Circular Business Development

Rethinking Value, Tools and Business Potentials

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BY
HEIDI SIMONE KRISTENSEN

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AALBORG UNIVERSITY
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by

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CV

Heidi Simone Kristensen obtained her Master of Science in Environmental Management and Sustainability Science at Aalborg University in 2016 and her Bachelor's degree in Techno-Anthropology at Aalborg University in 2014. Heidi began her academic career as teaching assistant at Department of Planning and a project employee at the Network for Sustainable Business Development North Denmark in September 2016, and in September 2017 she initiated her industrial PhD journey at 3R Kontor and Holmris.Designbrokers (now HOLMRIS B8) and the research group of Sustainability, Innovation and Policy (SIP) within the Department of Planning at Aalborg University. Heidi will continue her work as a research assistant in the SIP research group.

ENGLISH SUMMARY

In this PhD thesis, circular business development is investigated. The concept of circular economy has been gaining increasing attention in recent years as having potential to support sustainable development. With many definitions and conceptualizations of circular economy, this thesis rests on the understanding of circular economy based on regenerating, narrowing, slowing, closing and informing resource flows. Simply put, circular economy is understood as making resource and product flows clean and renewable (regenerate), whilst using less (narrow), using longer (slow), and using again (close), supported by using data (inform). Moreover, circular economy is understood intended to support sustainable development. With the growing academic and practical interest in circular economy, the outset for this PhD is to explore the potentials for companies to engage in circular business development.

This research is a result of an industrial PhD project, conducted in the furniture company HOLMRIS B8 in collaboration with the research group of Sustainability, Innovation and Policy at the Department of Planning, Aalborg University. The aim of this research is to expand the academic knowledge of circular economy as well as contribute applicable knowledge to support further implementation of circular economy in HOLMRIS B8. The primary research question guiding this research is: *How can circular economy support sustainable business development in the furniture industry?*

The core of this thesis consists of five academic papers that contribute with different perspectives on circular business development. The research process was thus guided by sub-questions for each of these papers, and an exploratory research strategy was applied to investigate circular economy potentials. This thesis rests on a predominantly qualitative research design, where several methods have been applied, namely engaging in practice, literature and document review, semi-structured interviews, focus group interviews and a survey. The details of the research design and methods are presented in Chapter 4.

This thesis contributes with a comprehensive understanding of how circular economy can support sustainable business development. This is enabled through changes in internal business aspects of product and business model design and organizational practices and systems. This also entails considerations of the context within which the organization operate, awareness to the supply-demand mechanisms influencing the organization and overall framework conditions. The research provides this comprehensive understanding through a new conceptualization of sustainable value propositions, assessment of micro level indicators for circular economy, analysis of the potentials for utilizing environmental management systems to align and manage circular economy initiatives, and insights into the practices of circular public

procurement. This comprehensive perspective enables an improved understanding of the complexity of circular economy. It puts emphasis on the interdependence and connected nature of the different elements of circular business development, as none of the investigated areas alone are enough for a transition towards a sustainable circular economy.

Each of the five papers included provide contributions to answering the primary research question through five sub-questions that focus on four different aspects of circular business development; value propositions, circular economy indicators, existing systems and practice (through environmental management systems), and public procurement.

A framework for *sustainable value propositions* is presented in the first paper, which is based on a conceptualization of product, service and system as key distinguishers of value propositions. Applying such distinction enable a demonstration of how value propositions can be innovated from product over service to system solutions, which puts emphasis on a comprehensive value perspective in a system perspective of circular economy. The framework thus enables a broader understanding of value for multiple stakeholders and include considerations of the changes in interactions between stakeholders in order to realize the sustainable value. Moving from product over service to system entails changes from single transactional exchanges over collaborations to partnerships.

Reviewing *circularity indicators*, the second paper provides insights into current ways to measure circular economy at micro level. The primary focus of current indicators was on recycling or in general on end-of-life management, while few indicators consider product lifetime extension, reuse or repair. Assessing the alignment between circular economy indicators and the three dimensions of sustainability showed that the majority of indicators focus on economic aspects with environmental and especially social aspects included to less extent. This bias in sustainability considerations in micro level indicators for circular economy does not support a sustainable circular economy, as priority is given to the economic feasibility of circular strategies. As circular economy is understood as a concept that is intended to support sustainable development, then the developed indicators need to also reflect this to avoid decoupling of sustainable development and circular economy.

Focusing on the potentials of *environmental management systems*, the third and fourth paper addresses two different aspects of environmental management systems. The third paper presents an analysis of companies that have discontinued their ISO14001 certification; the reasons for discontinuation and the impact of this decision on their environmental practice. As a primary reason for discontinuation is a lack of strategic focus in the environmental management system, the potentials for broadening the scope towards strategic aspects is highlighted to avoid discontinuation, secure continuous improvements and ensure connection to the overall strategic direction of the company. Broadening the scope from primarily

narrowing strategies in production towards slowing and closing strategies in product and business model design can improve the strategic value of environmental management systems. This is investigated in the fourth paper, which puts emphasis on the potentials for using environmental management systems to align and manage circular economy initiatives in companies. Although not yet an established practice, the potentials of integrating circular economy in environmental management systems present opportunities for companies to expand existing practices and systems to encompass circular economy.

The fifth and final paper places emphasis on the supply-demand mechanisms of circular business development through an analysis of *circular public procurement* practices in Danish municipalities. A traditional view of public procurement is focused on defining requirements, setting demands and awarding the contract based on lowest price. On the opposite, circular public procurement requires a different perspective that focus on needs, functionality, total cost and value creation through closer interactions with the market and end-users.

In conclusion, the potentials for circular economy to support sustainable business development rests on a comprehensive understanding of how companies need to rethink value, tools and embrace new business potentials. For circular economy to support sustainable business development, companies must give attention to rethinking and redesigning value propositions for a sustainable circular economy and ensure the use of relevant indicators for measuring and documenting progress, which ensures inclusion and prioritization of the different circular strategies. Such activities can be supported by using environmental management systems to align and manage these activities in the organization, as a broader scope of environmental management systems can enable integration of strategic aspects of circular economy. Finally, the focus on circular public procurement provide insights into demand-side practices, where attention is given to increased collaboration and knowledge sharing. This PhD thesis consequently provides a comprehensive view on circular business development and shows how circular economy can support sustainable business development.

DANSK RESUME

Cirkulær forretningsudvikling i relation til danske møbelvirksomheder bliver undersøgt i denne PhD-afhandling. Gennem de seneste år har begrebet cirkulær økonomi har fået en stigende opmærksomhed grundet dets potentiale for at understøtte bæredygtig udvikling og samtidig bidrage til at imødegå klimaforandringerne. Da der findes forskellige definitioner og konceptualiseringer af cirkulær økonomi, hviler denne afhandling på en forståelse af cirkulær økonomi gennem fem strategier for ressourcestrømme: regenerativ, reducere, forsinke, lukke og informere. Kort sagt forstås cirkulær økonomi som at gøre ressource- og produktstrømme rene og vedvarende (regenerativ), mens der bruges mindre (reducere), bruges i længere tid (forsinke) og bruges igen (lukke), understøttet af brug af data (informere). Men den stigende akademiske og praktiske interesse i cirkulær økonomi er udgangspunktet for denne PhD-afhandling at undersøge potentialer for virksomheder i at engagere sig i cirkulær forretningsudvikling.

Forskningen er et resultat af et erhvervsPhD-projekt udført i møbelvirksomheden HOLMRIS B8 i samarbejde med forskningsgruppen Bæredygtighed, Innovation og Politik på Institut for Planlægning, Aalborg Universitet. Formålet med forskningen er at bidrage til den faglige viden om cirkulær økonomi samt bidrage med relevant viden til at understøtte yderligere implementering af cirkulær økonomi i HOLMRIS B8. Hovedforskningsspørgsmålet for denne afhandling er: *Hvordan kan cirkulær økonomi understøtte bæredygtig forretningsudvikling i møbelindustrien?*

Kernen i afhandlingen består af fem akademiske artikler, der bidrager med forskellige perspektiver på cirkulær forretningsudvikling. Forskningsprocessen blev således styret af underspørgsmål til hver af disse artikler, og en eksplorativ forskningsstrategi blev anvendt til at undersøge potentialer for cirkulær økonomi. Denne afhandling hviler på et overvejende kvalitativt forskningsdesign, hvor flere metoder er blevet anvendt, såsom at engagere sig i praksis, litteratur og dokumentanalyse, semistrukturerede interviews, fokusgruppeinterviews og spørgeskemaundersøgelse. Detaljerne om forskningsdesign og metoder er præsenteret i Chapter 4.

Forskningen bidrager med en omfattende forståelse af, hvordan cirkulær økonomi kan understøtte bæredygtig forretningsudvikling. Dette kan opnås gennem ændringer i den interne praksis relateret til design af produkter og forretningsmodeller samt organisationsstruktur og -systemer. Dette indebærer også overvejelser om den kontekst, som organisationen opererer inden for, herunder opmærksomhed omkring udbud og efterspørgselsmekanismer, der påvirker organisationen og de overordnede rammebetingelser. Forskningen bidrager med en helhedsorienteret forståelse gennem en ny konceptualisering af bæredygtig værdiskabelse, analyse af indikatorer for cirkulær økonomi, analyse af potentialerne for anvendelse af miljøledelses-systemer til at integrere og styre cirkulær økonomi initiativer samt indsigt i cirkulær

offentlig indkøbspraksis. Dette mangesidige perspektiv muliggør en bedre forståelse af kompleksiteten i cirkulær økonomi. Der lægges vægt på en gensidig afhængighed og sammenhæng mellem de forskellige elementer af cirkulær forretningsudvikling, da ingen af de undersøgte områder alene er nok til at sikre en bæredygtig cirkulær økonomi.

Hver af de fem artikler bidrager til besvarelse af hovedforskningsspørgsmålet gennem fem underspørgsmål, der fokuserer på fire forskellige aspekter af cirkulær forretningsudvikling; værdiskabelse, indikatorer for cirkulær økonomi, eksisterende systemer og praksis (gennem miljøledelsessystemer) og offentlige indkøb.

En model for *bæredygtig værdiskabelse* præsenteres i den første artikel. Denne model er baseret på en sondring mellem produkt, service og system som rammesættende for forskellig bæredygtig værdiskabelse. Anvendelse af denne sondring muliggør en forståelse af, hvordan værdiskabelse kan innoveres fra et produkt fokus over service og tjenesteydelser til systemløsninger. I sidstnævnte lægges der vægt på et omfattende værdiperspektiv i relation til systemiske cirkulære løsninger. Dette indebærer en bredere forståelse af værdiskabelse for flere interessenter og inkluderer refleksioner over de nødvendige ændringer i interaktioner mellem interessenter for at realisere dette. At udvide fra produkt over service til system indebærer ændringer fra enkelte transaktioner over samarbejde til partnerskaber.

Gennemgangen af *indikatorer for cirkulær økonomi* bidrager med indsigt i aktuelle måder at måle cirkulær økonomi på mikro niveau. De analyserede indikatorer fokuserer primært på genanvendelse eller affaldshåndtering, mens få indikatorer inkluderer levetidsforlængelse, genbrug eller reparation. En analyse de tre bæredygtighedsdimensioner i relation til indikatorerne viste, at hovedparten fokuserer på økonomiske aspekter, mens de miljømæssige og især sociale aspekter er inkluderet i mindre grad. Denne skævvridning understøtter ikke en bæredygtig cirkulær økonomi, da der primært fokuseres på om det økonomisk kan betale sig at implementere cirkulære strategier og løsninger. Eftersom cirkulær økonomi forstås som et middel til at opnå en bæredygtig udvikling, bør indikatorer for cirkulær økonomi afspejle dette for at imødegå en afkobling mellem bæredygtig udvikling og cirkulær økonomi.

Den tredje og fjerde artikel fokuserer på *miljøledelsessystemer*, og indeholder to forskellige undersøgelser. Den tredje artikel præsenterer en analyse af virksomheder, der ophører med en ISO14001 certificering gennem opsigelse heraf, årsagerne til dette samt hvilken betydning det har haft på deres miljøpraksis. En af de primære årsager for frafald er manglende strategisk fokus i miljøledelsessystemet, hvilket sætter fokus på potentialerne for at udvide miljøledelsessystemer til at rumme strategiske indsatser for at sikre kontinuerlige forbedringer og sikre sammenhæng mellem systemet og virksomhedens overordnede strategiske retning. Den strategiske værdi af miljøledelsessystemer kan derfor potentielt øges ved at udvide fokus fra primært ressourceoptimering af produktionsprocesser mod strategier for forsinkelse

og lukning af kredsløb inden for design af produkter og forretningsmodeller. Dette undersøges i den fjerde artikel, hvor der lægges vægt på potentialerne for at anvende miljøledelsessystemer til at integrere og styre initiativer for cirkulær økonomi i organisationen. Selvom det endnu ikke er en veletableret praksis, giver potentialerne for at integrere cirkulær økonomi i miljøledelsessystemer nye muligheder for virksomheder til at udvide eksisterende systemer og praksisser til at omfavne cirkulære strategier.

Den femte og sidste artikel lægger vægt på udbuds- og efterspørgselsmekanismerne relateret til cirkulær forretningsudvikling gennem en analyse af nuværende praksis indenfor *cirkulære offentlige indkøb* i danske kommuner. En traditionel tilgang til offentlige indkøb indebærer fokus på kravspecifikation og laveste pris, mens cirkulære offentlige indkøb indebærer et andet perspektiv. Her er fokus på behov, funktionalitet, totalomkostninger og værdiskabelse gennem tættere interaktioner med markedet og slutbrugerne.

Opsummerende, så baseres potentialerne for cirkulær økonomi som understøttende for bæredygtig forretningsudvikling på en helhedsorienteret forståelse af, hvordan virksomheder skal genoverveje værdi, værktøjer og omfavne nye forretningspotentialer. For at cirkulær økonomi kan understøtte bæredygtig forretningsudvikling, skal virksomheder gentænke værdiskabelse for en bæredygtig cirkulær økonomi og sikre brugen af relevante indikatorer, der sikrer inklusion og prioritering af de forskellige cirkulære strategier. Disse aktiviteter kan understøttes af miljøledelsessystemer, der tilpasses hertil gennem udvidelse af omfanget af systemet, hvilket muliggør integration af strategisk cirkulær økonomi. Slutteligt har fokus på cirkulære offentlige indkøb bidraget med indsigt i praksis relateret til efterspørgsel, hvor fokus er på øget samarbejde og videndeling. Denne PhD-afhandling bidrager derfor med et mangesidigt overblik over cirkulær forretningsudvikling og viser, hvordan cirkulær økonomi kan understøtte bæredygtig forretningsudvikling.

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Doing an industrial PhD is not an easy endeavor as several objectives, opinions and factors influence the work. I am therefore grateful to my great team of supervisors who kept me focused and guided me through the process. During the three years, the supervisor team has changed, but I am nonetheless grateful to all that have contributed to my journey: Professor Arne Remmen (AAU), Associate Professor Mette Alberg Mosgaard (AAU), Assistant Professor Jaco Quist (TU Delft), CSR Director Steffen Max Høgh (HOLMRIS B8), Head of Quality, Environment and Processes Anne Stokvad Madsen (HOLMRIS B8) and Head of Sales Enok Kloster (HOLMRIS B8).

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Heidi Simone Kristensen
August 2020
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LIST OF PUBLICATIONS

The following list present the papers included in this PhD project and the corresponding chapter in this thesis.

Paper I: Kristensen, H.S., Remmen, A., 2019. *A framework for sustainable value propositions in product-service systems.* Journal of Cleaner Production, 223.
DOI:10.1016/j.jclepro.2019.03.074 Chapter 5

Paper II: Kristensen, H.S., Mosgaard, M.A., 2020. *A review of micro level indicators for circular economy – moving away from the three dimensions of sustainability?* Journal of Cleaner Production, 243.
DOI:10.1016/j.jclepro.2019.118531 Chapter 6

Paper III: Mosgaard, M.A., Kristensen, H.S., 2020. *Companies that discontinue their ISO14001 certification – Reasons, consequences and impact on practice*. Journal of Cleaner Production, 260.
DOI: 10.1016/j.jclepro.2020.121052 Chapter 7.1

Paper IV: Kristensen, H.S., Mosgaard, M.A., Remmen, A., 202x. *Bridging the gap between environmental management systems and circular economy*. Accepted for publication in the Journal of Cleaner Production
Accepted, revised version under review Chapter 7.2

Paper V: Kristensen, H.S., Mosgaard, M.A., Remmen, A., 202x. *Circular public procurement practices in Danish municipalities*. Accepted for publication in the Journal of Cleaner Production
Accepted, revised version under review Chapter 8

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

The current linear economy based on economic growth and a "take-make-waste" approach to resources represents an unsustainable path for mankind (Bonciu, 2014; Velenturf et al., 2019). In 1966, Boulding argued that the Earth is a closed system with a constant availability of resources and a certain capacity to manage the waste generated (Boulding, 1966). Several have supported this argument since, e.g., Meadows et al. (1972), Pearce and Turner (1989), and more recently, Rockström et al. (2009), who proposed nine planetary boundaries within which mankind can operate safely. Despite these efforts, global resource consumption, waste generation, and adverse environmental impacts continue to increase, which calls for new solutions that can support sustainable development (UNEP, 2016; Velenturf et al., 2019). The Brundtland report defined sustainable development as: *"…a 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), and Elkington (1997) popularized sustainable development as one that balances the three dimensions of sustainability: economic prosperity, environmental protection, and social equity. As the global population grows, the demand for resources and energy continues to increase, and leads to levels of consumption that are greater than the rate at which resources can be renewed.

One of the building blocks of sustainable development is the change from linear to circular economy, a concept characterized by the intent to design out waste, maximize resource value, minimize negative environmental impacts, keep products and materials in circulation, and build economic, environmental, and social capital through systems innovations (Ellen MacArthur Foundation, 2013; Korhonen et al., 2018a; Webster, 2017). The growing population and increasing middle class present challenges for sustainable development because of the increasing resource consumption globally and the fact that the majority of the population growth is located in the least developed countries (Ellen MacArthur Foundation, 2013; UN, 2019). With this increasing global demand for resources, companies are experiencing greater exposure to risks, such as increasing resource prices, lack of secure supplies, etc. (Ellen MacArthur Foundation, 2013), which drives the interest in closing resource loops to reduce exposure to such risks. Society's current demand for resources and energy compromises future generations' ability to meet their needs, and radical changes need to be made to ensure sustainable development now and in the future.

1.1. TOWARD A SUSTAINABLE CIRCULAR ECONOMY

The concept of circular economy is rooted in several academic and non-academic disciplines (Borrello et al., 2020; Ghisellini et al., 2016; Korhonen et al., 2018b), such as ecological economics (Boulding, 1966; Ring, 1997), industrial ecology (Frosch and Gallopoulos, 1989; Graedel, 1996), cleaner production (Lieder and Rashid, 2016), and cradle-to-cradle design (McDonough and Braungart, 2002). Its diverse historic origins have resulted in a broad characterization with multiple definitions and understandings of the concept (Kirchherr et al., 2017), which has also caused it to be presented as an *umbrella concept* that encompasses a broad set of diverse phenomena (Blomsma and Brennan, 2017) and is an *essentially contested concept* according to Korhonen et al. (2018b). As the Ellen MacArthur Foundation (2015) noted, circular economy is a concept that is characterized rather than defined, and in this PhD thesis, the following meta-definition of the concept is applied to characterize circular economy:

> *"A circular economy describes an economic system that is based on business models which replace the 'end-of-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 parks) and macro level (city, region, nation 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 generations."*
>
> (Kirchherr et al., 2017, p. 224-225)

This meta-definition allows circular economy to be characterized as firstly, a concept based on *new business models* that are intended to keep materials and products in circulation; secondly, one that denotes a *system perspective*, and lastly, one with the goal of *sustainable development.* These three key characteristics offer a broad, yet clear, conceptualization of circular economy. To conceptualize it further, this thesis builds on the three resource strategies Bocken et al. (2016) presented as narrowing, slowing, and closing resource flows that combined, enable circular economy. Konietzko et al. (2020) updated this conceptualization to also include a strategy to regenerate resource flows, as well as a supportive strategy to inform resource flows. These five circular economy strategies are summarized in Table 1.1, and elaborated in Section 2.2.2, as they provide the conceptualization of circular economy applied in this thesis.

Table 1.1. Circular economy strategies, based on Konietzko et al. (2020)

Strategy	Description
Regenerate	*Make clean and renewable* Use non-toxic materials and renewable energy, and regenerate natural ecosystems
Narrow	*Use less* Use fewer products, components, materials, and energy in the entire lifecycle (from design to recovery)
Slow	*Use longer* Extend or intensify a product's period of use through design of long-life products and extending product life
Close	*Use again* Create a circular resource flow by closing the loop between post-use and production through recycling
Inform	*Use data* Use information technology as a support strategy for the other circular economy strategies

In the context of sustainable development, it has been debated whether and how circular economy contribute to sustainable development (Borrello et al., 2020). In an extensive literature review, Geissdoerfer et al. (2017) identified three types of relations overall between sustainability and circular economy: 1) circular economy as a condition for sustainability; 2) circular economy as beneficial to sustainability, and 3) there is a trade-off relation between circular economy and sustainability. These different perceptions of the relation between sustainability and circular economy can be expected to depend upon the way the two concepts are defined. With many circular economy definitions (Kirchherr et al., 2017) and a broad definition of sustainability, it can be difficult to determine the way the two concepts can be connected, and circular economy may contribute to one or more sustainability dimensions. In an analysis of 114 circular economy definitions, Kirchherr et al. (2017) found that only 13% consider all three sustainability dimensions explicitly, while 46% of the definitions present circular economy as one designed primarily for economic prosperity, e.g., as a tool to enhance growth, and 37-38% of the definitions focus primarily on environmental quality. Thus, circular economy research has focused largely on these two dimensions (Blomsma and Brennan, 2017; Merli et al., 2018) and the social dimension is often absent in circular economy initiatives and research (Kristensen and Mosgaard, 2020 (chapter 6); Murray et al., 2017). However, other scholars have emphasized circular economy's potential benefits to all three dimensions of sustainability (Korhonen et al., 2018a), and within the framework of the 17 sustainable development goals (SDGs), circular economy has also been highlighted as a tool to support several, and particularly as one with the potential to achieve goal 12: *Ensure sustainable consumption and production patterns* (Schroeder

et al., 2018). In this thesis, circular economy is understood as one that is intended to address all three dimensions of sustainability to ensure a sustainable circular economy.

