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CIRCULAR ECONOMY IN THE DANISH CONSTRUCTION AND DEMOLITION SECTOR

A case study of communication challenges and implications for implementing circular economy initiatives

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Executive summary

In recent years, sustainability has been given much attention in academia and the concept of circular economy has become increasingly popular within the field of sustainable development. One industry that has a large negative imprint on the environment is the construction and demolition sector, which is one of the biggest producers of waste, requires a lot of CO2 heavy processes and uses a high amount of virgin materials in production (EUR-Lex, 2015; European Commission B, n.d).

From the perspective of the industry association Danish Association of Construction Clients (DACC), this thesis examines how DACC can contribute to the transition towards a circular economy in the Danish construction and demolition sector. It does so by 1) outlining the relevant stakeholder relations to DACC and construction client members, 2) identifying how knowledge communication problems affect DACC and construction clients in regards to the transition towards a circular economy, and 3) identifying how cognitive biases influence DACC, construction clients and other experts in relation to the transition towards circular economy. Consequently, it takes a communicative perspective on research on the circular economy in the Danish construction and demolition sector.

The research takes a case-based approach in that semi-structured interviews were conducted with six participants from different parts of the construction and demolition sector. These interviews were analysed on the basis of a theoretical framework that the author developed on the basis of transition theory, theory on communication problems between experts and decision makers and a theory on cognitive biases and their influence on decision making (Geels, 2002, 2011; Eppler, 2007; Kahneman 2012).

The analysis found that there are relatively high levels of influence and dependence between different actors in the industry in relation to the circular economy. It points to the need for better network and knowledge sharing in order to facilitate working with circular initiatives. Some communication problems were present in the political dimension but a higher number of problems were found in the market and industry dimension. Also, cognitive biases were identified in the cultural dimension. The knowledge communication problems thus seems to complicate the process of implementing circular initiatives for DACC, construction clients and other experts. Some of the most pressing issues that cause communication problems were found to be a lack of transparency and governance, little available information on the circular economy, no clear definition of the

concept, no concrete tools for construction clients and unstructured processes for knowledge sharing and communication about the circular economy.

The thesis concludes that identified communication problems and cognitive biases negatively influence the transition towards a circular economy. Consequently, DACC is recommended to facilitate networking in the industry, educate construction clients on the circular economy, provide the industry with clear and concise definition, and use its influence to push the agenda politically.

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1) Introduction

Awareness of the current state of the global environment and the field of sustainable development has increased massively in recent years, both among academics, organisations, politicians and consumers. And for good reasons. Most of us are aware of the dangers of for example CO2 emissions, global warming and the fact that Earth is running out of virgin materials to source (European Commission C, 2016). In fact Earth Overshoot Day this year, 2020, fell on 22nd of August, meaning that demand for resources and services exceeded what Earth could reproduce in a year on that particular date (Earth Overshoot Day, n.d.). One industry that has been identified to have a large negative impact on the environment is the construction and demolition sector (EUR-Lex, 2015). The industry is one of the biggest sources of waste producing approximately 500 million tonnes of waste in the European Union per year (European Commission B, n.d.). Consequently, both the EU and the Danish government have recognised that a means to decrease the negative imprint from construction and demolition is the implementation of a circular economy (European Commission A, 2018; European Commission B, n.d.; Miljø- og Fødevareministeriet, 2018). However, the Danish industry has not yet implemented circular processes into construction and demolition, and only very few experimental circular projects have seen the light of day.

On this basis, this thesis wishes to investigate the implementation of the circular economy in the Danish construction and demolition sector. It takes a case based approach and focuses on the industry organisation Danish Association of Construction Clients (DACC) and its primary members construction clients, since these actors hold a lot of responsibility for the decisions that are made in the industry. It examines the lack of progress in implementation in a communicative perspective and focuses on communication problems and cognitive biases that complicates the communication between decision makers and experts and influences decision making processes. By doing so it seeks to solve a practical problem in the industry while providing research to the field of the circular economy. This research hopes to contribute to previous research that primarily has an academic focus and fills a gap in knowledge by providing 1) a communicative perspective on the circular economy and 2) more hands-on insights from the decision makers and experts in the construction and demolition industry.

The thesis seeks to answer the research question: *How can DACC contribute to the transition towards a circular economy in the Danish construction and demolition industry?* The following sub-questions will guide

the focus and the analysis: 1) *Which are relevant stakeholders to DACC and members of DACC in relation to the circular economy?* 2) *How does knowledge communication problems affect DACC and construction client organisations in regards to the transition towards a circular economy?* 3) *How does cognitive biases influence DACC, construction clients and other experts in relation to the transition towards a circular economy?* The study takes a case-based approach from the perspective of DACC. It develops a theoretical framework from recognised communication theory and a theory on biases and mental processes (Eppler, 2007; Kahneman, 2012). On the basis of this, semi-structured interviews are conducted to discover both stakeholder relationships and the mechanisms behind the communicative challenges relating to the circular economy in the industry.

