
- Do you think that vertical integration of CS, by translating organizational objectives into tactical and operational imperatives, is important and something you want to do at Northvolt?
    - Have you begun doing this yet?
- Do you think that horizontal integration of CS across departments, functions, and the supply chain is important and something you want to do at Northvolt?
    - Have you begun doing this yet?
- Have you developed a technical structure including integrated manuals, procedures, work instructions, and processes for CS?
    - If so, how?
    - Do you think it is important to do?

- Have you developed social structures such as teamwork, training, and collective corporate sustainability competencies?
  - If so, how?
  - Do you think it is important to do?
- Have you aligned those two?
  - If so, how and how much?
  - Do you think it is important to do?
- How have you developed CS routines?
- Would you say you have developed a culture that is promoting corporate sustainability?
- How do you manage Northvolt's knowledge regarding corporate sustainability?
  - How do you plan to manage it in the future?
  - Do you think it is important to manage knowledge?
- How do you adhere to strategic plans for sustainability to ensure you reach your long-term objectives?
  - Do you think it is important?
- Give an example of how you act or plan to act upon transgression.
  - Would you say that you respond appropriately upon transgression?
- Have you ensured transparency in sustainability matters when you integrate it throughout the organization?
  - If so, how?
  - If not, how would you like to do this?
  - Do you think it is important to be transparent?

Additional questions to the SMS project leader:
- What requirements would you say shareholders, investors, and banks have on Northvolt?
  - What do they mean for your operations?
- Do you think that competitors have any requirements on you?
  - If so, which ones?
- Do you collaborate with them in any way?
- How do you adhere to strategic plans for sustainability to ensure you reach your long-term objectives?
  - Do you think it is important?
- How have you ensured transparency in sustainability matters when you integrate it throughout the organization?
  - If not, how would you like to do this?
  - Do you think it is important to ensure transparency in CS integration?

Appendix 3. Compliance Analysis with SMS Framework

Table B. Compliance with the activities in Asif et al. (2013)

Activity in the framework by Asif et al. (2013)	Phase	Description of activity at Northvolt	Compliance?	Important activity?
1. Environmental scanning to identify issues that impact the organization (issue = not satisfied stakeholder)	Plan	"We are handling a lot of dangerous chemicals." "We have a scrap facility where we scrap the cells that we don't need and we have a whole team that is figuring out how we should scrap cells safely." "Regarding emissions to air, we will have filters for that, and we will do measurements as we will have emissions to air, which is controlled within our permits, we have conditions of everything, in regard to both water and air." "In manufacturing, when we talk about the stakeholders, we come back to the authorities and the people living nearby." "Taking that decision to place this company in Sweden, you need to have a thorough investigation done beforehand. You know your competitors, you know what they pay for, you know how the payments within those companies are divided, you need to know what kind of products and materials you use, how much is the cost of each material, the cost portion of the price, how much energy you will use."	Yes	Important
2. Defining stakeholders and their requirements	Plan	"That is part of the standard. It is a thorough investigation, it's called a stakeholder analysis. It's Northvolt's stakeholders, shareholders, employees, communities, cities, and countries." "We have done the stakeholder analysis in order to map out who the stakeholders are and where we get in contact with them. As far as I know, at Northvolt, we haven't done the last part of seeing what kind of demands they have on us and what kind of demands we can have on them." "It's the government. It's, of course, the people around us, so the inhabitants of Stockholm, Västerås, Skellefteå, and surrounding areas. Also our workforce, then of course employees. Then you divide employees into managers to management as well, then you have the investors, the different banks, our competitors, our customers. Saying competitors, I also would like to include, which we had already, espionage. We also have different countries which we are not located in, when it just comes to a stable market or unstable market." "We have a number of international standards and guidelines with requirements on us from our investors, our customers, and ourselves." "We are aware and we implement new interested parties when they come up. Lately, after our little spy incident	Yes	Important