1.1.1. CIRCULAR ECONOMY POLICIES

For the past decade, policy efforts that support circular economy have been developed around the globe, which have built on existing resource-efficiency frameworks and policies that have been in place for approximately the past 20 years (Ghisellini et al., 2016). Focusing on Europe, the European Union (EU) has been encouraging and supporting the implementation of circular economy through several strategies, action plans, and has revised existing directives to favor circular economy principles. In 2015, the European Commission presented the first circular economy Action Plan, which was followed by a new Action Plan in 2020 as part of the European Green Deal introduced in 2019 (European Commission, 2015; 2019; 2020). The European Green Deal presents a roadmap to make the EU economy sustainable through several initiatives, e.g., those concerning increasing efforts to address climate change, zero pollution goal for a toxic-free environment, accelerating the shift to sustainable and smart mobility, and mobilizing industry for a clean and circular economy (European Commission, 2019). In summary, the Green Deal "*…is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use"* (European Commission, 2019, p.2).

Within the complex field of EU policies, the first circular economy Action Plan was designed to provide a coherent policy mix to support circular economy; however, Milios (2018) emphasized the need to further a system-wide policy framework for circular economy by identifying policy gaps and recommendations for three policy options to advance circular economy from a resource-efficiency perspective. The policy gaps he identified highlight that policies are lacking particularly for the distribution and use phases from a lifecycle perspective; however, additional policy developments are also needed for the production and end-of-life phases. From these gaps, he proposed three policy areas: Firstly, reuse, repair, and remanufacturing; secondly, public procurement for resource efficiency, and lastly, policies to strengthen secondary resource markets. Hartley et al. (2020) emphasized these policy areas further and made eight policy recommendations to advance circular economy within the EU. These recommendations focus on circular design standards and norms, circular public procurement, alterations to taxes for circular economy products, liberalization of waste trading, circular trading platforms, eco-industrial parks, a circular economy marketing and promotion campaign, and a global material flow accounting database (Hartley et al., 2020).

In addition to these initiatives on an EU level, several European countries have also implemented national strategies and roadmaps, e.g., the Netherlands, France,

Sweden, and Finland. A national strategy for circular economy was presented in Denmark in 2018, with 15 initiatives to support further uptake and implementation of circular economy in Denmark (Miljø- og Fødevareministeriet, 2018). This strategy is also presented as a key element of the Danish efforts to achieve the Sustainable Development Goals. The initiatives presented in the strategy cover a wide lifecycle perspective and focus on mobilizing companies to drive the transition to a sustainable circular economy, support circular design and new consumption patterns, use digitalization and data to further circular economy, and ensure well-functioning markets for waste and recycled materials (Miljø- og Fødevareministeriet, 2018).

The circular economy Action Plan places emphasis on economic actors, such as companies and consumers' role in facilitating the transition to circular economy, while local, regional, and national authorities play a supportive, yet important, role in providing the correct regulatory frameworks. The European Green Deal also emphasizes the need to mobilize industry for circular economy, which in the Danish context, is supported further by the national circular economy strategy, in which companies are highlighted as a key driving force (European Commission, 2019; Miljø- og Fødevareministeriet, 2018).

1.2. BARRIERS TO CIRCULAR ECONOMY

Despite the increasing attention to the concept of circular economy, several barriers to the implementation of its strategies and principles have been reported (de Jesus and Mendonça, 2018; Masi et al., 2018). In a distinction between soft (institutional and social) and hard (technical and economic) barriers and facilitators of circular economy, de Jesus and Medonça (2018) found that globally, circular economy is driven by soft factors primarily, while the primary barriers identified in their literature review were hard barriers. However, in an analysis of barriers within the EU, Kirchherr et al. (2018) found that the three primary barriers to implementing circular economy were cultural (soft) barriers of *hesitant company culture*, *lack of consumer interest and awareness*, and *operation in a linear system*, while hard barriers of regulatory, technological, and market relevance were less dominant in the European implementation of circular economy strategies. Focusing on the European context, these barriers are concerned largely with the micro-level of circular economy, and research focused on this level could support furthering the adoption and implementation of circular economy in the European context.

Focusing on implementing circular economy on the micro-level, several scholars have described additional barriers, e.g., Rizos et al. (2016), Guldmann and Huulgaard (2020), and García-Quevedo et al. (2020). Rizos et al. (2016) highlighted two primary barriers to implementing circular economy in SMEs, the lack of value chain and market support and lack of financial resources. The first barrier, the lack of support for circular economy in companies' value network, emphasizes the need to address circular economy from a system perspective, as no company can implement circular economy strategies without consideration of the wider system in which it operates. In addition,

Guldmann and Huulgaard (2020) identified several barriers to circular business model innovation in Danish companies, those on a market and institutional, value chain, organizational, and employee level, where barriers on the organizational and employee level were present particularly in companies established in the linear economy. García-Quevedo et al. (2020) emphasized different barriers for companies depending on the type of circular strategies on which they focus, as companies that implement waste minimization, energy-efficiency, etc., primarily experience barriers related to administrative procedures, while companies that experiment with innovative redesign of products and business models are more likely to experience barriers related to regulation, administration, capabilities, and financial aspects. Similar interdependencies were also identified in Garcés-Ayerbe et al.'s (2019) literature review, who found that when implementing circular economy strategies, proactive companies experienced other barriers related to procedures, regulation, and capabilities compared to reactive companies, that experienced financial barriers of cost-benefits and investments primarily. This indicates that there is no "one-size-fits-all" model to implement circular economy, and that it is a gradual process of broadening the scope of circular economy strategies continuously (Garcés-Ayerbe et al., 2019; García-Quevedo et al., 2020; Katz-Gerro and López Sintas, 2019).

Because of technical (hard) and non-technical (soft) barriers (de Jesus and Mendonça, 2018; Kirchherr et al., 2018; Masi et al., 2018), companies can struggle in practice to translate the concept of circular economy into strategies, business model innovation, operations and practice, and internalization of circular economy strategies is still in an embryonic stage (Gusmerotti et al., 2019). Hard barriers to circular economy implementation relate to, e.g., high up-front investments, lack of appropriate technology and knowledge, and the position in the value chain, while soft barriers focus on, e.g., risk aversion or inertia, current company culture, and limited circular procurement (Brown et al., 2019; de Jesus and Mendonça, 2018; Masi et al., 2018). Further, Pieroni et al. (2019) found that the current approaches to sustainability-oriented and circular economy-oriented business model innovation did not consider the *"…continuous activities necessary to adapt the companies' capabilities to the dynamic changes (internally or externally) required by 'CE/sustainability thinking'."* (Pieroni et al., 2019, p.208). For example, Lieder and Rashid (2016) and Katz-Gerro and López Sintas (2019) also emphasized this need for a comprehensive view of circular economy implementation. In their review of circular economy implementation in manufacturing industries, Lieder and Rashid (2016, p.48) argued that circular economy is in *"…need of a systemic perspective on waste and environmental, natural resources as well as economic aspects,"* and that *"…future developments towards CE implementation ought to avoid isolated views on any of these aspects."* This interdependence of circular economy's different elements and strategies has been emphasized further by Katz-Gerro and López Sintas (2019, p.494), who also argued that *"…the chances of implementing a particular CE activity depend on experience already acquired in implementing previous CE activities."* Thus, applying a broad perspective on circular economy implementation allows a more comprehensive understanding of the dynamics of implementing circular economy in

companies, including both internal and external practices, capabilities, and collaborations for circular economy thinking (EFIC, 2020; Gusmerotti et al., 2019; Pieroni et al., 2019).

1.3. EXPLORING CIRCULAR ECONOMY IN THE FURNITURE INDUSTRY

As this thesis is the result of an industrial PhD project in collaboration with HOLMRIS B8, the research takes a practical point of departure in the furniture industry. Furniture constitutes an interesting product group for circular economy exploration, as it is facing significant challenges from the linear economy, e.g., low quality materials and poor design, poor consumer information and availability of spare parts, limited collection and infrastructure for reverse logistics, high labor costs for repair and refurbishment, low demand for recycled materials, and the absence of overarching policy frameworks (Ecores et al., 2018; Forrest et al., 2017).

In the European Commission's new circular economy Action Plan, furniture is mentioned as a priority product group, together with textiles, electronics, ICT, and highly important intermediary products, such as steel, cement and chemicals (European Commission, 2020). In response to this, the European Furniture Industries Confederation (EFIC), which include the Danish association of wood and furniture industries, developed a position paper. In this position paper, the EFIC pointed to a need for further harmonization of EU rules and policies for circular economy in member states from a value chain perspective, increased collaboration and research on circularity in the furniture industry, and emphasized digitalization and skills to advance circular economy in the European furniture industry (EFIC, 2020).

Some of the recent trends in the European furniture industry include an increase in imports from outside the EU, particularly from China, as well as an increase in flat-pack furniture categorized as ready-to-assemble (RTA) (CEPS, 2014). This development also represents a technological development of standardized and automated processes within the furniture industry, which allows low-priced products (Hedemann and Nissen, 2013). While optimizations have been made in the production processes in the furniture industry, less attention has been given to the use and disposal phases in furniture products' lifecycle. Applying a lifecycle perspective on furniture is needed to explore circular economy's potential in the furniture industry.

Within the industry, efforts must be made to advance circular economy in both the domestic (business-to-consumer; B2C) and the contract market (business-to-business; B2B, and business-to-government; B2G). However, this thesis focuses on the contract market, as the host company of this industrial PhD is one of the largest actors in the Danish contract market. Further, in an extensive systematic mapping of barriers to circular economy, Sopjana et al. (2020) identified a lack of research focused

on B2B interactions and inter-organizational challenges to implementing circular economy.

1.3.1. INTRODUCING HOLMRIS B8

HOLMRIS B8 is one the largest furniture companies in the Danish contract market with three factories, more than 250 employees, and more than 1000 suppliers. The company's core vision is to *"…create room for people. with character"* through innovative design solutions that accommodate people best. The company specializes in four distinct segments of furniture: Office; Learning; Care and Hospitality. All four segments supply private and public customers with interior design solutions. As one of HOLMRIS B8's core values, the company focuses explicitly on sustainability and circular economy:

> *"Sustainability is an integral part of our DNA. In fact, it always has been.*
>
> *Our history begins as a sawmill in 1914. With our own forest in the back garden. With reforestation as a core principle. And with respect for every single piece of material.*
>
> *We are no longer in forestry. But sustainability and circular thinking still make up the core of our business. In every process. In every product. From production to disposal, recycling, reselling, and donations.*
>
> *Responsibility is therefore our heritage. And on this foundation, we create solutions that safeguard the environment and give people the best possible conditions to thrive. Today and tomorrow."*
>
> (HOLMRIS B8, 2019)

As part of this strategic focus, HOLMRIS B8 has employed an aggressive acquisition strategy, which included the acquisition of the small circular start-up, 3R Kontor (est. 2014), in 2017 to establish a circular department within HOLMRIS B8. The purpose of this department is to provide circular services to customers in collaboration with the remaining HOLMRIS B8 organization. This entails a take-back system for used office furniture, refurbishment and resale of used furniture, a moving service, and donations. In addition, the company intends to integrate the concepts and knowledge of the circular department into the remaining organization to advance the implementation of circular economy strategies in the organization overall. The company will be discussed further in Chapter 3.

1.4. PRIMARY RESEARCH QUESTION AND THESIS STRUCTURE

The objective of this PhD thesis is to expand our academic knowledge of circular economy implementation, as well as of circular economy within HOLMRIS B8, to support further development and exploration of its potential within the company. This dual objective of contributing to both academic and practical knowledge will be investigated from a comprehensive perspective on circular business development,

which rests on considerations of supply and demand, framework conditions, and internal processes. Thus, this thesis is designed to contribute to the growing body of circular economy literature with an extensive understanding of the way circular economy implementation can be advanced in the furniture industry. The primary research question that guides this research is:

How can circular economy support sustainable business development in the furniture industry?

This thesis consists of four primary parts, as illustrated in Table 1.2. The core part consists of five academic papers that address separate, yet related, aspects of circular business development, and provide answers to five sub-questions, presented in detail in Section 2.4.

Table 1.2. Thesis structure

Introduction
Chapter 1 Introduction *Outlining the problem field of this research, Chapter 1 shows the way radical changes need to be made in current production and consumption patterns to ensure sustainable development that does not exceed planetary boundaries. Circular economy is introduced as a concept to enable such radical changes, which is relevant to the furniture industry, as the industry is facing significant challenges in developing circular economy.*
Framing the research
Chapter 2 Conceptual framework *The conceptual framework of this thesis builds on the development of environmental thinking, companies' sustainability strategies, and the concept of circular economy. This provides the foundation to conceptualize key elements of circular business development, which focus on framework conditions, supply-demand mechanisms, and internal business organization.*
Chapter 3 Contextual framework *Presenting the furniture industry and the host company, HOLMRIS B8, this chapter provides insights into the industry and context in which this research was conducted. This illustrates why circular economy is relevant to the industry and provides insights into organizational changes in the company that have influenced the research.*
Chapter 4 Research design and methodology *The overarching research design and data collection methods are introduced to show the way the primary research question is answered through an exploratory and qualitative research design, which is supported further by the distinct methodologies applied in each of the five papers.*

Table 1.2. cont.

Research findings
Chapter 5 A framework for sustainable value propositions in product-service systems *Placing emphasis on the need for a broader value understanding of circular economy business models, paper I presents a framework for sustainable value propositions, which is exemplified through a case study of school furniture.* ***Research sub-question 1**: What can sustainable value propositions offer using product, service, and system as a key framework?*
Chapter 6 A review of micro level indicators for a circular economy – moving away from the three dimensions of sustainability? *A systematic literature review of the micro level indicators of circular economy shows the way circular economy strategies are measured currently, primarily through recycling indicators. The consistency of the indicators reviewed, and the three dimensions of sustainability shows limited inclusion of social sustainability and the priority of economic indicators.* ***Research sub-question 2:** Which micro level indicators exist for circular economy, and how do they align with the three dimensions of sustainability?*
Chapter 7 Environmental management systems for circular economy *Two papers that focus on environmental management systems are included to emphasize their value and highlight the potential to integrate circular economy strategies into such systems and organizations' internal practices.* ***Research sub-question 3:** Why do some companies choose to discontinue their ISO14001 certification, and what are the consequences of this on their environmental practice?* ***Research sub-question 4:** How can environmental management systems be used to align and manage circular economy strategies in organizations?*
Chapter 8 Circular public procurement practices in Danish municipalities *This chapter focuses on the way the current procurement practices in Danish municipalities influence the development of circular public procurement, and sheds light on the ways these practices may hinder further implementation of circular public procurement and the way customers' practices can influence companies in circular economy.* ***Research sub-question 5:** How do the current procurement practices in Danish municipalities influence a development towards circular public procurement?*
Conclusion and recommendations
Chapter 9 Discussion and conclusion *This chapter synthesizes and discusses the research findings from the five academic papers to clarify this thesis' academic contributions. Finally, limitations of this study are presented, and conclusions are drawn from the five papers overall.*
Chapter 10 Recommendations *In this final chapter, recommendations to advance circular economy implementation in HOLMRIS B8 are presented based on the key findings. Finally, recommendations for further research are presented.*

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CHAPTER 2. CONCEPTUAL FRAMEWORK

This chapter outlines the conceptual foundation of this thesis, which positions itself broadly in the field of circular economy and seeks to contribute further to the academic and practical knowledge of circular business development. The conceptual framework for this research is based on the development of environmental perceptions over time, which have developed from an "out of sight-out of mind" system perspective of circular economy as an element of sustainable development. This helps us understand the way companies perceive and address sustainability issues, which creates the foundation on which to investigate how circular economy can support sustainable business development in the furniture industry. This is nuanced further by three nested sustainability strategies companies employ. In addition, the conceptual framework builds on the concept of circular economy, which will be elaborated through five circular strategies of regenerating, narrowing, slowing, closing, and informing resource flows. This chapter focuses on companies and their role in circular economy and presents key elements of circular business development.

2.1. FROM "OUT OF SIGHT–OUT OF MIND" TO SUSTAINABLE DEVELOPMENT

The perception and understanding of the environmental and social effects of production and consumption have developed over time, and represent different environmental paradigms with different focuses, stakeholders, and practices (Colby, 1991; Remmen, 2001). The development in environmental thinking and perception from the 1960s to the present is summarized in Table 2.1, with the point of departure in the Danish context. This development shows a change in the understanding of the problem, the solutions, and the stakeholders involved.

During the 1960s, environmental problems were perceived primarily as smoke, noise, and waste in local settings, where the solution to these problems focused on dilution (Kørnøv et al., 2007; Remmen, 2001). This "out of sight-out of mind" perception of environmental problems involved a short-term perspective in which the solutions were convenient here and now but did not consider potential future effects. Companies built higher smokestacks to dilute the smoke and extended wastewater pipes. With society's increasing environmental awareness in the 1970s, the perception of the problems changed from smoke, noise, and waste to emissions, and the focus became environmental protection and pollution abatement with such solutions as adding filters and other end-of-pipe solutions, and initiating good housekeeping practices (Hens et al., 2018; Remmen, 2001). However, these solutions often simply transferred the problem from one medium to another, which did not solve the environmental problems, and can be seen as "damage control" measures

that attempted to limit harm (Colby, 1991). Then, the focus expanded from a local to a global perspective, as the awareness of the complexity of adverse environmental impacts increased. These impacts were not confined only to local surroundings, but to the global ecosystem, whereby a broader understanding of environmental problems and solutions is needed.

Table 2.1. Development of environmental thinking and perception, based on (Ceschin and Gaziulusoy, 2016; Colby, 1991; Kørnøv et al., 2007; Lehmann, 2006; Remmen, 2001)

Perception	Problem	Solutions	Stakeholders
"Out of sight-out of mind"	Smoke, noise, and waste	Dilution	Environmental authorities
Environmental protection	Emissions	End-of-pipe (damage control)	Environmental authorities
Pollution prevention	Resource consumption, waste, and emissions	Cleaner production	Environmental authorities, environmental consultants, production engineers
Continuous improvements	Resource consumption, emissions, and impacts of production	Environmental management	Environmental authorities, environmental consultants, management, and employees
Lifecycle thinking	Resource consumption, emissions, chemicals, and products' environmental impacts	Cleaner products	Government, designers, product developers, consumers, customers, and public buyers
Sustainable development	Exceeding planetary boundaries, unsustainable consumption and production	Triple-bottom-line System innovations	Government, local authorities, industry, consumers, customers, public buyers, local communities, research centres

During the 1980s and 1990s, the focus changed to preventing pollution and developing cleaner technology to prevent and reduce environmental problems at the source (Hens et al., 2018). Pollution prevention builds on cleaner production that seeks to improve production processes' environmental efficiency through good housekeeping practices, process optimization, and "best available techniques" (BAT), and also ensures economic efficiency (Kørnøv et al., 2007; Remmen, 2001). At the United Nations Conference on Environment and Development in Rio (Rio Summit) in 1992, the Rio Declaration on Environment and Development was produced, which defined 27 principles that guide nations to sustainable development, where, among others, the precautionary principle and the polluter pays principle were presented (UN, 1992a).

Since then, the discourse on environmental problems and solutions has become more comprehensive, as the perception of environmental aspects has broadened from pollution prevention to continuous improvements in environmental management (EMAS and ISO14001), and lifecycle thinking (Lehmann, 2006; Remmen, 2001). Since the 1990s, companies have adopted voluntary environmental management systems to manage and reduce adverse environmental impacts. Environmental management systems provide a systematic tool for companies to extend beyond regulatory compliance and manage and reduce their environmental impact (Tibor and Feldman, 1996). Danish companies have outsourced or offshored production increasingly, which also shifts the local environmental impact to other areas that were not included in traditional environmental management in Danish companies. Broadening the perspective on lifecycle thinking, new aspects emerged for industry, including corporate social responsibility (CSR), ecodesign, attention to chemicals in products, and product ecolabels, such as the Nordic Swan and the EU Ecolabel (Hens et al., 2018; Kørnøv et al., 2007; Remmen, 2001). Widening the scope and understanding of environmental aspects, from process-oriented cleaner production to an understanding that includes environmental management, CSR and ecodesign, entails a broader scope of problems, solutions, and stakeholders (Brezet and van Hemel, 1997; Hens et al., 2018; Remmen, 2001).

Although the concept of sustainable development has guided efforts since the Brundtland report in 1987 (World Commission on Environment and Development, 1987), it has been a somewhat "fluffy" concept that has taken time to become integrated in companies' environmental thinking (Colby, 1991; Remmen, 2001). Sustainable development was popularized through the triple-bottom-line (Elkington, 1997), in which companies are encouraged to adopt a responsible approach that gives economic prosperity, environmental protection, and social equity equal attention. However, despite global awareness of the need for sustainable development and efforts to support sustainability, production and consumption's adverse impacts still exceed planetary boundaries, and with the rising global and increasing middle class populations, these problems will continue to grow (Steffen et al., 2015; WBCSD, 2010). Thus, it is necessary to develop new solutions that ensure sustainable development, which within the past decade, have focused on system innovations and circular economy strategies (Blomsma and Brennan, 2017; Ceschin and Gaziulusoy, 2016; Geissdoerfer et al., 2017; Homrich et al., 2018; Savaget et al., 2019).

FURNITURE INDUSTRY

development of environmental understanding

Environmental protection

End-of-pipe solutions in the furniture industry have been directed primarily to local emissions from production, and as wood is the primary material used in furniture production, the focus was on dust and waste from wood processing.

Pollution prevention

The Forest Principles defined at the Rio Summit provided the direction for legal and sustainable forestry for the furniture industry (UN, 1992b). In addition to these principles that guide national policy primarily, companies also applied EU-specified BATs, e.g., to produce wood-based panels that focus on emissions from production, consumption of raw materials, energy and water, and production waste (Stubdrup et al., 2016). In addition, a focus point of the industry was to reduce or substitute the use of acid-curing varnishes and improve efficiency in the application process (Lauritsen, 1988).

Continuous improvements

From the perspective of environmental management, furniture companies in Denmark often focus on integrated management systems, as quality management and safety were high priorities in the industry, while environmental management has not been a stand-alone strategy. Increased awareness of CSR and sustainable supply chain management accompanied increasing outsourcing and offshoring of production. Further, the use of ecolabels to reduce the use of hazardous chemicals increased. However, until 2016, the only ecolabel used in the Danish furniture industry was the Nordic Swan, as it was possible to obtain the EU Ecolabel only on wooden furniture, and although wood is the material used most, furniture are often multi-material products. In 2016, the EU Ecolabel criteria were revised and now include those suitable for most furniture products, as requirements are now included for plastic, metal, foam, textiles, etc. in addition to wood (European Commission, 2016), and the number of furniture products with the EU Ecolabel is increasing.

Sustainable development

With an increasing focus on sustainable development, companies increased attention to CSR in supply chains through standardized ways of managing CSR, e.g. through membership of UN Global Compact or the Global Reporting initiative. Additional awareness to global biodiversity and the need for sustainable forestry also increased in the industry, and it has become market standard in Denmark to use wood that is certified sustainable, through Forest Stewardship Council (FSC) or Programme for Endorsement of Forest Certification (PEFC).