The structure of the thesis will be the following; 1) literature review, 2) research design, including philosophy of science and methods, 3) case description, 4) theoretical framework, 5) analysis, 6) discussion, 7) conclusion and 8) future directions.

2) Literature review

This thesis takes a communication perspective in its research of the topic of the circular economy. This is done in the context of the Danish construction and demolition sector and the industry organisation DACC. In the following chapter literature on the circular economy, a theory on knowledge communication problems and a theory on cognitive biases are reviewed in order to identify where new knowledge is needed and how it contributes to previous research.

First, aspects of the meta theory on the circular economy by the Ellen MacArthur Foundation, Webster (2017), Kircherr, Reike and Hekkert (2017), Kircherr et al (2018) and Ritzén and Sandström (2017) are presented and reviewed. This section serves to identify some of the main concepts and definitions of the circular economy, to identify why further research in this area is necessary and to justify the need for a communication perspective on circular economic issues. Second, some of the operationalising theories of knowledge communication problems by Eppler (2007) and a theory on cognitive biases by Kahneman (2011) are reviewed. Theories of transformation by Geels (2002, 2011) and the stakeholder theory (Mitchell, Agle and Wood, 1997) are not included in the literature review, since these two well-established theories does not contribute to identifying the need for further research.

2.1) From a linear to a circular economy

The meta theory of this thesis consists of research by various authors concerning the nature of circular economy. The literature review will be limited to a few of the most relevant pieces of work on the circular economy. The first part of the following section will include a brief introduction to the concepts of the circular economy from the Ellen MacArthur Foundation and the seven schools of thought that the circular economy is based on.

The Ellen MacArthur Foundation is working to accelerate the transformation from a linear to a circular economy. The mission of the foundation is to put the circular economy on the agenda of decision makers in business, global politics and in academia (Ellen MacArthur Foundation A, n.d.). The foundation is also the publisher behind the book 'The Circular Economy - A Wealth of Flows' (Webster, 2017). The economy today is disconnected from its resource base and the accumulation of wealth is guided by the strive for utility maximization, what is called the neoclassical consensus (Webster, 2017). It criticises this world view, arguing that the underlying assumptions of the neoclassical consensus are wrong and that the economy is embedded and has an intimate connection with how all things flows (Webster, 2017, p. 26). According to Webster and the Ellen MacArthur Foundation there is a need for a shift towards a more circular economy. They describe these overall four shifts as a strive for 1) resource efficiency, 2) biomimetic modes of production, 3) services rather than goods and 4) reinvestment in natural capital (Webster, 2017, pp. 15-16). Further, they argue that there is a need for a circular economy that is built on endless flow of energy from sustainable sources. Materials should be transformed into goods and services so that food equals waste, meaning that no materials exit the loop as waste, but is circulated and used again as input for production. Prices must reflect the full cost of things, the economy should be dynamic and adaptive, celebrate diversity as a means of resilience and creativity, and be led by for profit businesses (Webster, 2017, pp. 20-21). These overall points of the Ellen MacArthur Foundation are best understood via a graphical representation of two flows of biological and technical nutrients in what can be called the 'Butterfly Model' (Ellen MacArthur Foundation B, n.d.). As seen in the model below, technical nutrients flow on the right side, while biological nutrients flow on the left side. Technical nutrients are finite resources such as cardboard, aluminium and plastic, and biological nutrients are renewable resources such as cotton, food and fertilizer. The general principles behind the model are to 1) preserve and enhance natural capital, 2) optimise use of resources by circulating materials as effectively as possible, and 3) foster system effectiveness by designing out leakage (Ellen MacArthur Foundation B, n.d.).

