



# Master Thesis

M.Sc. in Environmental Management and Sustainability Science

Project Title	Circular-oriented Environmental Management Systems A Case Study on how to Support the Potential for Integrating Circular Economy in an EMS According to ISO 14001	
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## Abstract

Environmental management systems (EMS) have been one of the cornerstones for working with environmental efforts in companies since the 1990s. However, traditional EMS tend to focus on incremental improvements in production processes and internal processes. In 2015, ISO 14001 was revised to follow a High-Level-Structure, which strengthened the strategic potential of EMS, and created a stronger frame for working with more advanced environmental efforts, one of these being circular economy. Integrating CE in EMS is an area of increasing interest, and based on the expected potentials of integrating CE in EMS, across the HLS of ISO 14001, this master thesis explore: *How can the potential from integrating CE in EMS, according to ISO 14001, be supported in large Danish manufacturing companies*?

This study applies a qualitative multiple-embedded case study on five large Danish manufacturing companies. A conceptual framework has been developed to characterise three different types of EMS for integrating CE, these are: Traditional EMS, Product-oriented EMS (POEMS) and circular-oriented EMS (COEMS). The latter is defined in the study and refers to strategic integration of CE in EMS, where the CE strategies are well-integrated into the core business and intend to integrate the slowing strategy.

The case companies are all working with EMS according to traditional EMS, and two companies have begun to expand their EMS into the product development, according to POEMS. The companies are all working strategically with the CE strategies, but through different strategies at varying intensities. The companies are working with EMS through a segmented application anchored at the operational level, with little strategic implications, and their CE activities are located in other departments and are managed as projects. Most of the companies do see a potential for integrating CE in their EMS, but emphasise that their ability to support the potential is influenced by several challenges, these are: 1) Current silo-thinking and -application of EMS and CE, 2) Organisational structures and practices, 3) Operational anchoring of EMS, 4) Lack of top management commitment and support, 5) Lack of clear CE strategy, and 6) Complexity of working with CE.

This study concludes, that to support the potential of integrating CE in EMS, the case companies will need to break down the current silo-thinking and -application of EMS and CE, by rethinking the use of their integrated management system. Preconditions for supporting the potential is further that the case companies create a clear CE strategy and objectives and ensures that the top management is committed and supports the CE activities. The top management further need to change their understanding of the EMS and use this in strategic decision-making and to align CE activities at the strategic level. For the case companies to support the potential to integrate CE in EMS, they will further need to involve both employees and external stakeholders. The employees are important to ensure anchoring of the CE activities and the daily operations of the EMS, and the external stakeholders enable the companies to work with the more advanced CE strategies.

## Dansk resumé

Miljøledelsessystemer (EMS) har siden 1990'erne været en af hjørnestenene i arbejdet med miljøledelsessystemer (EMS) har siden 1990'erne været en af hjørnestenene i arbejdet med miljøledelsessystemer. Den traditionelle tilgang til EMS har imidlertid en tendens til at fokusere på gradvise forbedringer i henholdsvis produktions- og interne processer. I 2015 blev ISO 14001 revideret til at følge ISO systemernes High-Level-Structure (HLS), hvilket styrkede EMSs strategiske potentiale og skabte en stærkere ramme for arbejdet med mere avancerede miljøledelses, såsom cirkulær økonomi (CØ). At integrere CØ i EMS er et område med stigende interesse, og på baggrund af de forventede potentialer ved at integrere CØ i miljøledelsessystemer på tværs af HLS i ISO 14001, undersøger denne masterafhandling: Hvordan kan potentialet for at integrere CØ i miljøledelsessystemer, i henhold til ISO 14001, understøttes i store danske produktionsvirksomheder?

Dette speciale er baseret på et kvalitativt casestudie på fem store danske produktionsvirksomheder. Der er blevet udarbejdet en konceptuel ramme for at karakterisere tre forskellige typer af EMS i relation til at integrere CØ, diss er: Traditionelle miljøledelsessystemer, Produktorienterede miljøledelsessystemer (POEMS) og Cirkulært orienterede miljøledelsessystemer (COEMS). Sidstnævnte er defineret i specialet og henviser til strategisk integration af CØ i EMS, hvor CØ-strategierne er velintegreret i en virksomheds kerneforretning og med intentionen om at integrere slowing strategien. Casevirksomhederne arbejder alle med traditional EMS, og to af dem er begyndt at udvide deres EMS in i produktudviklingen, i henhold til POEMS. Virksomhederne arbejder alle strategisk med CØ, men gennem forskellige strategier med varierende intensitet. De arbejder med EMS gennem en segmenteret anvendelse, der er forankret på det operationelle niveau med manglende strategisk orientering, og deres CE-aktiviteter er placeret i andre afdelinger og forvaltes som projekter. De fleste af virksomhederne ser et potentiale for at integrere CO i deres EMS, men understreger, at deres evne til at understøtte potentialet er påvirket af flere udfordringer, som er følgende: 1) Nuværende silotænkning og -anvendelse af EMS og C $\emptyset$ , 2) Organisatoriske strukturer og praksis, 3) Operationel forankring af EMS, 4) Manglende engagement og støtte fra den øverste ledelse, 5) Manglende CØ-strategi og 6) Kompleksiteten i at arbejde med CØ.

Dette konkluderes, at for at understøtte potentialet ved at integrere CØ i EMS skal casevirksomhederne bryde den nuværende silotænkning og -anvendelse af EMS og CØ ved at gentænke brugen af deres integrerede ledelsessystem. Forudsætningerne for at understøtte potentialet er endvidere, at casevirksomhederne udarbejder en klar CØ-strategi og mål, samt sikrer, at topledelsen er engageret i og støtter CØ-aktiviteterne. Topledelsen skal desuden ændre sin forståelse af miljøledelsessystemet og bruge dette i de strategiske beslutningsprocesser og koordinere CØ-aktiviteterne på det strategiske niveau. For at casevirksomhederne kan understøtte potentialet for at integrere CØ i EMS, skal de desuden inddrage både medarbejdere og eksterne interessenter. Medarbejderne er vigtige for at sikre forankringen af CØ-aktiviteterne og den daglige drift af EMS, og de eksterne interessenter gør det muligt for virksomhederne at arbejde med de mere avancerede CØ-strategier.

## Preface

This master thesis is my final report as part of the Master of science program *Environmental Management and Sustainability Science* at Aalborg University. The report was conducted in the period 01.02.2022-03.06.2022 and covers 30 ECTS.

My master thesis explores the strategic potential of environmental management systems, according to ISO 14001, to integrate circular economy strategies in large manufacturing companies. I decided to explore this field of research due to the experiences obtained on the strategic potential of ISO 1400 gained during my Internship at MAN ES Frederikshavn as well as an interest in circular economy strategies. Writing this thesis has allowed me to expand my interest in advancing a sustainable development in the private sector. I hope that the results of my thesis can provide both academia and practitioners with an initial framework for understanding different types of EMSs and its potential for integrating CE strategies, as well as recommendations on how this potential can be supported in companies.

#### Acknowledgements

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- Signe Malberg, Danish Standards
- Charlotte Vincentz Fischer, Danish Standards
- Kasper Hillgaard Mühlbach, Danish Standards

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# Abbrevations

Abbreviation	Name
BM	Business Model
BREEAM	Building Research Establishment Environmental Assessment Method
CBM	Circular Business Model
CBMI	Circular Business Model Innovation
CE	Circular economy
COEMS	Circular-oriented environmental management systems
$\operatorname{CSR}$	Corporate social responsibility
EMAS	Eco-Management and Audit Scheme
EMS	Environmental management systems
ESG	Environmental, Social, and Governance
FSC	Forest Stewardship Council
HLS	High-level structure
IMS	Integrated Management System
LCA	Life Cycle Assessment
LEED	Leadership in Energy and Environmental Design
MNC	Multinational coorporation
POEMS	Product-oriented environmental management systems
$\operatorname{RE}$	Renewable Energy
SBTi	Science Based Targets initiative
SDG	Sustainable Development Goals

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# 1 Environmental efforts in companies and environmental management systems

## 1.1 Expansion of the environmental efforts in companies

The environmental understanding in companies has evolved over the past 60 years, influenced by the societal development and varying dominant institutions, values and norms in society. This change in the conceptual understanding of the nature and cause of environmental problems have further influenced the environmental efforts and tools applied to solve the these problems [Remmen, 2001; Remmen et al., 2015]. Table 1.1 illustrates the expansion of environmental efforts from the 1960s to the present.

Perception	Problem	Solutions	Actors
"Out of sight-out of mind" Noise, smoke and waste		Dilution of pollution	Environmental au- thorities
Environmental pro- tection Emissions		end-of-pipe	Environmental au- thorities
Pollution prevention	Emissions, waste and resource consump- tion	Cleaner production	Environmental au- thorities, consultants and companies (engi- neers)
Continuous improve- ments	Emissions, resource consumption and impacts from inside 'the fence'	Environmental man- agement	Environmental au- thorities, consultants and companies (man- agers and employees)
life cycle perspective	Emissions, chemicals, resource consump- tion and environ- mental impacts of products	Cleaner products	Government, compa- nies (developer and designers), product chain actors
Sustainable develop- ment	Unsustainable con- sumption and pro- duction, irreversible planetary boundaries	Triple bottom line, system innovation and collaboration	Government, local authorities, industry, product chain actors, research centres

**Table 1.1.** The expansion of environmental perception and efforts. Inspired by [Remmen et al., 2015; Kørnov et al., 2007; Kristensen, 2020]

In the 1960s, the environmental problems was perceived by both companies and authorities as local, visible problems related to noise, smoke and waste, and the solution to these focused on **dilution of pollution** following an "out of sight-out of mind" perception [Remmen, 2001]. The environmental awareness increased during the 1970s, and the nature of the solutions changed to focusing on abatement and environmental protection through end-of-pipe solutions, still through a reactive approach [Remmen, 2001].

The 1980s represents a paradigm shift in the understanding of environmental problems and solutions, resulting from the gradual realisation that environmental problems are diffuse and complex. The focus shifted towards pollution prevention opposed to the previous reactive approach, facilitated by the concept of 'cleaner technology', introduced by the Ministry of Environment in 1983 [Remmen et al., 2015]. The preventive environmental efforts initiated in companies at the time were related to **cleaner production**, focused on resource consumption, waste, and reducing emissions from the factory [Remmen, 2001].

**Environmental management** became essential for pollution prevention in the beginning of the 1990s, and environmental management systems were introduced to foster systematic and continuous environmental activities in companies [Remmen, 2001]. The focus expanded from the technical, fragmented and single solution nature of the cleaner production measures to organisational preconditions and anchoring across the organisation [Remmen et al., 2015]. The EMS has been a cornerstone for managing and reducing environmental impacts in companies since then [Kristensen, 2020]. With the introduction of preventive efforts through cleaner production and environmental management, the underlying rationale for working with environmental problems in companies changed from being perceived as a necessary expense into a potential for reducing costs through resource efficiency, improving corporate image and stakeholder relations [Remmen and Kristensen, 2016]. These efforts were considered successful in reducing the environmental impacts inside the 'fence' of the organisations.

It became evident that to grasp the scale of environmental problems, the scope of the environmental efforts in companies needed to be broadened, which resulted in a shift in focus towards **cleaner products** in the mid 1990s. The environmental efforts in companies were expanded to the environmental impacts across the life cycle of products, by focusing on eco-design, life cycle assessments and eco-labelling [Remmen, 2001]. The scope of EMS has thus gradually expanded as the environmental understanding has changed over time, which has influenced the corresponding practices implemented through the EMS [Kristensen et al., 2021]. This is reflected in the emergence of product-oriented EMS (POEMS) in the late 1990s following the expanding focus towards cleaner products, and a need to ensure a dynamic process of continuous improvements on the environmental performance [Brezet and Rocha, 2001]. POEMS are EMS that cover the life cycle of a product and aim to ensure continuous improvements of the product's eco-efficiency (ecological and economic) by systematic integration of eco-design into the strategy and practices of a company [Brezet and Rocha, 2001; Schmidt et al., 2001].

The concept of **sustainable development** became a central topic following the publication of the Brundtland report *Our Common Future* in 1987, in which a sustainable development is defined as "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [World Commission on Environment and Development, 1987, p. 41]. Elkington [1997] popularised the notion of sustainable development in terms of the triple bottom line, emphasising the need for businesses to balance the three dimensions of sustainability: environmental, economic and social. Correspondingly, the environmental perception has gradually changed, under the influence of international policies and plans, that has outlined principles, goals and necessary actions to achieve a sustainable development [United Nation, 2022]. The most recent is the agenda for sustainable development outlined in the report, *Transforming Our World: The 2030 Agenda for Sustainable Development*, adopted by the United Nations in 2015. The 2030-Agenda outlines necessary actions to achieve a sustainable development by 2030 framed by 17 sustainable development goals (SDGs) [United Nation, 2022]. As illustrated in Table 1.1, system innovation and collaborations are needed to enable sustainable development and to find new solutions to stay within the planetary boundaries. One of the solution-oriented approaches is the circular economy [Design et al., 2020].

The concept of circular economy (CE) has gained momentum in society over the last decade, reinforced by the first Circular Economy action plan adopted by the European Commission in 2015, which outline actions to stimulate a transition towards CE [European Commission, 2015]. The current linear economy is based on a take-make-dispose paradigm, which represents a challenge for achieving a sustainable development and emphasise the need for a transition to CE [European Commission, 2015]. The growing global population and middle class causes an increase in resource consumption, which is further influenced by constraints by the resource scarcity [Ellen MacArthur Foundation, 2013]. This has implications for business as usual as companies are experiencing increased exposure to risks, higher resource prices and disruptions in the supply. Companies are beginning to initiate efforts to transition to CE by closing resource loops while targeting the unsustainable production and consumption patterns and transforming these into sustainable practices in collaboration with the supply chain [Ellen MacArthur Foundation, 2013].

It appears that there is a relation between sustainable development and CE. However, based on an extensive literature review, Geissdoerfer et al. [2017] argue that the relationship between the two concepts is not explicit in the literature. The authors further identifies three different types of relationship based on the literature: 1) a conditional relation between circular economy and sustainability, 2) a beneficial relation between circular economy and sustainability, and 3) a trade-off relation between sustainability and circular economy. The perception of the relationship between the two concepts are influenced by how these are defined and understood, as there are many definitions of CE [Kirchherr et al., 2017] and a broad conceptualisation of sustainability across the triple bottom line. Kirchherr et al. [2017] analysed 114 definitions of CE and found that merely 13 % of these explicitly cover all three dimensions of sustainability, whereas the rest mainly focuses on either the economic or environmental dimension of sustainability. However, [Korhonen et al., 2018] emphasise the potential of CE in terms of contributing to all three dimensions of sustainability. CE is furthermore acknowledged as a toolbox that can support achievement of several of the SDGs, especially SDG 12: responsible consumption and production [Schoeder et al., 2018]. In this master thesis, CE is understood as a tool that intend to address all three dimensions of sustainability and encompasses different strategies to support a sustainable development. CE is thus understood as having a conditional relationship with sustainable development, however still acknowledging that it can be accompanied by other complementary strategies to foster a sustainable system [Geissdoerfer et al., 2017].

Companies play a vital role in achieving a sustainable development and their commitment is crucial, as they can help foster innovation, new technological solutions and reduce the negative, economic, environmental, and social impacts from their activities, products and services [United Nations, 2015; European Commision, 2006]. The concept of sustainable development has since its origin guided the efforts in companies, through the application of a triple bottom line approach, supply chain management, and working with corporate social responsibility (CSR) measures which amongst others is guided by the SDGs and circular economy [Remmen and Kristensen, 2016]. Today, the preventive and more proactive environmental efforts are of strategic importance in companies, and are often a prerequisite for access to international markets and competitive advantages by product differentiation. The premise of working with environmental problems has thus expanded with the focus on a life cycle perspective and sustainable development, as it requires collaboration with a broader range of stakeholders [Remmen and Kristensen, 2016].

The nature of the environmental efforts has expanded over time and, today, the focus exceeds technical solutions to balance technical and social considerations in collaboration with a broad range of stakeholders. The solutions posed to solve environmental issues have broadened rather than replaced each other, and thus add new possibilities for the companies [Remmen, 2001]. EMS has become one of the cornerstones for working with environmental efforts [Remmen, 2001], and as the perception of the problems as well as the solutions expanded, so did the strategic orientation of the practices introduced through the system, as illustrated with the emergence of POEMS. This product-orientation represents a potential for EMS to elevate the environmental efforts needed to address the complex environmental problems. Another benefit of EMS is that companies have obtained over 20 years of experience, and that it is a well-established tool that provides a solid foundation for companies to continue to expand the environmental efforts. This master thesis will explore the forthcoming role of EMS' in terms of its potential for working with CE to contribute to a sustainable development.

### 1.2 Environmental management systems (EMS)

EMS is a voluntary approach that enables companies to go beyond regulatory compliance by applying a systematic and iterative approach to achieve continuous improvements in their environmental performance [M. Mosgaard and Remmen, 2015]. An EMS is a system of interrelated elements that covers both organisational structures, procedures, practices, processes, resources and responsibilities. These elements enable companies to organise, implement, report and follow-up on their strategy based on an environmental policy and targets for managing and reducing their environmental impacts from activities, products and services [M. Mosgaard and Remmen, 2015; Jørgensen and Remmen, 2007].

According to Melnyk et al. [2003] it is possible to distinguish between two types of formal EMS. The first is *a formal system* where the company develops and maintain their own formal EMS that do not meet the requirement of an EMS standard nor aim to be used to obtain a certification [Melnyk et al., 2003]. This type of EMS are by Danish practitioners and academics called a *farmer model* and is a simplified system compared to the requirements of EMS standards and thus more flexible and requiring less resources [M. Mosgaard and Remmen, 2015]. Several manuals and industry specific guidelines have been made to help companies understand how to develop their own EMS and how to prioritise the efforts [M. Mosgaard and Remmen, 2015; Zilahy, 2017, s. 344]. The second type is *a formal, certified system* that meet the requirements of an EMS standard and are certified by an independent third party [Melnyk et al., 2003]. "Eco-Management and Audit Scheme" (EMAS) and ISO 14001 are the two international reference standards for formal, certified systems for EMS, and these are referred to as meta-standards [Testa et al., 2014]. ISO 14001 has become the main reference in the corporate environmental management field [Boiral et al., 2018], and has a more global outreach and validity, making it more popular. This is also evident in Denmark, where 939 organisations had a valid ISO 14001 certificate in December 2020 [ISO, 2021b], opposed to 14 EMAS registered organisations in November 2021 [European Commission, 2022]. This master thesis will therefore focus on EMS according to ISO 14001.

#### 1.2.1 ISO 14001

ISO 14001 was published in 1996 by The International Organisation for Standardisation (ISO) [ISO, 2015], and follows on the plan-do-check-act methodology, which enable continuous improvements in an iterative process [Dansk Standard, 2021].

ISO 14001 was revised in 2015 and is now structured according to the *High-level Structure* (HLS), which is the core structure of ISO management systems outlined by 10 clauses [ISO, 2021a]. The HLS will be introduced and elaborated in section 2.4. The HLS enables companies to align their EMS according to ISO 14001 with other management systems into an *integrated management system* (IMS), which can provide overview, better coordination, better balance between different focus areas, and ensure common understanding across the organisation [ISO, 2021a; M. Mosgaard and Remmen, 2015]. Other key improvements in the 2015-revision are related to the new requirements for considerations to the context of the organisation, actions to address risks and opportunities and application of the life cycle perspective [ISO, 2022a]. The revision have thus strengthened the strategic focus in ISO 14001 [M. A. Mosgaard and Kristensen, 2020]. The strategic potentials of ISO 14001 are further elaborated in section 2.2 and section 2.4.

As introduced in section 1.1, the scope of EMS have expanded gradually as the perception of the environmental problems expanded. The strategic potentials of ISO 14001 can further help expand the scope and subsequent application of EMS, supporting its forthcoming role and potential to help companies work with circular economy.

# 2 State-of-the-art on working with ISO 14001 in companies

## 2.1 ISO 14001 implementation and continuation

Standard-based management according to ISO 14001 is a research field that have received much interest from both academics and managers alike for many years. It is still a widely debated topic, in terms of the achievable outcomes of ISO 14001 implementation and certification [Heras-Saizarbitoria and Boiral, 2013; Boiral et al., 2018]. This section outlines the state-of-the-art on ISO 14001 implementation and continuation. A detailed description of the methodology for the literature review can be found in section 4.3.1.

The aim is to gain a better understanding of the motives that drives companies to implement ISO 14001, the barriers that influence companies to not become certified or discontinue certification and the outcomes of implementation and continuing certification of ISO 14001. To delimit the focus of the review, the selected literature has been on empirical studies on companies within the European Union (EU), due to the similarities in the contextual conditions (environmental legislation and corporate management practices), which makes it possible to draw parallels to the context of Danish companies.

#### 2.1.1 Motivations for ISO 14001 implementation and certification

The literature included in the review uses different terminologies to describe what drives companies to ISO 14001 implementation and certification. The most used terminology is *motivations* [Schylander and Martinuzzi, 2007; Arena et al., 2012; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Bravi et al., 2020; Heras-Saizarbitoria et al., 2011]. J. Gonzalez-Benito and O. Gonzalez-Benito [2005, p. 134] defines motivations "...as company beliefs in certain potential outcomes of environmental proactivity...." and is understood as the expectations of what ISO 14001 implementation and certification will lead to.

There is a difference in how the motivations are categorised in the literature. Several studies do not differentiate between types of motivations. J. Gonzalez-Benito and O. Gonzalez-Benito [2005] distinguish between *ethical motivations* related to a company's ecological responsibility, *competitive motivations* as either operational or commercial advantages and *relational motivations* related to obtaining better relations with stakeholders and gain legitimacy. Bravi et al. [2020], Heras-Saizarbitoria et al. [2011], and Psomas et al. [2011] simplifies the categorisation into either *internal motivations* or *external motivations*. The findings from the literature review are presented in Table 2.1, and have been categorised as internal- or external motivations.