Box 2.1. Development of environmental understanding in the furniture industry

The development of environmental awareness entails a broader focus than purely technical solutions and requires a balance between technical and social solutions that also involve a broader range of stakeholders. From a regulatory perspective, the focus has evolved from a "command-and-control" to voluntary actions, and self-regulation and dynamic regulation based on dialogue and consultation (Lehmann, 2006; Remmen, 2001). Thus, this development in environmental thinking and understanding represents a development in society, policy, and companies, which illustrates the complex interdependency between stakeholders at all levels, i.e., individuals, companies, governments, supply chains, cities/regions, and networks (Mohrman and Worley, 2010). In this respect, it is important to note that the problems and solutions have broadened rather than been replaced, and this illustrates the nested principles of development, which, for example, makes it continuously relevant for companies to apply cleaner technology solutions, and also work to develop environmental management, cleaner products, and circular economy. Therefore, the environmental discourse has developed from focusing on doing less harm to creating value and doing good (Adams et al., 2016; Remmen, 2001).

2.1.1. SUSTAINABLE BUSINESS DEVELOPMENT

Companies are uniquely placed in global society to lead the development of sustainability and circular economy, but are also challenged, as they lack robust support frameworks and models (Hart, 2010; Mohrman and Worley, 2010). This thesis' conceptual framework builds on sustainable business development within companies, where companies' different sustainability strategies can be used to frame their different understandings of the business opportunities circular economy offers. Therefore, companies can adopt different sustainability strategies depending on their environmental perception and understanding (Adams et al., 2016). These strategies are illustrated in Figure 2.1, and represent three different, but overlapping strategies companies can use to integrate economic, environmental, and social sustainability into their business. In this thesis, understanding these sustainability strategies provides the foundation to frame strategies for circular economy, and opportunities for companies to integrate sustainability and circular economy into their business.

The first strategy, operational optimization, focuses on a factory and process scope, while the second, organizational transformation, focuses on collaboration in supply chains and a company's immediate network. The third strategy, systems building, extends beyond individual companies and requires systemic changes at the meso- and/or macro-level to identify and implement novel circular solutions. This indicates that the span of influence and the companies' role change during the shift from operational optimization to systems building. As the first strategy focuses on internal processes, companies have the most influence on this compared to organizational transformation, which requires collaborations, and lastly, in systems building, companies are one of several actors that work collaboratively to change systems and reshape society.

	OPERATIONAL OPTIMIZATION	ORGANIZATIONAL TRANSFORMATION	SYSTEMS BUILDING
Focus	Compliance and efficiency	Novel products, services or business models	Novel products, services or business models through new collaborations
Drivers	Regulation Economic benefits	New markets	Reshaping society Changing the game
Interactions	Organizational	Inter-organizational	Societal
Sustainability outcome	Less harm to the environment	Shared value for multiple stakeholders	Net positive impact in society
Organizational outcome	Incremental improvements to business-as-usual	Improvement of sustainability performance	Extends beyond the company to drive institutional change

Figure 2.1. Sustainability strategies in companies, adapted from Adams et al. (2016).

Operational optimization

The first strategy focuses on ensuring compliance and improving production processes' efficiency through cleaner production, eco-design, and general efficiency (Adams et al., 2016; Schaltegger et al., 2012). This strategy is associated with the environmental perception of *pollution prevention* and focuses primarily on environmental impacts and problems within the company's boundaries. The primary driver of sustainability in companies that employ this strategy is regulation or economic benefits that are obtained from improved efficiency (Adams et al., 2016; Schaltegger et al., 2012). Thus, the company's sustainability profile is generally *traditionalist*, with no or limited strategic sustainability initiatives (Formentini and Taticchi, 2016), which can be linked to a *defensive* corporate sustainability strategy (Schaltegger et al., 2012). Thus, the outcome is limited to reducing environmental harm and is often a result of a reactive strategy. Companies that orient their sustainability efforts to operational optimization focus on reducing material input, improving resource-efficiency, integrating better waste management, and controlling pollution (Adams et al., 2016). These initiatives can be integrated through incremental improvements to business-as-usual without fundamental changes in processes, product design, and business models, as the goal is to be *"doing the same things but better"* (Adams et al., 2016, p.188). The scope of interactions in this strategy is focused primarily on organizational boundaries and applies an individual company perspective (Boons and Lüdeke-Freund, 2013), and application of traditional supply chain management, where the focus is on high-volume, efficiency, and low prices (De Angelis et al., 2018). However, companies may also need to involve external experts

to gain insights into appropriate sustainability tools and their implementation (Adams et al., 2016). The focus is on exploiting existing knowledge, capabilities, and tools, which limits the extent of sustainability innovation possible.

Organizational transformation

The second strategy entails a shift in perspective, as the scope expands beyond optimizing the company' internal processes and doing less harm, to creating shared value for multiple stakeholders (Adams et al., 2016). Sustainability is no longer an "add-on" for companies, but becomes integrated in business practices through, for example, lifecycle thinking, environmental management systems, voluntary labelling, and CSR initiatives. Therefore, this sustainability strategy represents the *continuous improvements* and *lifecycle perspective* presented in Table 2.1. The drivers are often a clearly articulated sustainability strategy where sustainability efforts are emphasized and awarded internally or driven by the opportunities to expand to new markets with sustainability-oriented products, services, or business models. The point of departure in innovation can be expected to rest on a sustainability profile of *sustainability practitioners*, as there is a clear focus on sustainability, but not necessarily strategically addressing sustainable development (Formentini and Taticchi, 2016). This is also consistent with a corporate sustainability strategy that is *accommodative*, in which sustainability issues are integrated into the business, but innovation processes are limited by current business logic (Schaltegger et al., 2012). Initiatives made in companies that employ this strategy apply a mix of organizational and inter-organizational boundaries (Boons and Lüdeke-Freund, 2013), in which immediate stakeholders in the supply chain are included, e.g., through sustainable supply chain management, environmental management systems, supplier code-of-conduct, or by incorporating customer feedback into development processes (Adams et al., 2016; De Angelis et al., 2018). Thus, the scope of interactions is broadened to the supply chain, where companies often focus on the upstream chain as the greatest impact often occurs here, and the sustainability effect can be expected to be greater (Adams et al., 2016). In addition to the external focus on the supply chain, companies also focus on improving communication between internal departments, and developing a sustainability culture. This strategy entails improving existing business models' sustainability, but rarely involves radical innovation in the core business (Schaltegger et al., 2012).

Systems building

The third strategy involves more radical changes through new perceptions of the companies' role and applies a collaborative network perspective on system innovations. The key feature of this strategy lies in the fact that it extends beyond the individual company and requires collaborative system innovations. This strategy is based on radical transformations of the production and consumption systems, which entail technological, social, cultural, institutional, and organizational change (Bocken et al., 2014; Ceschin and Gaziulusoy, 2016; Loorbach, 2010). However, companies play an important role in such collaborative system innovations, which require radical changes to integrate sustainability into their core, as incremental innovation in

companies focused on operational optimization and/or organizational transformation will not be sufficient to achieve a more sustainable society (Brown et al., 2019; Ceschin and Gaziulusoy, 2016). This strategy represents the perception of *sustainable development* and *system innovations* in Table 2.1. Companies that engage in this sustainability strategy employ at least a *proactive* corporate sustainability strategy (Schaltegger et al., 2012) and a sustainability profile of a *sustainability leader* (Formentini and Taticchi, 2016), but additional efforts are needed, as the initiatives extend beyond the company and companies are seen as only one of many actors in system innovation processes (Adams et al., 2016; Ceschin and Gaziulusoy, 2016). The drivers to engage in this sustainability strategy extend beyond traditional drivers, such as cost and risk reductions, increased sales and profit margins, reputation and brand value, etc. (Schaltegger et al., 2012), as companies are driven by creating a positive impact, changing the rules of the game and *"doing good by doing new things with others"* (Adams et al., 2016, p. 192). Companies that work with this sustainability strategy apply a societal perspective and collaborate with multiple stakeholders to develop novel products, business models, and systems (Adams et al., 2016; Boons and Lüdeke-Freund, 2013). A key prerequisite in this strategy is the understanding that individual companies cannot achieve sustainable development, but instead, it requires partnerships and collaboration in existing and new networks. Therefore, the focus changes to pursuing sustainable development collaboratively rather than individually and entails a view of sustainability as a socio-technical challenge to be solved on a system level (Ceschin and Gaziulusoy, 2016). For companies, the dependency on stakeholders increases when engaging in this sustainability strategy, and *"…with this interdependency has come a realization that cooperation and partnership are essential prerequisites for the achievement of longterm mutual benefit"* (Christopher and Jüttner, 2000, p.117). The initiatives for building systems often entail radical innovation of the core business, products, and value propositions. However, as sustainable development is not something that an individual company can achieve, companies' role as systems builders is to initiate, mobilize, inspire, and lead the change (Adams et al., 2016).

FURNITURE INDUSTRY
sustainability strategies

Operational optimization
Efforts to enhance production's cost-effectiveness within the furniture industry have been associated primarily with offshoring, automatization of production (e.g., to enable flatpacks and lost cost mass production) or the development of high-quality niche production centered around classic Danish design (Hedemann and Nissen, 2013).

Organizational transformation
The furniture industry has focused its attention on developing sustainable supply chains and ensuring sustainable materials, e.g., through FSC or PEFC certified wood, and through new product design that focuses on customer needs (Lifestyle & Design Cluster, 2018). Many furniture companies in Denmark have either hired interior designers or work closely with them to design interior solutions, e.g., for new buildings, company relocations, etc.

Systems building
Furniture companies are considering the wider system in which they operate increasingly, where, e.g., the relevance of furniture in such building certifications as LEED, WELL, and DGNB is considered, and companies collaborate more widely to ensure compliance with these criteria. In addition, an increase in broader value propositions is also evidenced in the furniture industry, where new partnerships are established with the goal to become total service providers, e.g., by moving old furniture, refurbishing new, developing innovative interior design solutions, etc (Lifestyle & Design Cluster, 2018). Finally, changes are made to the furniture system through requirements to reuse, refurbish, and recycle, e.g., in France, where companies that place furniture products on the French market are responsible for collection and waste management or will be subject to increased tax (Code de l'environnement article L541-10-6). To meet this requirement, the industry has joined to establish the non-profit organization Éco-mobilier to manage reusing and recycling furniture through partnerships and collaborations.

Box 2.2. Sustainability strategies in the furniture industry

Characteristics of sustainable business development

The three strategies are separate, yet overlapping and nested, and companies can be expected to employ hybrid strategies that are rooted in one but include elements of the others. The three sustainability strategies can also be seen as a process of sustainable business development (Adams et al., 2016; Mohrman and Worley, 2010), which can be characterized by the following (Adams et al., 2016):

- From *technology* (technical tools) to *people* (socio-technical systems)
- From *insular* (focused on the company itself) to *systemic* (company as part of an organizational ecosystem)
- From *stand-alone* (individual internal units/departments) to *integrated* (embedded in culture and structures)

In addition to these three characteristics, attention to understanding value is also important for sustainable business development, as it broadens from cost reductions and maximizing shareholder profit to shared value from a CSR perspective, and lastly, a broader understanding of value in building systems, where the scope broadens to societal value that extends beyond shared value. Therefore, sustainable business development requires changes in companies, in which they need to redesign structures, increase stakeholder collaboration, work processes, goals and metrics, and rethink capabilities for sustainability (Mohrman and Worley, 2010). Companies' initiatives have developed from a focus on end-of-pipe solutions, such as cleaner production technologies in production processes, to cleaner products, ecodesign, environmental management, circular economy strategies, and system innovations (Adams et al., 2016; Carrillo-Hermosilla et al., 2010; Remmen, 2001). Companies' role is changing from being focused primarily on internal processes and technological improvements to an inter-organizational, societal, and systemic role that focuses instead on collaboration and partnerships with other stakeholders to achieve system innovations (Carrillo-Hermosilla et al., 2010; Geissdoerfer, 2018a; Prieto-Sandoval et al., 2018).

Thus, becoming a sustainable business requires fundamental changes rather than optimizing the existing organization (Loorbach and Wijsman, 2013) and broadening the scope from product innovations to socio-technical system innovations (Ceschin and Gaziulusoy, 2016). Companies have engaged in sustainable business development for several years by applying different sustainability strategies; however, more recently, this has been linked to circular economy, which is an emerging sustainability paradigm that is consistent with the sustainability strategy of systems building (Adams et al., 2016; Brown et al., 2019). Although circular economy is linked primarily to the systems building strategy, some elements have been integrated into the strategies of operational optimization and organizational transformation as well, such as resource-efficiency, waste minimization, and recycling (Gusmerotti et al., 2019). The following section clarifies the concept of circular economy and elaborates the five circular strategies introduced in Chapter 1.

2.2. CIRCULAR ECONOMY

The concept of circular economy has gained traction during the past decade, and has become a trending topic in industry, academia, and policy as a new sustainability paradigm that supports sustainable development (Geissdoerfer et al., 2017). In this thesis, a broad perception of circular economy is applied to encompass different strategies that support its development.

2.2.1. A BRIEF HISTORY OF CIRCULAR ECONOMY

Many scholars have investigated the history of circular economy, e.g., Ghisellini et al. (2016), Blomsma and Brennan (2017), Murray et al. (2017), Reike et al. (2018), Borrello et al. (2020), and Calisto Friant et al. (2020). These reviews of circular economy's origins provide similar accounts of it that build on several schools of

thoughts (as also introduced in Chapter 1), and according to Borrello et al. (2020), the concept of circular economy incorporates principles from different schools of thought and combines these into a new narrative that can inspire policy actions. The roots of circular economy are found in the strategies and perceptions presented in Table 2.1, where environmental protection, pollution prevention, and improved waste management can be seen as part of the *preamble* that leads to a conceptualization of circular economy (Blomsma and Brennan, 2017; Remmen, 2001). The following *excitement period* for circular economy (cf. Blomsma and Brennan, 2017) was associated with continuous improvements, a lifecycle perspective, and sustainable development (see Table 2.1), in which companies' sustainability strategy changed from primarily defensive and reactive to more proactive (Blomsma and Brennan, 2017; Remmen, 2001; Schaltegger et al., 2012). The excitement period culminated in the beginning of the 2010s, when the Ellen MacArthur Foundation presented the most widespread conceptualization of circular economy, which has also been described as the turning point in circular economy development, where the concept proved successful in spreading from research to business and policy (Borrello et al., 2020).

With the concept's diverse history, scholars have described circular economy appropriately as an *umbrella concept* (Blomsma and Brennan, 2017; Homrich et al., 2018), as it can be viewed as a general term for activities that seek to reduce, reuse, and recycle materials in production, distribution, and consumption (Murray et al., 2017). Thus, many different definitions of the concept have been presented, but without a coherent understanding of it, the concept is at risk of collapsing because of *"…permanent conceptual contention, not only in research, but also in practice"* (Kirchherr et al., 2018, p. 228), which represents the current period of circular economy development to which Blomsma and Brennan (2017) referred as the *validity challenge period*. To resolve some of the challenges surrounding the concept of circular economy and further a systemic perspective, Calisto Friant et al. (2020) proposed a new discourse of circular society to foster a broader understanding of circular economy to prevent the concept from becoming *"…discredited as a refurbished form of greenwashing."* (Calisto Friant et al., 2020, p.15). With the plurality of definitions available, there is no need to add yet another in this study, and thus increase the risk of concept collapse. Instead, this study rests on the meta-definition Kirchherr et al. (2017) presented, which is given in Chapter 1 (p.2). This definition provides a comprehensive overview of circular economy's key aspects, which offers a broad understanding of different areas relevant to the development of a sustainable circular economy.

2.2.2. CIRCULAR ECONOMY STRATEGIES

To define and conceptualize circular economy further, this section elaborates the five circular economy strategies shown in Table 1.1 with the goal to frame the understanding of circular economy applied in this study, and the different strategies companies can apply when working with circular economy solutions. As this thesis

builds on the concept of circular economy, a clear understanding of the concept is important to address the potentials of circular economy to support sustainable business development. Thus, this study adopts the framework of circular product design and business model strategies as Bocken et al. (2016) introduced first, and Konietzko et al. (2020) developed further. The framework Bocken et al. (2016) presented introduces three circular strategies: Narrowing; slowing and closing resource flows, which was expanded by Konietzko et al. (2020) with the strategies of regenerating and informing resource flows. This framework is shown in Figure 2.2. The four strategies of regenerating, narrowing, slowing, and closing, are essential strategies of circular economy, while informing is a supporting strategy. These five provide the framework of circular economy adopted in this study:

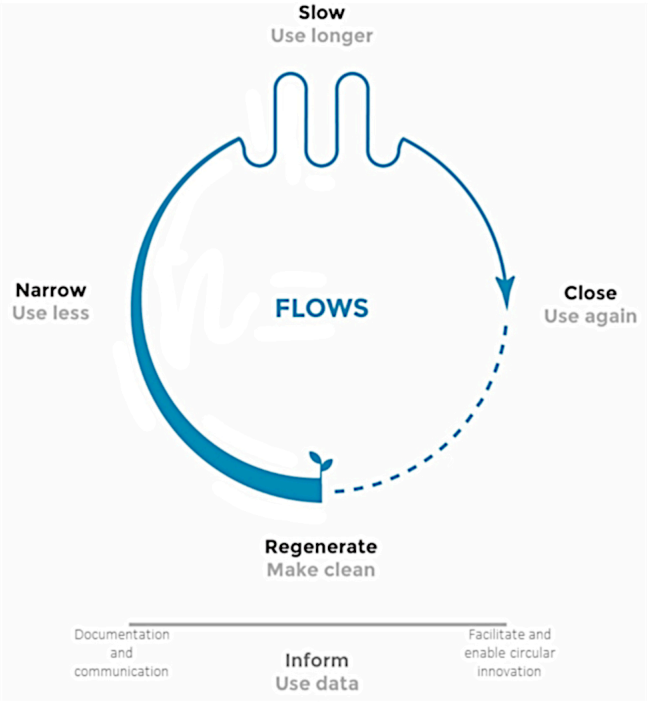

Figure 2.2. Circular economy conceptualization, adapted from (Konietzko et al., 2020, p. 5)

Regenerating resource flows refers to using renewable and nontoxic materials and renewable energy in processes and builds on the notion of cleaner production (Konietzko et al., 2020; McDonough and Braungart, 2002). This strategy focuses primarily on the biological cycle of circular economy (Morseletto, 2020), but ensuring clean and safe input and the use of renewable energy are also relevant in the technical cycles (Konietzko et al., 2020).

Narrowing resource flows refers to using fewer resources, components, products, and energy during all lifecycle stages, i.e., design, production, delivery, use, and recovery (Bocken et al., 2016; Konietzko et al., 2020). The strategy reflects the principles of reduction, resource-efficiency, and eco-efficiency, which have been established in industries for many years (Reike et al., 2018). In the light of circular economy, it is important to note that narrowing resource flows does not influence the speed of product flows, and considering only this strategy may lead to *"…further speeding up of linear resource flows (selling more of a more efficient product), resulting in very little overall savings"* (Bocken et al., 2016, p.310).

Slowing resource flows refers to using resources, components, and products longer and intensifying the use period, e.g., through design to extend product life, providing products as a service, etc. (Bocken et al., 2016; Konietzko et al., 2020). This strategy entails a wide range of ways to slow resource flows, such as maintaining, repairing, reusing, remanufacturing/refurbishing, etc. (Konietzko et al., 2020). The Ellen MacArthur Foundation (2013) presented all of these as the inner circles.

Closing resource flows refers to using materials again through recycling and focuses on recirculating post-consumer waste (Konietzko et al., 2020). Thus, closing resource flows relates to the well-known waste management strategy of recycling, which has become established in the waste hierarchy because it is more favorable than energy recovery through incineration and disposal through landfill (European Commission, 2008). However, from the perspective of circular economy, recycling represents the least sustainable option (Ghisellini et al., 2016; Stahel, 2013), and can be seen as the last option, when the flow of products and resources has been narrowed and slowed as much as possible.

Informing resource flows refers to using information technology as a support strategy for other circular economy strategies (Konietzko et al., 2020). Several information technologies have been highlighted as potentially helpful to circular economy, e.g., artificial intelligence (Ellen MacArthur Foundation, 2019), Internet-of-Things (Ingemarsdotter et al., 2019), and big data (Jabbour et al., 2019). However, it is important to emphasize the supporting and helpful role of information technology in circular economy, as information technology can support circular strategies, but does not represent a circular strategy in itself (Konietzko et al., 2020). In this thesis, a dual understanding of the informing strategy is applied, and is characterized by the differences in the reason to use information technology; the first focuses on circular innovation through information technology, while the second focuses on using information technology to facilitate communicating and documenting circular efforts.

These five strategies provide the foundation for the understanding of circular economy applied in this thesis, as they are mutually beneficial and allow the changes needed for companies to develop circular economy to that is framed through initiatives that attempt to regenerate, narrow, slow, close, and inform resource flows (Konietzko et al., 2020). These strategies allow an understanding of the way products

and materials could flow in circular economy; however, from a company perspective, operationalizing these strategies requires both technical and organizational expertise (Blomsma and Brennan, 2017; Brown et al., 2019).

FURNITURE INDUSTRY

circular economy strategies

Regenerate

This strategy has been implemented for years with FSC- or PEFC-certified wood that ensures sustainable forestry, and as wood is the material used most in the furniture industry , increased attention to regenerating resource flows and ensuring clean input is important in the industry (Lifestyle & Design Cluster, 2018). Further, attention to chemicals in furniture products has also been an element of practice for the past decade and remains important to ensure circular flow.

Narrow

Optimization efforts have been implemented primarily to reduce material consumption, production costs, etc. (Ecores et al., 2018). The potential to narrow resource flows further can be found, for example, in relation to minimizing off-cuts from production, light-weight products etc.

Slow

Slowing initiatives have been in place for years through secondhand shops and private secondhand sales. However, these are small-scale, and often voluntary, which indicates that there are good opportunities for furniture companies to explore this strategy further, particularly as the primary environmental impact from furniture stems from production processes, such that prolonging furniture's lifetime can reduce the environmental harm from a lifecycle perspective (Donatello et al., 2017; Ecores et al., 2018).

Close

Strategies for closing resource flows have focused primarily on using recycled content in new products, e.g., by using production waste from wood processing to manufacture different fiberboards, e.g. LDF, MDF, HDF, and OSB, or using recycled metal and plastic in new products (Lifestyle & Design Cluster, 2018).

Inform

Digital communication and documentation of circular initiatives are used widely, while circular innovation through information technology is implemented to a lesser extent. Some digital experiments have been conducted concerning, e.g., 3D printing, such as using furniture waste to produce composite materials used in 3D printing (Pringle et al., 2018), or optimizing the use of shared office spaces through sensor technology (Šimek and Fictum, 2019).