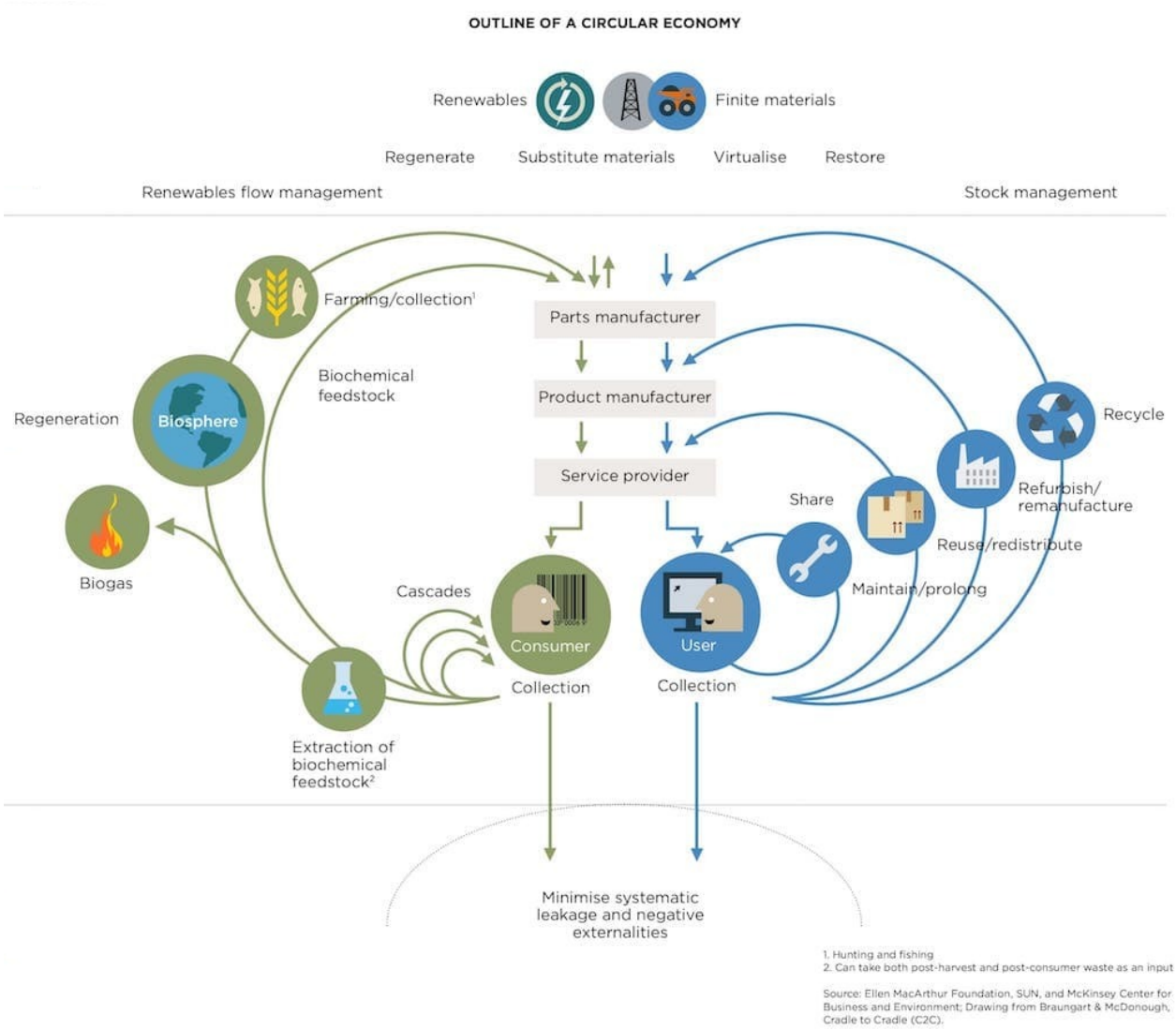

Fig. 1. Butterfly Model (Ellen MacArthur Foundation B, n.d.)

Despite the increasing interest in the circular, the concept is not new. It cannot be traced back to one specific author, but its practical implication has gained momentum since the 1970s (Ellen MacArthur Foundation C, n.d.). Academics and though-leaders have since then developed different schools of thought within the field of the circular economy. These will be briefly presented and the ones relevant for the thesis will be explained. 1) 'Cradle to Cradle' was develop by chemist Michael Braungart and architech Bill McDonough. Cradle to cradle is a design philosophy in which all materials are considered as either biological or technical nutrients. The framework focuses on design for effectiveness with the goal of reducing negative impacts of business through efficiency (Ellen MacArthur Foundation C, n.d.). 2) The 'Performance Economy' was developed by

Walter Stahle in the 1970s. The goal of this school of thought is to develop closed loops production processes by focusing on waste prevention, product-life extension, long-life goods and reconditioning activities (Ellen MacArthur Foundation C, n.d.). 3) The idea of 'Biomimicry' was developed by Janine Benyus. It can be described as innovation inspired by nature and the approach seeks to study nature's best designs and to imitate these processes (Ellen MacArthur Foundation C, n.d.). 4) 'Industrial Ecology' has a focus on industrial systems and the connection between players within the system. By adopting a systemic point of view it aims to design a closed-loop process within the local constraints, meaning to eliminate waste by facilitating cooperation between interdisciplinary operators. (Ellen MacArthur Foundation C, n.d.). 5) 'Natural Capitalism' was developed by Paul Hawken, Amory Lovins and L. Hunter Lovins. The goals of natural capitalism is to make natural resources last longer through changes in design and technology and to shift to biologically inspired materials and production models (Ellen MacArthur Foundation C, n.d.). 6) The 'Blue Economy' is a movement developed by businessman Gunter Pauli. It is based on the principle of using resources that exist in a cascading system in which waste of one product is the input for the next. Also, solutions in the blue economy approach should be determined by the local environment and characteristics (Ellen MacArthur Foundation C, n.d.). 7) The 'Regenerative Design' idea was developed by John T. Lyle on the basis of the regenerative nature of agriculture which should be applicable to all other systems (Ellen MacArthur Foundation C, n.d.).