		we added an interested party as 'espionage'." "I think it's not thoroughly complete, but for practical things, I would say it's OK-ish. An 80% solution."		
3. Ensuring that there are no clashes of interest/ redundancies in different stakeholders' requirements	Plan	"When we did the QMS certification, we did the basic stakeholder analysis of all of the aspects of that, and that's what we are working with right now. I actually think a lot of our stakeholders are aligned with what they want. We are really trying to drive a change in the industry." "We have some people that feel that the factory is coming close to them in regard to noise and so on, and some people that are really happy that the factory is here [in Skellefteå] which will lead to more work opportunities."	Partly	Important but could do more
4. Ensuring that different stakeholders' requirements do not pull the organizational processes in different directions	Plan	"They are pulling the processes in different directions, or at least the outcomes. (...) Investors or the banks or whoever is financing this company have different goals than environmental law obligations by countries and cities so they literally make us do things that cost a lot of money, and the investors are of course interested in not spending so much money." "Actually, it doesn't make it go in different directions. I wouldn't say that those things are contrary to each other, if a company is doing well financially, they are doing really well sustainability-wise."	Partly	Important but do not know how to accomplish it
5. Engaging in stakeholder consultation	Plan	"We are planning on having at least once a year, but maybe twice a year, meetings with the residential areas." "We want to be considered a good name, and an enabler for development in the society, so it goes both ways. We want to be a participant in the development of Skellefteå as a society as well." "We have a lot of people having meetings with the municipality weekly in order to try and both explain about where we are in our construction, but also, we are hiring a lot of people. A lot of people will move into Skellefteå, Northvolt has taken a big part in that as well, in making sure everything is ready and so that everything can run smoothly." "Peter [the CEO] is literally speaking to all of the stakeholders all the time. Like European Union, government meetings, talking to city governors… So he is talking to a lot of them and he is also being controlled by the board of managers, the board of investors, so there is also a control function."	Yes	Important
6. Defining CSR in the context of the organization	Plan	"For me, CSR is the whole scope. It's both the raw material from the start and it goes through production. When we are in production, it's about having good communication with the people around us, the residential areas, the government, and the authorities. (...) CSR is also about the end-user of the battery and	Yes	Important but for CS not CSR

		the end of the battery as well, in regard to waste." "To me, CSR is how we work with the most challenging issues when it comes to Northvolt's role in the world and how we affect it." "We're calling sustainability instead of CSR. CSR is an old definition. Sustainability has to do with being accountable to stakeholders and to yourself." "CSR is kind of already integrated, it's a part of our environmental and sustainable part so we are already paying attention to this."		
7. Defining the business case for CS (CSR has been replaced by CS from hereon)	Plan	"We are in a company where everyone is interested in working at Northvolt because it's a sustainable business idea, so we are all working with sustainability."	Yes	Important
8. Exploring competencies for CS at both individual and organizational level	Plan	I don't really have the overview of what our environmental team is doing."" "We sent out a sustainability survey and it's very clear that we need to do a lot of training internally. We need to do a lot of training on different topics." "We did the survey in December internally to ask about a number of sustainability topics. It had some to do with the competencies but also it gave us a lot of feedback so we could make an action plan on what the internal stakeholders think that we should do." "We have environmental competence and waste management or international standards here and those types of things."	Yes	Important
9. Development of indicators to measure performance	Plan	"For the environment, it's regarding the outlet to the surrounding environment but also following up on the different tasks that we need to do in order to be compliant as well. In terms of KPIs, it's more emissions to air and water." "It's a bit interesting when it comes to a supporting function like we are in the E-team. Our role is more about handing over the data to the different managers so that they can deal with that data. (...) Our KPIs are more qualitative than quantitative, for example, finishing the report before the end of the quarter, and things like that." "We have said yes to everything in the financing agreements so we have to abide by global compact, ILO declarations, UN guiding principles on business and human rights, which are extensive, and IFC performance standards." "We are sitting down with the environmental team and the health and safety team in order to figure out what kind of KPIs we should have. Then we're going through that with the management team to make a decision that this is something we want to follow up on, or if there's anything we want to add to that or something we want to take away in order to focus on	Yes	Important