Internal motivations	
Improve environmental performance	[Poksinska et al., 2003; Bravi et al., 2020; Arena et al., 2012; Carrillo-Labella et al., 2020; Santos et al., 2016; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005]
Improve quality and safety of products and services	[Bravi et al., 2020; Carrillo-Labella et al., 2020; Pacana and Ulewicz, 2017].
Cost savings	[Bravi et al., 2020; Poksinska et al., 2003; Schylander and Martinuzzi, 2007; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005].
Improve environmental skills of employees	[Bravi et al., 2020; Poksinska et al., 2003]
Improve productivity and efficiency of internal processes	[Pacana and Ulewicz, 2017; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Heras-Saizarbitoria et al., 2011].
Existing ISO 9001 certification	[Carrillo-Labella et al., 2020]
Increase commitment from top- and middle management	[Psomas et al., 2011].
Improving organisational system and management	[Pacana and Ulewicz, 2017; Santos et al., 2016].
Enable continuous improvements	[Pacana and Ulewicz, 2017].
External motivations	
Improve corporate image	[Poksinska et al., 2003; Schylander and Martinuzzi, 2007; Psomas et al., 2011; Heras-Saizarbitoria et al., 2011; Arena et al., 2012; Santos et al., 2016; Carrillo-Labella et al., 2020; Pacana and Ulewicz, 2017; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005].
Compliance with environmental regulation	[Schylander and Martinuzzi, 2007; Psomas et al., 2011; Heras-Saizarbitoria et al., 2011; Carrillo-Labella et al., 2020; Bravi et al., 2020].
Obtain competitive advantages	[Carrillo-Labella et al., 2020; Poksinska et al., 2003; Pacana and Ulewicz, 2017; Santos et al., 2016; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Heras-Saizarbitoria et al., 2011].
Commitment to environmental protection	[Santos et al., 2016; Bravi et al., 2020; Heras-Saizarbitoria et al., 2011]
Recommendations from other companies	[Poksinska et al., 2003; Pacana and Ulewicz, 2017]
Satisfying stakeholder demand and pressures	[Poksinska et al., 2003; Bravi et al., 2020; Pacana and Ulewicz, 2017; Heras-Saizarbitoria et al., 2011; Psomas et al., 2011]
Improving relationship and cooperation with stakeholders	[Poksinska et al., 2003; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Arena et al., 2012; Pacana and Ulewicz, 2017].
Improve market share, - position and access to new markets	[Bravi et al., 2020; Carrillo-Labella et al., 2020; Pacana and Ulewicz, 2017; Psomas et al., 2011]
Overcome trade barriers and increase export	[Carrillo-Labella et al., 2020; Poksinska et al., 2003; Santos et al., 2016; Pacana and Ulewicz, 2017]
Increase sales	[Carrillo-Labella et al., 2020; Pacana and Ulewicz, 2017]
Satisfy stakeholder demand or pressures and obtain trust	[Bravi et al., 2020; Poksinska et al., 2003; Pacana and Ulewicz, 2017; Psomas et al., 2011; M. A. Mosgaard and Kristensen, 2020]

Table 2.1. Overview of internal- and external motivations found in the literature review

There is no clear consensus in the literature on which of the internal- and external motivations, listed in Table 2.1, that are the main drivers for ISO 14001 implementation. The studies included in the review covers companies of varying sizes ranging from micro, small- and medium-sized to large companies, and no correlation is found between size and main motivations. Bravi et al. [2020] concluded that companies of different size are driven by the same motivations to ISO 14001 implementation, but that size as a dimension influence the level of importance of the motivations.

Some studies found that the ISO 14001 implementation is influenced primarily by the external motivations [Poksinska et al., 2003; Santos et al., 2016; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005]. In these studies, the strongest drivers are the external motivations related to improving corporate image, ensuring compliance with environmental regulation, commitment to environmental protection and to satisfy stakeholder demands and pressures. Poksinska et al. [2003] showed, that in Swedish companies, ISO 14001 is mainly seen as an image-building and public relations tool. Contrarily, others have found that the internal motivations are the strongest drivers for ISO 14001 implementation [Psomas et al., 2011; Pacana and Ulewicz, 2017; Arena et al., 2012]. These strong internal motivations are improved productivity and efficiency of internal processes, to improve environmental performance, improving the organisational system and management and ensuring commitment from top- and middle management. Psomas et al. [2011] studied ISO 14001 implementation in Greek companies and concluded that external motivations are insufficient, as the effectiveness of improving environmental issues can not be obtained if there are no internal motivations. This is supported in the study by Heras-Saizarbitoria et al. [2011] who found that there is a relationship between underlying motivations and the experienced benefits. The authors found, that companies that adopted ISO 14001 driven by internal motivations gained superior benefits compared to those without, including greater satisfaction in the process itself.

#### 2.1.2 Barriers of ISO 14001 implementation and certification

The barriers identified in the literature covers both the barriers that hinders companies from obtaining the ISO 14001 certification in the first place, the barriers that influence the maintenance of the system (difficulties) and those that lead companies to discontinue their ISO 14001 certification. The literature included in the review do not distinguish between types of barriers. Be that as it may, the barriers are divided into internal and external barriers to indicate what type of barriers the companies are facing and where these stem from. The barriers found in the literature review are presented in Table 2.2.

The literature covers, as emphasised previously, companies of varying sizes, and it is possible to state, that there is correlation between the perceived barriers and company size. Here, Bravi et al. [2020] conclude, that the perceived barriers decrease as company size increases, which is further supported by Santos et al. [2016] who found that the benefits are outweighed by costs in SMEs and M. A. Mosgaard and Kristensen [2020] who concluded that the majority of companies that discontinued ISO 14001 were SMEs.

Internal barriers	
Cost of implementation and certification	[Bravi et al., 2020; Carrillo-Labella et al., 2020; Pacana and Ulewicz, 2017; M. A. Mosgaard and Kristensen, 2020].
Lack of resources (financial, human, knowledge and time)	[Schylander and Martinuzzi, 2007; Pacana and Ulewicz, 2017; Carrillo-Labella et al., 2020; M. A. Mosgaard and Kristensen, 2020].
Increased bureaucratization or fear of the same (excess paperwork, audits, and system formalisation)	[Carrillo-Labella et al., 2020; Bravi et al., 2020; Schylander and Martinuzzi, 2007].
Difficulties changing the company culture and motivating employees	[Santos et al., 2016; Pacana and Ulewicz, 2017; Bravi et al., 2020].
Lack of or insufficient training and education of employees	[Pacana and Ulewicz, 2017; Psomas et al., 2011].
Employee resistance to change	[Pacana and Ulewicz, 2017; Santos et al., 2016].
Implementation of the life cycle perspective	[Fonseca and Domingues, 2018].
Lack of top management commitment and support	[Pacana and Ulewicz, 2017; Fonseca and Domingues, 2018].
Difficult to understand and follow requirements of the standard (determine objectives, risk and opportunities, context of organisation and stakeholders)	[Fonseca and Domingues, 2018; Psomas et al., 2011; Pacana and Ulewicz, 2017].
Increased complexity of environmental processes and procedures	[Schylander and Martinuzzi, 2007; Bravi et al., 2020; Pacana and Ulewicz, 2017].
Lack of economic and environmental benefits and further improvement potential (no low-hanging fruits)	[M. A. Mosgaard and Kristensen, 2020].
Replacement with another systematic approach	[M. A. Mosgaard and Kristensen, 2020].
Companies find that they can save time and money by not setting environmental demand in supply chain	[M. A. Mosgaard and Kristensen, 2020].
External barriers	
Lack of investment support	[Santos et al., 2016]
Lack of demand and attention from customers and external stakeholders	[M. A. Mosgaard and Kristensen, 2020]
Lack of demand in public tenders	[M. A. Mosgaard and Kristensen, 2020]

Table 2.2. Overview of the barriers of ISO 14001 implementation and certification

There is some consensus in the literature on which of the barriers that have the greatest influence on ISO 14001 implementation and continuing certification. These are: increased bureaucratisation and formalisation [Bravi et al., 2020; Pacana and Ulewicz, 2017; Carrillo-Labella et al., 2020], high certifications costs both for the implementation and costs of maintenance (especially in SMEs) [Santos et al., 2016; M. A. Mosgaard and Kristensen, 2020; Bravi et al., 2020; Carrillo-Labella et al., 2020], and a low value added compared to the time spend which the companies feel like could be better spend elsewhere [M. A. Mosgaard and Kristensen, 2020; Santos et al., 2016; Carrillo-Labella et al., 2020]. Be that as it may, not all the literature presents the barriers based on significance, so it is difficult to say which ones are most important to overcome, which is further influenced by the fact that several of the barriers are interrelated. However, the majority of the barriers are internal barriers, which indicate that it is something that can be solved within companies.

Most of the literature included in the review are on the barriers of the 2004-version of ISO 14001, whereto it can be argued that some of these barriers might have been overcome by the introduction of the revision 2015-version, especially in terms of integration with other ISO management systems and new requirements on top management commitment [M. A. Mosgaard and Kristensen, 2020], and the strengthened strategic orientation. Fonseca and Domingues [2018] studied the 2015 version transition process among Portuguese companies to identify benefits and difficulties encountered by the new requirements. Here, the authors identified a new range of difficulties that pose as a barrier for working with ISO 14001, being the implementation of the life cycle perspective, determining risks and opportunities, top management involvement and determining context of the organisation, which at the same time are acknowledged as the concepts that add the most value from the revision.

Lastly, it is interesting whether the barriers are influenced by the approach applied for working with environmental efforts through EMS. Here, M. A. Mosgaard and Kristensen [2020] argue that the companies in the study focused their efforts according to traditional EMS in terms of a focus on production and resource efficiency, which is problematic as the potentials gained from a strategic approach remain unexplored by the companies. Here, the authors further argue that the fact that companies experience a lack of benefits and improvement potentials after having harvested the low-hanging fruits, could be related to their narrow focus and lack of strategic-orientation in the management of environmental activities. The strategic potential is elaborated in section 2.2.

#### 2.1.3 Outcomes of ISO 14001 implementation and continuation

The different outcomes of ISO 14001 implementation and continuation of the certification are categorised in various ways. Some authors do not distinguish between types of outcomes [Bravi et al., 2020; Santos et al., 2016; Arena et al., 2012]. Psomas et al. [2011] differentiated between four categories of outcomes: *improved company position on market*, transition from conventional to sustainable practices, improved relation with society due to environmental performance and improved waste processing. Pacana and Ulewicz [2017] categorised outcomes as either internal- or external outcomes.

The outcomes of ISO 14001 are interrelated with the barriers that hinders implementation or continuation. Boiral et al. [2018] argue that it is possible for negative and positive outcomes to co-exist, such as minimising waste generation but increase of paperwork, which indicate that it is a complex field of research. This is further supported by the lack of consensus on what the outcomes of ISO 14001 implementation and maintenance companies can obtain, identified during the literature review. The outcomes from the literature are divided into internal- and external outcomes and are presented in Table 2.3.

Internal outcomes	
Improved risk prevention and safety procedures	[Bravi et al., 2020; Schylander and Martinuzzi, 2007; Radonjič and Tominc, 2006; Fonseca and Domingues, 2018].
Increased environmental awareness and motivation of employees and management	[Schylander and Martinuzzi, 2007; A. Matuszak-Flejszman, 2009; Santos et al., 2016; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005].
Better use of resources (reduce waste, resource- and energy consumption)	[Schylander and Martinuzzi, 2007; Santos et al., 2016; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Psomas et al., 2011; Radonjič and Tominc, 2006].
Improved top management commitment	[Fonseca and Domingues, 2018].
Technology adaption, -improvements and -innovation	[Psomas et al., 2011; Radonjič and Tominc, 2006].
Costs reductions	[A. Matuszak-Flejszman, 2009; Santos et al., 2016].
Better operational control and quality of internal processes	[Poksinska et al., 2003; Psomas et al., 2011].
Systematisation and improved company performance	[Schylander and Martinuzzi, 2007; Bravi et al., 2020; A. Matuszak-Flejszman, 2009].
Increased productivity and efficiency	[Poksinska et al., 2003; Santos et al., 2016].
Improved internal- and external communication	[Fonseca and Domingues, 2018].
Integration with other ISO management systems	[Schylander and Martinuzzi, 2007; Bravi et al., 2020; Fonseca and Domingues, 2018].
Better alignment with business strategy	[Fonseca and Domingues, 2018]
Improved environmental performance	[Schylander and Martinuzzi, 2007; Poksinska et al., 2003; Santos et al., 2016; A. Matuszak-Flejszman, 2009; Arena et al., 2012; Fonseca and Domingues, 2018].
External outcomes	

Table 2.3. Overview of internal- and external outcomes found in the literature review

Improved corporate image	[Schylander and Martinuzzi, 2007; Poksinska et al., 2003; A. Matuszak-Flejszman, 2009; Santos et al., 2016; Psomas et al., 2011; Arena et al., 2012].
Increased competitiveness	[Psomas et al., 2011; A. Matuszak-Flejszman, 2009].
Improved relationship and cooperation with stakeholders	[Arena et al., 2012; Psomas et al., 2011; Poksinska et al., 2003; A. Matuszak-Flejszman, 2009; Schylander and Martinuzzi, 2007].
Increased market share, -position and access to new markets	[A. Matuszak-Flejszman, 2009; Poksinska et al., 2003; Psomas et al., 2011].
Reduced trade barriers and increased export	[Bravi et al., 2020; Poksinska et al., 2003].
Showing commitment to environmental protection	[Poksinska et al., 2003].
Compliance with environmental regulation	[Bravi et al., 2020; Santos et al., 2016; Heras-Saizarbitoria et al., 2011; Psomas et al., 2011; Schylander and Martinuzzi, 2007].
Lees fees and complaints	[A. Matuszak-Flejszman, 2009].

Not all studies conclude on the most important outcomes of ISO 14001 implementation and certification in companies, and those that do highlight a wide range of outcomes. Bravi et al. [2020] and Fonseca and Domingues [2018] highlight outcomes that have been enabled or strengthened by the 2015 revision of ISO 14001. These include possible integration with other management systems, improved environmental performance, alignment with business strategy, improved top management commitment, improved communication, risk and opportunity identification, and understanding the organisation's context.

Other studies looked into whether there was a difference between expected benefits (motivations) and experienced benefits (outcomes), and they concluded that the majority of expectations were met in the companies [Schylander and Martinuzzi, 2007; J. Gonzalez-Benito and O. Gonzalez-Benito, 2005; Arena et al., 2012].

A main theme in the literature is the relationship between environmental management through ISO 14001 and improved environmental and/or economic performance of companies, which have shown to be complex [Schylander and Martinuzzi, 2007; Aravind and Christmann, 2011]. The goal of ISO 14001 implementation is to go beyond regulation in terms of environmental performance, but several studies highlighted the lack of specific targets and requirements to ensure better environmental performance as a critique. thus questioning whether EMS improves environmental performance [Psomas et al., 2011; Poksinska et al., 2003; Zobel, 2016]. This is supported by some of the barriers described in section 2.1.2, that emphasises a lack of economic and environmental benefits and lack of opportunity for further progress. Contrary, others found that ISO 14001 implementation can result in improved environmental performance, in terms of reduced environmental impacts, especially related to improved waste management and recycling Psomas et al., 2011; Schylander and Martinuzzi, 2007]. This is supported by Arena et al. [2012] that conclude that companies in the Italy obtained better environmental performance after ISO 14001 implementation. Lastly, Fonseca et al. [2018], who studied the implication of the transition towards ISO 14001:2015, show that the new requirements of ISO 14001 resulted in benefits that enhanced the environmental performance of the companies.

Another main theme in the literature is the relationship between the quality and character of implementation and the outcomes achieved, as the outcomes achieved are influenced by the environmental management methods and a number of other factors. Chiarini [2019] studied companies in the Italian construction industry, and found that the three most important factors for successful ISO 14001 implementation are employee involvement, top management commitment and involvement, and development of environmental skills. These were also identified as significant factors in [Alina Matuszak-Flejszman, 2011]. Fonseca and Domingues [2018] concluded that there are difficulties in the transition to ISO 14001:2015, and that availability of training for the employees are important for a successful transition period. Lastly, Schylander and Martinuzzi [2007] who argue that a high organisational commitment and proactive environmental culture are important independent variables that influence the effect of ISO 14001 implementation.

To summarise, the literature on motives, barriers, and achievable outcomes is part of a complex field of research with little consensus and a broad range of results. This is clearly indicated by the lack of consensus on whether EMS, according to ISO 14001 in this study, results in an improved environmental performance in companies. This complexity and

different understanding is influenced by the many interdependencies between the barriers and outcomes, as well as the context in which the case studies are performed. Furthermore, the findings in the literature support the potential of the strengthened strategic-orientation of ISO 14001, as introduced in section 1.2.1, both to overcome some barriers and to foster a more proactive approach to EMS which can help obtain more strategic outcomes.

## 2.2 The strategic potential of EMS according to ISO 14001

EMS are a central approach to the environmental management, and it widely adopted by companies as a means to remain competitive in the increasingly competitive global market [ISO, 2021b]. The environmental efforts performed by EMS help to foster a sustainable development [Fortunski, 2008], and EMS are acknowledged as a tool for corporate sustainability [Witjes et al., 2018]. Be that as it may, EMS practices have tended to focus on the environmental and economic dimension of sustainability, with limited consideration to the social dimension [Remmen, 2001]. The environmental efforts of traditional EMS revolve around incrementally improving the existing production system and internal processes, which can result in EMS lock-ins that prevent the strategic potential of EMS from being realised [Könnölä and Unruh, 2007]. EMS lock-in is a path-dependent evolution in environmental management that restricts an organisation's focus on leveraging the present production system rather than exploring superior, radical innovations to support a sustainable development [Könnölä and Unruh, 2007].

Companies are finding it challenging to identify improvement potentials within the traditional scope of EMS [Kristensen et al., 2021], causing some to discontinue their ISO 14001 certification after harvesting the low-hanging fruits [M. A. Mosgaard and Kristensen, 2020]. However, EMS have a strategic potential as introduced with the emergence of POEMS, that broadened the scope as a response to the expanded focus on environmental efforts for cleaner products, as introduced in section 1.1. The practical application of POEMS have been scarce, but they have demonstrated the potential of EMS as a strategic tool with the application of a broader scope to encompass the life cycle perspective in products and product development [Kristensen et al., 2021].

The revised ISO 14001:2015 have strengthened the strategic potential of EMS, as the HLS has enabled alignment of strategic efforts that exceed the previous focus on operational optimisation and are thus better equipped for working with more advanced environmental efforts [Kristensen et al., 2021; Milazzo et al., 2017]. This is supported by Williams [2018], that conclude that the 2015-revision represents a fundamental reframing of how companies can work with EMS, shifting from operational to strategic thinking and thus creating a stronger frame for companies to work with more strategic efforts supporting a sustainable development. As introduced in section 1.1, CE is one of the solution-oriented tools needed for companies to support a sustainable development, and can therefore be expected to further expand the scope of EMS [Kristensen et al., 2021].

Due to requirements for considerations to the context of the organisation, consideration to overall strategy, LC perspective, and leadership, ISO 14001's increased strategic orientation provides a stronger foundation for the systemic rethinking required for implementing CE

practises [Kristensen et al., 2021]. Additionally, the implementation of HLS have made it possible for companies to work integrated with management systems, which can provide better coordination and overview across the organisation [ISO, 2021a], and thereby increase the potential of integration of the CE measures across both strategic and operational levels. Ghisellini et al. [2016] emphasise, that even though CE are receiving more and more attention, its practical implementation is still low. Several standardisation efforts have been made to support CE implementation in organisations, e.g., an ISO technical committee (ISO/TC 323) was established in 2018 to develop management standards for CE and where several are currently under development [ISO, 2022b]. In the context of EMS, both ISO 14009, "Guidelines for incorporating material circulation in design and development", and ISO 14006, "Guidelines for incorporating ecodesign", aim to support companies with CE implementation [ISO, 2020a; ISO, 2020b].

The potential of using EMS to work with CE is further emphasised in [Marrucci et al., 2019], that reviewed six Sustainable Consumption and Production (SCP) tools that promote CE and conclude that EMS and Eco-design are the tools with the highest level of integration with CE, and identify the role of EMS in increasing corporate circularity is one of three areas for future research. This master thesis thus focuses on the strategic potential of EMS according to ISO 14001 as a tool for working with circular economy.

### 2.3 Circular economy

CE has gained momentum amongst policymakers, academics and practitioners during the last decade, as an alternative model to the current linear economy and the 'take-makedispose' paradigm, as introduced in section 1.1. However, the idea of a new economy to disrupt with the existing linear economy is not new. In the 1960s, a British economist introduced a new 'spaceman' economy, where the Earth is seen as a closed system symbolised as a single spaceship, and with limited availability of resources and nowhere to store waste [Boulding, 1966]. The concept of CE further have its roots in different academic fields, which have contributed to development of different practices over time [Blomsma and Brennan, 2017]. The concept was popularised by the Ellen MacArthur Foundation [2013] as it set out to accelerate the transition to CE.

At the core, CE is restorative and aim to design out waste and rethink the linear production and consumption patterns to keep products and materials in circulation [Ellen MacArthur Foundation, 2013]. There is no commonly accepted definition of CE yet, and Ellen MacArthur Foundation [2015] state, that CE is a concept that is characterised more than defined. Kirchherr et al. [2017] have proposed a meta-definition of CE, which define CE as "an economic system that is based on business models which replace the 'endof-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parts) and macro level (city, region, nations and beyond) with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generation" [Kirchherr et al., 2017, p. 224-225]. This definition conceptualise CE as a concept focused on new business models, encompassing the dimensions of the waste hierarchy, applying a system perspective and with a clear reference to sustainable development.

Further conceptualisation of CE can be made by specifying strategies for managing resource loops. N. M. P. Bocken et al. [2016] introduced the taxonomy of 'slowing', 'closing', and 'narrowing' resource flows as circular strategies to guide companies on the transition to CE. Building on this, Konietzko et al. [2020] elaborated on the conceptualisation of CE strategies, by adding the two strategies 'regenerating' and informing resource flows [Konietzko et al., 2020]. The five circular economy strategies (CE strategies) are interrelated strategies that can be used by companies to innovate towards CE and outline the framework for CE applied in this master thesis. The five CE strategies are presented in Figure 2.1.



*Figure 2.1.* The five CE strategies for managing resource loops [Konietzko et al., 2020, p. 5]. The blue line represents the four key strategies and the grey line, the supportive strategy 'inform'.

The CE strategies provide an understanding of how companies can transition to CE framed by measures to regenerate, narrow, slow, close and inform the resource flows. The CE strategies will be elaborated upon in section 5.2, so they are only briefly introduced here as representing different types of managing resource flows [Konietzko et al., 2020]:

- **Regenerate**: use less toxic substances and increase renewable materials and energy
- Narrow: use fewer products, components, materials and energy over entire lifecycle
- Slow: extend or intensify use of products, components and resources
- Close: close the loop between post-use and production by recycling
- Inform: use information technologies to support the other CE strategies

The CE strategies are not new to companies, they have been part of the environmental efforts in companies for many years, especially *narrowing* strategies as they correspond with the EMS practices in cleaner production, as introduced in section 1.1. Additionally, both *regenerate* and *closing* strategies have been part of the agenda for years [Kristensen et al., 2021]. Contrary, the *slowing* strategies are newer to companies, as they emphasise the importance of durability and extending lifetime of products through repair and remanufacturing etc., and where a prerequisite is that companies rethinks their business model and applies a system perspective [N. M. P. Bocken et al., 2016].

The CE strategies presented aim to reduce the consumption of materials and natural resources, and represents different levels and intensities of circularity. This can be supported by consideration to the different re-principles, as these share a common hierarchy. Here, [Potting et al., 2017] introduced the 9R framework (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover) emphasising the importance of considerations to the re-principles of refuse and rethink as well.

Operationalising CE strategies in companies is a comprehensive task, not only does it pose a technical and engineering challenge, it also requires organisational changes and expertise [Blomsma and Brennan, 2017; Brown et al., 2019]. The inherent properties of CE highlight the importance of applying a system perspective, life cycle thinking, redefine product design strategies and business models etc. [Konietzko et al., 2020; Brown et al., 2019]. The system perspective of CE calls for a broader understanding of collaboration where stakeholders become partners and companies gain new both technical and organisational capabilities [Ellen MacArthur Foundation, 2015], by balancing both the 'hard' (economic and technical) and 'soft' (organisational and social) capabilities [Brown et al., 2019]. Companies are thus expected to have a higher dependency on other stakeholders, as CE cannot be achieved by the companies alone [Khan et al., 2020].

## 2.4 The potential for integrating CE in EMS

The relationship between, and the potential for integrating CE in EMS, is an area of increasing interest for both practitioners and academics [Marrucci et al., 2019]. This section outlines the state-of-the-art on working with CE through EMS, based on a systematic literature review, see methodology in section 4.3.1. The literature review is not limited to ISO 14001 as there is still little literature on the subject.