Box 2.3. Circular economy strategies in the furniture industry

To understand further what each of these strategies entails for companies, different re-principles are used that cover both products, business models, production, and more systemic principles (see Table 2.2). These principles are based firstly on the 3R framework (reduce, reuse, recycle), which is the terminology used most often in circular economy research (Ghisellini et al., 2016; Schöggl et al., 2020). This was extended further in the EU Waste Framework Directive to 4R (3R + recover) (European Commission, 2008). In addition to the 3R and 4R frameworks, other re-frameworks have also been developed to cover a wide range of re-principles, e.g., 6R (4R + remanufacture and redesign) (Joshi et al., 2006) and 9R (4R + refuse, rethink, repair, refurbish, remanufacture, and repurpose) (Potting et al., 2017). Building on the 9R framework, Blomsma et al. (2019) presented a Circular Strategies Scanner, which adapted the re-principles from the 9R framework and included new re-principles of, e.g., reinvent, reconfigure, and replace. This broader conceptualization of re-principles was chosen, at it allows a nuanced understanding of different strategies companies can apply to advance circular economy implementation. Further, the re-principles Blomsma et al. (2019) included allow an improved connection between product and process-oriented re-principles and organizational and system-oriented re-principles.

The relation between the different re-principles is emphasized through the flow of circular strategies in Figure 2.2. Taking regenerating flows as the point of departure can ensure the right input to circular flows that focus on renewable and regenerative resources and replace harmful substances with pure, non-toxic substances. Thus, regenerating resource flows is intended to ensure the best possible input to create cyclical flows. Following this strategy, the concept of narrowing, slowing, and closing flows resonates with the 3R framework of reducing, reusing, and recycling, respectively (Bocken et al., 2016; Ghisellini et al., 2016; Konietzko et al., 2020; Prieto-Sandoval et al., 2018).

The different re-frameworks have in common a hierarchy between the principles, and within the 3R framework, reducing has higher priority than reusing, which is prioritized over recycling. This prioritization of principles is also emphasized in relation to circular economy, e.g., by the Ellen MacArthur Foundation (2013), which highlighted the *power of the inner circle* and the *power of circling longer*, which prioritizes repairing, maintaining, and long product lifetime over reusing, which is prioritized over refurbishing/remanufacturing, while recycling is the least sustainable and favorable circle of circular economy, but is still prioritized over recovery through incineration. The re-principles presented in Table 2.2 also represent prioritizations within the strategies of narrowing, slowing, and closing, while the re-principles of regenerating are considered more equal, which is also the case for the re-principles that span the other strategies.

Table 2.2. Circular economy strategies and re-principles, based on Konietzko et al. (2020), Potting et al. (2017), and Blomsma et al. (2019).

Strategy	Re-principle	Description
-	Reinvent	Reinventing systems and business logic to strive for full decoupling and circularity
-	Reconfigure	Reconfiguring value generation architecture for circular flows
-	Rethink	Rethinking consumer needs and potentials to fulfil needs through innovative solutions
-	Refuse	Making products redundant by abandoning their function or by offering the same function with radically different products, services, or solutions (sufficiency)
Regenerate	Replace	Substituting toxic chemicals and materials in products and production processes with non-toxic alternatives
	Renew	Using renewable materials in products, and integrating renewable energy and materials in production and consumption processes
	Regenerate	Promoting activities that manage and sustain natural ecosystem services and regenerate polluted ecosystems
Narrow	Reduce	Increasing efficiency in product manufacturing, distribution, and use by reducing consumption of resources, materials, and energy. Making products' use more intensive, e.g., through sharing or by placing multi-functional products on the market.
Slow	Repair	Repairing and maintaining (corrective or predictive) defective products so they can be used according to their original function
	Reuse	Another consumer's reuse of discarded products that are still in good condition and fulfil their original function
	Refurbish	Bringing a discarded product up to date to fulfil the same function
	Remanufacture	Using parts of discarded products in new products with the same function
	Repurpose	Using discarded products or parts in new products with a different function
Close	Recycle	Processing materials to obtain the same (high grade) or lower (low grade) quality
-	Recover	Incinerating materials with energy recovery or composting materials to recover biological nutrients

From Table 2.2, it becomes clear that circular economy encompasses not only the strategies of regenerating, narrowing, slowing, closing, and informing, but also entail re-principles and system innovations that extend beyond these five and also consider a more systemic position through reinventing and reconfiguring existing systems and organizations. In addition, viewing sustainability as a socio-technical challenge emphasizes the need to expand the focus from designing products and business models with re-principles in mind to designing system innovations and transitions (Ceschin and Gaziulusoy, 2016).

As circular economy implies a shift from singular strategies to systemic solutions, it is necessary to understand the relation between different strategies to create synergies between different circular strategies and re-principles (Blomsma and Brennan, 2017). However, these re-strategies do not cover all aspects of circular economy fully, as they focus predominantly on a product/service level and are internal to companies. The systemic nature of circular economy can be lost easily in such a conceptualization if the wider context and system are not included. The re-principles of reinventing, reconfiguring, and rethinking provide the first indications of potential system innovations; however, further attention must be given to socio-technical system innovations (Ceschin and Gaziulusoy, 2016). Achieving such system innovations for sustainable development requires interwoven innovations in products, business models, and social practices (Ceschin and Gaziulusoy, 2016). While ownership is at the core of the current consumption model, transforming consumption to circular economy requires changes in this model through innovative collaborative consumption models (Ghisellini et al., 2016). Such models are based on concepts of sharing, lending, trading, renting etc., which entails shared ownership between multiple consumers/users. However, such change from ownership to usership in circular economy presents one of the strongest potential barriers, as it challenges traditional values associated with ownership in the current consumption model (Sempels and Hoffmann, 2013; Tukker, 2015).

In light of the system innovations required to achieve circular economy, companies' role and potential can be seen in two ways: 1) What is possible from the company's position, and 2) what needs to be changed in other parts of the system. This does not suggest that companies do not play a role in both, but rather acknowledges their limitations and highlights the importance of collaborative innovation in circular economy (Brown et al., 2019; Kraaijenhagen et al., 2016; Niesten et al., 2017).

2.3. CIRCULAR BUSINESS DEVELOPMENT

From the previous sections, the increase in environmental understanding over time and the sustainability strategies companies have applied demonstrate a continuous broadening of their scope, focus, and outcomes, which in recent years, have focused particularly on circular economy strategies. This development and the strategies presented should not be seen as replacements, but must be viewed as nested and additions to existing practices and solutions. This means that solutions for, e.g., environmental protection and pollution prevention still are relevant and applicable, but have been expanded and supported by the addition of continuous improvements and sustainable development. This development and expansion of understanding needs to be explored further, as the practical implementation of circular economy still appear to be limited, as presented in Section 1.2. The three characteristics of sustainable business development also apply to circular business development, as the solutions and practices also change from technology to people, from insular to systemic, and from stand-alone to integrated (Adams et al., 2016).

Focusing on companies established in the linear economy, integrating circular economy in their business requires redesigning existing, or developing new, products, services, business models, practices, and structures within them, as well as new value chain relations up- and downstream (De Angelis et al., 2018; Govindan and Hasanagic, 2018; Hopkinson et al., 2020; Jørgensen and Remmen, 2018). Further, these changes can be supported through enabling factors within the organization, such as an environmentally-supportive company culture (Rizos et al., 2016) and through supportive external conditions, such as policies that favor circular economy (de Jesus and Mendonça, 2018). However, the lack of such supportive factors and conditions are also seen as barriers to circular economy (Garcés-Ayerbe et al., 2019; Guldmann and Huulgaard, 2020; Kirchherr et al., 2018).

To conceptualize business development for circular economy in this thesis, a simplified conceptual model of its key determinants is presented in Figure 2.3. This conceptualization is inspired by Prieto-Sandeval et al.'s (2018) application of eco-innovation determinants to circular economy. The conceptual model begins with the way companies are influencing, and influenced by, supply-demand mechanisms and framework conditions, such as policy and regulation. The following sections clarify the conceptual foundation for this thesis and build on key elements from the conceptual framework. The first element focuses on the framework conditions and collaboration that encompass the remaining elements of the supply-demand mechanisms and the internal business organization. These three elements constitute the conceptual framework applied in this thesis, and for the purpose of clarity, they will be presented separately, although they are connected and overlapping. As with any model, their complex nature may be lost in an attempt to simplify model elements to communicate better. The simplicity of this framework is not to be misunderstood as simplicity in practice; broadly speaking, the conceptual framework allows an overview of relevant topics to consider in relation to circular business development.

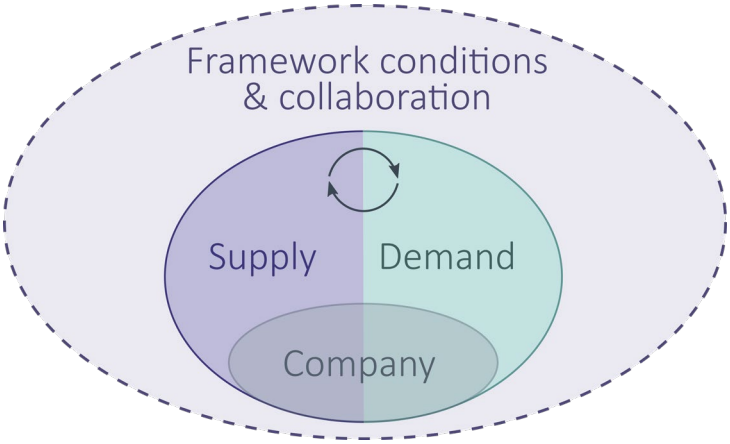

Figure 2.3. Conceptual framework, developed by author

2.3.1. FRAMEWORK CONDITIONS AND COLLABORATION

Regulation and policy provide the legal framework for circular economy, which supports actions related to production and consumption (Prieto-Sandoval et al., 2018). When establishing appropriate framework conditions for circular business development, attention must be given to circular economy conceptualizations, strategies, and indicators to measure progress. In addition, supportive and favorable system conditions to develop new cross-industrial collaborations for circular solutions have also been emphasized (Ellen MacArthur Foundation, 2013).

Regulation and policy

Regulation and policy that influence production and consumption patterns can pave the way to implement circular economy, and policy is presented as a key driver of circular economy (Cainelli et al., 2020; Govindan and Hasanagic, 2018; Milios, 2018; Prieto-Sandoval et al., 2018). As introduced in Section 1.1.1, efforts are made to advance the policy arena for circular economy by revising existing policies or defining new ones to support circular economy strategies. However, as Milios (2018) and Hartley et al. (2020) pointed out, it is still necessary to further a systemic perspective on circular economy policies to ensure a coherent policy mix that supports circular economy initiatives from a lifecycle perspective. The current policy landscape for circular economy within the EU includes both mandatory and voluntary policy instruments and represents a complex policy landscape (Domenech and Bahn-Walkowiak, 2019). Within the EU, policies for circular economy have been framed primarily in terms of revising the Waste Framework Directives to achieve higher recycling targets and the Ecodesign Directive, which includes repairability, durability, and increased focus on resource-efficiency (Bundgaard et al., 2017; Domenech and Bahn-Walkowiak, 2019). However, as circular economy needs more than technical policy measures, Ghinoi et al. (2020) concluded that targeted policy interventions are

needed to create and support networks and knowledge sharing between stakeholders in circular economy.

In addition to legislative actions, several strategies are presented that encourage voluntary actions within the EU, and public procurement is often presented as an important instrument to promote horizontal objectives, such as circular economy, in addition to functional objectives (Arrowsmith, 2010; Milios, 2018). Alhola et al. (2019) and Klein et al. (2020) also emphasized the potential to promote circular economy through public procurement; they argued that, although great potential exists for circular public procurement, significant barriers also hinder further acceptance, e.g., because of lack of knowledge, experience, and capabilities in public procurement departments, the dominant emphasis on price rather than quality, and lack of collaboration and interaction with markets and stakeholders.

In the national circular economy strategy, the Danish Government also emphasized the need to create favorable conditions for companies to explore circular economy, as several initiatives focus on helping industry shift to circular economy (Miljø- og Fødevareministeriet, 2018). This includes supporting business development and increasing Danish efforts in international standardization for circular economy, promoting circular public procurement, and harmonizing the Danish waste management system (Miljø- og Fødevareministeriet, 2018).

Standardization and indicators

In addition to regulations and policies, framework conditions for circular economy also require industry standards for it to be established (Ellen MacArthur Foundation, 2013). In recent years, attention to standardization for circular economy has increased, e.g., through development of management standards to help organizations implement circular economy (AFNOR, 2018; BSI, 2017; ISO, 2019). Although these standards may support more harmonized ways to do so, companies still lack standardized ways to monitor their progress (Corona et al., 2019; Pauliuk, 2018). Without common agreement and guidance on what is important when implementing and measuring circular economy, Pauliuk (2018, p.89-90) concluded *that "…there is a danger that a pool of incoherent circular economy indicators will evolve and organizations, left without specific guidance on monitoring and assessment, cherry-pick results that fit their corporate message but not necessarily contribute to the wider circular economy and sustainability goals."* Because of the multitude of different definitions and understandings of circular economy, what and the way to measure it remains debated; nonetheless, the need to monitor and measure progress is not (Elia et al., 2017; Moraga et al., 2019; Parchomenko et al., 2019).

Collaboration and partnerships

In developing circular economy as part of sustainable development, it is assumed that all stakeholders involved must acquire new knowledge, resources, competences, and capabilities, and collaborate to innovate systems (Brown et al., 2019; Prieto-Sandoval et al., 2019). However, although stakeholders acquire new knowledge and skills regarding circular economy, the shift to circular economy may not necessarily be realized. All actors and stakeholders involved need to share knowledge, and sustainable systems innovations *"…can only be realized by a certain level of concerted action by stakeholders related to this system; this implies that mutual learning and collaboration are essential to bring sustainable innovations about"* (Quist and Tukker, 2013, p.168). For circular economy, new configurations of value chain relations and collaborations are required to facilitate circular production and consumption systems (Jørgensen and Remmen, 2018). Thus, companies are changing the way they interact with their surrounding environment (Govindan and Hasanagic, 2018; Prieto-Sandoval et al., 2018), and Geissdoerfer et al. (2018a) highlighted pro-active multiple stakeholder management and the application of a long-term perspective as additional elements companies need when engaging in business development for a sustainable circular economy through circular business models and supply chain management.

Therefore, identifying relevant stakeholders is key to further circular economy acceptance and implementation. In relation to circular supply chain management, Farooque et al. (2019) identified parts/product manufacturers, service providers, consumers, and users as key stakeholders. Govindan and Hasaganic (2018) conducted a systematic review of circular economy in supply chain and identified five key stakeholders: Consumers; society; the organization; suppliers, and the government. The authors concluded that furthering circular economy implementation requires a multi-stakeholder perspective and emphasized that it is all stakeholders' shared responsibility (Govindan and Hasanagic, 2018). Circular economy also entails new roles of the stakeholders involved, e.g., in models of collaborative consumption, and sharing and renting, in which consumers participate in new systems of using rather than owning, which necessitates a different role, increased responsibility, and different relationships with other stakeholders. Thus, a broad understanding of stakeholders is necessary for companies to be able to embed circular economy strategies in all stages of the value chain (Ellen MacArthur Foundation, 2013; Gusmerotti et al., 2019) through new inter-organizational relations that expand traditional organizational boundaries (Boons and Lüdeke-Freund, 2013; Ruggieri et al., 2016). However, as Guldmann and Huulgaard (2020), companies can be reluctant to involve value chain partners up- and downstream and often lack trust in these relationships. Without trust and continuous efforts to develop these relationships, companies can be expected to struggle to establish inter-organizational collaborations and partnerships (Christopher and Jüttner, 2000; Vanpoucke et al., 2014).

Ranta et al. (2019) emphasized that value propositions in circular economy extend beyond traditional product/service offerings and involve value co-creation processes

between different actors in a wider ecosystem. Parida and Wincent (2019) also emphasized such value co-creation and extended co-creation processes further from inter-organizational collaborations to a network perspective. In general, a broader value perspective is considered in circular economy, with emphasis on environmental, economic, and social value that includes a multi-stakeholder and shared value perspective rather than primarily a customer and shareholder perspective (Lüdeke-Freund et al., 2019).

2.3.2. SUPPLY-DEMAND MECHANISMS

A broad perspective is applied to supply and demand in this thesis, in which supply is understood in broad terms as any company input (e.g., materials, components, knowledge, staff, etc.), while demand is understood as customers, consumers, and users within circular economy. The dynamic relation between supply and demand can be expressed through sustainable production and consumption, in which different mechanisms affect the supply and production side and the demand and consumption side. With the Rio Summit in 1992, the joint concept of sustainable production and consumption emerged as a global agenda that emphasized the inter-relation between the concept of sustainable production and consumption (Roy and Singh, 2017). Korhonen et al. (2018) also noted the importance of integrated production-consumption systems in circular economy. In this thesis, considerations are given primarily to the material perspective of supply, circular supply chain management, and customers and users' role.

Material input

Within circular economy, the reliance on new raw materials is supposed to decrease with increasing circulation of materials already in the loop, which leads to reduced demand for primary raw materials and reduced material expenses (Fellner et al., 2017). Thus, companies can employ different strategies to mitigate material supply vulnerability, in which recycling, lean manufacturing, and dematerialization have been highlighted (Gaustad et al., 2017). This emphasizes improved waste management practices and technology to allow material flows to be closed with high quality recycling of materials, as well as product and production innovations.

In 2008, the EU presented the Raw Materials Initiative, which included initiatives to secure supply and mitigate supply risks from the high dependency on imported materials (particularly metals), as well as an increased focus on resource efficiency and recycling (Commission of the European Communities, 2008). In addition, the flagship initiative for a resource-efficient Europe has provided a long-term framework for action, investments, and innovation (European Commission, 2011). Thus, resource efficiency and recycling are seen as important strategies to manage potential material risks.

Circular supply chain management

The concept of circular supply chain management builds on several supply chain concepts, such as the green and closed-loop supply chains, industrial symbiosis, and reverse logistics; however, the novelty of circular supply chains lies in the explicit considerations of restoring and regenerating resources through system-wide innovations that involve all stakeholders from a lifecycle perspective (Farooque et al., 2019; Lahane et al., 2020). Another aspect of circular supply chains is the broadened scope of flows, as they deal not only with product flows, as in linear supply chains, but also by-products, waste materials, and return products, either in the same or across different industries, and thus require networks of companies rather than traditional buyer-supplier relations (Batista et al., 2018; De Angelis et al., 2018; Lopes de Sousa Jabbour et al., 2019). Although circular economy emphasizes regenerating, narrowing, slowing, and closing resource flows (Konietzko et al., 2020), the majority of research on circular supply chains focuses on one particular closing strategy, extending resource value (Lahane et al., 2020). Furthering other circular strategies in supply chains requires increased collaboration, and Julianelli et al. (2020) highlighted the importance of promoters and relations in reverse logistics for circular economy, in which shared responsibility for returning products and parts, trust between stakeholders, and creating collaborations creates the foundation for value creation.

While a linear economy provides a clear distinction between up- and downstream relations, this distinction blurs in circular economy, because of the return flow of products, parts, and materials, and thus can benefit from a network perspective on value chain relations (Batista et al., 2018; De Angelis et al., 2018; Parida and Wincent, 2019); further, a higher degree of collaboration and partnerships are needed because of circular economy's systemic nature (Brown et al., 2019).

Customers and users

Customers and users' role in circular economy has been emphasized in relation to product return and changes in ownership structures, as product-service systems, such as pay-per-use or leasing models, are highlighted as potential methods to support circular economy strategies (De Angelis et al., 2018; Fernandes et al., 2020; Pieroni et al., 2019b). However, in comparison with literature concerning the production side of circular economy, less attention has been given to aspects of consumption (Camacho-Otero et al., 2018; Schöggl et al., 2020).

Consumers and users' responsibility increase in circular economy, and they are expected to participate more actively in its activities (Ghisellini et al., 2016). Close interactions can be expected between companies and customers, consumers and users in circular economy; however, these interactions differ depending on whether the customer is a private individual (B2C), a private company (B2B), or a public sector organization (B2G). The inherent differences in purchasing processes between these types of customers rely on the conditions of purchasing (Arlbjørn and Freytag, 2012), and Telgen et al. (2007, p.19) noted that *"…public sector procurement is more complex than private sector procurement"* because of more complex and demanding

regulation, expectations of transparency, dealing with multiple demands and interests, etc. The drivers of, and barriers to, private and public consumption can be expected to differ as the practices of purchasing and consuming differ. As circular economy entails changes in the traditional consumption model based on ownership to one of access and usership (Ghisellini et al., 2016), new consumption practices are needed in circular economy.

Collaborative consumption models are believed to have the potential to change consumption from linear to circular (Ness, 2008; Preston, 2012). Collaborative consumption models are seen as access-based and sharing models. Changing consumption models from ownership- to access-based will alter the relationship and potentially the power relations between producers and consumers (Camacho-Otero et al., 2018; Preston, 2012). Current collaborative consumption models focus primarily on web-based tools, which could lead to the assumption that collaborative consumption is a technological phenomenon (Ertz et al., 2019). Although many models are based on digital technologies, others also exist that do not rely on web-based tools, such as local sharing solutions. Within the broad scope of collaborative consumption, several sub-categories can be defined, e.g., those pertaining to the economic nature (free, swap, subscription, cost, etc.), type of access and sharing (mutualization, short-term access, long-term access, redistribution, etc.), and channels (offline, online) (Ertz et al., 2019). Although collaborative consumption models are highlighted as an important element in circular economy, consumers have not yet accepted such models widely (Gullstrand Edbring et al., 2016). The value and desire for ownership is still a strong barrier to adopting collaborative consumption models (Gullstrand Edbring et al., 2016; Sempels and Hoffmann, 2013; Tukker, 2015).

2.3.3. INTERNAL BUSINESS ORGANIZATION

For companies established in the linear economy, reconfiguring existing structures, systems, and organization is necessary to integrate circular economy strategies (Jørgensen and Remmen, 2018). Reconfiguring the internal business organization requires the ability to change and learn (Adams et al., 2016; Zollo et al., 2013), and to experiment, develop, and implement new circular solutions (Bocken et al., 2018; Guldmann and Huulgaard, 2019).

Design of products, services, and business models

Product design for circular economy focuses on providing multiple lifecycles of products and materials (Sassanelli et al., 2020), with the intent to circulate them, e.g. through modular design, design for disassembly, and other circular design strategies (Bocken et al., 2016; Hollander et al., 2017; Mestre and Cooper, 2017). While existing design strategies are relevant for circular economy, e.g., design for sustainability and ecodesign, new design strategies or modifications of existing designs are also necessary to facilitate circular flows of products, components, and materials (Hollander et al., 2017). Design principles for circular economy differ depending on the circular strategy in focus. At times, these principles and strategies can create

tensions, e.g., when life extension strategies are intended to prolong product lifetime through repair, reuse, etc., while newer products may focus more on energy-efficiency. Another tension can occur when recycled content is used, as it may shorten a product's lifetime because of low quality, or alternatively, when composite materials are developed to reduce product weight or avoid gluing, which then reduces recyclability (Prendeville et al., 2017). Managing such tensions in circular product design can be supported by new design competencies that extend beyond traditional competencies, e.g., by including those for circular impact assessment, design for recovery, and design for multiple use cycles (Sumter et al., 2020).