In relation to this thesis and the case, three of the above mentioned schools are particularly relevant, that is the cradle to cradle, performance economy and to some degree the industrial ecology schools. First, an important from cradle to cradle for the construction and demolition industry to become more circular is that of food equals waste, meaning that building materials should be designed so that they are safe and non-toxic for humans and can be reused consistently. This is important since not all building materials are safe for disassembly today such as tiles that contain asbestos. However, many materials in the construction industry, such as bricks, are relatively homogeneous, why it is sensible to consider reusing this type of materials to a greater extent. Also, an important aspect in cradle to cradle is to respect human and natural systems. This entails that companies guide operations and stakeholder relationships in a socially responsible way (Ellen MacArthur Foundation C, n.d.). This is crucial if the whole value chain across the construction and demolition industry, which consists of a large number of players who must benefit from the circulation of materials. The principles of the performance economy are also relevant when operating in the construction and demolition industry. Working to close material loops seems vital since natural resources, such as sand that is used in

production of cement and concrete, is becoming a scarce resource in many regions and will often be transported a long way to be incorporated in production processes (Lear, 2017). Also, waste prevention has major potential in the construction and demolition industry. Demolition companies specialise in waste handling and demands such as material banks and a focus on including waste sorting in procurements are starting to gain ground. However, much work is still needed to secure waste prevention. The ideas of the industrial ecology school are mostly relevant to the case because it takes an overall systemic view. The goal is to create a closed-loop interdisciplinary system in which there is no undesirable by-product (Ellen MacArthur Foundation C, n.d.). This perception of creating a sustainable closed-loop system with actors from various disciplines is highly relevant in the construction and demolition industry. However, the focus on local industrial systems can be difficult to transfer to the construction and demolition sector due to the relatively long life of buildings and accordingly the potential distances between demolition sites and construction sites.

A point of criticism in relation to the circular economy that Kircherr, Reike and Hekkert elaborate on in their 2017 article is the issue of defining the circular economy. The authors review 114 definitions of the circular economy and find that the circular economy is often defined as a combination of reduce, reuse and recycle actions that does not point to a need for a systemic shift or sustainable development. Their study concludes that the concept of circular economy is diffused by differing definitions, which may result in a collapse of the concept or lack of development (Kircherr, Reike, Hekkert, 2017). This may be a result of the novelty of the research area. Kircherr, Reike and Hekkert (2017) contribute to the circular economic literature by providing a suggestion for a fuller definition that incorporates all relevant aspects. They define circular economy as: *"An economic system that replaces 'end-of-life' concepts with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level, meso level and macro level, with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to benefit the current and future generations. It is enabled by novel business models and responsible consumers.*" (Kircherr, Reike, Hekkert, 2017, p. 229). This is also the foundation for the working definition that is adopted by this thesis.

On the topic of the circular economy, several studies have been conducted to identify and elaborate on the barriers to implementing a circular economy. Kircherr et al (2018) for example find that barriers such as a hesitant company culture and lack of consumer awareness and interest, i.e. cultural barriers are the most

pressing. But also market barriers such as a lack of governmental intervention hinders the process of implementing a circular economy. Further, the study suggests that the circular economy at this stage remains a niche in the discussion of sustainable development. Similarly, another study finds that a circular economy is barely implemented in practice and requires disruptive change and radical innovations (Ritzén and Sandström, 2017). It identifies structural, financial, attitudinal and operational barriers to the implementation. Also, it states that research on barriers, although relevant, are rarely empirically founded (Ritzén, Sandström, 2017). Even if research on the circular economy is becoming more prominent in the sustainable development agenda, it remains mostly a niche discussion in relation to how modern society has developed. Consequently, more empirically founded research is needed to elaborate on the barriers to implementation.

2.2) Communication problems and cognitive biases

Eppler's 2007 article offers a review of prior known communication and knowledge transfer problems in organisations. These theoretical concepts are applied in a larger study and categorised according to expert-, and manager-caused problems and reciprocal problems. The theoretical foundation of the study is well established in prior research of the area of knowledge communication barriers (Eppler, 2007). This categorisation of knowledge communication problems as caused by either experts, managers/decision makers or both have not prior to this study been applied to circular economic- or sustainable development research. This categorisation is applicable in relation to the implementation of circular economic initiatives, where construction clients often take the role of decision makers in relation to a construction and/or demolition site, and where communication with experts on circular economic initiatives may influence the outcome of the project. However, there is no indications that prior research has applied this theory of knowledge communication to the area of circular economic transitions and in the construction and demolition sector.