The literature mainly focus on the potential role of EMS for integrating CE, and exploring whether it has a positive impact on the level of CE adoption in companies: Fonseca et al. [2018] studied CE in Portuguese companies and concluded that both EMS certification and maturity positively impact the level of CE adoption. Yang et al. [2019] showed that EMS enable integration of CE activities and complementarity between the front-end (eco-design) and back-end (reverse activities). The authors emphasise, that manufacturing companies should adopt EMS to enhance CE activities as a mean to anchor the corresponding environmental practices deep into their operational framework.

Marrucci et al. [2019] reviewed six SCP tools to support CE integration in companies and concluded that EMS are one of the two SCP tools with the highest level of CE integration. The authors further argue that more studies on 'circular EMS' are vital for the practical implementation of CE in companies and suggest that "...even though EMS were the most investigated SCP tool, its level of integration with CE could be greatly increased." [Marrucci et al., 2019, p. 8]. The positive relationship between EMS and CE is also confirmed by Scarpellini et al. [2020] that studied Spanish companies and showed a positive relation between EMS as formalised structures that can facilitate the development of conditions that thus enable integration of CE activities in companies.

More recently, Barón Dorado et al. [2022] analysed the mediating role of EMS in CE adoption in Spanish companies, and showed, that EMS provide companies with a strategic position that enable alignment of operations with CE. The authors emphasise, that companies with EMS adopt a higher number of CE practices, mainly in terms of developing best technological practices, eco-innovations for processes, products and services, and reducing energy consumption. The authors conclude, that EMS does not necessarily contribute to CE at all lifecycles of a product as it tend to focus on the stages where they have control, mainly in the production processes corresponding to the traditional EMS. The explicit focus on the potential for integrating CE in EMS is also found in Kristensen et al. [2021], where the authors investigated how EMS according to ISO 14001 can be used to manage and align CE strategies in organisations, by investigation of the status of EMS in Danish companies and identification of the potential for how 'circular EMS' can be developed and implemented. The authors conclude that, integrating CE can 'revitalise' EMS and potentially add new value by broadening the scope of the traditional EMS towards more sustainability, and provide companies with a dynamic system for systematic and continuous improvements on the CE practices [Kristensen et al., 2021].

Integrating CE in EMS requires a broader scope than traditional EMS and addition efforts to ensure the radical changes needed in both the strategic direction of companies in CE and their business model designs [Adams et al., 2016; N. M. P. Bocken et al., 2016], to enable the potential of integrating CE in EMS. This further emphasizes the need for new capabilities in companies as a prerequisite for EMS to be used on a strategic level and not only at the operational [Kristensen et al., 2021]. This is supported by the findings of Williams [2018] and Barón Dorado et al. [2022] in which it is concluded, that for companies to obtain the strategic potential of ISO 14001 it is important that managers are capable of leading, engaging, communicating, and identifying creative solutions in collaboration with both internal and external stakeholders thus exceeding the 'within the fence' mentality often applied in a traditional EMS.

Integrating CE in EMS has gained interest in recent years, but remains a largely unexplored field of research. Most of the literature focused on investigating whether there is a positive relation between CE and EMS by analysis of the potential for CE implementation, where EMS are only one of several factors included. Common for these studies is that they conclude that there is a relation and potential in integrating CE in EMS, but without further elaboration on the potential. Here, both Barón Dorado et al. [2022] and especially Kristensen et al. [2021], advances the body of literature on CE integration in EMS, where the latter not only establishes a positive relation between EMS and CE, but also provides a more detailed understanding and specification on the expected potential for EMS, according to ISO 14001, to align and manage CE strategies across the HLS.

In this master thesis, the potential for integrating CE in EMS according to ISO 14001

is thus framed by the findings of [Kristensen et al., 2021]. The potential is therefore understood as the duality of revitalising EMS and to enable a systematic approach to CE, which provides companies with a new agenda to keep identifying improvement potential, and mitigate some of the reported tensions related to the traditional EMS implementation, as introduced in section 2.2. The potential is further specified in appendix A, by an overview of the potential for integrating CE in EMS across the HLS of ISO 14001.

It is interesting, that despite the potential identified for integrating CE in EMS, companies still seem to be working with the traditional EMS focused on production processes and incremental improvement within the organisational boundaries [M. A. Mosgaard and Kristensen, 2020; Kristensen et al., 2021]. This is supported in a report by M. Mosgaard et al. [2015], that, based on a survey of 277 Danish companies, found, that EMS is anchored at an operational level focused on traditional environmental efforts for cleaner production, with little strategic topics where only 10 % of the companies included environmental objectives for CE. Additionally, the findings also highlighted, that EMS is not used strategically, and that product development is not a part of the focus and therefore not something where they have environmental objectives in place. This master thesis thus aim to explore how the potential for integrating CE in EMS can be supported in large manufacturing companies, based on the aspects that influence companies ability to integrate CE in EMS and thereby support the potential.

To understand how the potential for integrating CE in EMS can be supported, a clear understanding of the different types of EMS are needed. This is needed to understand the varying strategic implications of each type of EMS, as well as clarity on how these relate to the diverse nature of the five CE strategies, introduced in section 2.3. The literature explicitly describes key characteristics of both traditional EMS [Kristensen et al., 2021] and product-oriented EMS [Brezet and Rocha, 2001; Schmidt et al., 2001]. The notion of 'circular EMS' is used in both Marrucci et al. [2019] and Kristensen et al. [2021], where the latter do provide an overview of how to possibly understand circular EMS compared to traditional EMS. In this master thesis, it is argued, that further clarification between the different types of EMS are beneficial to understand how it relates to different EMS understandings and the CE strategies. This master thesis therefore further aim to explore what characterises different ways of working with EMS and how these different ways influence the companies' ability to support the potential for integrating CE in EMS.

## 3 Research Question

EMSs has become one of the cornerstones for working with environmental efforts. The scope of the EMS have expanded over time, from operational optimisation to an increased strategic orientation, as the perception of the environmental problems and solutions have changed, as introduced in section 1.1. EMSs thus holds a potential forthcoming role as a tool that can help foster corporate sustainability [Witjes et al., 2018]. Be that as it may, a concern is, that the environmental efforts of traditional EMS evolves around optimising the existing production system and focus on internal processes, which can result in an EMS lock-in that hinders the strategic potential of EMSs [Könnölä and Unruh, 2007].

The 2015 revision of ISO 14001 have strengthened its strategic potential [M. A. Mosgaard and Kristensen, 2020], which have created a stronger frame for companies to work with a broader scope on more strategic efforts, see section 2.2. Circular economy is an emerging paradigm and represents one of the solution-oriented tools needed for companies to support a sustainable development, and is thus expected to further expand the scope of EMS [Kristensen et al., 2021]. The existing body of literature establishes that there is a relation between EMS and CE, and that EMS holds a potential for integrating CE, see section 2.4. In this master thesis, the potential for integrating CE in EMS relates to the expected potential identified by Kristensen et al. [2021], which reflects the 'duality' of revitalising EMS according to ISO 14001 and add more strategic value and at the same time provide companies with a dynamic platform for systematic and continuous improvement on CE activities. However, despite this potential, companies still seem to be working with traditional EMS focused on incremental improvements within the organisational boundaries, see section 2.4, and this master thesis therefore aim to answer the following research question:

### How can the potential from integrating CE in EMS, according to ISO 14001, be supported in large Danish manufacturing companies?

#### Sub-questions

- 1. What characterises different ways of working with EMS, and how do these different ways impact the potential for integrating CE in EMS?
- 2. How are the companies currently working with EMS and the five CE strategies?
- 3. What influence the companies' ability to integrate CE in their EMS and thereby support the potential?

## 4 Methodology

This chapter aim to provide transparency and reliability of the research conducted during the master thesis by introducing the research design, argue for the research approach applied as well as describe the qualitative methods for data collection used to answer the research question and sub-questions of this study presented in chapter 3.

## 4.1 Research design

The research design applied in this master thesis is depicted in Figure 4.1 and outlines the strategy used to ensure that the data collection enables an unambiguous and valid answer to the research question [DeVAUS, 2001; Yin, 2009]. The research question influences the design, and as illustrated, the sub-questions are used to frame the focus of the analyses. The sub-questions are not answered separately, as there is a dependency where the results of the first sub-question influences how the second and third sub-question is answered.



Figure 4.1. The research design. Own illustration.

As this master thesis is performed within the field of environmental management, it is informed by the pragmatic philosophy that emphasise practical relevance to solve contemporary environmental problems [Prasad and Elmes, 2005]. The starting point for exploring how to support the potential from integrating CE in EMS, is a practice-based problem defined within a social and organisational context. To understand this context, knowledge on the current practices in companies and challenges that influence the potential to integrate CE in EMS, is constructed based on interviewees practices, perspectives and within the setting of the case companies. Knowledge is understood as contextual to the practical experiences of the interviewees and a result of social interactions, subjective to the multiple realities [Saunders et al., 2009].

The master thesis follows an abductive research approach [Kovács and Spens, 2005], where, the gap between the expected potential for integrating CE in EMS and the companies current type of EMS, initiated a creative process to create a framework for understanding this observation. Thus, as a prerequisite to answering the research question, a conceptual framework has been defined to create clarity on different types of EMSs and how these relate to the potential for integrating CE in companies, cf. sub-question 1. The conceptual framework conceptualises three different types of EMS, one of them being circular-oriented EMS, defined in this master thesis to represent the ideal integration of CE in EMS. The conceptual framework is developed by inclusion of different theories on sustainable business development and circular economy, as illustrated in Figure 4.1, which will be elaborated in section 5.3. The conceptual framework is used to identify how the companies in the case study are currently working with EMS and CE, cf. sub-question 2, and in the analysis of what influences the case companies ability to support the potential for integrating CE in EMS, cf. sub-question 3. Lastly, the conceptual framework is used in recommendations on how companies can support the potential for integrating CE in EMS.

A qualitative research approach is applied to support the exploratory nature of the research question [Creswell, 2014], which derived from a field of research that is largely unexplored. A multiple case-study has been performed to investigate how large manufacturing companies are currently working with EMS and CE, and how it relates to the potential for integrating CE in EMS. To support data collection for the case study, several qualitative methods have been applied, and these will be elaborated in section 4.3.

The exploratory approach further enabled a flexible and iterative approach to the research process [Jupp, 2006].

### 4.2 Case study of five large manufacturing companies

To investigate and gain insights on how large manufacturing companies are working with EMS and CE, as well as their perspectives of the potential on integrating CE in EMS, a qualitative case study have been applied. The case study is an empirical inquiry that can be applied to obtain an in-depth understanding of a contemporary phenomenon within its real-life context [Yin, 2009; Flyvbjerg, 2006].

The exploratory nature makes it valuable to include several cases to obtain a better understanding of current practices on EMS and CE, and different perspectives related to the potential of integrating CE in EMS in the case companies. This further make it possible to obtain a more nuanced discussion on how the potential can be supported in the large companies. The case study applied in this master thesis thus follows the *multiple-embedded* case design introduced by Yin [2009]. Opposed to a holistic case design, the embedded case design have several units of analysis [Yin, 2009], and in this master thesis these are determined by the sub-question and are: The case companies' current approach to EMS and CE as well as the challenges that influence the potential of integrating CE in the EMS. The benefits of a multiple case design are that the results are often considered more credible and robust compared to a single case design [Yin, 2009]. However, the multiple case design still requires reflection of the type of cases included. A *strategic case selection* has been made by applying specific criteria for choosing the cases included in this research, as a mean to enable the information-oriented selection rather than random selection [Flyvbjerg, 2006]. The focus has thus been on selecting companies best suited to explore the phenomena being investigated. The case companies are selected based on the following criteria presented in Table 4.1.

Criteria	Why and where to find this information
Have been certified with ISO 14001 for more than 10 years	To ensure that they have profound experience, practice and knowledge on working with ISO 14001. Identified by certification date on the companies ISO 14001 certificate and by skimming websites. It has been difficult to determine if the companies also had EMAS. One company was opted out during the study, as it became evident that they had EMAS as well.
Manufacturing companies	To ensure that there will be similarities that make it is possible to draw parallels and inspiration between the companies as well as to draw conclusions. Identified on company websites.
Large companies >250 employees (MNC)	large companies are often better equipped (competences, resources and structure) for working in a formalised approach on their environmental efforts [Mac, 1999, p. 69-71]. The cases companies are all multinational corporations, which have a high level of influence through their activities. The fact that they are all MNCs have added to the complexity as they are structured in complex relationships, interactions and exchanges in various networks that are always in a state of flux, with activities spread across different national jurisdictions [Dickens, 2015]. Information found in the companies' annual reports and websites.
Work strategically with CE (technical circles)	To ensure that the companies had advanced knowledge on CE to obtain high-value inputs on their application of the five CE strategies. The focus is limited to the technical circles, due to choice of conceptualisation of CE and to enable comparisons between how the companies work with CE. The information have been difficult to obtain and determine, but was found based on information from own professional network, media exposure, reputation and information about CE on the company websites.

Table 4.1. Criteria used for strategic case selection

The strategic selection criteria ensured inclusion of large manufacturing companies with

advanced knowledge on EMS according to ISO 14001 and on working with CE. It has been assumed that their size and advanced knowledge on both EMS and CE imply, that the companies have a sufficient maturity level that make them ready to work strategically with integrating CE in EMS. All the case companies have a global integrated management system, with ISO 9001, ISO 14001 and ISO 45001, where the frame is determined centrally at group level (strategy, policy, targets, manuals, guidelines). The application of this IMS varies in terms of level of local flexibility and roles and responsibilities, which is elaborated in the analysis of how the companies currently work with EMS and CE, in chapter 6.

As described in Table 4.1, a limitation was made to focus on the technical circles of CE. In total, 16 companies were contacted over a one-month period, out of which seven companies responded and five ended being part of the study. An overview and introduction to the case companies is presented in Table 4.2. The interviewees from each of the case companies, their job titles and responsibilities are elaborated in section 4.3.3.

Company	Industry	Employees	Continents*	ISO 14001 certified since	Established
А	Textiles and furniture	1 200	AS, EU, NA	1996	1851
В	Maritime-, energy-, and automotive	15 000	AF, AS, EU, NA, OC, SA	1999	1758
С	Machinery and mechatronics	40 000	AF, AS, EU, NA, OC, SA	1996	1933
D	Metal solutions, cables and printed electronics	600	AS, EU	1999	1954
Е	Machinery and mechatronics	20 100	AF, AS, EU, NA, OC, SA	1996	1945

Table 4.2. Overview of main characteristics of the five case companies

\* AF = Africa, AS = Asia, EU = Europe, NA = North America, OC = Oceania, SA = Sount and Central America

The five companies are included anonymously to ensure full disclosure on their experiences, perspectives and environmental policy. To ensure appropriate application of the sources of information used to describe and analyse the case companies, Table 4.3 provide an overview of how and where the various sources have been applied to increase the transparency.

Source of information	How is the source applied		
Websites	The companies' websites are used to describe characteristics about the companies (see Table 4.2) and to identify relevant material, including ISO 14001 certificates, use of ecolabels and certificates, strategies and specific webpages on how the companies currently work with sustainability, CE and EMS used in chapter 6.		
Sustainability strategies/reports	The sustainability strategies/reports of the companies have been used to identify the companies overall sustainability strategy and targets, including application of ecolabels and certificates. These are furthermore used to identify how the companies are working with circular economy related to the five CE strategies and their application of ISO 14001. This information is used in chapter 6, and an elaborate description of how these strategies have been analysed can be found in section 4.3.2.		
EMS documents (ISO 14001 certificates and environmental policies)	The EMS documents have been used to identify how the companies are currently working with EMS in chapter 6, both in terms of the scope of the EMS and reflections on the topics mentioned in the environmental policies as an indication of the EMS application. A description of how these documents have been analysed can be found in section 4.3.2.		
Interviews with employees	Information gained provide insights on both EMS and CE activities in the companies and how this source of information is applied is elaborated in section 4.3.3.		

Table 4.3. Sources of information on the case companies

## 4.3 Methods for data collection

As introduced in the research design in Figure 4.1, several qualitative methods have been applied to obtain in-depth information on how the case companies are working with EMS and CE, their perception on the potential of integrating CE in EMS as well as the challenges that influence their ability to support the potential. The methods are: *systematic literature review, document analysis, and semi-structured interviews.* 

The use of method triangulation is recommended when conducting case studies [Yin, 2009], and has enabled uncovering of different aspects of the phenomena being studied in this master thesis, e.g., the use of interviews have supported the findings in the document analysis and allowed identification of challenges that influence how companies can realise the potential of integrating CE in EMS. Additionally, method triangulation have decreased biases of the single methods.

#### 4.3.1 Systematic literature review

A systematic literature review has been conducted to evaluate the state of the knowledge on working with ISO 14001, including a focus on the potential for integrating CE in EMS, this lead to the identification of a gap in the literature [Snyder, 2019], which have framed the focus of this master thesis. The systematic review was conducted in the problem identification phase, as illustrated by the research design, in Figure 4.1. The review was conducted from the beginning of February 2022 to the end of March 2022.

First, the relevant databases for the literature search were selected, being both *Scopus* and *Primo*. The searches have been limited to English peer-review articles to ensure the quality of the articles. The systematic literature review consist of two separate search strings that follow two different search strategies, as illustrated in Figure 4.2. The search strings consist of keywords identified in the literature and prior knowledge on the topics.



Figure 4.2. The search strategy for both search strings included in the systematic literature review. Own illustration.

#### Search string 1: ISO 14001 implementation and maintenance

The search strategy applied to uncover the state of the art on ISO 14001 implementation and maintenance, is presented in Figure 4.2. Gaining insights on what motivates companies, as well as barriers and outcomes of ISO 14001 implementation and continuation, helped provide an understanding of the strategic potential of ISO 14001.

To delimit the focus of the review, screening 1 focused on ensuring that the literature was based on case studies of ISO 14001 implementation in companies in the European Union (EU). The empirical data from case studies was considered beneficial to ensure that the motivations, barriers and outcomes stem from corporate practices. The delimitation to companies in EU was made as geographical span influence the extent to which the results can be used [Boiral et al., 2018; Mas-Machuca and Marimon, 2019; Psomas et al., 2011]. The similarities in contextual conditions of companies in EU, being both corporate practices, culture and environmental regulations, makes it possible to draw parallels to the context of companies in Denmark. The snowball method was applied to the existing literature uncovered, if they referred to other empirical case studies in EU. In both screening 2 and 3 focus was on ensuring an explicit focus on EMS/ISO 14001 and either drivers, barriers and/or outcomes of ISO 14001 implementation or maintenance. To determine whether it was an explicit focus the keywords needed to reflect both aspects and doing the skimming the section headings, methodology and conclusion should indicate that the drivers, barriers and outcomes was a main focus point.

#### Search string 2: the potential for integrating CE in EMS

wordings like: role of EMS\*, potential\*, relation\*, integration\*.

The search strategy for the second search string is presented in Figure 4.2. This search has been imperative for this master thesis, as it have enabled insights on the current body of literature on the relation between CE and EMS, and on what the potential is for integrating CE in EMS, and have been used to frame the problem area.

As this master thesis, have limited the focus to be on EMS according to ISO 14001, the original search string only covered ISO 14001. However, as it is a new and emerging field of interest, little literature was found, and only one article was identified as relevant. This was the article by Kristensen et al. [2021], due to the explicit focus on the relation and potential for integrating CE in EMS. However, to further unfold the body of literature on the relation between CE and EMS, the search string was redefined, and the snowball method was applied based on [Kristensen et al., 2021]. This redefinition entailed that the focus was no longer restricted to ISO 14001, but EMS and not only in EU but globally. As this is a new field of research, screening 2 was centred on the abstracts and keywords and whether these reflected a focus on the relations between EMS and CE. This was determined based on whether the keywords both covered EMS/ISO 14001 and CE related notions, and on the scale to which it was a focus in the articles. Lastly, doing screening 3, the remaining articles were skimmed further determining whether the relation between EMS and CE was a main focus in the articles, where the section titles were skimmed and the methodology, discussion and conclusions red focusing on the explicit mentioning of the
#### 4.3.2 Document analysis

In this master thesis, a document analysis have been conducted on the sustainability strategies/reports, ISO 14001 certificates and environmental policy of the case companies. The aim have been to provide background and understanding of the company profiles and gain an understanding of how the companies work with EMS and CE.

The sustainability strategies/reports of the case companies have been analysed, focusing on several aspects, including consideration of the case companies overall strategy for sustainability, their targets, use of ecolabels and certificates, as to get an indication of their ambitions. This includes considerations on argumentation and rationales of their strategy. The main focus of the document analysis on sustainability strategies/report was to identify the activities that the companies engage in related to circular economy, where the five CE strategies were used to outline different themes [Bowen, 2009]. A part of this included uncovering of whether the companies CE activities mainly evolves around their own production and operations, or whether it expands to the product and systemic levels as well. Another part of the document analysis have been to gain an understanding of the context in which ISO 14001 is mentioned, where its application and purpose is used as an indication of how the companies understand the use of EMS.

The companies ISO 14001 certificates have been analysed in terms of its scope to provide background and identification of questions in the interviews. Lastly, the environmental policies have also been analysed by identification of the topics mentioned in the environmental policy, and, in the cases where the environmental policy is combined into an integrated one, consideration to the weighting of the focus between e.g., environmental aspects and health and safety. The topics included in the environmental policy is used to uncover the range of efforts to indicate the companies understanding of EMS, as proactive companies include other aspects in their environmental policy than those required by ISO 14001 [M. Mosgaard, 2019].

The documents that have been available for use in this master thesis, are all corporate level documents aligned with their strategy, and it is argued, that it would have been interesting to dig deeper into the specific EMS documents (procedures and targets) for local sites of the case companies to see how that reflected on their practices. The case companies did not wish to share these, which relate to one of the limitations of document analysis, being that it have a low retrievability [Bowen, 2009]. However, the document analysis have still been a valuable source of information and has been used to identify the company profile, gain insights on their main CE activities, as those being in focus, and to explore how they describe the use of their EMS. The document analysis has been used to identify important questions to ask during the interviews [Bowen, 2009].

#### 4.3.3 Semi-structured interviews

A total of nine interviews have been conducted to answer the research question. Eight interviews with informants from the case companies and one with three different consultants from Danish Standards. The qualitative interviews are considered beneficial within social sciences as it enables the researcher to explore an uninvestigated field of research in-depth and explore it from the respondents perceptions [Bryman, 2012]. According to Brinkmann and Tanggaard [2015], it is important to reflect on the approach used during an interview as a method of data collection, to ensure a valid outcome. The thematisation of the interviews have been guided by central issues and keywords identified during the systemic literature review and pre-existing knowledge on the field of research. This ensured congruence between the field of research and the interviews, which have increased the validity of this master thesis. The interviews were designed as semi-structured to create flexibility and enable both interviewer and interviewees to differ from the interview guide to unfold other aspects [Brinkmann and Tanggaard, 2015].

During the preparation, two different interview guides were made; one for the interviews with the case companies and one for the interview with the three consultants from Danish Standards. The interview guides for the case companies were modified slightly to each company after having done some initial readings about the companies on their webpages and sustainability reports. The interview guides were sent to all interviewees in advance and are included in appendix C. All interviews were conducted online via Microsoft Teams, and recorded with approval from the interviewees and later transcribed to enable use of citations in this study. All interviews were conducted in Danish. However, the citations used have been translated into English, which might have influenced the understanding. The citations have been sent to the interviewees for verification to avoid misinterpretations and increase the validity of the study [Brinkmann and Tanggaard, 2015].

#### Interviews with large manufacturing companies

The interviews with the case companies were conducted first to gain a better understanding of the problem area of this master thesis, based on their experience, knowledge and perspective [Bryman, 2012]. The information gathered has thus been used to identify the companies' current approach to EMS and CE in chapter 6, and to gain a deeper understanding on what influence this approach and how it relates to the potential for integrating CE in EMS in chapter 7.