		something else. (...) When we are in production, we will start working together with the different departments to filter that down so they know what kind of KPI we have and how they can contribute to those KPIs."		
10. Development of community indicators	Plan	"We have a limit in our permit that states what kind of noise we can generate, and what the people have to tolerate (limit levels), but that might not coincide with what they feel is irritating noise." "When you go for an environmental permit you need to do all of the research in the environmental impact assessment and then we have a monitoring program that we report noise and water and everything to the authorities. We also report all of this to our investors."	No	Important but have not had time for it
11. Identifying the resources required for CS	Plan	"One part is that the MS that we are getting certified is the EMS, so there isn't a sustainability system, but then there is an MS for the sustainable supply chain in a way." "There is also a green factories team in the environmental team that works closely with the authorities and all the requirements we have in the environmental permits." "The social dimension is very important, the talent department is working a lot with collective agreement and gender equality." "We have just hired two people this year and we are good for now but we need to grow as Northvolt grows."	Yes	Important
12. Securing top management commitment	Plan	"We report back to the sustainability and compliance committee, which meets bi-weekly. It consists of the Chief Environmental Officer/Head of Sustainability, General Council, Director of Raw Materials and Metals, Sustainability and Compliance Manager." "The management committed itself to sustainability by creating the business case they have. If that is not enough commitment I don't know." "I think that was already there when I started."	Yes	Important
13. Developing business model for CS	Plan	"Actually, the entire business model is based on sustainability so it probably tells everything." "I would say that we are working with the whole scope for sustainability, from the cradle to the grave"	Yes	Important
14. Development of organizational organogram with clearly defined CS responsibilities	Plan	"I think the ideal idea of working is that there isn't a sustainability department that you can point out, but that sustainability is integrated overall in all of the different departments." "What we refer to when it comes to organizational charts is Microsoft Teams, but we also have job descriptions, both presented in ppt format, like who's part of the team, and we also have job descriptions like when you get hired 'this is your role for this specific job'." "I have an organizational chart although I'm in the	Yes	Important

<table>
<tr><td colspan="2"></td><td>process of hiring the people that are going into my organization. For the environment, I'm divided on what kind of areas we need, and the same goes for health and safety. (...) I have done the assessment of what kind of expertise we need and how many people we need."
"We do have a chart for the sustainability team and we have an organization that is the sustainability team in the environmental team. So we kind of do have that organization but I think it is the responsibility of top management to make sure that sustainability is embedded in everything that we do."</td><td></td><td></td></tr>
<tr><td>**Activity in the framework by Asif et al. (2013)**</td><td>**Phase**</td><td>**Description of activity at Northvolt**</td><td>**Compliance?**</td><td>**Important activity?**</td></tr>
<tr><td>15. Vertical integration of CS by translating organizational objectives into tactical and operational imperatives</td><td>Do</td><td>"We (in the environmental team) need to come up with KPIs for each of the teams in the EMS. One such thing could be to see how we are tracking IT because they could also have environmental goals but we haven't really come to that part yet. That's another part that we need to get into; tracking different KPIs and all of the different teams."
"We will integrate these topics into our change management process and into many of our processes so that we also ask for sustainability."
"I think that our mission is to make sure that we have sustainability in all of the different processes."
"They would probably like us to do more when it comes to strategic sustainability goals. I think that it's [more ambitious sustainability goals] actually positively received from management."
"The overarching company goals were set by the board together with the management team of course but mainly by the board and then the management team pushed that out into the organization like 'these are the q1,q2,q3,q4 goals' and then different managers divide these goals to sub goals and trickled down to that a specific person needs to deliver something."</td><td>No</td><td>Important but have not done it yet</td></tr>
<tr><td>16. Horizontal integration of CS across departments, functions, and the whole supply chain</td><td>Do</td><td>"We think that we should have a broad sustainability approach to everything that we do."
"I think the ideal idea of working is that there isn't a sustainability department that you can point out, but that sustainability is integrated overall in all of the different departments."
"Right now, we distinguish between environment and quality so all of our quality employees don't really get in contact with environmental topics and the other way around."
"The only thing we still struggle with in Poland that I know is that in western European countries you can get, for example, data from logistic partners on how much they consume of oil or how much they produce of CO2. We don't have it yet in Poland so this is the thing that</td><td>Partly</td><td>Important and will complete yet</td></tr>
</table>