In addition to circular product design, supporting services and business model design must also be designed for circular economy. Circular business model innovation entails developing new or reconfiguring existing business models and value propositions that consider circular strategies. A key feature of circular business models is a different value creation logic (Nußholz, 2017), and Zacho et al. (2018) noted the need for a broader value conceptualization in circular economy to capture not only monetary value, but also environmental and social value for multiple stakeholders.

Much research has been conducted on circular business models, e.g., through extensive reviews (Bocken et al., 2019; Lüdeke-Freund et al., 2019; Nußholz, 2017; Pieroni et al., 2019a), development of tools and frameworks for circular business model innovation (Antikainen and Valkokari, 2016; Blomsma et al., 2019; Guldmann and Huulgaard, 2019), and identification of barriers (Guldmann and Huulgaard, 2020; Werning and Spinler, 2020). Thus, the importance of new business models in circular economy has been cemented in the literature; however, the complexity of developing and implementing circular business models has also become clear. For instance, Geissdoerfer et al. (2018b) identified four types of business model innovations, either start-up (no current business model in place; creation of new business model), business model transformation (current business model in place needs to be changed into another model), business model diversification (current business model remains in place, and an additional business model is developed), and business model acquisition (an additional business model is identified, acquired, and integrated). Guldmann and Huulgaard (2019) identified three different circular business model innovation processes: *Internal* (implemented locally but does not interfere with the core business); *hybrid* (complements existing business model), and *systemic* (advances existing circular business model). The authors emphasized the importance of focusing on both product and service design in these models to ensure comprehensive circular economy. Employing a singular view could lead to only potential circularity, e.g., by designing products that could be remanufactured, but taking no actions to ensure that they are (Guldmann and Huulgaard, 2019). Gusmerotti et al. (2019) presented a similar distinction of companies as those that either: 1) Focus on optimization through waste reduction and resource efficiency; 2) satisfy market expectations through product ecodesign and consumer information, or 3) circular champions that have applied a systemic view in their business and

internalized circular economy strategies. This is also consistent with the three sustainability strategies presented in Section 2.1.1. Further, Pieroni et al. (2019) emphasized the need for a broad and comprehensive organizational strategy to circular business model innovation that considers the organization's capabilities and context. In describing this context-dependency, Guldmann and Huulgaard (2019) indicated that companies' engagement in circular business model innovation depends on the organizational setting, e.g., organizational point of departure, sustainability strategy, goals, and collaboration.

Organizational tools and systems

Sustainable consumption and production tools, such as environmental management systems and product ecolabels, can support circular economy implementation (Marrucci et al., 2019). Environmental management systems have been an element of industry practices for decades, and companies have experienced better environmental performance through continuous improvements (Massoud et al., 2010; Remmen, 2001) particularly if the system becomes internalized and embedded in daily practice (Iraldo et al., 2009; Testa et al., 2014). Fonseca et al. (2018), Yang et al. (2019), and Scarpellini et al. (2020) highlighted environmental management systems' potential to support circular economy implementation in companies; however, the practical integration of circular economy and environmental management systems remains largely unexplored. With respect to the role of ecolabels in circular economy, Marrucci et al. (2019) emphasized the potential to integrate circularity in ecolabel criteria to increase circular consumption. In their review of existing criteria in the Nordic Swan Ecolabel, Suikkanen and Nissinen (2017) concluded that most criteria sets include considerations of durability and recyclability; however, for the Nordic Swan to support circular economy further, future revisions of the criteria sets should consider the way the ecolabel can support circular strategies of reusing, remanufacturing, repairing, and upgrading.

Organizational practices and capabilities

Practices in organizations relate to both formal procedures and structures (canonical practices) and informal routines and daily workarounds (noncanonical practices) (Brown and Duguid, 1991). Thus, an organization's actual practices are influenced by the situational context in which they develop and change and cannot be understood purely through formal descriptions and structures (Brown and Duguid, 1991; Gherardi and Nicolini, 2002; Orr, 1996). Awareness of both canonical and noncanonical practices in the organization is important when trying to develop new capabilities. To avoid the *"…ossifying tendencies of large organisations"* (Brown and Duguid, 1991, p.50), noncanonical practices' flexibility and adaptability can support the development of new capabilities through learning. However, noncanonical practices are also resistant to change, as they are based on routines and habits (Brown and Duguid, 1991; Orr, 1996), and under conditions of uncertainty, this resistance is amplified (Gherardi and Nicolini, 2002). Thus, changing practices can be a difficult task; nonetheless, it is an important one for companies when engaging in circular business development. To change existing practices, organizations must learn (Brown

and Duguid, 1991), and individuals must acquire and apply new knowledge through social interactions (Gherardi and Nicolini, 2002). In this context, learning is a social phenomenon and cannot be expected to occur isolated from practice through knowledge transfer from one individual to another, as *"What is learned is profoundly connected to the conditions in which it is learned"* (Brown and Duguid, 1991, p.48).

With respect to capabilities for circular economy, the concept of dynamic capabilities has attracted attention as a conceptual framework of circular economy development (Khan et al., 2020; Pieroni et al., 2019; Prieto-Sandoval et al., 2019). Teece et al. (1997, p.516) defined dynamic capabilities as *"…the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments."* In relation to circular business development, the learning a company needs naturally differs depending on its point of departure and the potential to learn and change, i.e., dynamic capabilities. Consistent with the three sustainability strategies (Section 2.1.1), companies can also engage in different strategies to develop a circular business. Firstly, they can engage in optimizing and innovating production processes (Ruggieri et al., 2016), which has focused traditionally on reducing environmental harm attributable to production through strategies that narrow and regenerate resource and energy flows (Adams et al., 2016; Gusmerotti et al., 2019; Konietzko et al., 2020), and on mobilizing existing capabilities within the organization (Brown et al., 2019). Secondly, companies apply strategies that focus on product stewardship (Gusmerotti et al., 2019) and new market opportunities (Brown et al., 2019), in which efforts focus on product-related circularity and complementing the existing business model with a circular business model (Guldmann and Huulgaard, 2019). Learning in this strategy emphasizes the need for leadership to engage a wider range of inter-organizational stakeholders to acquire and generate new knowledge (Brown et al., 2019). Lastly, companies that engage in system building (Adams et al., 2016) integrate circular economy principles in all aspects of their business (Gusmerotti et al., 2019). Companies that adopt this strategy engage in novel collaborations in networks and partnerships to allow experimentation for new knowledge creation and learning (Brown et al., 2019; Sumter et al., 2020). A key feature of system builders is their relation to other stakeholders and actors in society, as the scope extends beyond the individual company (Adams et al., 2016).

2.4. RESEARCH QUESTIONS

From the conceptual model presented in Figure 2.3, the different elements of framework conditions and collaboration, supply and demand, and internal business organization within companies were elaborated in Sections 2.3.1-2.3.3. These three elements provide a conceptualization of relevant elements for circular business development and are the foundation for the research. These elements are interdependent, as changes in one may require or induce changes in another and changing one element will not be sufficient to achieve a sustainable circular economy. Circular business development appears to be a complex matter, and the purpose of

this PhD is to provide insights into this through five academic papers that jointly provide an answer to the primary research question:

How can circular economy support sustainable business development in the furniture industry?

To answer this research question, five sub-questions were posed. These sub-questions support each other in investigating different elements of circular business development that focus on framework conditions, internal business organization, and demand, while the element of supply, as such, is not central to the research.

The first sub-question of this thesis pertains to sustainable value creation in circular economy solutions, as this was identified as a good starting point to understand the way companies can engage in circular business development. In Section 2.3.3 the first aspect focuses on the need to redesign products and business models for circular economy, which is investigated in the first sub-question of this thesis, as its goal is to re-conceptualize sustainable value propositions:

1. *What can sustainable value propositions offer using product, service and system as a key framework?*

This sub-question is answered in Chapter 5, which contains paper I: "A framework for sustainable value propositions in product-service systems", published in the *Journal of Cleaner Production*.

The second topic investigated focuses on the way circular economy strategies are measured on a company level, and thus focuses on micro-level indicators. Although the framework conditions for circular business development focus strongly on the legal framework, in the context of an industrial PhD, it would be more interesting to focus on aspects closer to organizations' practices. In addition, the relation between circular economy and sustainability deserves more attention, as established in Chapter 1. This led to the second sub-question:

2. *Which micro level indicators exist for circular economy, and how do they align with the three dimensions of sustainability?*

The second sub-question is answered in Chapter 6, which contains paper II: "A review of micro level indicators for a circular economy – moving away from the three dimensions of sustainability?", published in the *Journal of Cleaner Production*.

The third area of investigation focuses on environmental management systems as part of the internal organizational systems and practices relevant for circular business development. Within this area, two separate sub-questions were posed. The first seeks to provide an understanding of the value of environmental management systems from the perspective of discontinuation. This perspective allows an understanding of why companies discontinue their certification, which provide

insights into the perceptions of the system's value or lack thereof. This led to the third sub-question:

3. *Why do some companies choose to discontinue their ISO14001 certification, and what are the consequences of this on their environmental practice?*

This sub-question is answered in Chapter 7.1, which contains paper III: "Companies that discontinue their ISO14001 certification – Reasons, consequences and impact on practice", published in the *Journal of Cleaner Production*.

Following the investigation of why companies choose to discontinue their ISO14001 certification, the fourth sub-question was posed to investigate the potential to use environmental management systems to advance circular economy implementation further in organizations:

4. *How can environmental management systems be used to align and manage circular economy strategies in organizations?*

This sub-question is answered in Chapter 7.2, which contains paper IV: "Bridging the gap between environmental management systems and circular economy", accepted for publication in the *Journal of Cleaner Production*.

With an improved understanding of the internal business organization and potential indicators of circular economy, the final sub-question focuses on the demand-side through public procurement. While both private and public procurement is relevant to circular business development, this final sub-question focuses only on municipal public procurement:

5. *How do the current procurement practices in Danish municipalities influence a development towards circular public procurement?*

The final sub-question is answered in Chapter 8, which contains paper V: "Circular public procurement practices in Danish municipalities", accepted for publication in the *Journal of Cleaner Production*.

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CHAPTER 3. CONTEXTUAL FRAMEWORK

This chapter presents the context in which this PhD project was conducted. As this thesis is the result of an industrial project, setting the scene for the research provides an understanding of the PhD process and insights into the context of the project.

The first section introduces the European furniture industry, with special attention to the Danish furniture industry and circular economy's potential within the industry. The second section then elaborates on the host company of this industrial PhD, HOLMRIS B8, which was introduced in Section 1.1. This includes the history and structure of the company, organizational changes and strategies, as well as the current activities of sustainability and circular economy within the organization.

3.1. THE FURNITURE INDUSTRY

The furniture industry is diverse and manufactures products for homes, schools, offices, hotels, restaurants, hospitals, etc. The European furniture industry includes approximately 120000 companies, employs approximately 1 million people, and generates an annual turnover of approximately 100€ billion[1]. The industry consists of a mix of small and medium-sized enterprises (SMEs) and large conglomerates; however, most are SMEs. The industry is characterized as traditionally low-tech and labor-intensive, with complex and fragmented supply chains in which many processes are outsourced (CEPS, 2014; Hedemann and Nissen, 2013). The European furniture market accounts for 23% of the global market (CEPS, 2014), and in 2018, the top ten furniture manufacturing EU countries jointly accounted for 83% of EU furniture manufacturing[1]. Within the European furniture market, Denmark has held a stable 2% market share for the past decade[1].

The Danish furniture industry is known generally for its excellence, and the industry is recognized globally for classic Danish design. However, despite these strong craftmanship traditions of high-quality design, the industry is also one that has been characterized for many years by outsourcing and offshoring, widespread and fragmented supply chains, and varied production and consumption patterns (Hedemann and Nissen, 2013).

During the past 15 years, the Danish furniture industry has been affected by two major crises, the financial crisis in the late 2000s and the COVID-19 crisis in 2020. During the financial crisis, the industry experienced a hard blow, and has struggled since to recover the loss of business and turnover. With a peak in annual turnover of approximately 2.8€ billion in 2006 and 2007, the industry experienced a rapid

[1] EuroStat; Annual detailed enterprise statistics for industry (NACE_R2: C31)

decrease of more than 1€ billion in annual turnover following the financial crisis[2]. The industry has since remained at a somewhat stable 2€ billion in annual turnover and adjusted to lower financial activities following the crisis. With the outbreak of COVID-19 and the subsequent global shutdown in early 2020, the global economy experienced immediate effects of reduced GDP and increased unemployment. At the time this thesis was written, the effects of the COVID-19 crisis are still unfolding, but Danish furniture companies have experienced decreasing turnover since April[3]. Although many companies have used the governmental furlough packages, employees have also accepted reduced pay, and many have lost their jobs.

3.1.1. SUSTAINABILITY AND CIRCULAR ECONOMY IN THE FURNITURE INDUSTRY

During the past decade, the furniture industry has experienced an increasing interest in environmentally friendly, sustainable, or circular products and solutions. However, it is also challenged by the current production and consumption practices.

Among the environmental impacts of the furniture industry, 80-90% are related to extracting and producing materials (Donatello et al., 2017). To reduce the industry's adverse environmental impacts overall, all five circular strategies (Section 2.2.2) are relevant. Regenerating can ensure clean, safe, and renewable inputs, narrowing can reduce material consumption, slowing can prolong product and component lifetime, and thus decrease the demand for new materials, while closing allows materials to be recycled to reduce the demand for new materials further. These can all be supported by informing strategies; however, because the furniture industry is a low-tech and labor-intensive industry, not all technological advances are valuable to consider in the industry.

Within the EU, 10 million tons of furniture are discarded annually, which accounts for approximately 4% of municipal solid waste (Ecores et al., 2018; Forrest et al., 2017). Of these 10 million tons, 80-90% are landfilled or incinerated, and approximately 10% are recycled (Ecores et al., 2018). However, in the Danish context, waste from the furniture industry has primarily been reported to be being recycled (86%) or incinerated (13%), while 1% is landfilled[4]. However, for the past several years, the demand for waste wood for board production has stabilized, while the supply has increased, which has posed a challenge to use wood waste for production of new boards, and instead, a larger fraction is used to recover energy through incineration. Although reuse is a common practice within the furniture industry, it is often through local, small-scale second-hand shops, social enterprises, or charities (Ecores et al., 2018). Therefore, the industry is facing significant challenges to implement circular

[2] Danmarks Statistik, https://www.statistikbanken.dk/OMS6

[3] Danmarks Statistik, konjunkturbarometer 30.07.2020

[4] Danish EPA Waste Data System; NACE code 31: Manufacture of furniture

economy, which were presented by the European Environment Bureau, and are summarized in Table 3.1.

Table 3.1. Summary of challenges in the transition from linear to circular economy in the furniture industry (Forrest et al., 2017)

Challenge	Description
Lower quality materials and poor design	The industry has progressed from using solid wood and metal to cheaper materials, which reduces product quality. Poor product design that does not consider disassembly hinders repair, maintenance, product or component reuse, and recycling.
REACH regulation	Legacy hazardous substances and the absence of information on chemicals products contain challenges the industry to reuse and recycle.
Poor consumer information and availability of spares	Consumers receive limited or no guidance on the way to maintain and repair products, and the lack of availability of spare parts often encourages consumers to purchase new furniture products.
Limited collection and reverse logistics infrastructure	The current collection and logistics for furniture takeback are limited and hinder further professionalization of second-hand markets. Further, producer responsibility mechanisms are not implemented widely in the industry.
High cost of repair and refurbishment	With high transport and labor costs in many parts of the EU, repair and refurbishment are costly. Economies of scale and economic incentives are needed to make repair and refurbishment a viable option in the industry.
Weak demand for second-hand furniture	The price differential between new and second-life furniture is not sufficiently significant to encourage circular purchasing and consumption. This is reinforced further by poor awareness of the availability and benefits of sustainable or circular furniture options, both for domestic and commercial furniture.
Poor demand for recycled materials	The end-markets for recycled materials are either underdeveloped or saturated, which hinders further investment in recovery.
Weak over-arching policy drivers	Furniture is rarely managed in accordance with the waste hierarchy, and reuse fails to be prioritized over recycling, incineration, and landfill. Combined with weak infrastructure to support this, the furniture industry is challenged to transition to circular economy.

Thus, the furniture industry faces challenges related to production, consumption, and policy to develop and implement circular economy. Although it covers a wide range of products, a distinction between the domestic and contract market will be applied to focus attention on the contract market, as the host company is a key actor in the Danish contract market.

Examples of circular strategies in the industry were presented in Box 2.3. Although efforts are made within all five strategies, special attention to the slowing strategy is relevant for the industry, as prolonging product and component lifetime can reduce the environmental harm overall by decreasing the need to produce new furniture. This is particularly relevant for the Danish furniture industry, as Danish furniture companies often function as assembly and retail organizations with no or limited production facilities and thus rely on a supply of manufactured products or components that are often imported from Eastern Europe or Asia. The potential for circular economy in the Danish furniture industry can be seen as potential that is directly applicable for Danish companies, as well as that in the value chain and networks, where collaboration is key to foster circular economy strategies (Ecores et al., 2018; Lifestyle & Design Cluster, 2018).

The Danish furniture industry is subject to several sustainability-related mandatory and voluntary regulations, in addition to product-specific standards to determine, measure, and document furniture products' safety, strength, durability, flammability, dimensions, etc. Focusing on voluntary instruments, the industry has employed product ecolabels increasingly to document its efforts, which primarily concern the Nordic Swan and the EU Ecolabel. Within recent years, increasing attention has also been given to furniture's role in acquiring certifications, such as DGNB, LEED, and WELL. Another relevant area for furniture companies relates to consumption, in which public sector organizations across the EU are supported to integrate green criteria in procurement through the EU GPP criteria set, developed for several product groups (European Commission, 2020). In the latest revision of the EU GPP criteria for furniture, three different furniture procurement processes were defined: 1) Refurbishment services for existing used furniture; 2) procurement of new furniture, and 3) procurement of end-of-life services (Donatello et al., 2017). This could help public sector organizations change procurement practices from those focused primarily on procuring new furniture to also consider refurbishment and end-of-life services to support circular strategies in the industry.

3.2. THE COMPANY: HOLMRIS B8

This industrial PhD project was conducted in HOLMRIS B8, one of the largest companies that operates in the Danish contract furniture market. The company provides interior design solutions from a unique mix of its own designs and products from more than 1000 suppliers.

The company's headquarters are located in Bjerringbro, Denmark, with production facilities in Bjerringbro, Silkeborg, and Vemmelev, sales offices in Bjerringbro, Løsning, and Copenhagen, and logistic centers in Bjerringbro, Løsning and Køge. The company employs approximately 250 people in Denmark and abroad. The investment company, BWB Partners, holds the majority of shares, while the remainder are shared among top management.

3.2.1. HISTORY

The history of the company has several roots, as HOLMRIS B8 is a result of several acquisitions and mergers over time, some of which are shown in Figure 3.1. Although several other acquisitions have been made during the company's history, Figure 3.1 presents its simplified history.

The company has two primary roots; one from the former B8 and one from the former Holmris. HOLMRIS B8 began as the former B8 in 1914, when two brothers, Martin and Kristian Bach, bought Bjerringbro Sawmill and began producing wooden furniture. Holmris' history began in 1937, when Søren Holmris opened his own workshop in Bjerringbro. Both companies remained in Bjerringbro, and also expanded to other parts of Denmark and abroad. Within the past decade, Holmris has employed a rather aggressive expansion strategy through acquisitions and mergers with several companies. In 2018, the largest merger in its history occurred when Holmris and B8 merged into HOLMRIS B8 A/S, which is now one of the largest contract furniture companies in Denmark, with a turnover of approximately 147€ million in 2019 (significantly lower in 2020 because of the effects of the COVID-19 crisis).

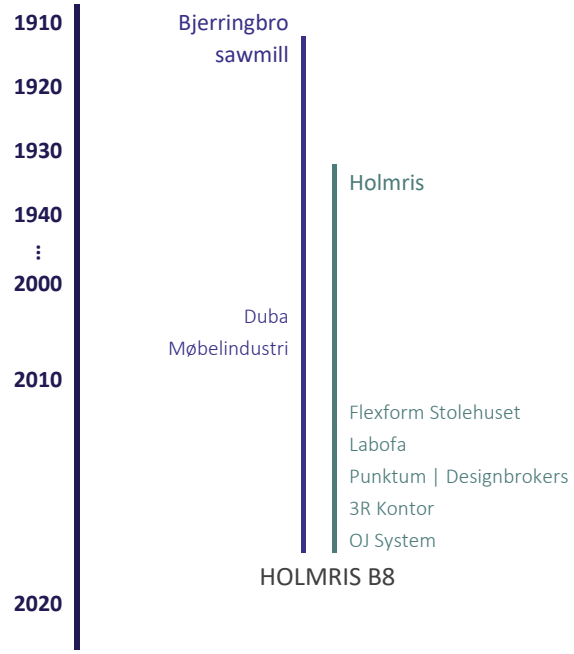

Figure 3.1. History of HOLMRIS B8 from sawmill to market leader

During the past decade, the company has expanded rapidly, and as a result of its many acquisitions, a multitude of structures and cultures exist in the company. During the past decade of acquisitions, two different strategies were applied to integration, in which some acquisitions were integrated into the existing organization and others became independent departments that function as a new part of the organization. One of these acquisitions took place in 2017 when the small circular start-up, 3R Kontor (established in 2014) was acquired, which has become a new department for circular economy within the organization. This strategy has also been applied to the acquisition of the factories in Vemmelev (Labofa) and Silkeborg (OJ System), which are two departments of Labofa and HOLMRIS B8 Customized, respectively. Labofa specializes in reinterpreting old design classics, developing new designs, and manufacturing student chairs. HOLMRIS B8 Customized is a specialized factory that manufactures customized solutions for customers that are wood-based primarily.

Since the merger in 2018, HOLMRIS B8 has attempted to streamline its production facilities, sales organization, and supporting functions. By 2020, the number of locations had decreased as a number of sales offices were closed, and the staff was reduced several times; first as a result of the merger, then because of decreasing turnover, which was followed by a reduction in staff because of the effects of the COVID-19 crisis, and lastly, in June 2020, the company announced its plan to close the primary production facility in Denmark (Bjerringbro), which also led to a staff reduction. Thus, within two years, the company has reduced its staff from approximately 450 to 250, which has affected the work environment, collaborations, and responsibilities of the remaining staff.