The interviewees were contacted by email, and with explicit mentioning of the desire to talk to employee(s) with insights on both how the company works with EMS and CE. For both *Company C* and *Company D* two employees were needed to cover the research area, but were interviewed separately. All interviewees are representatives from the Danish divisions of these MNC companies, and are employed in various functions at their respective company. The interviewees are presented in Table 4.4, including a description of their responsibilities.

Company	Interviewee	Responsibility
Company A	Sustainability Manager	Works at Group level in Quality, Environment and production department. Works with supply chain management, product labelling and IMS.
Company B	Senior Environmental Manager	Responsible for management of ISO 14001 certificate for the Danish division that covers three sites. Collaborate with managers at headquarter to improve environmental focus in IMS globally.
Company C	Standardisation Manager	Responsible for company's engagement in standardisations internationally. Head of product compliance committee in which they work with compliance and sustainability on products.
	EHS Manager	Responsible for Quality and EHS in Danish division of one of the branches of the company.
Company D	QHSE Manager	Works at Group level in Business Support function with responsibility for global IMS.
Company E	Manager on Environment and Climate	Project manager on several CE projects at Group level, e.g., resource recovery, green supply chain, waste-to-landfill projects and reducing resource consumption within organisational boundaries.
	EHS Senior Manager	Works at Group EHS and help local sites on how to work with ISO 14001. Has been part of working with ISO 14001 in both production- and product development function.

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Table 4.4.	Overview	of interview	vees from th	e case companies

#### Interviews with consultants from Danish Standards

Danish Standards are Denmark's Standardisation Organisation and provides standards, eco-labels, courses and consultancy services and have a wide range of standardisation committees [Dansk Standard, 2022]. After interviewing the case companies, a consultant from Danish Standards was contacted based on an interest in understanding how they see the potential for integrating CE in EMS based on their knowledge and expertise on helping companies with working with both ISO 14001 and CE. Due to the many facets related to the problem area of this master thesis, it was arranged, that three different consultant would take part of an interview. The three consultants and their respective areas of expertise are presented in Table 4.5.

Interviewee	Job title	Expertise
Signe Malberg	Senior Consultant	<ul><li>Courses and consultancy within environmental management systems</li><li>Practical experience with implementation and maintenance of EMSs.</li></ul>
Kasper Hillgaard Mühlbach	Chief Consultant	<ul> <li>Implementation of management systems as a transformative process.</li> <li>Subcommittees within the S-1000 committee for sustainability and business development</li> </ul>
Charlotte Vincentz Fischer	Senior Consultant	<ul> <li>Standardisation in committees for circular economy, governance and environmental management.</li> <li>Processes of writing standards related to CE, sustainability and CSR.</li> </ul>

Table 4.5. Overview of interviewees from Danish Standards

The interview will be used to answer sub-question 2 and 3, as the interview with all three consultants enabled a broader range of perspectives to unfold from their experiences with how companies are working with EMS and CE, their perspectives on the potential for integrating CE in EMS and their thoughts on the conceptual framework developed and the preliminary findings of this master thesis.

# 5 Conceptual framework

This chapter introduces the theory used to develop a conceptual framework to clarify what characterises different types of EMS and to investigate how to support the potential of integrating CE in EMS, cf. the research question in chapter 3. The theory of sustainable business development is introduced to create an overall frame for what working with sustainability entails and to conceptualise different stages with different maturity levels. The five CE strategies are elaborated, to create a frame for analysing how companies are currently working with CE and help understand the forthcoming potential. Lastly, the conceptual framework is developed to conceptualise the three types of EMS.

#### 5.1 Sustainable business development

Business sustainability entails a long-term perspective, and a focus on strong relationships with stakeholders. Business sustainability is defined as: "...business models and managerial decisions grounded in financial, environmental and social concerns." [Network for Business Sustainability, 2012a, p. 4]. Companies can work with business sustainability through different activities and strategies, at different levels and intensities [Baumgartner and Ebner, 2010]. Network for Business Sustainability [2012a] have developed a 3stage framework for business sustainability, presented in Figure 5.1, to help companies understand how they can obtain a sustainable business development. The framework conceptualises different stages and strategies, to help companies evaluate and plan their sustainability efforts.



Figure 5.1. 3-stage framework for business sustainability [Network for Business Sustainability, 2012a, p. 6].

The 3-stage framework can be seen as a three-step development process for business sustainability, where a company can move across the different stages at different departments and as they evolve over time [Network for Business Sustainability, 2012a]. There is coherence between the development process outlined in the 3-stage framework in Figure 5.1 and that of the environmental perception and efforts in companies, outlined in section 1.1. The different stages can be understood according to their respective focus, going from factory (operational optimisation), product (organisational transformation) to system (systems building) [Remmen and Kristensen, 2016].

#### 5.1.1 Operational optimisation

In this stage, the focus of the sustainability activities is centred around the factory and processes, aiming to optimise production and improve performance by increase efficiency of the business as usual. The overall goal is to be "doing the same but better" to reduce harm [Network for Business Sustainability, 2012a]. The drivers at this stage are compliance and/or economic benefits. The activities are related to cleaner production, introduced in section 1.1, and are often incremental technological improvements within the organisational boundaries [Network for Business Sustainability, 2012a; Schaltegger et al., 2012]. The activities that characterise operational optimisation are thus reductions in resource use, better waste management, pollution control, and use of clean materials and renewable energy [Network for Business Sustainability, 2012a]. The activities are company-centric, with inward innovation driven by internal resources [Network for Business Sustainability, 2012a], and it can thus be achieved by mobilising existing knowledge, capabilities and tools which restrains the possible level of sustainability innovation [Adams et al., 2016].

#### 5.1.2 Organisational transformation

The second stage represents a shift in perspective as it expands from an internal factory and process oriented focus, towards creation of more sustainable business models centred around the product and services [Network for Business Sustainability, 2012a; Remmen and Kristensen, 2016]. The goal is to be "doing good by doing new things" where the outcome is creation of shared value for multiple stakeholders. The driver is to view sustainability as a market opportunity, and the activities aim to provide novel products and services as well as to create new markets [Network for Business Sustainability, 2012a]. The focus expands from compliance towards business development with inclusion and interactions with more of the product chain through e.g., supply chain management, voluntary labelling and CSR initiatives [Adams et al., 2016; M. Mosgaard and Remmen, 2015]. At this stage, a collaborative approach and redefinition of relationships are necessary [Adams et al., 2016], as the activities entails that companies to work up- and/or downstream in the value chain in collaboration with internal and external stakeholders [Network for Business Sustainability, 2012al. Companies improve the internal communication between departments to ensure that sustainability is embedded in the culture of the company [Adams et al., 2016]. The sustainability of the existing business model is improved, but the core business often remain the same, limited by current business logic [Schaltegger et al., 2012].

#### 5.1.3 Systems building

Systems building requires a broad system-perspective on sustainability [Remmen and Kristensen, 2016]. The goal is to be "doing good by doing new things with others" where the outcome is positive net impact and results [Network for Business Sustainability, 2012a]. The driver for companies is thus to create positive impact and reshape society by disrupting with existing infrastructures and rules [Network for Business Sustainability, 2012a; Remmen and Kristensen, 2016]. The focus expands beyond the organisational boundaries and value chain of companies, towards a reframing of the purpose of business in society [Network for Business Sustainability, 2012a]. A key aspect is acknowledging that the individual companies cannot achieve sustainable development alone, but that innovative partnerships and collaborations between a broad range of societal actors in existing and new networks are needed [Network for Business Sustainability, 2012a]. Companies are one of many actors needed to enable system innovations and their role as system builders is to initiative, mobilise, inspire and lead change. Examples of activities at this stage involves industrial symbiosis and B-corporations [Adams et al., 2016].

[Network for Business Sustainability, 2012a] concluded, that 70 % of companies approach sustainability related to the stage of operational optimisation, 28 % to the stage of organisational transformation and 2 % represents an approach following a combination of activities across these two stages. Network for Business Sustainability [2012b] describe the stage of systems building "...as an ideal or aspirational stage", and it is said to be unattainable for the majority of conventional businesses today. Companies can apply a hybrid approach to business sustainability, where their work is rooted in one of the stages, but at the same time entails activities that correlate with the other stages [Network for Business Sustainability, 2012a]. Figure 5.2 illustrates, that the three stages are embedded in one another and that the dimension of sustainability activities change from insular to systemic, from stand alone to integrated and from technical to sociotechnical as companies move towards systems building [Network for Business Sustainability, 2012b].



Figure 5.2. Three interrelated dimensions for business sustainability [Network for Business Sustainability, 2012b, p. 9]

Becoming a sustainable business and moving from operational optimisation to organisational transformation to systems building requires radical innovation and changes to the mindset and value of companies [Adams et al., 2016]. As companies becomes 'system builders' their value understanding expands from shared- to systems value, as they acknowledge that business can only thrive if society flourishes, which depends on the environments' capability of supporting its needs [Walker et al., 2019].

Companies have worked with sustainable business development for many years through different sustainability strategies, and in recent times, this has been coupled to CE as an emergent paradigm that can contribute to sustainable development correlating to the sustainability stage of systems building [Adams et al., 2016; Brown et al., 2019]. However, some CE practices, mostly related to the closing and narrowing CE strategies, have been integrated into the work related to the stages of operational optimisation and organisational transformation, due to the nature of the sustainability focus and activities at each stage [Kristensen, 2020].

# 5.2 Circular economy strategies

The five CE strategies defined by [Konietzko et al., 2020] are used to conceptualise CE in this master thesis, as introduced in section 2.3. To answer sub-question 1 and 2, this section elaborates on the five CE strategies to frame the identification of how companies are working with CE, as a prerequisite of understanding the potential for integrating CE in EMS.

**Regenerate** resource flows refers to activities for minimising the use of toxic substances and increase use of renewable materials as well as energy to regenerate natural ecosystems [Konietzko et al., 2020]. This strategy is mainly related to the 'biological cycle' of CE, but focusing on clean inputs and the use of renewable energy is also relevant in the 'technical cycle' [Konietzko et al., 2020].

**Narrowing** is a strategy that refers to the use of fewer products, components, materials and energy from design to recovery by designing for low-impact inputs [Konietzko et al., 2020; N. M. P. Bocken et al., 2016]. This strategy focus on activities for reducing resource use and increase eco-efficiency, as shown in Table 5.1. A critique of this strategy is that it does not concern the time dimension and thus the speed of product flows, which might cause the linear resource flow to speed up and result in minimal overall savings [N. M. P. Bocken et al., 2016].

Slowing resource flows aim to use resources, components and products longer and intensify use period, e.g. by extending product life and offer the product as a service [Konietzko et al., 2020; N. M. P. Bocken et al., 2016]. As shown in Table 5.1, slowing strategies also include maintenance, repair, reuse, and remanufacture etc. [Konietzko et al., 2020]. The activities under slowing correlate with those of the inner circles according to Ellen MacArthur Foundation [2013]. Slowing represents a new strategy of CE in companies, where a prerequisite of working with these activities is for the company to rethink and change its current product and business model [Kristensen et al., 2021].

Closing strategies aim to close the loop between post-use and production [N. M. P.

Bocken et al., 2016], by reuse of materials through recycling and by recirculation of postconsumer waste [Konietzko et al., 2020]. As shown in Table 5.1, this strategy entail designing products for recycling or product or component take-back systems. However, Ghisellini et al. [2016] argue that in terms of CE, recycling activities represents the least sustainable option, and should therefore only be considered when strategies for narrowing and slowing have been applied to the resource- and product flows to the greatest extent possible. **Informing** is a strategy that emphasise the importance of using information technologies in CE to support the other CE strategies, e.g. by tracking the resource intensity of product-in-use. [Konietzko et al., 2020]. The information technologies can include artificial intelligence, big data or online platforms. This strategy needs careful considerations and: "...information technology needs to be viewed as a means to an end (in this case circularity) and not as an end in itself" [Konietzko et al., 2020, p. 6].

To identify how the case companies are working with CE, each CE strategies are elaborated in Table 5.1, with examples of activities, based on the focus area of this research.

CE strategies	Activities		
	Use of renewable energy in production and processes (bm)		
Regenerate	Design product that use renewable energy in use-phase (bm)		
	Design with non-toxic and renewable materials (p)		
	Reduce material- and/or energy consumption (p)		
Namer	Reduce production waste (bm)		
Narrow	Localise supply where appropriate (bm)		
	Enable and incentivise consumers to use less (bm)		
	Maximise capacity use of products (sharing) (e)		
	Design for durability (p)		
	Design to ease maintenance and repair (p)		
Slow	Enable user to maintain and repair products or provide as service (bm)		
510w	Provide products as a service (bm)		
	Remanufacture existing products and components (bm)		
	Extended warranty (bm)		
	Design with recycled input (p)		
	Design for disassembly (p)		
	Conscious design for recyclability (p)		
Close	Considerations to recyclability (p)		
	Reuse or sell components and materials from discarded products (bm)		
	Create incentive and enable product returns (bm)		
	Take part of industrial symbiosis (e)		
	Use product-in-use data and materials data in circular design (bm)		
Inform	Design connected products (sensors) (p)		
	Market circular products, components and materials in online platforms (e)		

Table 5.1. The five CE strategies and examples of activities, inspired by [Konietzko et al., 2020].

The five CE strategies presented in Table 5.1 are interrelated and the activities within each relates to different innovation perspectives covering either product, business model or ecosystem [Konietzko et al., 2020]. In practice, companies often work with several of the CE strategies at the same time through different activities [Kristensen et al., 2021].

# 5.3 Developing a conceptual framework

Based on the theory of sustainable business development and the CE strategies introduced in this chapter, this section summarises how these are applied to develop a conceptual framework used to investigate how the potential for integrating CE in EMS according to ISO 14001 can be supported, cf. the research question in chapter 3. The purpose of developing the conceptual framework is two folded. First, it is used to answer sub-question 1, by creating a frame for understanding different types of EMS and identification of how these are characterised. Next, it further enables investigation of how the companies current approach to EMS and CE relates to the potential.

#### 5.3.1 Different ways of understandings: Three types of EMS

As presented in section 2.4, the notion of 'circular EMS' is found in the literature, and Kristensen et al. [2021] provide an overview of how to understand potential circular EMS, but further clarity is needed to understand how different EMS represents different understandings and how these relate to the integration of CE strategies. This is considered a prerequisite for exploring how to support the potential of integrating CE in EMS according to ISO 14001. The first two types of EMS: traditional EMS and product-oriented EMS (POEMS) are found in existing literature and defined accordingly. The last type of EMS, circular-oriented EMS (COEMS), is defined in this master thesis, and represents an optimal integration of CE in EMS. The definitions of the three types of EMS are presented in Table 5.2, and these are further conceptualised in section 5.3.3.

Types of EMS	Definitions	Inspired by
Traditional EMS	"An environmental management system used to implement a company's environmental policy, and improve their environmental performance through systematic and continuous improvements of a company's production processes and activities within the organisational boundaries."	[Remmen, 2001; ISO, 2004]
Product-oriented EMS (POEMS)	"An environmental management system that include special focus on continuous improvements of a product's eco-efficiency through the life cycle of a product by systematic integration of eco-design in a company's strategies and practices and by cooperation with stakeholders in product chain."	[Brezet and Rocha, 2001, p. 250-251]
Circular-oriented EMS (COEMS)	"An environmental management system with strategic application to ensure the continuous improvements of a company's operations, processes, products, services related to its business model through the regenerate, narrow, close, slow and inform strategies, deployed in systemic integration in an optimal way. This entails collaboration and partnerships with actors beyond the traditional product chain, in existing and new networks, to achieve a sustainable development."	Elaborated in section 5.3.1.1

Table 5.2. Definitions of the three types of EMS

#### 5.3.1.1 Defining circular-oriented EMS (COEMS)

To understanding what it means to integrate CE in EMS in an optimal way, the concept is defined in this master thesis, building upon the definition of POEMS. There are some similarities between POEMS and working with CE in EMS related to the strategic potential for a broader scope. However, working with CE in EMS have a somewhat different orientation related to the broad nature of the CE strategies and the inherent system perspective of CE [Korhonen et al., 2018]. In this master thesis, the concept of integrating CE in EMS is called circular-oriented EMS (COEMS) to continue with the wordings of POEMS, and is defined in Table 5.2.

Building upon the definition of POEMS, COEMS is defined with acknowledgement of the importance of broadening the scope of the EMS and with explicit focus on continuous improvements as a core value [Brezet and Rocha, 2001]. The explicit mentioning of a strategic application aim to underline the need for a proactive and ambitious use of EMS that extends beyond the traditional EMS focused on production processes on the more tactical and operational levels [Remmen, 2001; Kristensen et al., 2021]. Additionally, to further expand the scope, COEMS does not only focus on product's eco-efficiency as in POEMS, but an integrated perspective covering all aspects of an organisation related to a company's business model [Adams et al., 2016; N. M. P. Bocken et al., 2016]. The inclusion of the CE strategies are inspired by the different types of strategies for managing resource flows as a way to conceptualise CE in companies [N. M. P. Bocken et al., 2016; Konietzko et al., 2020]. As introduced in section 2.3, not all of these CE strategies are

new for companies, and some are more of a challenge than others. The explicit mentioning of the need to deploy these CE strategies in systemic integration aim to emphasise that companies need to work with CE strategies of a certain scale and depth. This is inspired by Guldmann and Huulgaard [2019], in which systemic circular business models (Systemic CBM) is described as a CBM that is developed with the intention to close and slow resource loops 'in an optimal way'. Be that as it may, the notion is not further elaborated by the authors. COEMS are aspirational and therefore reflects what to be achieved as companies work with CE in EMS. The understanding of how CE is integrated into EMS 'in an optimal way' should be seen as a dynamic concept that change over time as the understandings change or expands. The bullets listed below outline some aspects to consider, to ensure optimal integrating of CE in EMS:

- The intention to integrate the slowing strategy
- CE activities are integrated into core business and company culture
- Radical innovation in existing BM or by new novel products/services
- CE activities represents a significant share of revenue to be well integrated

Collaborations and partnerships are included in the definition of COEMS as a prerequisite for working with COEMS, as it is acknowledged that working with CE is something that cannot be achieved by the company alone [Khan et al., 2020; Brown et al., 2019]. Here, emphasis is put on the need to engage in new and existing networks beyond the traditional product chain to identify new business models aimed at different types of value creation [Adams et al., 2016]. This further support the revised ISO 14001 in terms of considerations to the broad context of the organisation, as introduced in section 1.2.1. Lastly, the definition of COEMS include sustainable development as the long-term strategic aim, which is inspired by the definition of CE introduced by Kirchherr et al. [2017], and emphasise that this is a new way of thinking and understanding EMS in a wider perspective.

#### 5.3.2 Combination of elements in the conceptual framework

The theory of sustainable business development outlines three stages of business sustainability, which is used in this master to create an overall frame for understanding the three types of EMSs in relation to business sustainability. The correlation drawn between the three stages for business sustainability and the three types of EMS, is supported in Network for Business Sustainability [2012a] where EMSs are acknowledged as a tool that can be used to integrate sustainability into products and processes across all three stages of the framework, depending on its application. It is assumed that each of the three types of EMS correlates to the respective stage of business sustainability, as illustrated in Figure 5.3. Each type of EMS represents an 'ideal' application that can be used as an indication of companies sustainability strategy. COEMS is thus acknowledged as being the optimal application correlating to the stage of systems building, due to the systemic perspective needed for working with CE and its strategic application of the EMS. The conceptual framework includes consideration to how and which of the CE strategies that companies are working with. Figure 5.3 illustrates, how the different elements are used in combination to create a conceptual framework.



*Figure 5.3.* Combination of elements used to create a conceptual framework. The arrows within the boxes represent different CE activities. Inspired by [Network for Business Sustainability, 2012b]

The illustration in Figure 5.3 aim to show, that each of the different EMS understandings and EMS types are embedded in one another, and where the more advanced types are adding to the focus of the traditional EMS. Inspired by the theory for sustainable business development, it is acknowledged, that progressing towards the full potential of integrating CE in EMS, is a process over time. Additionally, as illustrated by the arrows in Figure 5.3, a company might focus predominantly on the traditional EMS, while also working with CE activities beyond this scope.

The three dimensions illustrated in Figure 5.3 all influence what type of EMS that a company can be said to be working with, and are interrelated. One of the dimensions in the figure aim to illustrate the difference in scale and depth of the CE strategies applied in a company. This dimension thus covers both how and which of the five CE strategies that a company work with. This is inspired by a model for circular business model innovation (CBMI) developed by [Guldmann and Huulgaard, 2019]. The authors developed a model that differentiate between three types of CBMI; internal-, hybridand systemic with corresponding CBMs, which amongst others, builds on three stages of business sustainability by Adams et al. [2016], and thus making it possible to draw parallels between the three types. The second dimension is **EMS application**, which reflects the difference between a segmented use in a single/few departments, contrasting to the strategic application where EMS is connected to the overall strategy of a company and most- or all business activities. The third dimension is **Interactions**, which is used to differentiate by the types of interactions as either being company-centric with minimal interactions with external stakeholders, or as the scope expands towards COEMS, collaborations with multiple stakeholders in society, in new and existing networks.

# 5.3.3 Conceptual framework for the three types of EMS for integrating CE

This section summarises on the conceptual framework developed in this chapter, by presenting a conceptualisation of the three types of EMS for integrating CE. This is done to outline what characterises different ways of working with EMS, to answer sub-question 1, and identify counters for an analytical frame used to determine how companies are currently working with EMS and CE, cf. sub-question 2. The framework is also used to support identification of factors that influence the case companies ability to support the potential of integrating CE in EMS in an optimal way, cf. sub-question 3.

The conceptualisation that characterises different ways of working with EMS is presented in Table 5.3. The conceptualisation is supported by eight different criteria that help to outline differences in the three types of EMS, the criteria elaborate on the three dimensions presented in Figure 5.3. The criteria Scope of EMS and Purpose of EMS describe basic characteristics of the three types of EMS and are based on literature on environmental management, EMS and the characteristics of the 3-stage framework introduced in section 5.1. Application of EMS aim to illustrate that there is a difference in how and where the EMS is used, as also reflected in the definitions of the three types of EMS. The difference in how EMS is applied is inspired by Huulgaard [2015], as the author develops a conceptual framework for characterising companies sustainability strategies, building on the 3-stage framework, where one of the parameters is the structure of the sustainability activities. The remaining criteria in the conceptualisation, in Table 5.3, can be used to unfold not only how companies are working with EMS, but also CE. The criteria Type of stakeholder interactions indicate the extent of interactions with both internal and external stakeholders and expands from being company centric to the product chain to networks. This is inspired by Adams et al. [2016] that emphasise the need for new partnerships to identify new ways of doing business in systemic perspective.

Kristensen et al. [2021] emphasise, that the stakeholders depend on the scope of the implemented EMS. To further characterise the interactions with stakeholders, a distinction is made between internal and external stakeholders. **Primary internal stakeholders** refers to the primary stakeholders within a company that holds the responsibility as a driver behind the activities. Here, it is acknowledged that the top management is involved with how companies work with EMS across all three types, but that these are given a primary role in COEMS to ensure that the EMS is related to the business strategy.