		we miss for sustainability." "We want them [the suppliers] to provide us with a lot of data and specifically LCA data so that we can make LCA for all of our products." "We are all very interested in data in all departments and I know we work a lot with the supply chain, but when you look at sustainability more broadly we would want to be able to track social questions internally. We would want to track gender distribution as well as energy and environmental aspects - in one system." "We are training our supply chain in LCA, what to do and what data there is that we need from them, where we see the whole business is going and what type of targets we are looking at for them to be a supplier for us, to have a low CO_2 footprint." "Yes, that's the training part for R&D, materials, purchasing. Our Q2 goal is to roll out sustainability training for everyone."		
17. Developing technical structures for CS such as the development of integrated manuals, procedures, work instructions, and processes	Do	"We have an environmental policy, manuals for how to conduct due diligence (DD), stakeholder engagement plans (how we engage with stakeholders), grievance mechanisms, whistleblower systems, procurement policy, and a governance structure."	Yes	Important
18. Development of social structures such as teamwork, training, and collective CS competencies	Do	"It's very clear that we need to do a lot of training internally. We need to do a lot of training on different topics. So we have focused our training on the ones that need it first, like the purchasing department and the ones that are in the procuring and supply chain. Now we are focusing on chemical compliance in the materials team. But we need to do a lot of training this year and that's what we are going to be focused on in 2021." "Every employee gets this through onboarding so when you join, you need to sign up for all the policy documents, and then we do environmental training. (...) It's continuous so we have this new system that the growth team bought which is like the training where you can track who is doing the training and you can do tests so we can monitor who's done what training."	Partly	Important and will complete later
19. Developing CS routines	Do	"[For the supply chain MS] we have policies, manuals, systems, and processes, and then we are going to put it together in Q1 in a sustainability strategy." "We do a lot of desktop DD and then we also do DD on-site. We do this according to IFC performance standards because those are the best ones and because our investors require them."	Yes	Important
20. Development of culture conducive	Do	"Yes." "I think many people joined Northvolt because it is	Yes	Important

for CS		sustainability-driven. And I also think that's what makes us different." "The bad thing with culture is it's even being created when you don't notice it. You can talk about culture, but you can act differently."		
21. Alignment of social and technical structures	Do	Technical: "We just purchased a system for material management but we do have several systems for, from a sustainability POV, we also have a strong IT team which we have had some discussions with so I think yeah we do. But you know maybe there is a system that we do not know about, you can always become better." Social: "The social aspect is included in everything that we do when it comes to both our supply chain and our internal work. We just bought the program though so it is not implemented." Alignment: "It would be wonderful if everything was in one system but that's not how it works, ever. So yes and no, but mostly no."	No	Important but do not know how to accomplish it
22. Managing CS knowledge	Do	"That's one of the things we really realized through the survey, we need to do more training so we are really focusing on training this year."	No	Important but have not done it yet
23. Adhering to CS strategic plans for the realization of long-term objectives	Do	"We don't really have that many long-term objectives because we are new, but the ones we do have, we have worked really hard to get them. But part of what we really need to do is to have a baseline because when you have an environmental baseline or social baseline then you can start measuring: "how do we reduce or improve?" But we haven't gotten there yet." "We do not have data from the factory until it's built. Then you can start measuring how much energy, how we are going to reduce that, and align with the Paris goal, for example. So when you're doing your strategy you need to have a way to measure so that you're getting data points and that also have to be data-driven so you need a baseline before you start going in different directions. So we can measure other things right now like suppliers, how we are doing this and that but the actual site isn't until it's finished."	No	Important but have not done it yet
24. Responding appropriately upon transgression	Do	"We have gotten some grievances in regard to noise, for example, in the autumn last year [2020], and when we got that we made contact with the person. In this case, we explained to them that the noise wasn't coming from Northvolt (since we didn't have operations that would render noise). In order to have good communication, we also dug into where the noise could come from and also informed those companies that there had been some complaints and asked them what they could do to lessen	Yes	Important

		noise for the surrounding areas. We try to handle each question as it comes in, and also always get back to those who reach out to us."		
25. Ensuring transparency in CS integration	Do	"We can't say where we are sourcing from because that's strategic information that we don't want to share. So that's a conflict that's difficult to solve when it comes to communicating and being transparent." "We're not transparent and that needs to be better." "What is good is that in this company we are aiming to have a high level of transparency and I think the way we achieve that is through the MS." "I think that we are not transparent enough internally and externally in what it is that we are doing." "Through the training, I think. But also through our sustainability report, I hope everybody will read [it]." "We are doing our first draft sustainability reporting this year and it's not going to be public. The first public one is going to be next year."	No	Important but do not know how to accomplish it