3.2.2. ORGANIZATIONAL STRUCTURE AND CULTURE

Several changes have been made to HOLMRIS B8's organizational structure since the merger to identify the best way to organize departments, responsibilities, etc. Figure 3.2 shows an overview of the organization and different departments. While the organizational structure is subject to change due to the new strategic direction of closing the production site in Bjerringbro and relocating departments and staff, Figure 3.2 shows a snapshot of the how the organization has been structured during this project as well as an approximate number of employees. The department of HOLMRIS B8 Circular is part of Customer Service, Telemarketing, Architects & Public Tenders; CSR, and Production Bjerringbro.

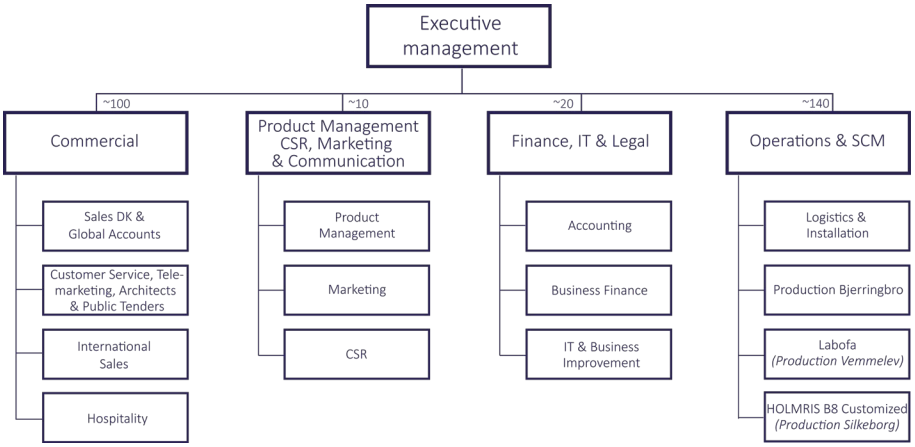

Figure 3.2. Organizational structure of HOLMRIS B8

The company's goal is to be a *one stop supplier* and it has developed several services and functions to enable this, all of which focus on providing the best possible customer service. HOLMRIS B8's goal is to become a priority service partner, and a combination of technological solutions, consultancy services, customized design solutions, and circular economy services provides the foundation for being a *one stop supplier*.

Table 3.2. Core of HOLMRIS B8

Culture	Values	DNA
A strong, diverse, and ambitious culture	Quality, innovation, sustainability, and room for diversity	A DNA where people are at the center, and have a passion for furniture and design

These mergers may have left a somewhat fragmented organizational culture that consists of many different perspectives that the company is attempting to combine now to create a new HOLMRIS B8 identity and culture that celebrates the organization's diversity. As the former Holmris and B8 were strong competitors, merging the two companies has proven a challenge for management and employees, as the competitive perception of "us" vs. "them" has persisted in the new organization. To integrate the organization's diverse cultures, different internal events were conducted, which also included presentation of the new joint organization's goals, which is illustrated in Table 3.2.

3.2.3. SUSTAINABILITY AND CIRCULAR ECONOMY IN HOLMRIS B8

The awareness of sustainability and circular economy has been increasing within HOLMRIS B8 over the past decade. With the acquisition of 3R Kontor, the strategic

prioritization of circular economy was emphasized further. The company works with different aspects of sustainability and circular economy, which will be presented in the following.

Certifications and systems for sustainability

One of HOLMRIS B8's key strategies for sustainability focuses on certifications, as it provides documentation to customers, suppliers, and other stakeholders of the efforts made to reduce environmental harm, improve the work environment, etc. HOLMRIS B8 employs a strategy that includes both management and product-level certifications. The primary factory in Bjerringbro is certified according to ISO9001 (quality management), OHSAS 18001 (occupational health and safety), and ISO14001 (environmental management). Because wood is the primary material used in production, the factory in Bjerringbro is also FSC CoC-certified, which covers several of the organization's sites, including the factory in Vemmelev and the site in Oslo. HOLMRIS B8 is attempting to purchase 100% FSC-certified wood to use in the factories but has struggled to transform this strategy into actions across different departments and ensure compliance with the requirements in IT systems. In addition, HOLMRIS B8 has set the goal that at least 30% of all furniture it sells must be FSC-certified, which puts emphasis on engaging with customers for this.

With respect to product-level certifications, the company has several products certified according to the Nordic Swan. These certifications focus on work desks and other tables as a result of a strategic partnership with a large B2B customer, Ramböll, that wanted to purchase certified sustainable furniture for its offices. This partnership resulted in a line of work desks with the Nordic Swan, which Ramböll continued to purchase, but it also provided HOLMRIS B8 with better insights into customer needs and the potential of product ecolabels. Since this partnership, the line of Nordic Swan-certified products has grown, and the company has also begun the process of having a student chair certified with the EU Ecolabel.

In addition to these certifications, HOLMRIS B8 is also a member of the Danish Furniture Maker Control, which ensures high quality production processes, as well as a member of the UN Global Compact.

Corporate social responsibility (CSR)

Three core themes, i.e., human rights, environment, and corruption are described in HOLMRIS B8's CSR strategy (HOLMRIS B8, 2018). Internally, these themes are managed through the integrated management system, which covers ISO9001, ISO14001, and OHSAS18001. Externally, a supplier code of conduct is used to ensure compliance in the supply chain. As part of efforts to streamline the organization after the merger, HOLMRIS B8 has evaluated the supplier base and advanced a goal to ensure that 80% of the purchased volume derives from suppliers who have signed the supplier code of conduct (HOLMRIS B8, 2019a).

In 2019, HOLMRIS B8 launched a new initiative, Furnitree, which the CSR Director developed to provide customers with the option to offset CO_2 emissions from furniture production and create local value. Customers can choose to buy 5 trees for each office workspace, which is estimated to offset emissions from production of such workspace over a span of 30 years (HOLMRIS B8, 2019b). The concept is based on a partnership with Growing Trees Network Foundation, which is an organization that plants trees in Denmark. In spring 2020, the first forest of 21700 trees was planted in Hasselager, Aarhus, in collaboration with Aarhus Municipality.

Product development

Product development is often performed in collaboration with external designers or architects, and focuses on design, aesthetics, and comfort, while sustainability or circular economy is often seen as a "nice-to-have" and an add-on. Although HOLMRIS B8's formal procedure for product development is based on a stage-gate model to ensure the inclusion of sustainability through the quality manager, in practice, thus does not always happen. This could be a result of the merger between Holmris and B8, in which two different methods to the previous product development were established. In the former Holmris organization, sustainability was not included systematically in product development. In contrast, the former B8 had established the stage-gate model that ensured inclusion of QHSE in product development to ensure a new product's quality, safety, production processes, and environmental aspects. With the merger, the system was carried over from the former B8, while the employees became a mix with a dominant culture from the former Holmris. Although the procedure is clear regarding QHSE's involvement in product development, the practice is less clear. Further, neither procedure nor practice has focused on inclusion of competences related to circular design. This could be an indication of an institutionalized practice of design and development that is focused on aesthetics, in which the feel and look of materials outweighs their properties of sustainability and circularity.

Although not yet an established practice, considerations of circular strategies are included in product development to some extent. During the development of a new chair for educational institutions, considerations of design for disassembly, easy maintenance, and the use of recycled or recyclable materials were included. However, what matters is defined predominantly from the perspective of closing (through recycled content or waste management) or narrowing (optimization), while slowing is not yet considered in the same way in product design. It appears that the circular department is perceived to address this strategy through takeback and selling used furniture, thereby extending the product life.

HOLMRIS B8 Circular

The business model of HOLMRIS B8 Circular is based on buying used office furniture and extending the product or material life as much as possible. To do so, the department has established a hierarchy that resembles the waste hierarchy (cf.

European Commission, 2008). This hierarchy is shown in Table 3.3, which shows a clear prioritization of how to manage used furniture in the department.

Table 3.3. Hierarchy of managing used furniture in HOLMRIS B8 Circular

Strategy	Description
1. Direct resale	The best furniture is cleaned and sold as is.
2. Repair and refurbishment	Damaged and broken furniture are repaired or refurbished (e.g. changing upholstery, wheels, tabletops etc.) and sold as used furniture through a web shop.
3. Donation	Functional furniture that cannot be sold or with too high handling costs, will be distributed in the donation network established by 3R Kontor and continued in HOLMRIS B8 Circular. The donation network consists of associations, NGOs, schools etc.
4. Recycling	The remaining furniture that cannot be sold, repaired, refurbished or donated will be separated into materials fractions and send for recycling (wood, metal, plastic).
5. Incineration	Furniture that cannot be separated into material fractions will be send to incineration (energy recovery). This is often office chairs and upholstered furniture that cannot be disassembled.

3R Kontor's original business, which is now HOLMRIS B8 Circular, was established as a socioeconomic enterprise in which 40% of the employees were employed on special terms, as they had a reduced work capacity in one way or another. These employees were primarily young males who had struggled in school and often had issues with drugs or criminality. This social responsibility was then linked to circular economy, as the business focused purely on extending its furniture's product life. After the acquisition and merger, the social responsibility changed from bringing in new employees on special terms to keeping those already in the department.

In the first year after the acquisition, the department continued its business-as-usual (i.e., same location, staff, system, business model); however, in fall 2018, the department moved to the former Holmris headquarters in Bjerringbro. With the organizational changes that followed the merger, the circular department entered a state of break-even or resting-in-itself, which may have disconnected the department from the remaining organization. The intention to integrate the circular department has been presented on several occasions; however, this has proven more difficult in practice. A supportive action of this was a reorganization of the department, so the employees formally are organized in different departments.

The internal understanding of the circular department has evolved since the acquisition. Initially, the general perception on the part of the established organization was that the circular department was a "trash-can." This indicated that

anything that was not usable in other departments or locations was sent to the department. This included products and components that were broken beyond repair such that the department could only discard them. Although the department intends to separate and sort all waste into material fractions, the sheer number of products and components sent to the department, combined with limited storage and manpower available, meant that most material had to be disposed with no separation and sorting. Since then, the understanding of the department has changed, as the value of circular solutions has become clearer through good examples, e.g., when the department's services of moving and refurbishing used furniture attracted large contracts. A new understanding emerged in which more employees took pride in having the circular department and acknowledged the potential of combining traditional and circular products and services.

A key factor in improving the understanding and value of the circular department relates to knowledge of circular economy and the services the department provides. Sales staff have experienced increasing demand and questions from customers concerning HOLMRIS B8's circular economy; however, some are uncomfortable talking about the circular department, as they do not feel knowledgeable about the topic. In addition, they have found that the customers' focus on circular economy took time away from what they perceive to be most important; selling furniture products. Management articulated this perception of the company as a "furniture pusher" explicitly at a public sales meeting, and as management defined what matters clearly, i.e., pushing furniture to as many customers as possible, it is unsurprising that employees do not embrace circular economy strategies. This is reinforced further by the fact that the value of circular economy is not necessarily associated with the product, but rather the business model and systems.

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CHAPTER 4. RESEARCH DESIGN AND METHODOLOGY

This chapter introduces the research design and methodological choices of the PhD project overall, while the specific methods applied for the papers included in this thesis are elaborated within each, and thus presented in the corresponding chapters (Chapter 5-Chapter 8). The goal of this chapter is to present the research design and methodological reflections of the project and focuses on the process of developing the project according to the conceptual (Chapter 2) and contextual (Chapter 3) frameworks. The purpose of this is to provide the reader with insights and understanding of the way the research was conducted and allow reflections of the methodological choices made during the research process.

The first section of this chapter focuses on the context within which this project was conducted, which will be elaborated with reflections on the study's contextual framework (Chapter 3). The purpose of this section is to provide insights into the project characteristics, company objectives, location in the company, and access to information that influenced the research objectives and process. The second section presents the research design overall, as well as the study's structure and organization, and the third describes the methods used to collect data throughout the project. Finally, a discussion of research quality is included.

4.1. CONTEXT AND BACKGROUND OF THE PROJECT

The context of this industrial PhD project was set within the host company, HOLMRIS B8. The purpose of this project is two-fold, as it attempts to both contribute to research and practice and is influenced as well by objectives from both arenas. Thus, explicit company objectives influenced the development of the research questions and focus during the project, and the design was modified throughout the project to fit the changing objectives. This relation between the conceptual and contextual frameworks is illustrated in Figure 4.1, which is inspired by Hevner's three-cycle design science research framework (Hevner et al., 2004; Hevner, 2007), which emphasizes the alignment of research with both the contextual (environment) and conceptual (knowledge) base through a relevance cycle and a rigor cycle (Hevner et al., 2004; Hevner, 2007). The third cycle in the framework focuses on what Hevner (2007) denoted as the design cycle, which, in this study, inspired the central box of the research framework.

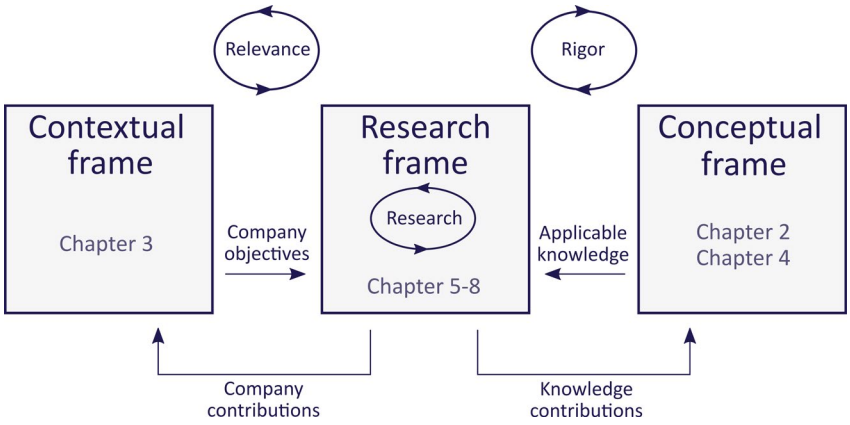

Figure 4.1. Research framework and chapter contributions, inspired by the research design in (Skelton, 2017), based on (Hevner et al., 2004; Hevner, 2007)

From a contextual perspective, the research was influenced by company objectives and contributed to a research-based foundation to support the acceleration of circular economy practices in HOLMRIS B8, and thus, advance the implementation of circular economy within the organization. The contextual frame also represents the overarching environment of the company, which also include external conditions such as megatrends, legislation, industry developments etc. This is what Hevner (2007) denoted as the relevance cycle, which both establishes objectives for the research, and also functions as an ongoing assessment of the research contributions' relevance.

The rigor cycle refers to the association with the relevant academic field by bringing in past literature and adding to the knowledge base from the research (Hevner, 2007). In this thesis, the knowledge base that provided the foundation for this research was presented in the conceptual framework (Chapter 2). The conceptual frame thus encompasses applicable knowledge and tools for carrying out the research. This thesis used applicable knowledge and attempted to contribute broadly to the field of circular economy by increasing academic knowledge of how circular economy can support sustainable business development, while also contributing to an improved understanding of conditions that influence circular business development.

These different cycles of ensuring the research's relevance and rigor led to a continuous process in which the research objectives were adjusted and developed to ensure that they contributed to both the contextual and conceptual frameworks. For example, an explicit interest from the company to understand customers' needs and demands in circular economy supported the definition of the fifth sub-question regarding circular public procurement. This interest emerged following a public tender of circular school furniture in a Danish municipality in 2017, which inspired other municipalities to explore potentials for circular public procurement of furniture. Being able to adapt the research frame in response to new problems or opportunities

arising during the process enables a flexible research process and supports the relevance cycle (Figure 4.1).

4.1.1. POSITION AND ACCESS

During the project period, my position and access in the company changed because of several organizational changes. Although several changes have influenced and shaped this project, the primary changes have arisen from the 2018 merger of Holmris A/S and B8 to create HOLMRIS B8. Because of this merger, the resources available to support the project decreased, as the organizational focus narrowed to integrating systems, procedures, and workflows within the two organizations and their different departments. When the production facilities were moved from one location to another during the summer of 2018, all available manpower was required. In addition, this merger addressed not only physical changes, but also included a merger of different company cultures, which emphasized further the organization's need to focus on operations. Following the physical move in 2018, the aftermath of the merger entailed several challenges for the organization, such that this project continued to be on the fringe of attention and focus for the remaining project period. To manage these changes, the project's focus was adapted from the original purpose to build internal capabilities for circular economy to a broader investigation of areas relevant to the company, which can then support future development of circular economy practices and capabilities in HOLMRIS B8 through guidance and recommendations that encompass circular business development more broadly. The purpose of this will be to help the organization develop a language to understand and discuss sustainability and circular economy with the intent to embed this in practice, which is currently lacking in the company.

The research was conducted in different departments during the project period from its initiation in 3R Kontor in 2017, which became HOLMRIS B8 Circular in 2018 and moved to new facilities. After two years in this department, I moved to the primary production site in Bjerringbro and joined the Quality, Health, Safety, & Environment team, which consisted of a Head of Quality, Environment, and Processes and a Compliance Engineer. This also meant that the company supervisor changed from the CSR Director to the Head of Quality, Environment, and Processes. However, in February 2020, both employees of the Quality, Health, Safety, & Environment department left their positions in the company, and I moved back to the Circular department, and was supervised again by the CSR Director. Although these changes have made the project difficult to conduct at times, they have also added value and new perspectives. For example, had I not moved to Quality, Health, Safety, & Environment, the focus on investigating the potential to integrate circular economy strategies in environmental management systems would not have been identified in the project's practical context. However, these changes have also affected the research results' practical application during the project period, as key staff involved in coproduction of knowledge and ideas left the company, which often meant that results or coproduced knowledge were not integrated into the organization.

The CSR Director anchored the project, which also meant that he played the role of gatekeeper in relation to it. Traditionally, the gatekeeper is understood as an individual or institution that gives or denies access to a researcher (de Laine, 2000). However, in this study, an understanding of gatekeepers as both access points, but also part of the research, was employed, which emphasizes the personal relationships and engagement with gatekeepers (Crowhurst and kennedy-macfoy, 2013). The relationship with the CSR Director provided access to different people in the organization, while, at other times, only limited access was possible. This was sometimes a deliberate choice by the CSR Director to not support access to other departments or employees at times when the CSR Director wanted to share new insights or research findings from this project himself or when he assessed that other employees were too busy. Other times access was denied when employees perceived me as an outsider and preferred to discuss matters internally. This perception was probably caused by being positioned in the circular department for the first two years, which was located separately from the remaining organization, as such difficulty with gaining access only occurred in other departments in the organization.

4.2. RESEARCH DESIGN

This PhD thesis predominantly employed an explorative and qualitative research design and used a variety of methods to explore circular economy potentials in the context of HOLMRIS B8 to provide an answer to the research question presented in Chapter 1. The choice to employ a primarily qualitative research design lies in the nature of qualitative research, which focuses on meanings, processes, and qualities, while quantitative methods focus on numeric measurements (Bryman, 2012; Creswell, 2014; Denzin and Lincoln, 2005). Consistent with most qualitative research, the epistemological position of this thesis is interpretivist, which indicates that the social world is constructed through the perceptions and interpretations of the participants in that world (Bryman, 2012). Further, this research has a constructivist orientation, which indicates that the social world and its properties are situated socially and outcomes of continuous processes of social interactions and sense making (Bryman, 2012; Weick, 1995). This orientation implies that this research's goal was to understand interpretations and perceptions rather than explain phenomena through causal reasoning (Bryman, 2012). Accordingly, the research focused on determining the way different actors in the social world understand, interpret, and work within circular economy as part of organizational behavior and practice, and seek to examine the phenomena of circular economy from different perspectives. The research does not aim for an objective, universal truth for circular business development; rather, it aims to explore and suggest potentials.

As circular economy is still an emerging concept with many definitions and conceptual understandings (Blomsma and Brennan, 2017; Borrello et al., 2020; Kirchherr et al., 2017), studying it becomes a complex process. The concept and content of circular economy is undergoing constant development, which leads to an interesting, yet complicated research journey. Thus, applying an exploratory and qualitative research

design in the field of circular economy can support an improved understanding of the practices and interpretations of business development for circular economy. An exploratory research strategy allows an open and empirically grounded investigation of contemporary and ongoing phenomena, which is suitable for circular economy research in the context of the furniture industry.

With the dual goal to add value to both research and practice, this PhD project was designed as an iterative process of furthering academic and practical knowledge continuously and ensuring mutually beneficial results. Further, this thesis took an abductive research strategy primarily to operationalize the interplay between theory and empirical data (Dubois and Gadde, 2002; Peirce, 1934). Abductive research is suitable for this research, as the aim is to gain new insights into an existing concept, i.e. circular economy, by examining this from new perspectives (Kovács and Spens, 2005).

A characteristic of abductive research is the simultaneous process of data collection and theory development, which indicates an interactive 'back and forth' direction between theory and empirical data (Dubois and Gadde, 2002; Kovács and Spens, 2005). The research process have thus been framed as an iterative process of continuous feedback loops between practice and research rather than a chronological process, as these feedback loops allowed the objectives and methodology to be adapted throughout the project to ensure the research's continuous relevance and applicability to both the conceptual and contextual frameworks (as illustrated in Figure 4.1). Figure 4.2 shows this research process, which takes a theory-informed point of departure in the concept of circular economy, which was then investigated in the practical setting of HOLMRIS B8. The contextual frame of HOLMRIS B8 has influenced the different research themes, where applicable knowledge from the conceptual frame has been brought in to further investigate each theme.

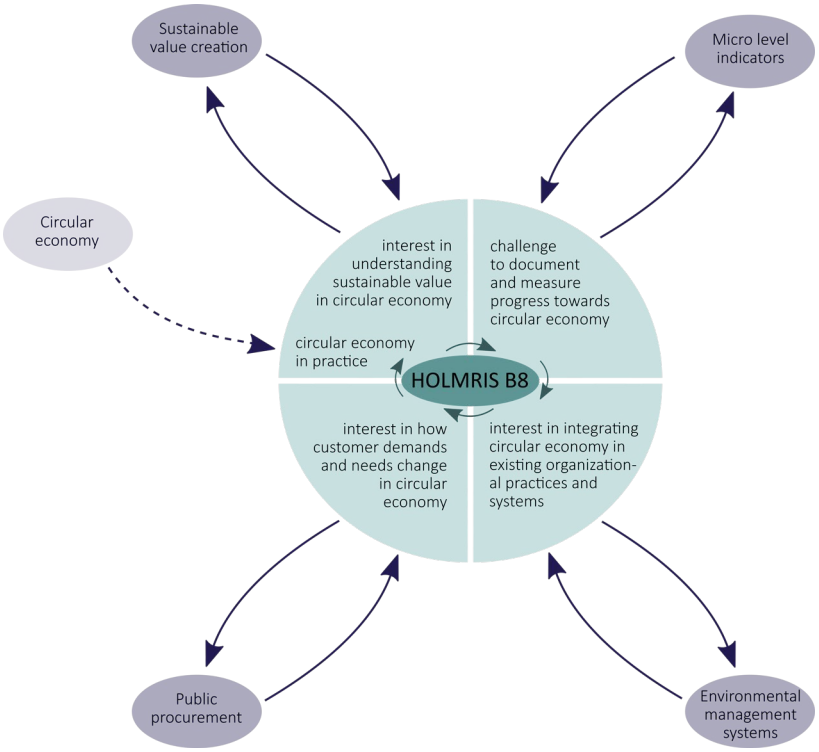

Figure 4.2. Research process of "back and forth" interactions between theory (purple) and practice (green), developed by author

4.2.1. RESEARCH STRUCTURE AND ORGANIZATION

The purpose of this thesis overall was to answer the primary research question of how circular economy can support sustainable business development in the furniture industry. To do so, five sub-questions were posed to guide the research. The primary research question was investigated in five separate academic papers (Chapter 5-Chapter 8), each of which focused on one of the sub-questions. All five sub-questions were designed to fill an academic gap, but also contribute to the advancement of circular economy practices in HOLMRIS B8, and provide an answer to the primary research question. Thus, each sub-question had the dual purpose to contribute to both academia and practice and were presented in detail in Section 2.4. Table 4.1 provides an overview of these sub-questions, the data collection methods used, and the reason each was used. Further details on the methodology can be found in each paper (Chapter 5-Chapter 8).