The criteria **External stakeholders** shows a difference in the type of external stakeholders involved as a company's approach to EMS expands towards more advanced integration of CE activities [Kristensen and Remmen, 2019]. Collaborations and partnerships are important when working with CE, as introduced in section 2.3. Going from POEMS to COEMS represents a shift from mainly working with a company's upstream relation, to working both up- and downstream, acknowledging that the customers are important to ensure knowledge of user needs and product use [Kristensen and Remmen, 2019; Ellen MacArthur Foundation, 2013]. The scope of the external stakeholders involved especially expands when working with slowing and closing resource loops [N. M. P. Bocken et al., 2016; Kristensen and Remmen, 2019].

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Production processes and activities inside the organisational boundaries [Remmen, 2001].	Services and products in a life cycle perspective (including product development) [Brezet and Rocha, 2001].	All relevant activities from operations, processes, products, services related to the business model in systemic perspective [Adams et al., 2016; Kristensen et al., 2021].
Purpose of EMS	Continuous improvement, compliance, and economic benefits [Remmen, 2001].	Shared value by continuously improving environmental performance across product lifecycle by integration of CE strategies [Brezet and Rocha, 2001; Adams et al., 2016].	Link EMS to business strategy to revitalise value of EMS and work systematically and continuously with CE to create net positive value through novel circular solution [Adams et al., 2016; Kristensen et al., 2021].
Application of EMS	Segmented use. EMS is managed in single departments (HSE), with local efforts and low coordination and awareness across department [Huulgaard, 2015].	Cross-functional coordination. Efforts are communicated and coordinated across departments to ensure environmental consideration, e.g., in product development, sales, purchasing [Huulgaard, 2015].	Strategic application of EMS with systemic integration of CE. EMS are business driven and connected to most- or all activities related to the business model to support the work with CE in an integrated and holistic manner [Adams et al., 2016; Huulgaard, 2015].
Type of stakeholder interactions	Internal and company-centric with single/few departments and minimal involvement of (external) stakeholders [Remmen, 2001].	Inter-organisational collaborations across life cycle, with immediate stakeholders in product chain [Brezet and Rocha, 2001].	Systemic collaborations both upstream and downstream and partnerships in existing and new networks beyond product chain (untraditional collaborations and experiments) [Adams et al., 2016; Guldmann and Huulgaard, 2019].
Primary internal stakeholders	QHSE managers, project leaders, technical employees and investors [Remmen, 2001].	Product development, designers, purchase, sourcing [Brezet and Rocha, 2001].	Top management and most departments relevant for the change in BM
External stakeholders	Environmental authorities, local communities and neighbours [Remmen, 2001].	Suppliers, customers, industry organisations, environmental- or management consultants (product chain) [Brezet and Rocha, 2001].	Customers, competitors, and a broad range of stakeholders from society, such as NGO's, regions, universities, governments, research centres (networks)
Organisa- tional outcome	Incremental improvement in production processes by adding criteria to the existing and without interfering with business model or core business. CE activities are not integrated, but single issues handled through projects [Adams et al., 2016; Guldmann and Huulgaard, 2019; Brezet and Rocha, 2001].	Improved environmental performance over product life cycle. Improving existing business model or adding new circular services and product designs. Circular criteria added in product development. CE activities are somewhat integrated in relevant practices, but do not influence core business [Adams et al., 2016; Guldmann and Huulgaard, 2019; Brezet and Rocha, 2001].	Radical changes where CE are integrated in business strategy and core business. Explicit focus on CE strategies in environmental policy. The existing circular business model is improved with new or refined circular services and/or product designs [Guldmann and Huulgaard, 2019; Adams et al., 2016].
Circular economy outcomes	Internal CBM mainly in production processes. Focus on the traditional CE activities for narrowing, closing and regenerating resource loops [Guldmann and Huulgaard, 2019; Kristensen et al., 2021]	Hybrid CBM that extend efforts across product life cycle by incorporation of closing and/or slowing strategies to supplement existing business model [Guldmann and Huulgaard, 2019; Kristensen et al., 2021]	Systemic CBM by improving existing circularity or radical innovation and new solutions in networks by integrating CE strategies into core business in an optimal way (must include slowing) [Guldmann and Huulgaard, 2019; Kristensen et al., 2021].

Table &	5.3.	Conceptual	framework	of the	three	types	of EMS	for	integrating	CE
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The criteria **Organisational outcome** indicate how activities are embedded into the organisational structure, its level of integration and its implication on core business and business model. This is inspired by the model for CBMI by Guldmann and Huulgaard [2019], in which different types of CBM are outlined with varying intensities and implications for a company's business model. Another source of inspiration is Adams et al. [2016], as the authors outline, that the innovation objective increases across the three stages, emphasising a shift from incremental improvements to radical changes. There is a close relation between the former and the last criteria, Circular economy outcome. The five CE strategies introduced in section 5.2, cannot be divided directly into each of the three types of EMS, as they consist of different activities with different intensities. Inspired by Kristensen et al. [2021] it is argued that the CE strategies of narrowing, closing and regenerate are used in the traditional EMS. However, the closing and slowing strategies encompass activities that have the potential to obtain radical changes depending on how they are applied. This is reflected in the differentiation between hybrid CBM and Systemic CBM as the latter focus on integrating CE into EMS in an optimal way into the core business and where the CE strategies must include some slowing activities to fully obtain the potential. The CE outcome of COEMS represents a broad range of possible business models. The difference between the CE outcome in POEMS and COEMS thus relates to whether the outcome is obtained in the core business, and where the solutions must be identified by new ways of engaging with stakeholders trough networks.

The conceptualisation in Table 5.3 is used to outline what characterise the three different types of EMS presented in this master thesis. This conceptualisation is used in the analysis to map how the companies are currently working with CE and EMS. A simplified illustration of the table will be used and is presented in the following chapter 6.

# 6 The case companies' current approach to EMS and CE

This chapter provides an overview of how the case companies are currently working with EMS and CE, cf. sub-question 2. This analysis is framed by the application of the conceptual framework on the three types of EMS and their potential for integrating CE, as developed in section 5.3, and by the five CE strategies presented in section 5.2.

The structure of this chapter is, that first, each of the five case companies' are presented separately to introduce their company profile, their current type of EMS and their main CE activities. Here various sources of information about the companies have been applied, as introduced in Table 4.3, including interviews with employees. A simplified illustration of the conceptual framework, presented in Figure 6.1, is used on each of the companies to give an overview of their current approach to EMS and CE and to illustrate how these relate. EMS activities are marked by an orange box and the CE activities with a green box. As a company's activities can vary across the three types of EMS, gradients are used to indicate where the primary focus of the respective criteria is placed.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.1. Simplified conceptual framework of the three types of EMS for integrating CE

This chapter ends by summarising how the case companies currently approach EMS and CE, including identification of the barriers and benefits that influence these approaches.

# 6.1 Company A

#### Company profile

Company A provide a range of products and services to the international textile and furniture industry. The company's mission is to use innovation and value-adding partnerships to become preferred partner/supplier, and they work in close cooperation with multiple stakeholders. The company have six action areas for sustainability: sustainable materials, sustainable design, circular economy, responsible production, culture and values and customer cooperation. The company works with SDG 6, 7, 12, and 17, and have endorsed the principles of the UN Global Compact, but are not committed. Company A has the largest selection of eco-labelled products on the market, including, the Standard 100 by OEKO-Tex, EU Ecolabel, FSC, Cradle-to-Cradle and other industry standards such as LEED, BREEAM and the Nordic Swan.

#### **Current EMS**

The company have eight ISO 14001 certificates across their locations as part of their IMS. The tactical and operational frames are defined in cooperation between Group level HSE and the local subsidiaries [Sustainability Manager, Company A, 2022]. The scope of their EMSs covers product development, manufacturing, sale and services sites. EMS is mainly used to work with legal requirements and ensure responsible production through reduction targets on energy consumption, waste, emissions to air and use of virgin raw materials. *Company A* have recently expanded focus to product development in the EMS and have updated their product design principles to consider circularity, especially recyclability, as part of designing new products. The company also use their EMS to set requirements for their suppliers to comply with Eco-label and Oko-tex requirements [Sustainability Manager, Company A, 2022]. There is some cross-functional coordination between the primary internal stakeholders, being those that at Group level sets the overall frame, the local responsible managers, employees that work in product development and sourcing personnel in terms of endorsing requirements for materials.

#### Main CE activities

Company A have made CE one of their strategic action areas for sustainability and document their circular actions through the broad range of labels that support the circular mindset. The company's main CE activities covers both their productions and their products where they work together with a broad range of actors in both product chain, industry and beyond (universities, customers, industry organisations, suppliers, contractors, labelling- and certification organisations). The main CE activities of Company A are:

- Design products with non-toxic materials through eco-labels (regenerate)
- Design products that are durable and with long-life (slow)
- Conscious design of textiles with pure mono-materials to enable recycling (close)
- 100 % RE at sites in Scandinavia and are helping suppliers with RE (regenerate)

The company have recently initiated take-back systems, on a pilot project scale, to ensure recycling of outworn fabrics. The company are working with both customers, their own production facilities and new partners to implement these take-back systems and solutions.

The CE activities are somewhat integrated in the company culture and represents both improvements and additions to the existing business model of the company [Sustainability Manager, Company A, 2022]. Table 6.2 summarises how *Company A* is currently working with EMS and CE.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.2. Company A's approach to EMS and CE in relation to the three types of EMS

# 6.2 Company B

#### Company profile

Company B produces a wide range of product and service solutions to both the maritime and energy industries. The company is undergoing strategic transformation from being a component supplier to becoming a global provider of sustainable energy solutions. Sustainability is becoming increasingly important to the company, and they are part of a larger Group that have endorsed a 2030 target of 30 % reduction in  $CO_2$  emissions compared to 2018 which they must contribute to. The company have set the target, that by 2030, sustainable technologies will account for the majority of the business.

#### Current EMS

Company B have 14 production sites with ISO 14001 as part of their IMS, where some are covered by the same multisite certification. At the national division in Denmark, one HSE manager is assigned responsibility for the ISO 14001 aspects of the system across three sites covered by one certificate. The specific environmental objectives are determined locally, and mainly encompass the environmental requirements for ensuring compliance with environmental regulation [Senior Environmental Manager, Company B, 2022]. ISO 14001 supports CSR reporting on key figures. ISO 14001 is thus used to ensure compliance at local sites in terms of production optimisation, with minimal interactions with environmental authorities in terms of renewing environmental permits. The scope of their EMS covers production and daily operations, including offices for sales and development. According to Senior Environmental Manager, Company B [2022], there are few employees involved with the work with ISO 14001, and a low awareness in the company about where the system and related documentations can be found.

#### Main CE activities

Company B is working with CE activities in their production and operations, through their service subsidies, and by their increased focus on developing a broader range of sustainable energy solutions in collaboration and partnerships. Their main CE activities are:

- Design product that are durable with long lifetime (slow)
- Design products to include sensors for detecting need for maintenance, improve efficiency and provide customer with data on their system (inform)
- Provide maintenance and repair through global service subsidiary (slow)
- Enable customers to use less through development of new technologies e.g., power-to-X and Carbon Capture Utilisation (narrow)/ (close)

The company is involved with several pilot studies and projects on producing and testing e.g., synthetic methane produced by renewable energy as a possible alternative fuel for their product catalogue, and are adding a retrofit part to the business to enable customers to upgrade or modify their products. *Company B* have begun focusing on how to integrate CE activities into existing practices and processes, but still on a small scale and segmented without an overall aim. There is a low explicit focus on CE in the company [Senior Environmental Manager, Company B, 2022], with no targets nor mentioning of circular economy in the CSR reports from 2019 and 2020 and only dispersed use on the company website. Table 6.3 summarises how *Company B* is currently working with EMS and CE.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.3. Company B's approach to EMS and CE in relation to the three types of EMS

# 6.3 Company C

#### Company profile

Company C produces a broad range of products for various applications within industry, transport and buildings. The company is integrating sustainability into its strategy and practices, guided by their 2030 vision for Environment, Social and Governance (ESG) focused on becoming a preferred partner and provide leadership in global decarbonisation, circularity, diversity and inclusion. The 2030 target is to be carbon-neutral at all global operations, reduce 15 % of CO<sub>2</sub>-emissions from value chain and reduce 25 % of CO<sub>2</sub>-emissions from value chain and reduce 25 % of CO<sub>2</sub>-emissions from purchased goods. The company is working targeted towards SDG 6, 7, 11 and 12 and are committed to both UN global Compact and Science Based Targets (SBTi).

#### Current EMS

Company C use the processes and activities related to ISO 14001 to "...drive activities at the factory locally and to ensure a systematic approach and manage daily operations" [Director of Quality and EHS, Company C, 2022]. The current structure of EMS is that each site have single ISO 14001, and there is little coordination between sites. The company will change their approach to ISO 14001 in the future to have a more global system, where each of the company divisions have a few larger certificates rather than many single certificates [Director of Quality and EHS, Company C, 2022]. The application of EMS is framed at group level, but with large local freedom. Here, ISO 14001 is used to reduce energy and resource consumption in production processes, ensure compliance and integrate requirements from customers Director of Quality and EHS, Company C [2022]. The application of the EMS is internal, where those involved are QEHS managers at group level, local QEHS managers and employees or managers from relevant production processes. The external stakeholders involved in EMS are the environmental authorities.

#### Main CE activities

Circularity is one of the new focus areas in Company C's new sustainability strategy, which include two 2030 targets for CE: 1) more than 80 % of new developed products must follow 'circularity approach' and 2) the company will engage in circularity collaborations with the majority of top-25 customers. The company works with the CE strategies not only in their production but also in their product development. Their main CE activities are:

- Increased focus on share of recycled materials (metals and plastic) and considerations to recycling at end of use (close)
- Produce energy efficient product in production and product use phases (narrow)
- Design products to enable maintenance and repair and offer this as a service (slow)
- New generation of products with more sensors with digital services (detect maintenance and obtain information on product and customer system) (inform)

Company C have initiated a project with a university to investigate how they can design for disassembly of their electronic equipment at a larger scale and in automatic processes. The company is also testing whether discarded products from warranty cases can be remanufactured into products and/ or components of a sufficient quality and sold to new customers [Standardization manager, Company C, 2022]. The company is working with most of the CE activities in portfolio based projects and portfolio management where top management is involved [Standardization manager, Company C, 2022]. The CE activities are driven from the Product Compliance business function. As CE have gained more explicit focus in the organisation, the company will start to look into how CE can be integrated into existing system and processes of the company's IMS in the near future, including how to use ISO 14001 in product development processes [Standardization manager, Company C, 2022]. Table 6.4 summarises how *Company C* is working with EMS and CE.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.4. Company C's approach to EMS and CE in relation to the three types of EMS

# 6.4 Company D

#### Company profile

Company D provide a product range 100 % determined by the solutions needed for industrial and electronic companies. Their 2030 ambition is to become the leading sustainable development- and production partner, and they have targets to reduce their  $CO_2$ -emission to become 100 %  $CO_2$ -neutral in 2025 (scope 1 and 2). The company aspire to establish innovative and partner-based relationships and to advise customers project development from early beginning, to production, packaging and logistics, based on specialised knowledge on products and production technologies. The company is committed to the UN Global Compact and works with SDG 5, 8, 9, 12 and 17. The company have a CSR Silver Rating from EcoVadis and strive to get Gold Rating in 2025.

#### Current EMS

Company D have several multisite ISO 14001 certificates across their four business divisions. The application of the EMS is internal with few employees involved, mainly from HSE departments and relevant employees in production. The external stakeholders

involved are the local environmental authorities (environmental permits) and, in few cases also the customers [Manager in Group HSE, Company D, 2022]. The scope of the EMS is on production processes, and ISO 14001 is used as a steering tool to ensure compliance at local sites and to meet customer requirements [Manager in Group HSE, Company D, 2022].

#### Main CE activities

Company D is working with the traditional CE strategies to "put their own house in order" as a first step towards their 2030 ambition [Manager in Group HSE, Company D, 2022]. The company is also working with suppliers and customers to improve the environmental performance of their products. The main CE activities of Company D are:

- Design with production in mind (resource and energy consumption) (narrow)
- Use RE in production process and operations (regenerate)
- Help customers identify optimal product design for durability (slow)
- Design with recycled inputs (close)
- 95% of packaging are sustainable (recyclable cardboard and pallets, bio plastics and FSC wood) and the company have target for 99 % by 2025. (close)

Company D works with most of the CE activities on the products in projects driven at group level, with sporadic inclusion of responsible managers/employees needed on a case by case basis, mainly in QHSE or product development. The company are using the Circulytics tool by Ellen MacArthur Foundation [2020] and got a B+ score. This was done by request of the top management, and is used internally to create knowledge foundation on the current activities, provide guidance on CE potentials to customers, identity areas of improvements and expand the employee's understanding and competences. Table 6.5 summarise how Company D is working with EMS and CE.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.5. Company D's approach to EMS and CE in relation to the three types of EMS

### 6.5 Company E

#### **Company profile**

Company E is one of the world's leading water technology companies. Sustainability is a core part of the company's business strategy and values, and their sustainability targets are to reduce their own water consumption and CO<sub>2</sub>-emissions with 50 % by 2025. The company wants to be climate-positive by 2030 and have targets for ensuring safe drinking water and reduce water usage globally. The company acknowledge its responsibility to reduce its environmental impact and create solutions that solve global challenges. The company's actions areas are: saving energy and water, embedding circular business principles and transforming water access for people in need. The company is working closely with stakeholders in the product chain, industry and on the global level. The company are committed to UN Global Compact and have submitted targets to SBTi.

#### Current EMS

Company E have multisite certificates across the 45 subsidiaries that have an ISO 14001 certificate. ISO 14001 is used in different systems across the company's IMS with variations amongst the subsidiaries with either QEHS or QE systems, where the latter is used in product development [EHS Manager, Company E, 2022]. The company have EHS specialist on group level to support local sites on how to work with the IMS, including ISO 14001 [EHS Manager, Company E, 2022]. The scope of ISO 14001 varies across the different subsidiaries, but is mainly used on production processes, especially in terms of achieving their 2025 strategy by reducing energy and water consumption and compliance. The company have in recent years expanded the scope of their ISO 14001 to cover the product development companies as well, where it is used to integrate end-of-life considerations in product development. The internal stakeholders working with ISO 14001 vary depending on local application, but range from EHS managers at group level and locally, to product development and top management.

#### Main CE activities

Company E have initiated a large strategic initiative to explore various CE activities towards 2025 and identify actions that can help embed circular principles throughout the company [Project Manager on Environment and Climate, Company E, 2022]. The company is thus working with CE activities in both production, product chain and networks. The main CE activities are:

- Investing in RE at facilities and transition to a 100 % electric car fleet by 2025 (regenerate)
- Green supply chain and reducing scope 3 emissions by reducing packaging, transport and suppliers' impacts by supplier requirements e.g., to use of Ecovadis (narrow)
- Design durable products and that can be disassembled at end-of-use (slow / close)
- Use sensors in product to provide digital service (app solutions) (inform)
- Provide repair and maintenance as a service (slow)
- Take-back system of products with disassembly lines globally (close)
- Remanufacture of products by repair or use of components in new products (slow)

The company have recently conducted a pilot study in collaboration with multiple customers, to test possible reusable and returnable packagings and how it matches the needs of both parties. This led to the identification of returnable, foldable plastic crates that can be used in the future. The company is also engaged in industrial symbiosis, where excess heating is used for district heating. The CE activities are not gathered in one division or department, but added "where it makes sense locally" with support from and initiatives initiated at Group level [Project Manager on Environment and Climate, Company E, 2022]. Many of the CE activities are managed as projects and has been developed dispersed and through an ad-hoc approach. Some anchoring has started to happen on more advanced CE activities like the take-back system. Table 6.6 provide an overview of how *Company E* is currently working with EMS and CE.

Criteria	Traditional EMS	Product-oriented EMS	Circular-oriented EMS
Scope of EMS	Factory	Product	Business model
Application of EMS	Segmented use	Cross-functional coordination	Strategic application
Type of stakeholder interactions	Internal and minimal involvement of stakeholders	Inter-organisational collaborations with immediate stakeholders	Systemic collaborations and partnerships in existing and new networks
Primary internal stakeholders	QHSE-, technical employees and project managers	Product development and designers	Top management and most departments
External stakeholders	Environmental authorities and neighbours	Suppliers, distributors, environmental- or management consultants	Customers and a broad range of stakeholders from society
Organisa- tional outcome	Incremental improvement without interfering with existing BM. Low CE integration.	Improved environmental performance of product. Improving existing BM and some CE activities are integrated	Radical changes. CE is integrated in core business.
Circular economy outcomes	Internal CBM (narrow, close and regenerate)	Hybrid CBM (close and slow)	Systemic CBM (close and slow in optimal way)

Table 6.6. Company E's approach to EMS and CE in relation to the three types of EMS

# 6.6 Summary of the case companies' current approach to EMS

As introduced in section 4.2, all the case companies have an IMS, and all of them state, that the quality management systems is the most widespread system that creates the contours for integrating the requirements of ISO 14001 and ISO 45001 into relevant parts and processes of the system. Additionally, despite variations in organisational structures (subsidiaries, divisions and sites) and distribution of responsibilities, all the case companies sets the framework centrally at a group levels. This includes environmental policies, guiding manuals, objectives and system boundaries. Some differences exist in the amount of objectives defined at a central level and the level of local flexibility. For all case companies, the responsibility for managing the ISO 14001 system in the daily practices is at the local level, leaving some flexibility to adapt these to the context in which they operate. In *Company A* the local processes and objectives are determined in cooperation between the Group level and the local sites, reflecting large coordination of efforts across the company [Sustainability Manager, Company A, 2022]. Contrarily, Director of Quality and EHS, Company C [2022] explain, that due to the size and organisational structure of the company, ISO 14001 is managed from a local level, with broad frames determined centrally. This reflects that the size of the companies influence how ISO 14001 is applied.

The case companies' EMSs are mainly focused on production processes and daily operations, with traditional environmental objectives aimed at energy, waste, water and chemicals etc. This correlate with most common objectives identified in a study on 277 Danish certified companies [M. A. Mosgaard et al., 2022], and the case companies are thus found to be representative of Danish companies. The objectives in the EMS is in all companies used to ensure compliance with regulation, especially in *Company B* where Senior Environmental Manager, Company B [2022] stated that compliance seems to be ISO 14001 main application. Other examples of how objectives are used, in *Company E* where the objectives are linked to the companies overall sustainability targets, and *Company C* where the objectives are used to integrate customer requirements. The case companies' current application of EMS reflects little awareness about its strategic value, as it is minimally connected to more strategic initiatives of product-development, business models, CSR and CE, which supports the findings of [Kristensen et al., 2021].

The case companies are all working with EMS according to the Traditional EMS, due to the production-orientation, as characterised in section 5.3.3. Be that as it may, *Company A* and *Company E* have both expanded their EMS to cover the product development, centered around their product design principles and integration of end-oflife considerations, respectively. Their type of EMS is thus expanding towards POEMS. Additionally, Standardization manager, Company C [2022] argues, that due to the increased focus on CE at a strategic level, *Company C* will begin to look into how ISO 14001 can be used in the product development phase in the future. Figure 6.1 presents the companies current type of EMS according to the conceptual framework.



Figure 6.1. Overview of the case companies' current type of EMS

The companies' current understanding and application of EMS is reflected in their environmental policy documents, where some differences in application are found. The type of environmental policy and an overview of the focus and characteristics of these, are found in Table B.1, in appendix B. Most of the companies environmental policies follows the elements outlined by the ISO 14001 standard, with little consideration to proactive elements. However, also supporting the fact that *Company A* and *Company E* are expanding their working towards POEMS, their environmental policies reflect a broader scope and a focus on their stakeholders, mainly upstream in terms of suppliers.