Nobel Prize winner and psychologist Daniel Kahneman presents a new view on decision making and the human cognitive system in his 2011 book 'Thinking Fast and Slow' (Kelly, 2011). The theory presents a sharp critique of the rational man assumption, i.e. that human decision making is guided by rational thoughts (Kahneman, 2012). According to professor of behavioural science Kelly (2011), this critique is convincing due to the presentation of a much richer theory of the two systems of the mind, system 1 and system 2. Kahneman's theory is based on well-founded research done in the 1970s in collaboration with Amos Tversky, another academically recognised cognitive psychologist (Kelly, 2011). The most important implications of the theory has been that it changed widely acknowledged assumptions about human nature associated with the

rational man theory of older philosophers such as John Stuart Mill and Jeremy Bentham (Kelly, 2011). In 'Thinking fast and Slow' Kahneman (2011) applies some theoretical concepts to explain why decision making of can be flawed, e.g. various cognitive biases and heuristics. Despite being widely used in academia, this theory have not yet been used in the analysis of decision making in the construction and demolition sector in relation to the implementation of circular economic initiatives.

This thesis thus contributes to research in the circular economic area by examining the process of implementing circular economic initiatives in a communication and knowledge sharing perspective. It fills a gap in existing knowledge as it combines theories on communication, knowledge sharing and mental processes in a theoretical framework in order to examine the phenomenon of the transition towards a circular economy in the specific context of the Danish construction and demolition sector. It takes a case-based empirical approach by investigating how members of the Danish construction and demolition industry experience this transition in its current state. It analyses these challenges to the transition towards a circular economy from the perspective of the industry organisation DACC with the specific focus on communication and decision making processes of construction clients, DACC and other experts on the circular economy.

3) Research Design

3.1) Philosophy of science

The philosophical standpoint of this thesis is a social constructivist paradigm, which shapes both the guiding theory, the theoretical framework and the choice of methods for data collection. It has implications for the type of knowledge produced, the insights and the conclusions of the research, as well as the ontological and epistemological standpoint.

The social constructivist paradigm facilitates the study of thoughts, figures of speech and everyday actions with a focus on processes rather than a state or situation. The social world is seen as constructed, made up of open-ended process why it cannot be studied as a fixed phenomenon (Morgan, Smircich, 1980). The ontological perspective of social constructivism is relativism. It allows the researcher to study a phenomenon in a specific context (Crotty, 1998). In this case the studied phenomenon is the implementation of circular economic initiatives in the Danish construction and demolition sector. Epistemologically social constructivism understands knowledge as determined by time and place and thereby by being changeable as well as dependent

on the context. Reality is thus seen as a social construction and the focus of the study must be on analysing the processes in which reality is created. The aim is to examine methods used by participants to create a subjectively agreed or negotiated social reality (Morgan, Smircich, 1980).

This social constructivist approach to the research entails that this thesis is not trying to obtain one objective truth, but rather to study and conclude on coherence between the system of understanding that is established on the background of the analysis. The study cannot be validated on the basis of concrete facts or objective answers or truths, but is reliable and valid if the individual statements and assertions are consistent with other aspects in the analysis and with the theoretical frame used in the study (Egholm, 2014). Also, the social constructivist perspective necessitates that the author only have access to knowledge about the world through representations of it. Language is central and the process of understanding and interpreting the studied perspectives of individuals is the only way to study a specific process. Knowledge is thus created in social processes that also include a constant struggle of different definitions. The way we define and understand the world becomes central to the way we act in it. In this perspective the individuals' actions, feelings and experience represent general social constructions and structures (Egholm, 2014). Knowledge is accumulated in a relative sense as a hermeneutical process which seeks to form ever more informed and sophisticated constructions (Guba, Lincoln, 1994).

In judging the quality of the research design construct validity, external validity and reliability must be considered (Yin, 2003). When doing research in social constructivism and case studies, construct validity can be problematic to ensure since researchers cannot develop subjective measures. However, some tactics that can facilitate construct validity during data collection are to use multiple sources of evidence as well as establishing a chain of evidence. In relation to the research of this thesis, construct validity is facilitated by conducting interviews with several construction clients as well as other players in the industry, a construction client advisor and an employee of DACC. External validity is concerned with finding if a study's conclusions are generalisable (Yin, 2003). It is important to note that in doing case studies, the goal is not statistical generalisation, but analytical generalisation, i.e. when the researcher is trying to generalise results to some wider theory, which is the case for this thesis as mention above. This external validity of the study is thus best achieved by using theory in single-case studies (Yin, 2003), which is the goal of the theoretical framework developed by the author of this thesis. Finally, the objective of determining reliability in this type of research

is to ensure that similar conclusions were found, should another researcher replicate the study following the same procedures described below. This is important also to minimise errors and biases in the study. It is typically achieved by describing a detailed research design and to document procedures making external reviews possible (Yin, 2003), which will follow in the section 'research design'.