Appendix 4. Compliance Analysis with IMS Framework

Table C. Compliance with the activities in Rebelo et al. (2016)

Activity in the framework by Rebelo et al. (2016)	Phase	Description of activity at Northvolt	Compliance?	Important activity?
1. Define a multidisciplinary Team for the Project - "Implementation of the IMS"	Plan	"Yes. The competencies needed for every part of the integration, like health and safety, and environmental, and quality, as well as finance and legal." "But it's not a project which we have in the waterfall perspective, we are working mainly in smaller groups, every department has its own tasks." "You plan to act in smaller increments, you do that basically for every task instead of for an entire project."	Yes	Important
2. Set up a "Steering Committee"	Plan	"Yes." "It's hard to get those people out of the project thinking. I'm not the project leader of this. I want this group to be communicating, but the group is expecting a project leader. They want somebody who's telling them what to do, instead of that they just do."	Yes	Important
3. Increase knowledge of the organization including its context, through a diagnosis, to accurately characterize the situation	Plan	"Not me personally, but I know that it has been done. It was part of when Northvolt was created. I mean, taking that decision to place this company in Sweden, you need to have a thorough investigation done beforehand. You know your competitors, you know what they pay for, you know how the payments within those companies are divided, you need to know what kind of products and materials you use, how much is the cost of each material, the cost portion of the price, how much energy you will use..."	Yes	Important
4. Identify the needs, and expectations of Interested Parties, both internal and external	Plan	"Yes. That is part of the standard. In ISO 9001, you need to do that. It is a thorough investigation, it's called a stakeholder analysis. It's Northvolt's stakeholders, shareholders, employees, communities, cities, countries. We really did that thoroughly, before my time. We showed it in the audit." "I think it's not thoroughly complete that we would say it would sustain a grade A in a school class but for practical things, I would say it's OK-ish. So an 80% solution. *What's missing?:* "I think more in detail, why the stakeholder is that important, and what we actually could do better to fulfill their needs or concerns."	Yes	Important
5. Determine and document the scope of the IMS	Plan	"I think that we didn't really do an analysis, it's more or less gut feeling – let's do it because we can save a lot. It's experience, I mean, gut feeling is experience and that's why we did not really do an analysis or a gap analysis. We all know that ISO 9001, 14001, and 45001 are pretty similar when it comes to some requirements,	Partly	Important but not prioritized

		so it is mainly also seen in common standards to integrate those three." "I think it's necessary if we want to have better communication towards our employees. To get them on board, we need to scope it perfectly or at least describe what it is for, yes."		
6. Conduct an evaluation of the MS standards' requirements and their compatibilities	Plan	"No, it's just experience. We have checklists of each standard and we can compare those checklists, but we did not really do a comparison in that sense, no, but we know it." "No, because I'm not standard-focused, I'm company-focused so I really would love to eliminate as much as possible from standards. I want to just use the idea of the standard and what they're basically looking for and then translate this into Northvolt or company language. Because if you use standard terms in this standard work, all the rest of the employees will not understand this. In order to get those people within the system, you need to speak their language, otherwise, it's just a silly system that needs to be made and nobody pays attention to and that's not the goal."	No	Not important
7. Identify legal and other applicable requirements, as well as all potential risks, and critical success factors to be considered in the IMS Program	Plan	"I think I will not be able to identify all the risks, but we should do that. I haven't considered this, but yes, we should do that." "But I also would consider that these things are somehow experienced-based from the past so there is, I wouldn't say valid, but there is a good gut feeling of what we need to do and how, and since we are under resources, you just have tasks that fall off the table and I think this would be one." "Legal requirements are of course an obligation, and they need to be identified." *Critical success factors:* "No, should I do that?"	Partly	Important and will complete later
8. Definition and approval of the IMS Policy by Top Management	Plan	"At least we are on the same page, nevertheless, we're not that aligned. We want the same thing. We want to have a beneficial system for Northvolt, instead of a documentational monster. Probably this is a success factor as well. If we notice that we have benefits out of what we're doing, the only thing is how do we measure that? We want the same thing and that is some alignment." "I hope that there is some alignment already but during the next few weeks, months, and years, of course, another alignment will take place."	Partly	Important and will complete later
9. Perform the needed actions to address and assess the significance of risks, and determine which have or may have significant	Plan	"Yes, SWOT analysis has been done but doesn't really have a value." "We have it but don't really use it, Northvolt is very weak in that sense, we do it to have it done." "Risk analysis and risk management are not the same things, we are doing the first." "Of course we only work with risks significant to us."	No	Important but have not had time for it