Table 6.7 summarises the outcomes and barriers of how the case companies are currently working with EMS. The outcomes and barriers varied amongst the companies, which reflects differences in how EMS is applied. This is elaborated below the table.

**Table 6.7.** Overview of outcomes and barriers of working with EMS in the case companies. If an outcome or barrier is not supported in the findings of the literature review on ISO 14001 implementation and continuation, then it is indicated by "new" in the column to the right.

Outcomes of EMS	Case companies	
Systematisation and structure	Company $A, C$ and $E$	
Improved corporate image	$Company\ C\ and\ D$	
Improved top management commitment	$Company \ A \ and \ E$	
Continuous improvements	Company $A$ and $E$	
Improved environmental performance	$Company \ A \ and \ E$	
Compliance with environmental regulation	Company $A, B, C, D$ and $E$	
Better alignment with business strategy	Company E	
Better operational control and quality of internal processes	$Company \ A, \ C \ and \ E$	
Barriers of EMS		
Lack of resources (knowledge and time)	Company B and D	
Difficult to obtain total integration across business functions	Company B, C and E	New
Lack of system continuity (spring-cleaning mentality*)	$Company \ B \ and \ E$	New
Illogical and complex system set-up	Company B	New
Lack of top management commitment and support	Company B and D	
Low awareness and understanding of EMS	Company $B$ and $E$	New

\*Spring-cleaning mentality where EMS is used mostly in the period up to an audit

All companies stated compliance as one of the main outcomes and motivations for why they have EMS, which was also identified in the literature review in chapter 2. Another main motivation for the case companies to have ISO 14001 are customer requirements [Sustainability Manager, Company A, 2022; Standardization manager, Company C, 2022; Manager in Group HSE, Company D, 2022]. The case companies all state external motivations as some of the main reasons, which are an issue, as [Psomas et al., 2011] conclude that these are insufficient for effective improvement to environmental performance. Three of the companies also highlighted the importance of the internal motivations for continuous improvements and improved environmental performance [Sustainability Manager, Company A, 2022; Manager in Group HSE, Company D, 2022; EHS Manager, Company E, 2022]. The outcomes of how the case companies are working with EMS, seem to support the findings of J. Gonzalez-Benito and O. Gonzalez-Benito [2005], as the case companies that also had strong internal motivations (*Company A, C and E*), experience greater EMS outcomes, than those that did not. The barriers on how the case companies work with their EMS are all internal, and that indicate that it can be done within the realm of the companies, and that their current application of EMS to some degrees are hindering utilisation of the strategic potential of EMS in the case companies [M. A. Mosgaard and Kristensen, 2020]. As indicated in Table 6.7, then the majority of the outcomes and barriers are supported by the findings in the literature review, which further indicate, that the case companies are representative for the EMS practices.

# 6.7 Summary of the case companies' current CE activities

To summarise how the case companies are currently working with CE, an overview is presented in Table 4.2. The case companies are all working with CE activities that encompass both product, business model and ecosystem innovations. The case companies are all working with the CE activities of the regenerate and narrow strategies, to minimise the environmental impacts stemming from their production and operations, and most of these efforts are managed through their EMS. The extent and strategic orientation of the companies' CE activities varies, which relates to the fact that working with CE is complex, and requires collaborations with a broad range of stakeholders, especially the closing and slowing strategies [Khan et al., 2020; N. M. P. Bocken et al., 2016]. All the case companies are, in various ways, collaborating with external stakeholders to test and do pilot studies to identify new solutions on the more advanced CE activities.

Company B and Company D are not as advanced on their CE activities as the other companies. Company D focus on CE activities in their production and argues, as the only of the companies, that their ability to work with the more advanced CE activities for closing and slowing, is highly influenced by their customers and their needs: "...in the end it is up to customers, if they do not like our suggestions or have strict requirements then we produce as they want within the legal framework. But we try to push them to think outside the box" [Manager in Group HSE, Company D, 2022]. Contrarily, Company B are expanding their focus, and are involved in pilot studies in collaboration with new partners to identify possible solutions for alternative fuels benefiting the industry.

As illustrated in Table 6.8, Company A, Company E, and to some degree Company C, have succeeded with integration of the advanced closing and slowing CE strategies, e.g., Company E who have successfully expanded a project for product take-back and remanufacture into a part of their business model, and Company A who apply extensive product labelling ensuring a circular mindset across their product chain. These three companies are also the only one of the case companies where CE is one of the strategic focus areas, and where collaborations with stakeholders both in the product chain, industry and beyond in broader networks are a large part of their CE activities.

**Table 6.8.** Overview of which and how the CE strategies are applied in the case companies. (X) marks that it is a pilot study and/or project based activity.

	CE strategies and activities		Companies				
	CE strategies and activities	Α	в	С	D	$\mathbf{E}$	
rate	Use of renewable energy in production and processes (bm)	Х		Х	Х	Х	
ene	Design product that use renewable energy in use-phase (p)		$(\mathbf{X})$				
$\mathbf{Reg}$	Design with non-toxic and/or renewable materials (p) $% \left( \mathbf{p}\right) =\left( \mathbf{p}\right) \left( \mathbf{p}\right$	Х	Х	Х	Х	Х	
мо	Reduce material- and/or energy consumption $(p)$	Х	Х	Х	Х	Х	
	Reduce production waste (bm)	Х	Х		Х	Х	
arro	Localise supply where appropriate (bm)		Х		Х		
Z	Enable and incentivise consumers to use less (bm)	Х	$(\mathbf{X})$				
	Maximise capacity use of products (sharing) (e)						
	Design for durability (p)	Х	Х	Х	Х	Х	
MO	Design to ease maintenance and repair (p)		Х	Х		Х	
	Enable to maintain and repair products or provide as service (bm)	Х	Х	Х		Х	
$\mathbf{S}$	Provide products as a service (bm)						
	Remanufacture existing products and components (bm)	$(\mathbf{X})$		$(\mathbf{X})$		Х	
	Extended warranty (bm)			Х		Х	
	Design with recycled input (p)	Х	Х		Х	Х	
	Design for disassembly (p)		Х	$(\mathbf{X})$	Х	Х	
e	Conscious design for recyclability (p)	Х			Х		
Clos	Considerations to recyclability (p)			Х	Х		
•	Reuse or sell components/materials from discarded products (bm) $% \left( {{{\rm{bm}}} \right)^{2}} \right)$						
	Create incentive and enable product returns (bm)	$(\mathbf{X})$		$(\mathbf{X})$		Х	
	Take part of industrial symbiosis (e)	Х	Х		$(\mathbf{X})$	Х	
	Use materials and product-in-use data in circular design (bm)		Х			Х	
mrc	Design connected products (sensors) (p)		Х	Х		Х	
Infé	Market circular products, components and materials in online platforms (e)	Х		Х	х	Х	

The CE activities of the case companies differ in terms of the extent they have become integrated. The companies' more advanced CE activities on their products and business models are largely project-based and separated from the companies' management systems. Here, some develop into being a part of how the companies do business, while others remain as projects that are not integrated after the process. Sustainability Manager, Company A [2022] says that CE has become embedded into the culture and are somewhat integrated into their IMS, mainly in the quality processes. Project Manager on Environment and Climate, Company E [2022], state that they have come a long way with CE, but that their activities are generated in an ad-hoc approach and where not all are integrated into the company, hindering its long-term success and integration across the many subsidiaries globally. This tendency was also identified in *Company B and C*.

Table 6.9 provide an overview of the benefits and barriers for working with CE, identified by the case companies. Four of the companies are driven both by internal desire to become more sustainable, and externally, by demand from customers and market as a whole [Sustainability Manager, Company A, 2022; Senior Environmental Manager, Company B, 2022; Standardization manager, Company C, 2022; Project Manager on Environment and Climate, Company E, 2022]. These four companies all experience competitive advantages from working with CE, and several further highlight that it reduces their environmental impacts. The CE activities in *Company D* are mostly driven by demand from their largest customers (some of the biggest companies in the machinery and mechatronics industry).

Some of the barriers for working with CE relates to the complexity of working with CE, in terms of uncertainties of- and difficulties in measuring CE, low availability of recycled materials and difficulties with refurbishing and/or remanufacturing products. The latter relates both to a low transparency that hinders product returns, that it requires another mindset, and that some of the companies products are made by customer specifications. Some of these barriers thus relate to the challenges of working with the slowing strategy, which requires that companies change and rethink their current products and BM [Kristensen et al., 2021]. In relation to this, the barriers thus also reflect the difficulties of changing existing systems, practices and ways of doing business.

Benefits of CE	
Cost and resource savings	Company C and E
Reduce environmental impact	Company $A$ , $C$ and $E$
Access to new markets	$Company \ B \ and \ E$
Identification of new business opportunities	Company A and D
Competitive advantages	Company $A, B, C$ and $E$
Employee attraction	Company A
Increase customer cooperation	Company A
Barriers of CE	
Uncertainties of working with CE	Company B, C, D and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities	Company B, C, D and E Company B, C and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE	Company B, C, D and E Company B, C and E Company B, D and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products Difficult to change mindset on how to do business	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E Company B, C and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products Difficult to change mindset on how to do business Difficult to measure and document CE	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E Company B, C and E Company A, B, E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products Difficult to change mindset on how to do business Difficult to measure and document CE Resistance to change amongst employees	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E Company B, C and E Company A, B, E Company A, B and E
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products Difficult to change mindset on how to do business Difficult to measure and document CE Resistance to change amongst employees Lack of top management commitment	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E Company B, C and E Company A, B, E Company A, B and E Company B and D
Uncertainties of working with CE Difficulties of adapting existing system to new activities Lack of focus and clear strategy for CE Difficult to refurbish and remanufacture products Difficult to change mindset on how to do business Difficult to measure and document CE Resistance to change amongst employees Lack of top management commitment Low availability of recycled materials	Company B, C, D and E Company B, C and E Company B, D and E Company B, C, D and E Company B, C and E Company A, B, E Company A, B and E Company B and D Company C and D

Table 6.9. Overview of the benefits and barriers of working with CE in the case companies

# 6.8 Relating their current approach to the potential to integrate CE in EMS

This last section summarise the findings of this chapter and relate it to the potential for integrating CE in EMS. As introduced in section 5.3.2, it is assumed that each type of EMS correspond to a different maturity level in terms of business sustainability, however, when looking at the case companies general approach to sustainability and the scale of the CE strategies applied, it is reasonable to argue, that the companies approach to EMS have remained focused on the production processes, indicating that the companies approach are somewhat influenced by an EMS lock-in, as introduced in section 2.2. Kasper Hillgaard Mühlback [2022] Chief Consultant from Danish Standards finds it alarming, that the preliminary findings of this master thesis show, that the understanding of EMS still primarily reflect a mindset where EMS is seen as a tool used on the production processes in large companies, and that the companies work with CE activities on product and services at other business functions. Contrarily, Signe Malberg [2022] Senior Consultant in Danish Standards is not surprised due to her practical experience on how companies work with EMS, but acknowledge the need to rethink EMS in companies.

While it can be argued, that there is a need to do pilot studies and projects to enable experimentation and testing outcomes of various activities, the effectiveness of the CE activities performed like that, can be limited if they are not integrated into strategies, systems and daily operations to ensure that continuous improvements are obtained [Brezet and Rocha, 2001]. The companies could benefit from starting out by integrating the existing activities through their EMS, rather than solely focusing on keeping identifying new activities in a project-based approach. The benefits and barriers, identified for both EMS and CE, emphasise the potential for integrating CE in EMS in the case companies.

An obvious potential is, that the CE barrier of a Lack of top management commitment can be overcome by the EMS outcome EMS of Improved top management commitment. The barrier of CE identified as Difficulties of adapting existing system to new activities can be overcome by integrating CE in EMS based on two of the outcomes of EMS. The first outcome is Systematisation and structure, where Scarpellini et al. [2020], found that EMS provide formalised structures that can facilitate and develop conditions for integration of CE. The second outcome supporting the potential is *Better operational control and* quality of internal processes, as EMS, according to [Yang et al., 2019], can be used to anchor CE activities into companies operational framework. The duality of integrating CE in EMS, can further ensure that, the current barriers of working with EMS related to Difficult to obtain total integration across business functions, Lack of system continuity and Low awareness and understanding of EMS, can be overcome by revitalising the EMS by integrating CE and thereby rethinking its application and add new value to it [Kristensen et al., 2021]. Contrarily, the barrier of CE for Lack of focus and clear strategy for CE influence how and which of the CE strategies that are applied, and despite the literature stating the better alignment with business strategy is one of the benefits of ISO 14001:2015 [Fonseca et al., 2018], this is not dominant amongst the case companies. The next chapter will analyse the aspects that influence the case companies ability to support the potential for integrating CE in EMS.

# 7 The case companies' ability to support the potential for integrating CE in EMS

This chapter analyses the case companies' perception of the potential for integrating CE in their EMS, and identification of what influence their ability to support the potential, cf.sub-question 3. The analysis builds on the companies current approach to EMS and CE, as outlined in chapter 6, and the conceptual framework developed in section 5.3.3.

# 7.1 The companies' perception of the potential for integrating CE in their EMS

This section introduces the case companies perception of the potential for integrating CE in EMS, as a prerequisite of analysing the aspects that influences of the case companies' ability to support this potential. Several of the case companies acknowledge that integrating CE in EMS can be used to ensure that CE is integrated across the strategic, tactical and operational level of the organisations. Here, Senior Environmental Manager, Company B [2022] and EHS Manager, Company E [2022] both refer to the strategic and systematic potential of the HLS of ISO 14001, as a framework for integrating CE into the existing system and ensure a red thread from strategy, policy, targets, processes, KPI and evaluation. This understanding of the strategic implication correlate to the COEMS understanding in the *Application of EMS* criteria, in the conceptual framework Table 5.3. The importance of integration at the strategic level will be elaborated in section 7.4.

Most of the case companies acknowledge that their EMS will be important to fully anchoring their CE activities, but they also state that it is the IMS as a whole that presents the full potential to integrate CE across their organisation, based on how the system is integrated [Sustainability Manager, Company A, 2022; Senior Environmental Manager, Company B, 2022; Standardization manager, Company C, 2022; EHS Manager, Company E, 2022]. They all support the centrality of the HLS to ensure strategic alignment of efforts [Fonseca and Domingues, 2018; Kristensen et al., 2021]. Standardization manager, Company C [2022] elaborates, that in the future, *Company C's* CE activities will need to be anchored in the EMS and other relevant IMS processes to ensure that they succeed and that the CE activities do not remain side-projects with a limited lifetime. Several of the companies further highlighted the duality of the potential, as they believe that CE can be used to identify further improvement potentials in the EMS. This is reflected in the following:

"We are currently finding it difficult to identify improvements, and I think we could benefit from applying a circular mindset and understanding in the EMS" (Senior Environmental Manager, Company B [2022]) Contrarily, Manager in Group HSE, Company D [2022] argue, that ISO 14001 do not relate to how *Company D* are working with sustainability and CE, but that it is a good start to create a system and frame: "... *ISO 14001 is a good start, but it is more about processes and control over operations. On top of this, we have sustainability and CE... It is not ISO 14001 that help us think outside the box."*. This reflects the role of EMS merely as an underlying system and Manager in Group HSE, Company D [2022] elaborates, that she understands the potential for integrating CE in EMS, but that it is not how the company use EMS. Director of Quality and EHS, Company C [2022] also stated that the potential did not fit with how *Company C* uses ISO 14001, as it is a 'backbone system' used locally. However, changes are happening according to Standardization manager, Company C [2022], as the company will be expanding their scope of EMS into product development in the near future, illustrating that *Company C* do see the potential of expanding EMS towards POEMS.

Both Project Manager on Environment and Climate, Company E [2022] and Standardization manager, Company C [2022], emphasised, that working with CE in ISO 14001 can help create a framework for working with CE, which is beneficial in these very large companies as they consist of many cultures and values represented across the different subsidiaries.

Company A and Company E have expanded their EMS towards POEMS, and Company C, will be looking into expanding their focus in the near future, as outlined in section 6.6. They all see a potential for using ISO 14001 to include circularity considerations and targets for working with CE. Standardization manager, Company C [2022] explain that one of the reasons they are going to look into this is to utilise the existing QEHS processes and structure to manage the CE activities. The two companies, who have already expanded their EMS, state that they use ISO 14001 to add circularity considerations in the product design principles and to increase the systematics and structure in their product development in general, and that they strive for circularity to become a criterion of equal importance to quality and price. These considerations correlate with the Organisational outcome of POEMS in the conceptual framework, see Table 5.3, but the focus is on recyclability of products and materials, with little implications for the BM, which can relate to the recency of this expanded focus. Both companies express that the application of ISO 14001 to work with CE is something they will look more into. Sustainability Manager, Company A [2022] explain, that they strive to use ISO 14001 in a new way to set targets, document and make improvements on CE, where the forthcoming potential of EMS is to determine CE action areas across levels of the organisation, considering both their own actions and their stakeholders. The forthcoming role of ISO 14001 to integrate CE was also emphasised by EHS Manager, Company E [2022], who state "... it is really interesting to start and explore how we can take the next step and use it (ISO 14001) more in the development phase and other parts of our business too".

It is evident that most of the case companies acknowledge that there is a potential to integrate CE in EMS, and some have started to explore this potential by integrating ISO 14001 in their product development processes. The case companies all emphasised that their ability to support the potential is influenced by several challenges, that therefore mainly hinders the companies abilities. The challenges are interrelated and influence different aspects. The challenges identified in the case companies are listed in the bullets below, and will be elaborated in the following sections.

- Silo-thinking and -application of EMS and CE
- Organisational structures and practices
- Operational anchoring of the EMS
- Lack of top management commitment and support
- Lack of clear CE strategy
- Complexity of working with CE

## 7.2 Silo-thinking and -application of EMS and CE

As outlined in section 6.6, the companies are all working with EMS in a segmented application where it is mainly centred at the technical (Q)EHS departments. Both, Senior Environmental Manager, Company B [2022] and Manager in Group HSE, Company D [2022] explained, that ISO 14001 was solely used for production optimisation and is not related to their overall strategy or strategic initiatives. Some cross-functional coordination is occurring in the two companies that have expanded their focus towards POEMS, but still with little integration to other business functions [Sustainability Manager, Company A, 2022; EHS Manager, Company E, 2022]. The case companies are working with different CE activities at various intensities, mainly centered around projects and pilot studies, as presented in section 6.7. Most of their more advanced activities on the product and business model are located in other departments and business functions than their EMS, with varying degrees of formalisation and anchoring. It can thus be seen, that the case companies' current approach to EMS and CE is influenced by silo-thinking.

EHS Manager, Company E [2022] and Senior Environmental Manager, Company B [2022] acknowledge that their current application and silo-thinking hinders integration between CE and EMS. The companies experience, that the project managers working with CE activities are not familiar with the EMS, and the technical experts managing the EMSs are not actively considering CE in their processes, but focus on business as usual within the frames of the existing system. As introduced in section 2.3, this support, that new 'soft' organisational capabilities are needed to support the companies' ability to realise the potential of integrating CE in EMS. The companies further experience, that the current application of EMS is influenced by a spring-cleaning mentality across some of their subdivisions, which further reflect a low understanding and awareness of the EMS. Here, both Schvlander and Martinuzzi [2007] and Chiarini [2019] conclude that one of the factors that influence the success of ISO 14001 are employee involvement and having a proactive environmental culture, which seem to be missing in the companies where the EMS lacks continuity. This is an issue, not only because it hinders the actual implementation of CE into EMS, but also because the existing structures, processes and systems of EMS are not utilised, causing companies to use unnecessary resources to operate on the CE activities [Signe Malberg, 2022]. Overcoming this silo-thinking requires that the EMS is integrated at a strategic level and across the other business functions of the companies, to create better conditions for integrating CE, this is elaborated in section 7.4.

## 7.3 Organisational structures and practices

Changing the current structure and practices for how the case companies are working with both EMS and CE, to overcome silo-thinking, is important for their ability to support the potential for integrating CE in EMS. This is supported by Signe Malberg [2022] who explains, that changes are needed as the application of traditional EMS limits improvements to the existing system where companies are likely to miss out on improvement potential in other parts of their business. The organisational structures and practices poses a challenge for the companies in two ways, both due to their organisational complexity and because of different understandings and resistance to change.

#### 7.3.1 Organisational complexity

As introduced in section 4.2, the case companies are all MNCs with complex organisational structures and a hierarchical model with predominantly top-down relations between local subsidiaries and the headquarters [Dickens, 2015]. This organisational complexity influence the case companies ability to change both their CE practices but also existing EMS counters and processes. This relates to the highly bureaucratic processes within the companies with many levels of decision-making, which results in a slow adaption to new CE activities. Here, both Project Manager on Environment and Climate, Company E [2022] and Senior Environmental Manager, Company B [2022] highlight the complexity of the existing formalised structures and the difficulty of changing these to integrate considerations to CE, also identified as one of the CE barriers in Table 6.9. Both companies further emphasise the extensive amount of time and resources needed to adapt existing EMS processes and documents to changes, and that they experience that this hinders employees and managers willingness to make changes. This corresponds with the literature review on ISO 14001 implementation and certification, where Lack of resources was one of the frequently stated barriers in section 2.1.2. Here, Senior Environmental Manager, Company B [2022] further emphasised that their EMS have a complex and illogical system set-up, which in Table 6.7 is identified as a new barrier. He elaborates that this hinders the current use of the EMS, and that it relates to the internal focus of the company, where the Q and HS systems are prioritised, due to demand from customers.

#### 7.3.2 Different understandings and resistance to change

The difficulties of changing the organisational structures and practices is also a matter of differences in understandings, where the technical experts that work with the existing EMS processes and system, need to understand why these changes are needed and this can be a challenge, especially employees of older generations Project Manager on Environment and Climate, Company E [2022] and Standardization manager, Company C [2022]. This can be seen as a resistance to change amongst the employees, both related to how the companies work with CE and EMS. This relates to the literature review, as *Employee resistance to change* and *Difficulties changing the company culture*, were amongst the internal barriers. Resistance to change in terms of CE activities is experienced in *Company*  A, but Sustainability Manager, Company A [2022] explains that a change is happening amongst the employees and that they are becoming more engaged with working with CE in general, but that it have been a process to get to this point and that communication, dialogue and education have been important. Barón Dorado et al. [2022] examined the potential for integrating CE in EMS, and concluded, that the managers play an important role in leading, engaging and communicating on strategic potential of ISO 14001 as a tool for working with CE, both internally and to external stakeholders, to positively influence a company's ability to support the potential.

Standardization manager, Company C [2022] and Senior Environmental Manager, Company B [2022] argues that the difficulties of changing practices also relates to the fact that their companies are somewhat 'old school', where the core logic and ways of doing business is centred around a traditional understanding of value amongst the top management. This is reflected in the following:

"We are an old school company, so changing the understanding of the potential of EMS and its use to work with CE requires a different logic and restructuring of our current system..."

#### (Senior Environmental Manager, Company B [2022])

Senior Environmental Manager, Company B [2022] further explains that the dominant logic of the company has been strengthened by being in an energy-intensive industry where the uptake on sustainability has been slow. He further elaborates, that the biggest current challenge of *Company B* is to get the top management onboard, the role of the top management in terms of supporting the potential for integrating CE in EMS is further elaborated in section 7.4. The role of the industry were also highlighted by Sustainability Manager, Company A [2022], who argued that the furniture industry have changed during the last decade towards a strong focus on sustainability, and where CE is one of the main competitive parameters, positively influencing the company to increase focus on CE.