An important implication of the social constructivist paradigm is the perspective of the researcher. This approach to research entails that the researcher cannot be separated from the research (Guba, Lincoln, 1994). In the preparation and formulation of the theoretical framework, interview guide and analysis, the author's own perceptions about the topic cannot be excluded as it will influence the formulation and thought processes in the study. Consequently, the facilitator cannot exclude values from the research since values are a part of what shapes social constructions. I.e. the researcher cannot avoid shaping constructions of participants as well as constructing and reconstructing own constructions in relation to the research (Guba, Lincoln, 1994). This is also why the case-study approach has been criticised by some, since biases are frequently seen in case studies (Yin, 2003). However, in this thesis the development of the theoretical framework prior to the research being conducted acts as the foundation for the analysis and can be seen as a means to avoid researcher biases to the most possible extent.

Operating in a social constructivist paradigm also guides the choice of methods and data collection (Crotty, 1998). Using mainly interviews as data collection in the thesis allows for a deeper understanding of individuals perspectives and social constructions relevant to the process of change and inertia in regard to circular economic initiatives in the Danish construction and demolition sector. By asking questions that reveal perceptions of stakeholder relations, decision making processes and mental processes and challenges such as biases and heuristics, the author seeks to create an understanding and interpretation of the challenges that construction clients experience in their daily work in relation to changes in the business of sustainability and circular economy.

3.2) Methodology

This section will elaborate on the methodological choices of this thesis and its implications for the research. First, it will introduce the case study and its context. Second, it explains how the data collection was conducted. Third, it elaborates on the selection and processing of the data.

3.2.1) Case study

This research has been conducted as a case study takes and takes an interpretive approach. It seeks to understand the processes of change, rather than to explain how and why circular economic initiatives are implemented in the construction and demolition sector (Thualagant, 2016). The goal is to develop an understanding of the phenomenon of change and processes behind them, meaning that this is a hermeneutic case study (Thualagant, 2016). Also, the goal of this case study is not to test or verify theory, but to understand the practical phenomenon on the basis of the theoretical framework. Consequently, the goal of the case study is to produce a contextualised and practical knowledge based on the theoretical framework developed by the author, which sets the premises for what can be found in the data (Thualagant, 2016). This type of study takes a theory driven approach, which is rooted in a problem oriented perspective on changes in the construction and demolition sector focusing on the implementation of circular economic initiatives and the communication challenges and mental processes.

This study has been conducted as a case study because this type of research is preferable when a how-question is being asked concerning current events, over which the researcher has no control (Yin, 2003). The specific case has been researched in collaboration with the Danish industry organisation DACC. The author of the thesis has been employed at DACC since 2019 and has had access to a network of construction clients and DACC employees who work specifically with sustainability. Members of DACC such as construction clients and construction clients advisors as well as DACC employees have provided information on the circular economic initiatives that the construction and demolition sector is trying to implement along with different views on the decision making processes and challenges that follows.

This thesis is designed as an embedded single-case study since its focus is the organisation DACC but it involves different sub-units, i.e. interview persons from DACC's member organisation (Yin, 2003). According to Thualagant (2016), it is important to recognise the time and space in which the study is conducted, i.e. the context in which the phenomenon is studied. Especially the sustainability agenda is developing constantly, and the construction and demolition sector is no exception. Therefore, this study will not give a final conclusion of how this process of change has be handled, but rather offer better understanding of the current process, phenomenon and challenges that members of the industry face today. Finally, it is noted that the knowledge

obtained in such a case study will only make sense and can be interpreted in its specific context. It is important to not oversimplify the narratives found in interviews to make this complex situation fit with theory in order to be applicable in other contexts and cases (Thualagant, 2016).

The intention of the research is to understand the specific phenomenon of circular economic initiatives in the Danish construction and demolition sector in this context. A case study exploring correlations in this area provides the researcher with the best possibilities to gain a deeper understanding of communication and mental processes of construction clients. Construction clients, construction client advisors and DACC employees are the main target group for the data collection, since construction clients are the head of decision making in relation to construction and demolition sites. Also, employees of DACC have been included to provide a perspective on the communication between the organisation and its members. This target group of the case study has been selected to ensure the best possible understanding of the process of change and challenges that construction clients face in relation to decision making problems, knowledge sharing and cognitive biases and heuristics.