impact (positive or negative) on the business including the environment		"The idea is to find FMEA-moderators who are trained to moderate risks. We need to understand the difference between a risk and effect, and that's why you need a moderator to make them think more broadly and outside the box." (A4, personal communication, April 15, 2021)		
10. Conduct an evaluation of existing integration models and select the one that to be adopted to support the IMS	Plan	"No. Are there ones?"	No	Not important mostly experience
11. Definition of the management program of the IMS which shall be consistent with the Policy and detailed in terms of: objectives and action plans with realistic targets, needed resources, competencies, documented information, and responsibilities	Plan	"Yeah, we have identified, nevertheless, we are working in restraint. There are two different possibilities to do it. You can do it as one team walking around to all the other teams, or you create a network structure where all the different apartments have one responsible within their teams to create processes and process structures. Then you just have an internal consultant from the IMS to go there to align the standard for how to describe a process and how to align on the templates we use, on the layout we use. That is our approach. We are using the network approach, instead of the team approach." "I'm not the person that is keeping track of the time plan. I'm not a planner. I tried just to act because from my perspective as soon as you store your time plan it's outdated, and then you are in the need of updating your time plan more and more and more, and you have less time of doing something."	Partly	Important but with a more agile approach
12. Discussion and consequent approval of the management program by the "Steering Committee"	Plan	"The vision is there. I think that [the vision] has arrived and everyone is on one page so that we want to make it easy for everyone, but I think the way of how we get there is different because everyone has different experiences, different expectations, and different resources." "The hypothesis is to stop the network group and plan the implementation in the conventional way instead. (...) People are declining the network group and prioritizing something else." (A4, personal communication, April 15, 2021)	No	Important but have had setbacks, will complete later
13. Definition of a specific plan of information and training for all Collaborators and others relevant Interested Parties	Plan	"Not yet."	No	Important but have not had time
14. Structure an IMS Manual, including	Plan	"I need the experts to draw the processes to get those processes somehow documented, but I constantly get 'I	No	Important but have

				not had time
the needed Processes, Key Performance Indicators (KPIs), and Process Owners, among other documented information		don't have time, I don't have time, I need to firefight here, I need to firefight there'. That's the situation right now." "We don't really have this change [management] process in place now. (...) Since we are lacking role descriptions, this is one big part of the process owner role. We need to make the process owners take on their responsibility." "When it comes to the quality and steering of it, we are now implementing a goal structure with five top goals of Northvolt broken down into each department, and each department then has to define their goals, and each team has to define their goals, to at the end finalize and to reach the top five goals of Northvolt. This process is being implemented and we are about to clarify that with our employees soon. (...) They're goals. They're not clear KPIs by the meaning of SMART, they are just named goals."		

Activity in the framework by Rebelo et al. (2016)	Phase	Description of activity at Northvolt	Compliance?	Important activity?
15. Communicate/ publish the IMS to all Collaborators and other Interested Parties	Do			
16. Implement the management program of the IMS	Do			
17. Define, structure, and test the needed Contingency Plans	Do			
18. Define, structure, and implement the needed Operational Instructions, including the outsourced processes	Do			
19. Retain the required documented information to demonstrate the compliance of the IMS	Do			