# 7.4 Operational anchoring of the EMS

This challenge relates to the segmented application and silo-thinking for how companies currently work with EMS, as introduced in section 7.2, where the lack of integration at the strategic level and across other business areas, hinders the ability to integrate CE. Most of the case companies explained, that their EMS was used to ensure systematics, compliance and control of processes, anchored at the operational levels and without being integrated at the strategic level of the organisation, as introduced in section 6.6.

Both Company B and Company E acknowledge the potential for EMS to anchor CE from strategic to operational level, see section 7.1, and both employees expressed the need for their current EMS to be more linked to the strategic level. Signe Malberg [2022] emphasise, that in many companies, EMS have been silo-implemented and solely anchored at an operational level in technical-oriented environmental departments where their focus and competences fosters an 'EMS language' that is difficult to understand in other business functions and at top management level. Signe Malberg [2022] elaborates:
"... in some companies, EMS ends up being a technical-system rather than a management system, and that is a challenge if it is to be used as a strategic framework for working with CE"

(Signe Malberg [2022])

It is a challenge for integrating CE in EMS, that EMSs often are anchored at lower levels of organisations, opposed to companies quality- and economic management systems [Signe Malberg, 2022], which also relates to its low application across different business areas.

#### 7.4.1 Low application across different business areas

Both Standardization manager, Company C [2022] and EHS Manager, Company E [2022] stress the difficulty of obtaining total integration across their many business areas and divisions. Director of Quality and EHS, Company C [2022] state, that the company struggle to identify a possible set-up for how to integrate activities across sites with different local systems, as they are difficult to coordinate between, despite having the same overall frame. This challenge is closely related to the companies organisational complexities, as introduced in section 7.3. The importance of ensuring that the EMS are more connected across different business areas is further highlighted in the following:

"We need to ensure that our operations in EMS are more connected across different business functions, because working with CE activities requires a broad range of internal departments and external stakeholders as well"

(EHS Manager, Company E [2022])

The current low coordination between EMS and CE in the case companies thus makes it difficult to integrate into one whole, as it requires a new way of thinking in a more holistic manner. Signe Malberg [2022] explains, that companies need to work with EMS at higher and more strategic level, so those in charge of the system have better overview of the organisation, existing competences and potentials in terms of integrating CE.

#### 7.5 Lack of top management commitment and support

This challenge is closely related to both the challenges of operational anchoring of EMS and lack of clear CE strategy. Ensuring the top management support and commitment is important both to integrate EMS at a strategic level and to focus support focus on advanced CE activities. Sustainability Manager, Company A [2022] explains that their top management are actively involved and committed to how the company is working with CE, which she believes is vital to keep progressing on the CE efforts. Both Manager in Group HSE, Company D [2022], Senior Environmental Manager, Company B [2022], and EHS Manager, Company E [2022] explained that a prerequisite for supporting the potential for integrating CE in EMS, is that the top management becomes more committed and allocate more resources and time to work with CE. In *Company E*, where circularity has been made a strategic focus area, the role of the top management is emphasised in the following way:

"(...) it is important that the top management is committed, otherwise there is a tendency that it become difficult to integrate into the daily operations. We need explicit targets for CE as well as allocation of resources"

#### (EHS Manager, Company E [2022])

Senior Environmental Manager, Company B [2022] further highlight, that their top management need to change their understanding of the role of EMS, to be able to increase strategic orientation. This support the findings of Fonseca and Domingues [2018] who concluded, that one of the difficulties of the 2015-revision relates to ensuring top management involvements, and that this at the same time is important for enabling the strategic potentials of ISO 14001.

#### 7.6 Lack of clear CE strategy

Another aspect that influences the case companies ability to support the potential of integrating CE in EMS is the importance of having a clear CE strategy, and where the case companies that do not have one, experience that this hinders their ability to integrate CE in EMS. The importance of having a CE strategy was expressed by all case companies. Both Company A, C and E, have made CE a strategic focus area and can therefore be said to having framed their CE actions. However, this is done to a varying degree. Sustainability Manager, Company A [2022] state that the company is working with CE at a strategic level, but where they are still to define clear targets for their ambitions. In Company E, EHS Manager, Company E [2022] explain, that even though the company have increased focus on CE at a strategic level, clarity is needed. She elaborates, that one of the first things that Company E will need to do, is to define a clear strategy for CE, to enable long-term anchoring of CE activities in their EMS and obtain the full potential of EMS in terms of continuous improvements. In relation to this, Project Manager on Environment and Climate, Company E [2022] further state, that "Despite the interest for CE on the strategical level, we are still miles away of having a functional system on the lower levels in daily operations where tasks, targets and focus is on something else". This show that while having a clear CE strategy is important, then the anchoring of the strategy across the organisation, is also important to enable actual changes towards CE. The need for a clear CE strategy with a long-term perspective was supported by [Senior Environmental Manager, Company B, 2022; Manager in Group HSE, Company D, 2022]. Here, Senior Environmental Manager, Company B [2022] further acknowledge that scrutiny is needed on their EMS frames and processes, as these currently do not enable a red thread from the strategic to the operational levels of the company, which is needed to manage the complexity of CE and enable new ways of thinking.

#### 7.7 Complexity of working with CE

Another challenge that influence the companies' ability to support the potential for integrating CE in EMS, is the complexity of CE and the changed mindset that it requires.

#### 7.7.1 Challenge to rethink how to do business

When looking at how the case companies are currently working with CE, summarised in section 6.7, it is evident that all companies are focusing not only on production processes, but also product and business model innovation. The companies' CE outcomes can, based on the conceptualisation in section 5.3.3, be said to expand between all three types of EMS and different types of CBMI, but where the main focus is to improve or add their existing business models, without changing their core business. Several of the companies state that it is a challenge to rethink how companies organise and do business to advance on their CE activities [Standardization manager, Company C, 2022; Project Manager on Environment and Climate, Company E, 2022; Senior Environmental Manager, Company B, 2022]. The complexity of CE challenges the existing dominant business logic, focusing on short-term gains and economic feasibility. This is especially the case for remanufacture and refurbish, and the long-term perspective it fosters [Senior Environmental Manager, Company B, 2022; Project Manager on Environment and Climate, Company E, 2022]. Here Senior Environmental Manager, Company B [2022] explain that it is not widely accepted amongst the top management, that it require resources to increase circularity, and that it is difficult for them to accept that it is not always possible to measure the outcome on the bottom line on the short-term. This reflects a focus on cost reduction rather than value creation, which hinders the realisation of the potential of COEMS. This was supported by Project Manager on Environment and Climate, Company E [2022] that states:

"Adding more focus in design principles on design for remanufacture and disassembly requires, that we change how we do business. Designing products with CE principles makes them more expensive in a short-termed perspective, and changing the underlying rationale is difficult."

(Project Manager on Environment and Climate, Company E [2022])

Several of the case companies acknowledge the need for them to increase their focus on communication and training, to ensure sufficient competences amongst employees and top management [Senior Environmental Manager, Company B, 2022; Manager in Group HSE, Company D, 2022; Standardization manager, Company C, 2022]. Here Project Manager on Environment and Climate, Company E [2022] further emphasised that for the company to further advance on their CE activities, they will need new technological and organisational capabilities, which will require a stronger focus from the top management.

#### 7.7.2 CE activities are difficult to put into system

EHS Manager, Company E [2022] explains, that it is a challenge for them to put CE activities into a system and combine these with EMS structures, but she acknowledge the potential of ISO 14001 as a steering tool for CE where it is used to state the intended outcomes, evaluation and ensure continuous improvements of the CE efforts. She elaborates on the complexity of changing current practices and combining these in new ways:

"It is a challenge to rethink and combine the strategic level with CE innovation and our EMS across the company... it is important to have a clear long-term strategy for CE which needs to be combined with pilot-studies and projects in collaboration with stakeholders, and then we need our EMS to create a frame and drive us forward"

#### (EHS Manager, Company E [2022])

The quote above further emphasises the role of innovation and doing projects and pilotstudies in collaborations, when working with CE. As introduced in section 2.4, [Barón Dorado et al., 2022] conclude, that the application of EMS influence the extent to which it can be used to contribute to CE, as the Traditional EMS tend to focus on lifecycle phases where the company have control. This pose a potential challenge for integrating CE in EMS in the case companies, as the more advanced CE activities requires a broader perspective. However, the authors further conclude that the managers play a vital role in overcoming the potential weakness by showing leadership and initiating new and explorative ways of operating and engaging with new stakeholders. As introduced in chapter 6, all case companies are undergoing projects or pilot studies with different stakeholders, either in the immediate product chain or beyond in new collaborations. This emphasises that the companies are working with or testing the more advanced CE activities, for the closing and slowing strategies, and when comparing to the Type of stakeholder interactions in the conceptual framework, it becomes evident that the companies have initiated CE activities that can support POEMS. However, their ability to support this potential is further influenced by the large uncertainty of working with CE.

EHS Manager, Company E [2022] explains, that the low preliminary knowledge, long time horizon and broad and complex product portfolio to consider makes the product development "a difficult process to put into a systematic approach from beginning to end". Be that as it may, Company E has recently developed their own toolbox for evaluation and identification of focus in the product development processes, in which ISO 14001 is applied and where LCAs play a huge role in terms of identifying where to focus their efforts. The process is divided into three parts from definition of focus area, to setting requirements and developing products, to improving and measuring on the performance of the product. EHS Manager, Company E [2022] who has been involved in the making of this toolbox argues that it has helped create a structure and understanding of what to focus on, but she emphasises that there is room for further improvements of the system to make it applicable across a complex and broad product portfolio. Creating such a system requires extensive knowledge and competence to ensure consideration of both materials, design, production

methods, packaging, energy use in use and end of life etc. [EHS Manager, Company E, 2022; Standardization manager, Company C, 2022].

Company E and Company A have expanded their EMS towards POEMS and are using ISO 14001 in their product development process and to set requirements for their suppliers. This correlates with the experiences of [Kasper Hillgaard Mühlback, 2022], as he describes, that a shift is happening in the larger companies as these are becoming more structured in their product development with more focus on improving the environmental performance of the product than previously. Both of the case companies use ISO 14001 to create systematics and structure in their product development, as a mean to manage the complexity of working with CE activities on products. However, both companies further explain that the integration into product development has been a challenge due to its lack of a focus on the product, compared to the requirements of ISO 9001. This is expressed by Sustainability Manager, Company A [2022] as she states: "ISO 14001 does not have requirements for considerations to the product like ISO 9001". This relates to the potential of having an IMS following the HLS, enabling the different standards requirements to supplement each other, as introduced in section 2.2.

#### 7.8 Summary of challenges and their implications

The case companies' perception on the potential for integrating CE in their EMS, emphasise that most of the companies acknowledge that there is a potential. However, based on the interviews with the employees, it became evident, that the companies' ability to support this potential is influenced by several interrelated challenges, which illustrate that it is complex to combine and rethink application of EMS and CE in companies.

The challenge of **Silo-thinking and -application of EMS and CE** can be seen to directly influence several of the other challenges and stems from the case companies current application of EMS and CE. The challenge of **Operational anchoring of the EMS** illustrate, that the current implementation of EMS at the operational level hinders its potential role to integrate CE at the strategic level. Additionally, companies are not obtaining the mutual benefits of applying existing systems, processes and competences of EMS to work with CE, nor the revitalised value of EMS [Kristensen et al., 2021]. This hinders the case companies ability to support the potential of COEMS, as a strategic application is a prerequisite, as indicated in the conceptual framework in Table 5.3. The case companies ability to use EMS to work with CE at the strategic level, is further influenced by that challenge of a **Lack of clear CE strategy**, which is considered a prerequisite to be able to frame specific action and ensure long-term anchoring of CE, and was also identified as one of the barriers of CE in the case companies in Table 6.9.

Another aspect that hinders the ability to support the potential of POEMS and COEMS is, that the companies current approach to EMS and CE are rooted in a certain **Organisational structures and practises**. This challenge relates to the complexity and inertia of the organisational structures which makes it difficult to make changes of the existing systems, and is further influenced by different understandings amongst both employees and top management, as well as a resistance to change. Here, Fonseca and Domingues [2018] concluded that EMS certification and maturity (years of certification) positively impact the level of CE adoption and the companies ability to define strategic goals and policies. However, based on the findings of this study, the case companies seem to have highly formalised and bureaucratic processes in their EMS, see section 7.3, which hinders their ability to change the EMS to enable CE adoption in a manner that support the potential of POEMS and COEMS. This complexity is however not attributed solely to their many years of having ISO 14001, but also to their characteristics of MNCs. It is also interesting to compare this challenge, to the outlined potential, based on experienced benefits and barriers of EMS and CE in the case companies in section 6.8. Here, the experienced CE barrier of *Difficulties of adapting the existing system to new activities* was outlined as one that could potentially be overcome by two of the EMS outcomes related to *Systematisation and structure* and *Better operational control and quality of internal processes.* However, the extent of these outcomes are influenced by the organisational complexity, and are thus currently limited at an operational level.

The challenge of **Lack of top management commitment and support** reflects a need for the top management to become more committed to working with CE and where they need to change their understanding of the role of EMS, to enable a strategic application to support the potential of COEMS. It is interesting to compare this to the expected potential identified based on the case companies' benefits and barriers of EMS and CE in section 6.8. Here it becomes evident, that for EMS to be used to overcome the barrier of *A lack of top management commitment*, then the case companies need to change their understanding of the role of EMS, from segmented use towards strategic application to support the potential of COEMS, cf. the conceptual framework in Table 5.3.

Lastly, the challenge **Complexity of working with CE** is found to further influence the companies ability to integrate CE into EMS, both due to the changes needed in mindset and dominant business logic to support the integration of CE in EMS, and where the companies struggle to work with the complexity of CE in a systematic and structured approach, hindering their ability to integrate CE in EMS. This challenge is closely related to the need for new capabilities in the companies for working with CE, both technical, financial and organisational capabilities [Brown et al., 2019], where the companies further highlight that this requires top management commitment to allocate resources and make it a priority.

Returning to the starting point of this chapter, most of the case companies acknowledged that there was a potential to integrate CE in EMS, but that their ability for supporting this potential is influenced by different challenges. Company A and E have started to expand their EMS towards POEMS, but still experienced similar challenges as the rest of the companies. Company C will expand their EMS into their product development process in the near future, and Company B acknowledge that it is something that they would benefit by doing, but without being able to do so based on their current approach to EMS and CE. Company D did not see the potential for integrating CE in EMS, which is mainly attributed to their EMS understanding. So despite the identified challenges, the companies are interested in exploring the potential. The next chapter will outline some recommendations for the case companies, to help them identify how they can support the potential for integrating CE in EMS.

### 8 Recommendations

This chapter introduces recommendations that can help the case companies support the potential for integrating CE in EMS, based on their current approach to EMS and CE, identified in chapter 6, and the challenges that influence the companies' ability to support the potential, outlined in chapter 7. The challenges identified, are all interrelated, which makes it difficult to separate the recommendations presented in this chapter, but these have been listed in a somewhat prioritised order.

#### 1. Break down silo-thinking and application through IMS

All case companies have an IMS with ISO 14001, ISO 45001 and ISO 9001. Most of these companies' perception of the potential to integrate CE in EMS, highlighted, that the full potential for integrating CE across their organisation is found in their IMS due to their system set-up and its coverage, see section 7.1. This recommendation is, therefore, that the case companies utilise the potentials of IMS to provide an overview, common understanding and better coordination across an organisation [M. Mosgaard and Remmen, 2015; ISO, 2021a]. This can further ensure that the different departments or subdivisions do not 'fight' over the available resources [Signe Malberg, 2022]. The centrality of the HLS across the different management standards can further help ensure that CE is integrated in relevant processes across business functions. Lastly, this recommendation aim to ensure that the case companies to restructure, -define and rethink their IMS structure and practices, make it more flexible and open to changes, as it is an iterative process to work with integration of CE in the IMS.

#### 2. Create CE strategy and objectives

This recommendation aim to overcome the challenge of lack of clear CE strategy, and is acknowledged as a precondition for being able to outline specific actions and long-term anchoring of CE activities at the strategic level, and thus the efforts performed in the EMS. This recommendation depends on the companies current approach to EMS and CE, cf. the conceptual framework in Table 5.3. If companies are currently working with Traditional EMS and without an overall CE strategy, then the company will need to start out by defining an overall strategy supported by 1-3 qualitative objectives for engaging in collaborations with external stakeholders, where these stakeholders can depend on the companies' ambition level, but should as a minimum be those presented in POEMS in the conceptual framework. For companies to support the potential of COEMS, the company will further need to ensure that their CE strategy is reflected in the environmental policy of the EMS and that the environmental objectives include qualitative and if possible quantitative targets for the more advanced CE strategies, which should include the intention to integrate the slowing strategy.

#### 3. Ensure top management commitment and support

This recommendation is closely related to the two previous ones, and emphasise the role of ensuring that the top management understand the potential for integrating CE in EMS, and ensure commitment and support to a specific CE strategy. This recommendation is supported by Kasper Hillgaard Mühlback [2022], as he stated, that companies need to expand their understanding of what EMS can do for the business and competitiveness, anchored at the top management, and that: "...as long as it is not a part of the strategic level, and as long as the top management are unaware of the strategic potentials, the EMS application will remain unchanged". The recommendation further highlights the importance of the HLS clause 5) Leadership, and that the top management practices must reflect a strategic application of EMS where it is used to manage the core business strategy and integrated in strategic decision-making processes, to align CE activities at the strategic level [Barón Dorado et al., 2022; ISO, 2015].

#### 4. Involve employees and external stakeholders

Employees play a vital role in changing CE practices and application of EMS [Chiarini, 2019], and the relevant employees to involve depend on whether the focus is on POEMS or COEMS, where the latter includes a broader range of employees [Kristensen et al., 2021]. To overcome the silo-thinking introduced in section 7.2, and change understanding of the role of EMS internally, companies need to involve the employees in the process of integrating CE in EMS. Here, emphasis is put on the need for interdepartmental brainstorm and collaborations, to create a space for developing new CE activities and identifying new ways of working within the IMS across the different departments or functions systems [Adams et al., 2016]. Involving the employees from various departments and subsidiaries, can help guide the HLS clause 7) support in terms of determining the resources, competences, and education needed to ensure that the employees have the capabilities needed to work with the CE activities [Brown et al., 2019; Kristensen et al., 2021].

The other part of this recommendation relates to collaborations and partnerships with external stakeholders, as CE is not something that the companies can achieve on their own [Khan et al., 2020]. The case companies collaborations will depend on their CE strategy, and the extent to which they aim to support the potential of integrating CE in EMS, cf. the conceptual framework in Table 5.3. For POEMS, the company will need to engage with their stakeholders in their immediate product chain. For COEMS this further entails going beyond the product chain, where the scope of external stakeholders expands when working with the closing and slowing strategy [N. M. P. Bocken et al., 2016].

#### 5. Experiment, learn, and adapt in ongoing process

This last recommendation emphasise the iterative nature of efforts to support the potential for integrating CE in EMS, which further relate to the fact that the potential stretches between a broad range of possible activities for both POEMS and COEMS. This recommendation is related to HLS clause *9) Performance evaluation* and *10) improvement* and the importance of continual evaluation and identification of continuous improvements. Here, Brezet and Rocha [2001] stated, that POEMS can be a stepping-stone for other CE activities, and the conceptualisation of the three types of EMS for integrating CE can be used to identify improvements, regardless of a company's starting point. This recommendation emphasise, that ISO 14001 is not a goal but rather a collective learning process constituted by different challenges, benefits and the sharing of knowledge [Boiral, 2011]. Explicit focus is furthermore put on the importance of experimentation's as a capability to support CE, where companies can learn, improve, and explore different possibilities for innovation activities [N. Bocken et al., 2018; Guldmann and Huulgaard, 2019].

## 9 Discussion

#### 9.1 Methodology

The aim of this master thesis has been to identify how large Danish manufacturing companies can support the expected potential of integrating CE in EMS. To investigate this, a multiple-embedded case study on five companies have been applied using a strategic case selection. The focus on large (multinational corporations, MNCs) have had implications for the result of the study. MNCs are expected to have more resources and competences to work with strategic and advanced environmental efforts [Mac, 1999], which is partly supported as the case companies are working strategically with CE. However, the lack of resources (time, competences and financial) have been identified as one of the barriers for integrating CE in EMS, but this is closely connected to a lack of focus and commitment from the top management as well. This selection criteria can further be said to influence the generalisation of the study. The case companies current EMS practices (scope and environmental objectives) correlate with the findings of several large studies on companies in Denmark [M. A. Mosgaard et al., 2022; M. Mosgaard et al., 2015], supporting that the case companies approach to EMS is representative, allowing for parallels to be drawn from the findings into other companies. However, the challenges that influence the case companies' ability to support the potential for integrating CE in EMS, are in many ways related to their organisational complexity (many business areas and division globally), formalised structures and many levels of decision-making. This makes it difficult to compare with the context of Small- and Medium Sized Enterprises (SMEs). In relation to the potential for integrating CE in EMS, SMEs are characterised as more agile and flexible in terms of changing their operations [Mac, 1999], which could indicate that they would experience less organisational challenges. However, SMEs can be struggling with the costs of working with ISO 14001, and make up the majority of those that discontinue their certification [M. A. Mosgaard and Kristensen, 2020].

Another case selection criteria that have influenced the results of this study is the focus on companies that are expected to work strategically with CE on the technical circles. The identification of this information has been based on existing knowledge, professional networks and the companies' reputation. It is argued that the case companies are all working strategically with CE, but with large variations in intensities and maturity levels. This has both ensured unfolding various perspectives and challenges, but have also posed a challenge for exploring what influence the companies' ability to support the potential of COEMS. Another possible approach here could have been to use and/or include best practices cases from Confederation of Danish Industry, to unfold if the challenges are the same or whether these expand from being largely company-centric to being systemic where issues of collaboration, reverse supply-chain operations and rethinking the BM might have been more influential, according to the conceptualisation in Table 5.3.3. However, it is uncertain whether these companies would fit the other criteria as well.

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Interviews and document analysis have been used to identify the case companies current approach to EMS and CE, as well as the challenges that influence the companies' ability to support the potential. These methods are considered valid methods in a qualitative research design [Creswell, 2014]. The document analysis provided insights on the companies profile, strategy and overall indication of how they are working with EMS and CE. However, the publicly available documents can be seen as deliberate strategies, that might not correlate to the actual practices or related challenges in the companies [Huulgaard, 2015]. The document analysis has therefore been supported by interviews with employees from the companies, in some cases two employees. It is interesting to consider whether it would have been beneficial to have altered case selection strategy to include companies with EMAS, due to the requirements for more communication through the public environmental statement that might have provided more information. However, EMAS requires more openness from the companies and do not have the same outreach or international validity [Jørgensen and Remmen, 2007; Heras-Saizarbitoria et al., 2016]. An update from the Environmental Protection Agency, in March 2022, shows that the amount of companies with EMAS in Denmark has decreased from 14 to 11 companies [Miljøstyrelsen, 2022]. In comparison, 939 companies had a valid ISO 14001 certificate in Denmark in December 2020 [ISO, 2021b], thus making it the only relevant standard to consider when focusing on integration of CE strategies into the existing practices of companies.