3.2.2) Interviews

The main data collection of this thesis is done by semi-structured interviews. This type of data collections allows the researcher to access personal experiences of interviewees, i.e. construction clients, advisors and DACC employees, with the studied phenomenon of circular economic initiatives in the Danish construction and demolition sector and the challenges in relation to decision making and knowledge sharing. The purpose of the interviews has been to collect specific, detailed and context dependent knowledge about the circular economy (Poulsen, 2016).

For this purpose, the author has chosen to conduct semi-structured interviews. An interview guide was prepared on the basis of the theoretical framework and the matrix developed by the author. The semi-structured form provided the researcher with the opportunity to remain open about the structure in which questions were asked, and to pursue other relevant narratives and questions that might occur during the interview. This approach allowed the interviewer to get a deeper understanding of the interviewees' perspective, cultural perceptions, an understanding of the themes discussed and allow for detailed explanations of personal experiences (Poulsen, 2016). This approach was relevant to the case studied since it seeks to understand complex issues of culture,

mental processes, decision-making and communication of construction clients. Knowledge that is not accessible unless time is taken to ask questions and allow for further exploration of the experiences embedded in interviewees.

The initial structure of the interviews was developed so that it allowed the interviewees to start off with some introductory and fairly easy questions, in order to get the conversation going and to establish a good connection and trust between the interviewer and interviewee. As interviews developed, more complicated and sensitive questions were asked and followed by questions that explored the subject further if necessary. In order to get the interviewees to bring forward personal experiences and opinions most of the questions can be characterised as descriptive and was regularly followed up by unprepared questions following a specific narrative or example.

In total six interviews were conducted each lasting up to one hour. This points to the importance of the depth of the interview rather than a large number of shorter interviews. The primary part of the interviewees are currently working in the construction and demolition sector. Four of the participants were construction clients, the fifth a construction client advisor and the sixth an employee with DACC who is in charge of the organisation's sustainability agenda including circular economy. See table 1 for overview of interviewees below. These interview participants were chosen because of their immediate relation to circular economic initiatives in the sector and all construction client and advisor participants have expressed an interest in the subject of sustainability and the circular economy. This was necessary for the study since only persons who are a part of the industry can provide the knowledge about cultural, personal experiences and challenges regarding the implementation of circular economic initiatives. Also, construction clients and the advisor are faced with questions regarding the research topic on a daily basis. Further, the interviewees were all members of DACC, hence had some knowledge about the work of the organisation. Some of the interviewees also are members of DACC's Sustainability Committee, in which they participate on a voluntary basis, indicating a general interest in the sustainability topic in the industry.

Name	Date	Job title	Company
Graves Simonsen	2nd April 2020	Project Manager	Bygherreforeningen
Jens Runge	3rd April 2020	Chief Consultant	Københavns Kommune
Bente Damsgård	3rd April 2020	Project Manager	Aarhus Kommune
Rasmus Olsen	30th June 2020	Associate	NREP
Morten Buus	30th June 2020	Construction Client Advisor	Buus Consult ApS
Palle Adamsen	1st July 2020	Managing Director	Lejerbo

Table 1. Interview participants, incl. dates, job title and company.

Interview participants were contacted via emails provided by the author's colleague in DACC. Due to the current situation of the COVID-19 pandemic, interviews were conducted via Microsoft Teams or Skype. This had minor implications for the interviews, since some were done without video and with only audio. This complicated the flow of the conversations and made understanding of non-verbal cues challenging. Also, conducting interviews in this manner can make having a friendly and positive body language more challenging and challenge the creation of a trustworthy and positive atmosphere. The audio of the interviews were recorded on both computer and mobile device, but due to COVID-19 and the closure of Copenhagen Business School it was not possible to collect professional recording equipment. This had some implications for the sound quality of the recordings. However, the general collection of data and understanding of the topic were not further disrupted by COVID-19, the interview form or audio issues.

3.2.3) Processing of data

The full length of all interviews has been transcribed prior to the coding and analysis with few exceptions of some small talk at the end of the interviews. All speech in the interviews are transcribed in a manner where

disturbing and unmeaningful, empty words and expressions are left out, and punctuations are put in to make the transcriptions more easily read and understood. Transcriptions are included to the thesis as Appendix A and recordings of all interviews are included as Appendix B.

Processing of the data was done primarily in a deductive manner to correspond to the theoretical framework of the study (Saldana, 2013). Code and categories of code were developed on the basis of the theoretical framework prior to the coding of the data. They aim to collect and categorise part of the interviews concerning stakeholder relationships, communication and knowledge sharing problems and cognitive biases in decision making processes. The coding is therefore generally guided by theoretical concepts but has also been allowed to develop from the data in order to capture any other interesting aspects in the interviews (Saldana, 2013). Coding was done manually, by hand, and were divided into three steps of 1) review of the interview transcriptions with noting of initial thoughts, 2) first round of coding which aimed to organise and create an overview of the collected data and 3) second round of coding where the author ensured that newly found codes were applied to all interview transcripts (Saldana, 2013). Following, the collection of coded material was written together and transferred to electronic files and all relevant citations were collected in a first draft ready for further analysis. Finally, a synopsis of the analysis was written as a basis for the full analysis and discussion of the data. The code book used for coding all interviews has been included as Appendix C.