Table 4.1. Overview of methods applied in papers

	Papers				
Methods	Paper I	Paper II	Paper III	Paper IV	Paper V
Literature review	Reviews of PSS. Non-exhaustive literature review on sustainable value creation.	Systematic review of 30 micro level indicators.	Brief review on drivers and barriers for implementing ISO14001	Brief review of circular strategies combined with a review of ISO14001 literature.	Review of public procurement concepts. Case documents: procurement policies, tender documents etc.
Case study	Single-case study to test and further develop the presented framework.		Multiple-case study of 19 companies that discontinued their ISO14001 certification		Multiple-case study of procurement practices in 8 municipalities.
Interviews	11 semi-structured interviews with suppliers and customers relevant to the case company.		19 semi-structured interviews conducted with case companies	25 semi-structured interviews with proactive companies. 2 focus group interviews.	8 semi-structured interviews with case municipalities. 2 interviews with Ecolabelling Denmark.
Meetings	15 meetings with strategic and operational staff at the case company				
Survey				National survey of 277 ISO14001 certified companies.	
Observa-tions	Observations of teaching situations supported the case study.				

Thus, this thesis' core contribution relies on the five academic papers presented above, which together provide a broad perspective on circular business development. Figure 4.3 illustrates how the different papers either have a theoretical or empirical focus and shows the nature of methods applied in each study. While predominantly qualitative research methods have been applied, the papers are more diverse in relation to the focus of either theoretical or empirical.

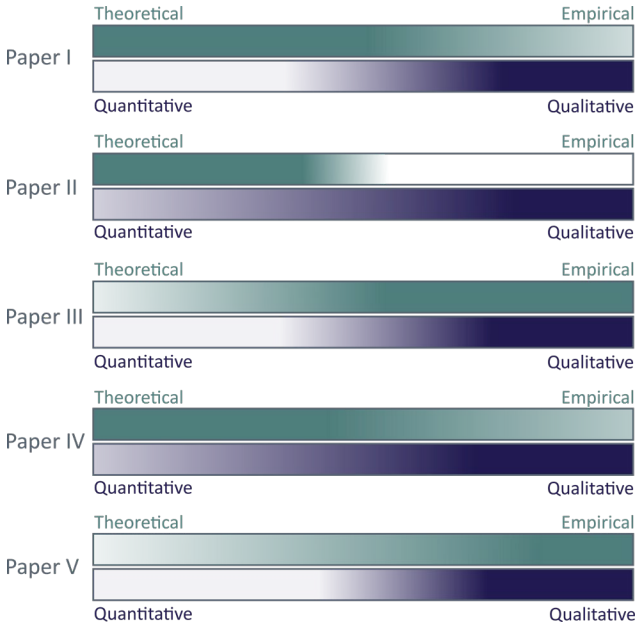

Figure 4.3. Overview of focus and methods applied in papers

As these academic papers include limited empirical data from the host company, such data were gathered instead as part of a longitudinal exploratory case study (Bryman, 2012; Yin, 2014). This study relied on action research in which the researcher's role can be characterized as engaged scholar (Van De Ven and Johnson, 2006). Engaged scholarship is defined as *"…a collaborative form of inquiry in which academics and practitioners leverage their different perspectives and competencies to coproduce knowledge about a complex problem or phenomenon that exists under conditions of uncertainty found in the world"* (Van De Ven and Johnson, 2006, p.803). This collaborative process of forming new knowledge allows a closer connection between theory (scholars) and practice (practitioners). The role of engaged scholar lies in what Dwyer and Buckle (2009) defined as the space between being an insider and an outsider. Occupying this space between allows the researcher to be an insider and outsider simultaneously, who acknowledges both the similarities and differences between him/herself as researcher and the "others" who are being studied (Dwyer and Buckle, 2009). In this longitudinal case study of HOLMRIS B8, continuous coproduction of knowledge focused on advancing implementation of circular

economy strategies, in which the five academic papers provided input for this coproduction process.

4.3. DATA COLLECTION METHODS

The research incorporated a variety of data collection methods, each with strengths and weaknesses. During the project, several methodological choices were made, and these are presented in the specific research design within each paper. This section presents the methods used to collect data for the longitudinal case study of HOLMRIS B8 overall, where the empirical data gathered provided the foundation to discuss the academic papers in the company's context and provide recommendations to advance its implementation of circular economy strategies (Chapter 10).

4.3.1. ENGAGEMENT IN THE COMPANY

As an industrial PhD, daily interactions and involvement in the host company are part of the research process. This is both a blessing and a curse. On the one hand, it provides a closeness that external researchers rarely find in companies. On the other hand, this closeness to practice may also have influenced the research objectives and "colored" the glasses through which the world was seen during the project. Finding and occupying the space between these different positions, that of a complete outsider and a complete insider, was key to engaging in the company. The space between became a fluid position where at times I was more an insider, and at other times, more an outsider.

Bryman (2012) acknowledged the "messiness" of business research, which emphasizes the importance of flexibility and adaptability of research in organizations. During this project, several organizational changes influenced the ability to engage in the company (see Chapter 3), which were elaborated in section 4.1.

One of the benefits of engaging in company practices for three years has been the development of longitudinal relationships that have allowed first-hand experiences of the organization's dynamics and practices (Schultz and Hatch, 2005) though unstructured observations (Bryman, 2012) and participation in daily practices. Such unstructured observations served as a method to access practices within the organization, and did not rely on an observation schedule, which allowed flexible observations. The observations became more structured over time, as specific themes emerged during the research process, and a more detailed and organized notebook of observations was established. Thus, data obtained from daily engagement in the company were organized in notebooks of observation notes, meeting minutes, and e-mail correspondences.

In addition to daily engagement in the company, I also had the opportunity to participate actively in different company activities within the scope of sustainability or circular economy during the project period. Within these different activities, I played the role of knowledge partner primarily to ensure that each activity had a

knowledge-based foundation and conducted the activities as well. Four key activities are summarized here, as these had the greatest influence on the project's scope, provided insights into practice in different ways, and demonstrated examples of co-production of knowledge related to circular economy.

Circular furniture procurement project (2017-2018): One of the first internal projects in which I participated focused on developing a concept for circular public procurement of furniture to showcase the way public sector organizations could conduct such procurement and the potential sustainable value to be gained from it. The concept was co-developed in a cross-departmental project group consisting of the CSR Director, Head of Tender and Procurement, Head of Sales (Learning), and me. The concept we developed was presented to, and discussed with, several public sector organizations, and also provided an improved foundation for further awareness of circular public procurement internally.

CSR group (2018-2020): During most of the project period, I was an active member of HOLMRIS B8's CSR group, which was established after the merger to facilitate organization-wide coordination and implementation of CSR-related initiatives. Although the group was established in 2018, I have participated in CSR activities since 2017 within 3R Kontor; however, these activities were not formalized in a dedicated group. In addition to me, the group consisted of the Head of Environment, Quality, and Processes, the CSR Director, the Compliance Engineer, and the Sustainability and Communication Manager, which ensured active participation from the Circular department and the department of Quality, Health, Safety, and Environment. The group planned bimonthly meetings to ensure continuous activities; however, the group struggled to reach the wider organization. Despite the intention to integrate CSR-related activities in the organization through a cross-departmental CSR group, many activities the group initiated were decoupled from other organizational practices and carried out by the group members alone.

Circular furniture design (2018-2020): No single group was assigned to work on this topic; rather, different sub-projects related to circular furniture emerged during the project period. Each of these projects focused on different ways to experiment with circular principles in product design, such as recycled and alternative materials and product refurbishment. Following the review of the micro-level indicators (paper II - Chapter 6), further work was conducted to establish circular design guidelines for furniture, as well as identify potential indicators of circular furniture. However, because of the organizational changes, these guidelines and indicators were put on hold until some of the changes were established.

EU Ecolabelling a student chair (2018-2020): I joined the group that was working to obtain an EU Ecolabel for a student chair. In the beginning of this process, my primary role was to provide input for circular design and materials, and overall discussions of the way product development and circular economy strategies could be connected. Later, my role changed from a knowledge partner primarily to a more practical role in

coordinating and gathering documentation to obtain the EU Ecolabel. Participating in this working group provided insights into the current understandings and perceptions of sustainable product design on the part of the group participants.

4.3.2. DOCUMENT ANALYSIS AND LITERATURE REVIEW

Throughout the project, document analysis and literature reviews were used as ongoing data collection methods. From the outset, extensive literature was used to set the research direction and determine the state-of-the-art in circular business development. In addition, different types of documents and literature were used throughout the study, such as academic and grey literature and company documents. Company information related to circular economy and sustainability provided the foundation for understanding the current strategies and activities applied in the company as well as the history of this. This included both internal and external documents. For example, insights into the established processes in the management system provided insights into potentially relevant actors in the company to involve in the research process. In addition, each paper involved some form of literature and document review, and an extensive and systematic literature review was conducted in paper II.

The document analysis was concerned particularly with company processes, including presentations, internal documents, reports, and strategies. Using archival documents from the company provided insights into the organization's history and development. Before and during the project period, several student collaborations were conducted that focused primarily on the circular department. For example, an anthropologist researched the social responsibility, rehabilitation of former criminals, and related work environment within the circular department, and a student of commerce management investigated customer relations for sustainable products. The reports from such collaborations were also included as secondary sources and provided insights into the way others have investigated relevant aspects within the organization.

All company documents were assessed to ensure their quality and validity using the criteria of authenticity, credibility, representativeness, and meaning that Scott (1990) defined. Thus, the assessment of the company documents' quality was based on these criteria to ensure that no documents of questionable origin, or that were unclear or distorted were used. During the project, some occasions required company-specific content's quality and validity to be assessed critically, particularly because of their lack of credibility and unclear meaning caused by errors in the published content. Most examples of this were found in marketing material related to sustainability, which demonstrated misunderstandings or misinterpretations. For example, when launching the new student chair, the marketing material stated that all chemicals used are REACH and RoHS certified, and that the chair was manufactured in conditions that met the EU Ecolabel requirements. The latter was especially problematic, as the application for the EU Ecolabel had not yet been submitted,

documentation for this claim was not present, and the marketing requirements for the EU Ecolabel are very precise in what you can and cannot do. However, during the project period, awareness of the need to review company material internally increased to avoid such errors. Casting a critical eye on company content proved necessary to ensure the information's validity, which also required me to bring information in material that did not meet the criteria above to relevant employees to check and validate. In the case of the student chair, the issue was brought to the working group and the marketing department to ensure correction of the errors and to discuss the importance of internal review of such material and how certification and labels work in practice.

4.3.3. INTERVIEWS, DIALOGUES, AND MEETINGS

Interactions with different actors throughout the project were the primary source of empirical data obtained in both formal and informal interactions. Interviews are a suitable method to study real-life contexts and problems (Brinkmann and Kvale, 2015; Yin, 2014). The knowledge and information obtained from interviews provides insights into the respondents' perceptions and worldviews (Tanggaard and Brinkmann, 2010a). The knowledge obtained during interviews is characterized as situated, contextual, and constructed in the interview situation, which is influenced by the conversation, linguistics, narratives, and relationship between the respondent and interviewer (Tanggaard and Brinkmann, 2010).

Bryman (2012) identified two distinct types of qualitative interviews, semi-structured and unstructured. Semi-structured interviews were used in three of the five papers developed during this PhD, and were also a key method used to collect data in the longitudinal case study of HOLMRIS B8. In addition to semi-structured and organized interviews with one-three respondents, one paper used focus group interviews, as this method is suitable to investigate new topics by discussing and sharing participants' experiences, opinions, and perceptions (Eriksson and Kovalainen, 2008; Krueger and Casey, 2015). In addition, the longitudinal case study also included meetings and dialogues of a more exploratory and unstructured nature.

Table 4.2 and Table 4.3 present overviews of the internal and external interactions that provided empirical data for the longitudinal case study. As most of these interactions were in meetings or ongoing dialogues, recording was often not possible; however, notes were made on each interaction. These interactions provided empirical data for the case study, while additional interviews and workshops were conducted for the academic papers. Interactions used for the academic papers are not included in this chapter, but instead, are described in detail in each paper.

Table 4.2. Summary of key internal interactions in the longitudinal case study

Date	Actors	Scope	Mode
2017-2020	*Circular department*: All employees in this department (10-13)	Ongoing interactions and participation in daily practice of working with used furniture; insights into practice, opportunities, and challenges to promote and implement circular economy strategies	Daily engagement; participation in biweekly morning meetings
2018-2019	*Product development and sales*: Key account managers; product developers; product managers; project managers	Introducing Circular department; insights into current practices of working with sustainability and circular economy; discussions of potential to integrate circular principles in their practices further	Meetings
2018-2019	*Public tender group*: Head of Public Tender & Procurement; Head of Sales (Learning); CSR Director; Sustainability and Communication Manager	Developing a concept of circular and sustainable public procurement of furniture; insights into practices of sustainable and circular public procurement	Regular meetings; ongoing dialogue and collaborations
2018-2020	*CSR group*: CSR Director; Head of Environment, Quality, and Processes; Compliance Engineer; Sustainability and Communication Manager	Coordinating, planning, and conducting CSR projects and strategies in the company	Bimonthly physical meetings; ongoing dialogue and collaborations
2019-2020	*QHSE department*: The two employees of the department (Head of Environment, Quality, and Processes, and Compliance Engineer)	Continuous involvement in the department's daily practice; insights into daily tasks, priorities, and interactions with other internal departments and external actors	Daily engagement; involvement in QHSE meetings and activities
2018-2020	*EU Ecolabel group*: Head of Environment, Quality, and Processes; Head of PTA; Supply Chain Assistant	Planning and preparing to obtain the EU Ecolabel on a new student chair	Regular meetings

Table 4.3. Summary of key external interactions in the longitudinal case study

Date	Actors	Scope	Mode
2017-2020	*Public sector organizations*: Municipalities; regions; schools; universities	Dialogue with public sector organizations on ways to advance circular economy implementation through collaboration and public procurement	Meetings; supplier dialogue; workshops
2017-2020	*Private sector organizations*: architects; distributors; suppliers	Exploring potential collaborations for circular solutions (product design, recycling; reuse, etc.)	Meetings
2018-2020	*Other external actors*: Ecolabelling Denmark; FSC Denmark	Insight into established organizations focused on sustainability, and the way they consider circular economy	Meetings

4.4. QUALITY OF RESEARCH

In qualitative studies, assessing the quality of the study is difficult to do through the application of the same criteria as in quantitative research (Bryman, 2012; Golafshani, 2003). While quantitative research can be assessed through measures of replicability, reliability and validity (Bryman, 2012), Tanggaard and Brinkmann (2010b) noted that common criteria to assess qualitative research are difficult to establish because of its diversity. The criteria are often reformulated to match the nature of qualitative research, e.g. through what Golafshani (2003) presents as a conceptualization of reliability and validity in qualitative research as trustworthiness, rigor and quality. The contextual underpinnings of qualitative research influence the methodological choices and the obtained results, which makes transparency in methodological choices important when assessing quality of qualitative research. An important aspect of assessing the quality of qualitative research is thus concerned with the craftmanship of conducting research, which pertains to a question of how the knowledge was produced (Flick, 2008), e.g. by assessing the consistency and appropriateness of research objectives, data collection strategy, applied methods and analytic framework (Walsh and Downe, 2006).

In this study, the continuous process of ensuring relevance and rigor (Figure 4.1) provides the foundation for assessing the quality of the research. Walsh and Downe (2006) highlights the importance of contextualizing research through a clear link between research and existing literature. In this thesis, the rigor cycle of continuously connecting the research to existing knowledge from the conceptual frame supports this. Additionally, such link between research and existing knowledge is also relevant for the contextual frame to ensure the relevance and practical foundation of the research.

The craftmanship of doing research is at the core of appraising the quality of qualitative research, and the methodological choices of this research are presented in this chapter and in each of the five academic papers. Transparency of research objectives and applied methods has been established through a clear conceptual and contextual frame (Chapter 2 and Chapter 3) and research design and methodology (Chapter 4). A way to assess the quality of the research is thus to assess the consistency between research objectives and research design, which puts emphasis on presenting and discussing the appropriateness of chosen methods for the specific research objectives (Walsh and Downe, 2006). In this chapter, such choices have been presented and discussed for the overall research design, while each paper include specific considerations for the included study.

To ensure the quality, trustworthiness and confidence of the results of this study, different triangulation techniques were used throughout the study (Denzin, 1978; Flick, 2004):

- Data source triangulation involves the collection of data from different sources, times and people, which was used to gain more comprehensive insights through different perspectives on the same theme (see e.g. the case study in paper I). Similarly, within the longitudinal case study, such data triangulation was used to gain enriched understandings of internal processes and practices through interactions with different people over time (see section 4.3.1).
- Investigator triangulation involves participation of multiple researchers, which has been used in all papers included in this thesis to ensure multiple observations and interpretations of data and reduce researcher bias by checking, correcting and expanding the subjective views of each researcher. For example, in paper II, checking and expanding the analysis of micro level indicators was enabled through collaboration between the two researchers.
- Method triangulation involves the use of multiple techniques to collect data, which has been summarized in Table 4.1 for the papers and in Section 4.3 for the longitudinal case study. By application of different methods to investigate a research theme, different aspects can be captured. For example, in paper V, the use of document analysis on procurement policies combined with semi-structured interviews on procurement practice captured differences between policy and practice, which may not have been uncovered through single-method studies.

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CHAPTER 5. A FRAMEWORK FOR SUSTAINABLE VALUE PROPOSITIONS IN PRODUCT-SERVICE SYSTEMS

This chapter contains paper I: "A framework for sustainable value propositions in product-service systems" (Kristensen and Remmen, 2019), which was published in the *Journal of Cleaner Production* as part of a special issue for the 2017 European Roundtable on Sustainable Consumption and Production.

**paper omitted in online version*

The paper examines the research question: *What can sustainable value propositions offer using product, service, and system as a key framework?* and seeks to provide insights into aspects of internal business organization and its relation to users' demand side aspects. The purpose of this paper is to provide a framework to map and understand sustainable value propositions in circular economy to determine the way business models can be designed for circular economy solutions that are either product-, service-, or system-oriented. For such business models to function, a broader perspective on stakeholders is necessary, which is also emphasized in this paper to provide insights into new value chain relations for circular business development.

Thus, a framework for sustainable value propositions is developed in the paper based on a product, service, and system conceptualization, which is then exemplified through a case study of school furniture. The paper presents a new system perspective in product-service systems, where the system is no longer seen as the infrastructure that combines products and services, but rather, it has an independent character and value proposition of its own. This new framing of product-service systems allows value propositions to be enlarged when the scope from a product perspective on service is broadened to a system perspective. Thus, applying the proposed distinction between product, service, and system as the key framework for sustainable value propositions in circular economy provides a better understanding of the way circular solutions can offer new forms of value to multiple stakeholders.

The sustainable value proposition framework presents business models' potential economic, social, and environmental value by focusing on either product, service, or system. In addition, the framework also includes the different interactions needed between stakeholders, as it changes from transferring ownership in a product-oriented business model to collaborations in service-oriented business models, and lastly, partnerships in systemic business models. Therefore, companies that pursue circular business models can benefit from a broader goal to solve societal problems,

rather than focusing on short-term financial profit and pursuing collaborations and partnerships in the value chain.

Thus, the framework demonstrates the potential value added in circular economy when business models are addressed from a system perspective, and provides inspiration for companies to rethink their value propositions to allow sustainable value creation and support circular economy strategies of regenerating, narrowing, slowing, and closing simultaneously. In this paper, special attention is given to the social value propositions, as this sustainability dimension is lacking currently in circular economy research. This paper demonstrates that circular solutions' potential social value extends beyond the traditional user-centric value from using products to a societal perspective on social value creation.

CHAPTER 6. A REVIEW OF MICRO LEVEL INDICATORS FOR A CIRCULAR ECONOMY – MOVING AWAY FROM THE THREE DIMENSIONS OF SUSTAINABILITY?

This chapter contains paper II: "A review of micro level indicators for a circular economy – moving away from the three dimensions of sustainability? (Kristensen and Mosgaard, 2020), which was published in the *Journal of Cleaner Production*.

**paper omitted in online version*

The paper examines the research question: *Which micro level indicators exist for circular economy, and how do they align with the three dimensions of sustainability?* and seeks to provide insights into the framework conditions for circular business development. Understanding the ways circular economy strategies are measured and understood on the micro-level provides insights into the maturity of circular economy standardization and indicators for companies to apply when engaging in circular business development.

The paper provides a systematic literature review of 30 academic and practical indicators of circular economy on the micro-level, and shows that there is no commonly accepted and agreed-upon way to measure it, either with respect to which principles to measure or the method and unit of measurement. Further, current indicators focus primarily on measuring circularity in terms of recycling, while limited attention is given to strategies to repair, maintainance, and reuse. This is emphasized further by the lack of prioritization of circular economy strategies in the indicators reviewed, which results in equating different strategies or principles, such as recycling, remanufacturing, and reusing. This poses the risk of missing the hierarchy of principles, both with respect to potential value creation and sustainability potentials. The current diversity of indicators complicates their applicability in industry, and further industry work could give attention to including circularity in standards and ecolabels to ensure comparable measures and inclusion of circular economy.

The majority of indicators reviewed are one-dimensional and thus focus on measuring singular strategies. Applying these one-dimensional indicators risks missing the system perspective and the wider context in which the product or material is situated, as well as risks of sub-optimizations, double-counting, and trade-offs.

The indicators reviewed were analyzed according to their consistency with the three sustainability dimensions, which showed a biased approach to sustainability when circular economy strategies are measured on the micro-level. The sustainability dimension included most commonly is economy, followed by environment, and lastly, very little attention is given to the social dimension. Thus, most indicators focus on a given circular strategy's economic feasibility, which is an approach too narrow to capture the potential value of circular economy from a sustainability perspective fully. However, the focus on economic feasibility could be expected to increase industry's use of these indicators, as they already "speak the language" of business. However, this represents a measure too narrow, as environmental and social sustainability are not considered, and thus pose the risk of disconnecting the environmental, and particularly, the social sustainability dimension from circular economy.