#### 9.2 The conceptual framework and COEMS

As a prerequisite for understanding how the case companies can support the potential for integrating CE in EMS, it has been argued that clarification is needed on what characterises different ways of working with EMS and its relation to the five CE strategies, cf. subquestion 1. A main contribution in the framework is conceptual COEMS. The strength of defining circular-oriented EMS and outline main characteristics, is that it creates clarity and frames necessary actions for companies. Be that as it may, a potential weakness can be found by relating it to POEMS, which, in a similar way, aimed to change the existing EMS practices. As introduced in section 2.2, the practical application of POEMS have been scarce, which might raise the question of why it should be different with COEMS? There are several timing issues of relevance here. First and foremost, ISO 14001 has been revised with a strengthened strategic-orientation guided by the HLS [M. A. Mosgaard and Kristensen, 2020], and secondly, it can be argued that companies' maturity level have expanded making these better equipped for working with advanced environmental efforts focused on the product and business model. This, along with the increased focus on circular economy in companies over the past decade [Ellen MacArthur Foundation, 2013], thus argues for the relevance and strength of COEMS. However, when comparing the conceptualisation of the three types of EMS for integrating CE, there is a large distance from the traditional EMS, like how the majority of companies work with EMS currently, and the ideal COEMS. On one side, it can be argued that the conceptualisation should encompass a broader range of types of EMS, to help companies understand how to progress, broken down in smaller steps. On the other side, the strength of the existing conceptualisation is the simplicity and clear distinctions made, inspired by the 3-stage framework for business sustainability.

The way COEMS are defined in this master thesis has an academic orientation, which might make it difficult to apply in practice, indicating that a 'light' version might have more use for companies. Such a version should be more concise, and stress the need for a strategic application of EMS to manage and consider CE as part of the core business, due to its potential for providing companies with a strategic position to align operations with CE [Barón Dorado et al., 2022]. It can be argued, that the importance of strategic application of EMS is not new to companies, as it is part of the focus in ISO 14001, where 5.1 Leadership and commitment highlight, that top management commitment need to ensure EMS is used to manage core business strategy and that EMS is more effective if it is intrinsic to the strategic direction [ISO, 2015]. However, as the case study have shown, companies' current application of EMS is situated at lower, and more operational levels with little integration into other business areas, see section 7.2. Another central aspect to highlight is the need to optimise not only products but also business models, by collaborations in product chain and beyond [Kristensen et al., 2021; Adams et al., 2016]. Lastly, it should also point out, that the CE activities should cover extend or intensify use of products, components and resources, supporting the importance of the slowing strategy [N. M. P. Bocken et al., 2016].

#### 9.3 The role of EMS for working with CE

The premise of this master thesis has been the strategic potentials of ISO 14001, as a means to integrate CE through EMS. Based on the findings in the analysis, it is interesting to discuss the role of EMS according to ISO 14001 to work with CE. Here, Charlotte Vincentz Fischer [2022] explains, that, on a product and business model level, there are other standards more relevant in terms of requirements and guidance for the companies in terms of CE, but that ISO 14001 can be used to set the strategic frame. The findings of this study, show, that all of the case companies have an IMS with ISO 9001, ISO 14001 and ISO 45001, which influence the companies' understanding and perception of the potential for EMS to integrate CE, as several of the companies state that it is the IMS that represents the full potential, cf. section 7.1. This was supported by Signe Malberg [2022], that while acknowledging the potential for using EMS, further explain that it could just as well be ISO 9001 or the IMS as a whole, because it is rooted in the same structures for ensuring continuous improvements. The potential therefore seem to point to the application of the HLS, where the IMS can ensure that CE activities are anchored and coordinated across relevant business functions and providing an overview of the processes, to overcome the silo-thinking and application. This is also supported by [Fonseca and Domingues, 2018].

Whether the focus is on EMS or IMS, it is interesting to reflect on whether they can or should be used to manage how companies work with CE. The five CE strategies for managing resource loops makes sense for companies, as the focus is on the technical cycles of CE. However, when taking a broader stance on CE, the importance of the re-principles of refuse and rethink becomes apparent as well [Potting et al., 2017]. It is possible to discuss whether it is possible for companies to use their EMS to work with these re-principles, it might be possible in product design strategies, but in terms of business models and the core of how the company does business, it might be, that the decisions belongs at higher strategic levels, than that of EMS. This also relate to the concept of *sufficiency-based circular economy* [N. M. P. Bocken et al., 2022], where the focus is shifted towards avoidance prioritised before managing strategies, where we no longer focus on slow and closing as the optimal strategies, but make do with less, where a larger redesign of the business logic is needed.

Returning to the five CE strategies used to conceptualise CE in this study, it is also interesting to discuss whether the EMS can in fact be used to manage and ensure strategic alignment of these, and how EMS relate to these. The case are all working with various CE strategies, including slowing strategies, with varying intensities. One of the challenges influencing the companies' ability to support the potential for integrating CE in their EMS was that the complexity of working with CE makes CE activities difficult to put into system and thus integrate into the EMS [EHS Manager, Company E, 2022; Sustainability Manager, Company A, 2022. This does to some degree, relate to the need for a different understanding than the one that currently dominate the companies. But as emphasised in the paragraph before, it can also be related to the fact that maybe not all CE strategies makes sense to work with in EMS. In terms of how the EMS relate to the CE strategies, it can be argued that EMS might be seen as a supportive inform strategy [Konietzko et al., 2020]. This is related to the fact that the inform strategy is still widely defined and unspecific for many companies to work with. [Könnölä and Unruh, 2007] further concluded, that EMSs must be used carefully as it can hinder companies' engagement in explorative activities and development of new capabilities which is needed to foster discontinuation of the business as usual. But the 2015-revision of the standard has increased the strategic potential of EMS, which can be argued to overcome this risk by creating a system that fosters and make room for innovative initiatives that seek improvements across all life cycles of a product. This does however require radical change and new competences and both hard and soft capabilities.

# 10 Conclusion

This master thesis explores the strategic potentials of ISO 14001, to integrate CE in EMS in large Danish manufacturing companies. Recent studies have advanced this field of research by outlining what the expected potential entails, emphasising various aspects across the HLS of ISO 14001. However, companies current application of the traditional EMS do not support the potential for integrating CE in EMS. This research follows an exploratory approach that aim to answer:

#### How can the potential of integrating CE in EMS, according to ISO 14001, be supported in large Danish manufacturing companies?

To answer this research question, a qualitative multiple-embedded case study was performed on five large Danish manufacturing companies, supported by the use of three different qualitative methods for data collections. These are: *systematic literature review*, *document analysis* and *semi-structured interviews*. Nine interviews have been conducted with employees from the case companies and three experts from Danish Standards.

CE has been conceptualised according to the five CE strategies for regenerate, narrow, slow, close and inform resource loops. A conceptual framework has been developed to understand what characterises different types of EMS, and how these relate to the potential for integrating CE in EMS. The three types of EMS for integrating CE are: Traditional EMS, Product-oriented EMS (POEMS) and Circular-oriented EMS (COEMS). It can be concluded, that the latter represents a strategic and optimal integration of CE in EMS, where the CE strategies are well-integrated into the core business and intend to integrate the slowing strategy. The conceptual framework has been used to identify how the case companies are currently working with CE and EMS. It can be concluded that the case companies are all working with traditional EMS focused on production optimisation, and two of the companies have begun to use their EMS in the product development processes, thus expanding towards POEMS. All case companies have anchored their EMS at the operational level in (Q)EHS departments in a segmented manner, with little strategic implications. The case companies are all working strategically with the CE strategies, but in various combinations and intensities. The CE activities are managed as projects from other business functions than (Q)EHS.

It is concluded, based on identification of the experienced benefits and barriers of EMS and CE respectively, that there is a potential to integrate CE in EMS in the case companies. Most of the case companies furthermore acknowledge that there is a potential to integrate their CE activities into their EMS. However, it can be concluded that the case companies ability to support this potential is influenced by several challenges, these are: 1) Current application and silo-thinking on EMS and CE, 2) Organisational structures and practices, 3) Operational anchoring of EMS, 4) Ensuring top management commitment and support,

5) Lack of clear CE strategy, and 6) Complexity of working with CE. These challenges are all interrelated and illustrate, that integrating CE in EMS is a complex process.

It can be concluded, that the potential of integrating CE in EMS, can be supported in large Danish manufacturing companies, by following these recommendations:

- 1. Break down silo-thinking and application through IMS
- 2. Create CE strategy and objectives
- 3. Ensure top management commitment and support
- 4. Involve employees and external stakeholders
- 5. Experiment, learn and adapt in ongoing process

As the recommendations emphasise, it can be seen, that supporting the potential to integrate CE in EMS, will require that the case companies break down current silo-thinking and rethink their current understanding of the role of EMS used to manage and align the companies' CE strategy at a strategic level and across different business functions. It can be concluded, that the case companies argue that the IMS represents the full potential for integrating CE across their organisation, due to the system set-up and coverage, which relates to the centrality of the HLS to enable strategic alignment. Expanding the potential from integrating CE in EMS into the IMS, requires, that the companies restructure and define their IMS practices and becomes better at using it to provide common understanding and overview, while making the system more flexible and open as working with CE in EMS is an iterative process. It can be concluded that the companies current approach to EMS and CE, makes it possible to argue that the companies can use the conceptual framework defined in this study, to reflect on how to support the potential and identify possible actions including different internal and external stakeholders depending on whether they aim for POEMS or COEMS. It is concluded, based on their current approaches, that the companies would benefit by starting to expand their focus towards POEMS and acknowledge that this can be a stepping stone for more CE activities.

To support the potentials for integrating CE in EMS, companies must acknowledge that working with CE in EMS is an iterative process, where the IMS must be organised and managed in a way where there is room for adjustments and changes, also at the strategic levels, as companies progress with experimentations in collaborations with both internal and external stakeholders. This further support the need to share knowledge to build capabilities across business functions and support that experimentation and innovation is needed for working with CE to learn, improve and explore possibilities.

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# A Overview of potential for integrating CE in EMS across the HLS

Clauses	Description of clause	The potential for integrating CE in EMS
<b>4</b> : Context of the organisation	Requirements to focus on the context of the organisation, to determine both external and internal issues that influence ability to reach intended outcome. This includes determining interested parties and their needs, legal requirements and risks related to environmental activities of the organisation covered by the determined scope of the EMS.	The explicit focus on internal and external stakeholder can enable companies to use EMS to explore and identify CE opportunities through collaborative and proactive stakeholder engagement. Identification of relevant stakeholders depend on scope of EMS, and the scope must be expanded towards product chain and system due to systemic nature of CE, which influence relevant stakeholders as companies will need to work in new ways both upstream and downstream in product chain and engage in new partnerships.
5: Leadership	Requirements for top management commitment, support and leadership to the EMS. This includes defining roles, responsibilities and creating an environmental policy. The environmental policy and objectives must be aligned with the overall strategy, context of the organisation, and commitment to prevent pollution.	The requirement to ensure a close connection between key elements of EMS and the overall strategic direction and context of organisation, can ensure better alignment with a CE strategy and the strategy creates a frame for what to consider in EMS. Alignment with CE strategy requires different management of EMS. CE integration beyond operations require continuous top management involvements as they need to align EMS with strategic levels to redesign BM, stakeholder interactions and internal business organisation.
6: Planning	Requirements on how organisations must plan processes and identify actions that address opportunities and risks on environmental activities and compliance obligation. Organisations must apply a lifecycle perspective to determine significant environmental impacts of their activities. Environmental objectives must be determined at relevant organisational levels.	Integrate consideration to circularity measures in the identification of significant environmental impacts in life cycle perspective, where scope is broadened from production to product chain. Span of influence in product chain might vary. By applying a different understanding of value creation when addressing risks and opportunities, represents an opportunity to shift focus from reducing environmental impacts to create value or mitigate potential risks in CE.

Table A.1. OVERVIEW of HLS elements and the potential for integrating CE in EMS [Kristensen et al., 2021; ISO, 2015]

Continued on next page

Clauses	Description of clause	The potential for integrating CE in EMS	
7: Support	Requirements for determining resources need in EMS. This includes a focus on competences, training and education, awareness and both internal and external communication. Furthermore, focus is on creating and controlling documented information on EMS.	As part of determining resources, competencies, training and education, the focus should be on building new soft (partnerships, develop new BM and gain circular buy-in) and hard capabilities (set measurable targets and identify relevant materials for CE) to support CE implementation. Other capabilities to consider is when training on how to use EMS, where there lays a potential for ensuring design competences focused on CE (design product and CBM). The internal and external communications can support new ways of interactions with (new) stakeholders and is closely linked to the inform CE strategy.	
8: Operation	Requirements for how organisations plan operational processes and control planned changes in EMS. This includes that organisations must control or influence the activities they have outsourced, apply lifecycle perspective, review consequences of unintended changes or emergencies and take actions to mitigate adverse environmental impacts.	The requirements of applying a lifecycle perspective, on both internal processes and outsourced work, including the design and development, indicate, that EMS can be used to enable and support a circular product design in various ways as considerations to the five CE strategies are included at all stages of a product's lifecycle.	
<b>9</b> : Performance evaluation	Requirements to determine how organisations monitor, measure, analyse and evaluate on EMS processes in EMS and compliance. Internal audits and management reviews must be conducted, to ensure continuous evaluation of actions needed to ensure EMS effectiveness.	Continuous evaluation of environmental performance can be used to ensure progress on CE activities. During the monitoring, measuring and evaluation of the effectiveness of the EMS, considerations to the progress on CE can be included by giving attention to circularity indicators. EMS scope expands when integrating CE and inclusion of stakeholders holds potential to evaluate performance of product chain and better foundation for identifying improvement potentials.	
10: Improvement	Requirements for the organisations to determine potential for continuous improvement and implement actions needed to achieve intended outcome. It thus includes requirements on how organisations must address nonconformity with the standard and perform corrective actions on relevant EMS processes.		

# **B** Overview characteristics of case companies' environmental policy

This appendix provides an overview of the type of policy that outline the environmental policy of the case companies, as well as their respective focus and characteristics.

Case company	Type of policy	Focus and characteristics
Company A	Quality- and Environmental Policy	Focus on product and supply chain, open and transparent dialogue with stakeholders to optimize supply chain and choosing suppliers based on their ability to meet quality and environmental requirements. Will go beyond environmental regulation to keep improving.
Company B	Management Policy	Broad QEHS management policy, little focus on environmental considerations reflected solely in one of the performance obligation, being to produce products that are environmentally friendly in lifecycle perspective.
Company C	Environmental, Health and Safety policy	Broad and where statements are combined. Explicit mentioning of the environment in the focus on 'minimizing their activities impact on the environment'.
Company D	Environmental Policy	Solely focus on environmental considerations to ensure compliance and within the organisational boundaries, mainly in production processes and operations.
Company E	Environmental, Health and Safety policy	Focus on assessing and improving the environmental impacts of both products, facilities and suppliers in a lifecycle perspective as well as identification of sustainable solutions to improve the environment. Will go beyond environmental regulation to keep improving.

Table B.1. Characteristics of the case companies environmental policies

# C Interview guides

This chapter contains interview guides used for the interviews. The interview guides was sent to all interviewees before the interview. The interview guides are in Danish, as the interviews was held in Danish. Before the interview started, agreements was made to record the interview. I started out reintroducing the problem area in my thesis, and afterwards the interviewees were asked to give a small introduction about themselves.

#### C.1 Interview guide Dansk Standard

#### Spørgsmål

- Vil du kort introducere og uddybe dit fokusområde og arbejdsopgaver i Dansk Standard
- Hvordan oplever i ved Dansk Standard at store danske virksomheder arbejder med ISO 14001?
  - Hvilke udfordringer præger deres arbejde med ISO 14001? hvordan forsøger i at hjælpe virksomhederne med at overkomme disse?
  - Oplever i forskel på hvordan store og små virksomheder arbejder med ISO 14001? hvilke tendenser ser i her?
- Hvilken rolle har i hos Dansk Standard i forhold til at hjælpe virksomhederne med at udnytte de strategiske potentialer for ISO 14001?
  - Hvilken rolle har i ift. at hjælpe virksomhederne med at få rammesat/integreret arbejdet med cirkulær økonomi?
- Kan du se potentialet ved at bruge det øgede strategiske fokus i ISO 14001 til at integrere store virksomheders arbejde med cirkulær økonomi derigennem?
  - Hvordan ser du fremtiden ift. at virksomhederne får integreret arbejdet med cirkulær økonomi? Tror du ISO 14001 kommer til at spille en rolle? (hvilken/hvorfor ikke og hvad gør så?)
  - Mener du at ISO 14001 kan bruges til at arbejde med cirkulær økonomi og samtidigt tage højde for alle tre dimensioner af bæredygtighed?
- Oplever i efterspørgsel fra virksomhederne ift. hjælp til hvordan man arbejder mere strategisk med cirkulær økonomi og/eller ISO 14001?
- Hvad mener i der er vigtigt for virksomheder ift. at integrere arbejdet med CE igennem ISO 14001?
  - Hvordan mener i virksomhederne skal bære sig af med at integrere arbejdet med CE igennem ISO 14001?
  - Virksomhederne arbejder på nuværende tidspunkt med CE andetsteds end deres (miljø)ledelsessystem, mener i at det er problematisk? Ja/nej, hvorfor?

- Hvad tror i der bliver det sværeste for virksomhederne ift. at udnytte de strategiske potentialer ved ISO 14001 til at arbejde med CE?
- Er de supplerende guidelines 14006 og 14009 en forudsætning for at kunne arbejde med CE i ISO 14001?
- Hvad var baggrunden for at udarbejde ISO 14009 (inkorporering af materiale cirkulation og design?)
  - Hvilken respons har i fået på denne? Har i mærket en stor efterspørgsel eller spørgsmål omkring noget særligt?
- Oplever i efterspørgsel på guidelines der uddyber flere cirkulære strategier? Er det noget i kommer til at kigge mere ind i fremadrettet?
  - Cirkulære forretningsmodeller (take-back?)
  - Samarbejder på tværs af værdikæden?
- Er der eventuelt relaterede temaer i fokus i hovedudvalget Bæredygtighed og forretningsudvikling ift. virksomheders arbejde med CE igennem (miljø)ledelsessystemer?
  - Hvordan er udvalget struktureret ift. udviklingen af ledelsessystemer for miljøledelse og cirkulær økonomi? Er der nogle synergier mellem underudvaglene heri?
  - E.g. der andre standarder, guidelines etc. I støbeskeen som skal hjælpe virksomhederne med at arbejde mere målrettet med cirkulær økonomi?
- Ud fra vores snak vil jeg opsummerende høre hvilke anbefalinger du har til mig ift. at komme med anbefalinger omkring det potentiale der er ved at integrere CE i ISO 14001? Hvad skal jeg være særligt opmærksom på?

#### C.2 Interviewguide case companies

#### Introduktion

- Vil du lave en kort introduktion af virksomheden og dine arbejdsopgaver i virksomheden?
- Hvad er jeres overordnede plan/strategi indenfor bæredygtighed? Hvad arbejder i hen imod?

#### Spørgsmål angående jeres miljøledelsessystem

- Hvorfor har i et miljøledelsessystem ifølge ISO 14001? Hvordan bruger i ISO 14001 på tværs af organisationen?
- Hvad påvirker jeres arbejde med miljøledelsessystemet? jeres interessenter, interne kompetencer, branchen, lovgivning eller andre ting? Og hvordan påvirker det?
- Hvilke fordele oplever i ved arbejdet med miljøledelsessystemet?
- Hvilke udfordringer oplever i i jeres arbejde med miljøledelsessystemet?
- Hvilke interessenter er vigtige for jeres arbejde i miljøledelsessystemet? Miljømyndigheder, forbrugere, leverandører, naboer, medarbejdere, vidensinstitiutioner og lokale netværker?

- Er jeres interessenter med til at definere arbejdet i jeres miljøledelsessystem?
   Hvis nej, hvorfor ikke? Hvis ja, hvem er involveret og hvordan?
- Hvilke områder arbejder i med igennem jeres miljøledelsessystem på nuværende tidspunkt?
  - Er der nogle områder i først for nyligt er begyndt at indtænke i miljøledelsesystemet?
- Hvordan vil du beskrive jeres virksomheds tilgang til arbejdet med miljøledelsessystemet?
  - Er det primært overholdelse af lovgivning, reduktionsmål eller et proaktivt værktøj til produktorienterede forbedringer?
- Hvilke afdelinger eller områder er dækket af arbejdet med miljøledelsessystemet? Hvilke medarbejdere har noget med miljøledelsessystemet at gøre?
- Hvilke fokus er der i arbejdet med miljøledelsessystemet?
  - Produktionsprocesser og interne optimeringer?
  - Produkt-orienterede forbedringer i samarbejde med jeres værdikæde?
  - Strategisk orienteret fokus på CSR, cirkulær økonomi, eco-design, LCA og supply chain management?
- Hvem bestemmer fokus i miljøledelsessystemer og fastsætter miljøpolitik og miljømål?
  - Hvilken rolle har topledelsen i arbejdet med miljøledelsessystemet?
  - Hvilken rolle har medarbejderne i arbejdet med miljøledelsessystemet?
  - Må jeg få tilsendt jeres miljøpolitik, miljømål og en/flere procedure der kendetegner jeres arbejde med miljøledelsessystemet? Jeg ønsker at se hvilket fokus der er, samt hvorvidt der indirekte er fokus på cirkulær økonomi og hvordan man eventuelt kunne øge fokus på selvsamme. Jeg behandler alternativt materialet fortroligt.

#### Spørgsmål angående jeres arbejde med cirkulær økonomi

- Hvorfor arbejder i med cirkulær økonomi?
- Hvordan arbejder i med cirkulær økonomi?

Spørgmål omkring hvordan de arbejder med CE har for hver af case virksomhederne taget udgangspunkt i tabellen med eksempler for CE strategier, ses i section  $ref{}$ , hvor der på forhånd er udfyldt på baggund af information tilgængelig online. Spørgmålene har derfor varieret.

- Hvad vil det kræve for jer at igangsætte flere indsatser på tværs af værdikæde og brede fokus mere ud?
- Hvilke fordele oplever i ved at arbejde med cirkulær økonomi?
- Hvilke udfordringer oplever i ved at arbejde med cirkulær økonomi?
- Hvilke interessenter er vigtige for jeres arbejde med cirkulær økonomi? Og arbejder i aktivt sammen med dem om cirkulær økonomi?

- Hvis ja, hvordan inddrager i jeres interessenter og hvem? Hvis nej, hvorfor ikke?

• Arbejder i med nogle af tiltagene for cirkulær økonomi igennem jeres miljøledelsessystem? I så fald hvilke og hvordan?

- Hvis nej, hvor og hvordan gør i så? (hvilket regi, afdeling, udvalg, system og struktur?)
- -Hvilken afdeling står for arbejedet med CE? Er det den samme som står for ISO 14001
- Stiller i målbare mål for arbejdet med cirkulær økonomi?

# Spørgsmål om potentialet for at integrere cirkulær økonomi i jeres miljøledelsessystem

- Kan du se potentialet i at i som virksomhed integrere arbejdet med cirkulær økonomi ind i jeres miljøledelsessystem?
  - Hvis ja, hvad bliver så afgørende for dets langvarige succes og forankring?
  - Hvis nej, hvad skyldes det og hvad skulle der til for at overkomme disse? Hører arbejdet med cirkulær økonomi til et andet sted og hvorfor?
  - Er potentialet relateret til ISO 14001 specifikt? Eller er det mere samlet det integrerede ledelsessystem der kan løfte opgaven? (konkrete krav i ISO 9001 for produktet mangler måske i ISO 14001?)
- Hvilke udfordringer tror du der vil være forbundet med at integrere cirkulær økonomi igennem miljøledelsessystemet? (organisatoriske udfordringer, kompetence og forståelse, teknologiske, øget samarbejde med interessenter og aktører?)
- Har du kendskab til ISO 14000 seriens guidelines som kan supplere arbejdet med cirkulær økonomi? ISO 14006 (guideline for inkorporering af ecodesign) og ISO 14009 (inkorporering af materiale cirkulation og design)?