CHAPTER 7. ENVIRONMENTAL MANAGEMENT SYSTEMS FOR CIRCULAR ECONOMY

This chapter contains paper III: "Companies that discontinue their ISO14001 certification – Reasons, consequences and impact on practice" (Mosgaard and Kristensen, 2020), which was published in the *Journal of Cleaner Production*, and paper IV: "Bridging the gap between environmental management systems and circular economy" (Kristensen et al., 202x), which was accepted for publication in the *Journal of Cleaner Production*, and has been re-submitted in revised form.

**papers omitted in online version*

The first paper seeks to answer the research question: *Why do some companies choose to discontinue their ISO14001 certification, and what are the consequences of this on their environmental practices?,* and the second paper seeks to answer the research question: *How can environmental management systems be used to align and manage circular economy strategies in organizations?* Jointly, these two papers seek to provide insights into aspects of the internal business organization based on the potentials of environmental management systems in circular business development.

Firstly, paper III examines the reason that 19 companies have chosen to discontinue their ISO14001 certification and the way this decision has affected their environmental practice. Companies discontinue their ISO14001 certification primarily when: 1) The resources needed to sustain the system outweigh the experienced or perceived benefits; 2) they substitute the ISO14001 system with a new system and no longer need the ISO14001 system, or 3) they face a lack of management support. Overall, the environmental practices are discontinued together with the certification, as the companies no longer work systematically with their environmental impacts, and focus less on employee involvement in environmental efforts, on the environment in supply chain management, and on interaction with environmental stakeholders. Although the companies had been certified for an average of 8 years, the environmental practices connected to the ISO14001 had not become embedded in general organizational practices, which indicates a need for further work to internalize the system and embed environmental practices in daily work. Companies that discontinue the ISO14001 often have a narrow understanding of the certification's potential benefits, as they focus on production, and do not apply strategic environmental management, e.g., by integrating lifecycle thinking, ecodesign, industrial symbiosis, or circular economy strategies.

Because of this lack of a strategic environmental management, paper IV examines environmental management systems' potentials to align and manage circular economy strategies in organizations as a way to use existing management systems to support implementation of circular economy. Further, companies that discontinue their certification often find it difficult to keep identifying improvement potential, and thus experience decreasing value of the system over time, which could be mitigated through a strategic focus of environmental management systems that can support management of companies' circular economy initiatives. Integration of circular economy strategies in environmental management systems requires both "hard" and "soft" tools and capabilities to ensure that new practices are internalized. This includes extending or reconfiguring existing tools and capabilities, as well as developing new ones that support circular economy.

7.1. COMPANIES THAT DISCONTINUE THEIR ISO14001 CERTIFICATION – REASONS, CONSEQUENCES AND IMPACTS ON PRACTICE

7.2. BRIDGING THE GAP BETWEEN ENVIRONMENTAL MANAGEMENT SYSTEMS AND CIRCULAR ECONOMY

CHAPTER 8. CIRCULAR PUBLIC PROCUREMENT PRACTICES IN DANISH MUNICIPALITIES

This chapter contains paper V: "Circular public procurement practices in Danish municipalities" (Kristensen et al., 202x), which was accepted for publication in the *Journal of Cleaner Production* as part of a special issue for the 2019 European Roundtable on Sustainable Consumption and Production and has been re-submitted in revised form.

**paper omitted in online version*

The paper examines the research question: *How do the current procurement practices in Danish municipalities influence a development towards circular public procurement?* and seeks to provide insights into demand side aspects of circular business development. The paper contains a multiple-case study of procurement practices in eight Danish municipalities to determine how current practices of public procurement influence development of circular economy. This provides further insights into the way the relations between public sector organizations and private companies change in circular economy implementation.

The paper shows that the eight case municipalities perceive circular public procurement as "something new," and that it is difficult to operationalize within the procurement departments. As circular public procurement is not an activity that can be confined to the procurement department, it requires collaboration internally across departments and externally with partners in the value chain. The case municipalities were used to set requirements for environmental aspects through green public procurement practices that appear to have become institutionalized in Danish municipalities, whereby green criteria are included in the procurement process without specialist competencies, e.g., through the inclusion of ecolabels. However, as circular public procurement extends beyond product-specific requirements, other competencies are needed. Further, the current practices in Danish municipalities show that green public procurement is driven primarily by end-user demands, which may complicate the development of CPP, as end-users cannot be expected to know what or how to set demands for circular solutions.

The procurement officers lack capabilities to integrate circular public procurement in in tenders that extend beyond a product-level. Despite procurement departments' awareness that they lack such knowledge, the respondents indicated that they rely on the same knowledge partners for circular as for green public procurement (e.g., Ecolabelling DK). Such reliance on existing knowledge partners may hinder increasing

their understanding of circular economy, as it is unlikely that they will acquire new knowledge and capabilities through this strategy. However, using knowledge within public procurement officers' existing network could support further acceptance of circular public procurement, e.g., through better utilization of market dialogue and supplier engagement to foster closer collaborations with the market to increase knowledge and codevelop new circular solutions.

CHAPTER 9. DISCUSSION AND CONCLUSION

The purpose of the investigations in this thesis has been to examine how circular economy can support sustainable business development. Through five sub-questions answered in five academic papers (Chapter 5-Chapter 8), different contributions have been made to this. The five papers focus on different pieces of the puzzle and have explored different aspects of how circular economy can support sustainable business development.

The importance of applying a comprehensive perspective on circular economy implementation was highlighted in the introduction due to the systemic nature of circular economy. The five papers provide insights into different aspects of circular business development, namely sustainable value propositions, micro level indicators for circular economy, environmental management systems, and circular public procurement. By contributing to these different aspects of circular economy implementation, the research aims to explore how to overcome some of the current tensions and limitations to circular economy implementation (as presented in Section 1.2).

Applying a distinction between product, service and system in business models enable a conceptualization of potential sustainable value propositions, as analyzed in paper I. Applying this distinction demonstrated how value propositions can be innovated in circular economy from product over services to system solutions, which puts emphasis on a broader value perspective. Rethinking value propositions in a system perspective supports circular business model innovation through a new understanding of sustainable value creation for multiple stakeholders, and not just the immediate customer. The case of school furniture exemplifies this as moving from cheap and ergonomic tables and chairs in a product perspective to designing flexible learning environments in a system perspective that can accommodate different learning styles and needs of students and teachers by focusing on functionality and rethinking the traditional understanding of classrooms. Taking inspiration in this case study, the framework can function as a tool for companies to rethink and redesign their value proposition from selling products to delivering services and systemic sustainable solutions. The system perspective of the framework aligns with the sustainability strategy of systems building and shows how circular strategies of slowing and closing, enabled through new stakeholder interactions and partnerships, can support sustainable business development.

The type of interactions needed to realize sustainable value in circular economy was emphasized in paper I as part of the presented framework. Moving from product over service to system entails an expansion of relevant stakeholders and the type of

interactions between stakeholders; from a single exchange over collaborations to partnerships. This aligns with the different perspectives of interactions in the different strategies for sustainable business development (Figure 2.1), where the scope broadens from internal organization in operational optimizations over inter-organizational interactions in the value chain in organizational transformation to societal partnerships in systems building. As a wider understanding and engagement of stakeholders is necessary to advance circular economy implementation, the presented framework provide the foundation for considering more stakeholders and understand which interactions to focus on, depending on the provided solution of either product, service or system. This is especially highlighted in relation to the system perspective, which puts emphasis on providing sustainable solutions to societal problems through partnerships.

The notion of a sustainable circular economy was presented in the introduction (Chapter 1), where circular economy was defined as a concept that aims to accomplish sustainable development. However, the social dimension is often found to be neglected in circular economy research and practice, which was also observed in the analysis of how the three sustainability dimensions are included in micro level indicators for circular economy (paper II). Here, a clear prioritization of the economic dimension was found with limited inclusion of the environmental and especially the social dimension. This bias in circularity indicators does not support a sustainable circular economy, as priority is given to the economic feasibility of micro level circularity. As circular economy is intended to accomplish sustainable development, the applied indicators need to reflect this to avoid further decoupling of circular economy from sustainable development.

The dominant and commonly applied indicators focus on measuring recycling strategies and are thus focused on a closing strategy. However, as this strategy is closely related to the linear economy, the actual value of circular strategies is lost when mainly measuring recycling. Thus, the current micro level indicators do not include much attention to the inner and high value circles of repair, maintenance and reuse. This is a problem for companies wanting to engage in circular business development, as they can become inclined to focus their attention and efforts on recycled content and resource-efficiency of products, and risk missing the potential broader value perspective from a service or system perspective (cf. paper I). This is further emphasized by the lack of prioritization of circular principles in the reviewed indicators, whereby companies will miss actual value creation in circular economy through systemic solutions (cf. paper I).

From insights into why companies choose to discontinue their ISO14001 certification, the importance of making environmental management systems function more strategically can be highlighted to avoid discontinuation, secure continuous improvements and ensure connection to the overall strategic direction of the organization (cf. paper III & IV). By broadening the scope of environmental management systems from production processes to also consider products and

services, companies can design their environmental management system to include processes that relate to areas of value creation in a lifecycle perspective and go beyond operational optimizations.

Regarding potentials for using environmental management systems to align and manage circular economy in organizations, companies need to broaden the scope of the management system from primarily narrowing strategies related to production towards slowing and closing strategies in product- and business model design. Although not yet an established practice, the potential of integrating circular economy in environmental management systems present opportunities for companies to align internal processes and activities with circular strategies. This holds potential to improve the strategic value of environmental management systems, but also support internal implementation and prioritization of circular economy. Broadening the scope of the environmental management system can be supported through utilization of the sustainable value proposition framework by expanding the boundaries of the environmental management system through a wider perspective on the value creation rationality of the organization.

Collaborations for circular economy was emphasized as part of broadening the scope of stakeholders relevant to a company's environmental management system (cf. paper IV). In this regard, companies can benefit from engaging more stakeholders to enable collaborative innovation. Designing the environmental management system to include collaboration and partnerships as explicit processes or targets can support alignment between the management system and circular strategies that focus on creating sustainable value through product, service and system solutions (cf. paper I).

The potentials of utilizing public procurement as a market driver for circular economy has also been investigated in this research (paper V). The importance of circular public procurement has been highlighted in the introduction, and this research provides insights into the current practices of public procurement to enable in-depth understanding of the drivers and barriers for further uptake of circular public procurement (cf. paper V). Circular public procurement requires a completely rethinking of public procurement and a broadening of the current practices. The traditional view of public procurement as defining requirements and setting demands to suppliers does not allow for innovative circular solutions. Additionally, the risk-averse culture of public procurement has resulted in limited interactions with markets, which may disconnect supply and demand. Closer interactions through market dialogue with potential suppliers can enable an improved understanding of relevant circular solutions. The end-users or the procurement officers themselves cannot be expected to know these solutions. Instead, interactions between end-users and procurement officers should focus on identifying the actual needs and required functionality and go beyond the product-oriented practice of doing the same as last time.

Cross-cutting conclusion

This thesis contributes to a comprehensive understanding of circular business development through investigations of how circular economy can support sustainable business development. Sustainable business development is understood through the three sustainability strategies of operational optimization, organizational transformation, and systems building, and innovation is characterized by changing from technology to people; from insular to systemic; and from stand-alone to integrated. This research enables an improved understanding of how circular economy can support such changes and a development from operational optimization to systems building. This comprehensive understanding was achieved through a new conceptualization of sustainable value propositions, assessment of micro level indicators for circular economy, analysis of the potentials for utilizing environmental management systems to align and manage circular economy initiatives, and insights into practices of circular public procurement.

These different perspectives on circular business development in the papers, emphasize four distinct areas of relevance for companies to consider when applying circular economy to support sustainable business development. In a development from operational optimization towards systems building, companies need to broaden the scope from incremental improvements to more radical system innovations. This includes a broader perspective on sustainable value and stakeholders for circular solutions, and circularity indicators and environmental management systems as tools to support circular and sustainable business development.

Thus, this research enables an improved understanding of the complexity of circular economy in practice and informs how companies can engage in circular business development through different actions internally and externally. The findings underline the interdependence and connected nature of the different elements of circular business development, as none of the investigated areas alone are enough to secure a transition towards a sustainable circular economy.

Limitations

As this research is conducted as part of an industrial PhD project, company-specific limitations have occurred, which have influenced the research objectives and outcomes. The first limitation concerns potentials for interactions in HOLMRIS B8, where organizational changes during the project period has impacted the potentials for interactions and influence in the organization. While the original project plan included more attention to internal capability building, this was not possible in practice due to these organizational changes and subsequent changes in prioritizations and available resources. In order to cope with this limitation, the focus of the research broadened and applied a more “outside-in” perspective on HOLMRIS B8 through investigations of relevant areas for the company. The scope was then expanded to consider more broadly the furniture industry and investigate how circular economy can support sustainable business development in a wider context than just HOLMRIS B8. This has enabled wider applications of results but have

however also limited the in-depth investigations and potentials within HOLMRIS B8. Although it has not been possible to fulfill the original intent of engaging in capability building and organizational learning within HOLMRIS B8 for circular business development, this thesis has instead provided new insights for the company to consider in future initiatives and efforts. The research areas chosen for investigation were thus chosen based on both gaps in academic knowledge, but also based on explicit interests expressed by HOLMRIS B8.

Each study included in this thesis has its own limitations (as described within each paper in Chapter 5-Chapter 8).These papers provide insights into different aspects of circular business development, and have focused on value propositions, circularity indicators, environmental management systems, and public sector customers through public procurement. However, an integrated study would have been beneficial to bring together the findings in a wider case study to consider the internal capabilities needed for circular business development.

CHAPTER 10. RECOMMENDATIONS

Based on the discussion and conclusions presented in Chapter 9, recommendations for further implementation of circular economy in HOLMRIS B8 will be presented in Section 10.1, which also include additional reflections from the longitudinal case study of HOLMRIS B8 that has not been covered in the academic papers. Additionally, recommendations for further research are proposed in Section 10.2 to complement the results of this PhD thesis.

10.1. RECOMMENDATIONS FOR HOLMRIS B8

The importance of advancing circular economy implementation in the furniture industry has been highlighted in the introduction, and the aim of this thesis was thus to contribute with applicable knowledge to the furniture industry on how to advance circular economy implementation, focusing on HOLMRIS B8. HOLMRIS B8 has generally applied the same understanding of circular economy as found in the micro level indicators for circular economy, i.e. an economic perspective and focused on closing and narrowing loops (cf. paper II). Although the circular department primarily focuses on slowing loops through buy-back and sales of used office furniture, the remaining organization has not fully adopted this strategy. Recommendations for HOLMRIS B8 will be presented, based on the key findings from the research and to further support circular economy implementation in the organization that goes beyond the current perception and strategy.

The first recommendation to HOLMRIS B8 is based on the sustainable value proposition framework (cf. paper I). Currently, HOLMRIS B8 employs a product-oriented strategy with the addition of some service options, e.g. solutions of moving, refurbishing and reusing old furniture in combination with new. However, as the case study of school furniture from another furniture company showed, the potential value creation from applying a system perspective on business models broadens in comparison to a product perspective. While HOLMRIS B8 has expanded the scope of the business to include services, additional development and expansion of value propositions towards a system perspective could support further circular business development in the company. Such system perspective enables new value creation potentials through focusing on users' needs and rethinking the company's purpose from being a 'furniture pusher' to a value creator. Furthermore, such perspective also includes new considerations of improved space management and flexibility in buildings. As HOLMRIS B8 is specialized in four segments of learning, office, care and hospitality, it may be beneficial to focus such efforts in one of the segments first to explore new potentials through pilot projects, and then build on these experiences and explore similar concepts in the remaining segments.

The second recommendation extends the insights gained from the review of micro level indicators. While the current landscape of micro level indicators aligns with the

general understanding of circular economy in HOLMRIS B8, attention must be given to indicators that focus on slowing loops. Prolonging the lifetime of products and components is essential in the furniture industry to keep materials in circulation and reduce new use of resources for production. For HOLMRIS B8, it would be recommendable to partake in industry-wide collaborations to codevelop indicators for the furniture industry to ensure a common understanding and strategy to measure circular economy. An important aspect to include in such work is the alignment with three sustainability dimensions to avoid a decoupling of circular economy from sustainable development.

The third recommendation for advancing circular business development is based on collaboration, both internally and externally. As the production site in Bjerringbro is scheduled to close, the organizational structure can be expected to change, which creates an opportunity to "shake" the existing structure and roles. The upcoming changes can also be expected to influence the type of collaboration and interaction with stakeholders and provides opportunities for closer collaborations with strategic suppliers to ensure security of supply and ensure that customer demands for sustainability and circular economy can be met. However, as seen in paper V, customers are not so certain what to ask for when it comes to circular solutions. The Danish furniture industry could become a stronger knowledge partner for public sector organizations to further explore and develop relevant criteria for circular public procurement of furniture solutions that goes beyond a product-level.

The fourth recommendation pertains to the potentials of embedding circular economy initiatives in the existing management system. With the production site closing in Bjerringbro, the current certifications will need to be moved to other locations. This provides an opportunity for redesigning the environmental management system from a production focus towards broadening the scope of the system towards products, system solutions and business models. Reorganizing the management system to align with the new strategic direction could provide the foundation for further integration of circular economy in other departments than solely HOLMRIS B8 Circular. Additionally, ensuring a clear strategic and high-level perspective in the core of the environmental management system can increase the value of maintaining and redesigning the system to fit the new organizational context.

The fifth and final recommendation extends the findings regarding the case study of the sustainable value proposition framework and circular public procurement. For HOLMRIS B8, it would be beneficial to engage in strategic collaborations with front-runner institutions and municipalities that are willing and able to engage in codeveloping and setting up more systemic requirements in their public procurement. As the case study of learning environments (cf. paper I) pointed to new opportunities for improved space management through systemic solutions, such strategic collaboration should focus on developing systemic requirements that go beyond product-specific demands and focus on better use of space, flexibility, multi-functionality etc.

In short, HOLMRIS B8 is recommended to:

- Initiate pilot projects within one segment to explore sustainable value propositions from a systemic perspective, which can then be expanded to the remaining segments.
- Initiate or engage in industry-level collaborations for developing circular economy indicators relevant to the furniture industry, that ensures a prioritization of circular strategies and inclusion of the three sustainability dimensions.
- Utilize the upcoming organizational changes as an opportunity to "shake" existing structures, roles and increase focus on strategic collaborations, internally and externally.
- Redesign the environmental management system by broadening to scope to match the new strategic direction of the company and use the system to align and manage circular economy initiatives in all departments.
- Engage in strategic collaborations with front-runner institutions to codevelop systemic solutions for circular public procurement that goes beyond product-level requirements and focuses on flexibility, multi-functionality etc.

10.2. RECOMMENDATIONS FOR FURTHER RESEARCH

This PhD thesis has applied a broad perspective on business development for circular economy, which has provided insights into different aspects that are subject to change in the transition from a linear to circular economy. To complement the findings of this research, recommendations for further research are proposed. Future research directions can be found within each of the different aspects investigated.

This research can be complemented with additional research into the complexity of sustainable value creation in circular economy. The scope of value applied in paper I is focused on positive value creation, while a more nuanced understanding of sustainable value in circular economy could be achieved by considering also potential tensions or trade-offs between the different sustainability dimensions. Additionally, the sustainable value proposition framework could be elaborated with more extensive circular strategies, focusing on circular product design, service options and systemic circular solutions. Expanding the sustainable value proposition framework to encompass a wider range of circular strategies as well as considerations of potential tensions and trade-offs could strengthen the applicability and value of the framework.

The research provided a comprehensive overview of existing micro level indicators for circular economy, which showed both a lack of indicators measuring high value circular strategies of the inner circles as well as a limited inclusion of social sustainability. Future research should thus focus on developing standardized indicators for micro level circular economy that ensures inclusion and prioritization of multiple circular strategies and all three dimensions of sustainability. Focusing such development on industry level could be beneficial to ensure inclusion and

prioritization of appropriate circular strategies relevant to the specific industry. Further, the potential trade-offs or compromises from prioritizing circular strategies will be important to investigate. Exploring such compromises and trade-offs require in-depth investigations of how different circular design strategies impact product lifetime, potentials for disassembly, reuse, repair and refurbishment etc., as well as the importance of developing new business models to make this a feasible business strategy.

Overall, this research can be complemented with in-depth investigations of the organizational learning and dynamic capabilities needed for companies to engage in circular business development. As this research is based primarily on an "outside" perspective on circular business development, further research into the internal learning processes could advance insights into how companies internally reconfigure processes and practices for circular economy. This builds on the potentials of utilizing environmental management systems to align and manage circular economy initiatives in companies, identified in paper IV. While such potentials for integrating circular economy in environmental management systems were identified, further research into the process and practice of doing so would be beneficial to strengthen the strategic alignment between environmental management systems and circular economy.

The research provided insights into potentials for circular public procurement and showed how the current procurement practices may be hindering a development towards circular public procurement. Further research into the practices of both private and public procurement could advance circular economy implementation, as consumption represents a blind spot in circular economy research. Understanding the new roles, responsibilities and potentials of customers and users in circular economy deserves further investigation through participant observations and interviews. Although quantitative studies have shown that customers are willing to pay more for sustainable products, this cannot just be replicated for circular solutions, as the role of the customer changes from purchasing, using and discarding a product to either purchase, use and sell back, rent or share products. The complexity of new consumer and user roles deserves further attention in research. Such research could focus on the motivation, acceptance, needs and responsibility of consumers and users and the perceived value of circular solutions by consumers and users. This pertains to both private consumers, procurement in companies and public procurement, as the decision-making process of what and how to fulfill the needs differ across these groups. As the findings of this research showed that the current practices of circular public procurement predominantly focus on product-level circularity criteria, further research is needed to advance public procurement of new business models and systemic solutions.

A final perspective on further research takes point of departure in the findings concerning interactions and collaborations. As circular business development in a system perspective requires a broader perspective on stakeholders and new ways to

collaborate through networks and partnerships, it would be valuable to further explore such networks and partnerships for circular business development. The need for establishing new interactions between stakeholders was affirmed in paper I and paper V. Focusing future research on collaborative innovation through innovation capabilities and dynamics in value chains could support further circular business development. Applying a research design of action research could be constructive to explore and engage with stakeholders for collaborative innovation in partnerships.

In short, future research directions could focus on:

- Expansion of the sustainable value proposition framework.
- Development of industry-specific circular economy indicators that ensures prioritization of circular strategies and alignment with sustainability dimensions.
- Investigation of the integration of circular economy in environmental management systems in practice.
- Understanding the new roles, responsibilities and potentials of customers and users in a sustainable circular economy.
- Collaborative innovation in value chains for circular solutions.

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