4) Case Introduction

The European Union have for years recognised the need for a transition towards a circular economy and have published several initiatives and guidelines for member countries (European Commission B, n.d.; EUR-Lex, 2015; European Commission A, 2018). In December 2015 the European Commission launched an EU action plan for the circular economy. This action plan includes a section on the construction and demolition sector, which is one of the biggest sources of waste in Europe producing approximately 500 million tonnes of waste in the European Union per year (European Commission B, n.d.). Also, the construction and demolition sector plays an important role in environmental performance of buildings and infrastructure (EUR-Lex, 2015). In September 2018, an EU construction and demolition Waste Management Protocol was launched by the Commission, introducing non-binding guidelines for the industry (European Commission A, 2018). This protocol is also part of the Commission's Circular Economy Package and its overall aim is to increase

confidence in the construction and demolition waste management process and trust in quality of recycled materials (European Commission B, n.d.).

In line with the EU Commission, the Danish government in September 2018 launched a strategy for a circular economy that points to the need for a sustainable transition and a focus on reducing material use, redesigning products and reusing materials (Miljø- og Fødevareministeriet, 2018). According to this strategy, the construction and demolition sector has great potential for improvements since it produces one third of all waste in Denmark, which in 2017 amounts to approximately 5,5 tonnes pr. year (Danmarks Statestik, n.d.). Two specific circular economic initiatives regarding the construction and demolition sector is included in this national strategy, no. 13: The development of a voluntary sustainability class and no. 14: Expand selective demolition (Miljø- og Fødevareministeriet, 2018).

Circularity in the construction and demolition sector has a lot to do with minimising waste of resources and requires a focus on prevention of waste, preparation for reuse of materials and recycling (VCØB, n.d.). According to Dansk Videnscenter for Cirkulær Økonomi i Byggeriet (VCØB), a Danish think tank, circular economy in the construction and demolition sector can be implemented by for example: 1) Using resources that rank as highly as possible in the waste hierarchy, 2) using building materials that are non-toxic and high quality, 3) increase traceability of building materials, 4) making business profitable while incorporating reusability and recycling and 5) collaborating with all actors across the value chain (VCØB, n.d.). Further, Danish construction companies are encouraged by the Danish government and by VCØB to increase their focus on the total economy of building, to work towards a digitalisation strategy that enables tracing and categorisation of materials as well as material banks, and to increase the focus on selective demolition processes to increase the usability of used materials (VCØB, n.d.). In this industry construction clients have a lot of potential influence on the building process, such as choice of materials, handling of waste as resources and recycling on the building site. Consequently, the construction clients' ambitions, mindset, willingness to take risks and motivation to change processes plays a significant role in the transition towards a circular economy in the industry.

In the Danish construction and demolition sector DACC is an industry organisation that primarily represents professional construction clients. This organisation is the point of departure for the thesis, since the author is

employed in DACC and has access to a network of other employees and members of the organisation. The goal of the DACC is to improve and influence the Danish construction and demolition sector (Bygherreforeningen A, n.d.). This is done mainly by educating construction clients via course activities, seminars and conferences, developing guides and tools for construction and demolition processes and through political influence. DACC has participated in niche projects such as 'City Loops' as a part of a EU/Horizon2020 project (Bygherreforeningen B, n.d.). An EU-funded project that aims to promote circular economy within construction by developing tools and guides that support the circulation of materials and handling of soil in certain cities and districts (Bygherreforeningen D, 2019). However, despite the clear goals of the EU Commission and the Danish government, and despite an articulated sustainability agenda DACC has not yet initiated any projects that contribute directly to the transition towards a circular economy in the industry (Bygherreforeningen C, n.d.). Nor have the organisation developed a clear circular economy concept or tools for enabling circular initiatives in the construction and demolition sector.

Consequently, it is of interest to investigate how DACC can more actively take part in the transition from a linear to a circular economy for the construction and demolition sector in Denmark in relation to its construction client members. This is done in a perspective of communication among industry players and decision making processes of construction clients. The research of the thesis involves identifying relevant stakeholders and stakeholder relationships, researching how specialised knowledge is communicated between DACC, its members and other players in the industry and how potential cognitive biases affect the development of new work procedures for DACC, other experts and construction clients to incorporate circular economic initiatives.

5) Theoretical framework

5.1) Transformation theory (Geels, 2002, 2011)

Geels' (2002) theory of transformation consists of an integrative evolutionary multi-level framework of technological transitions, see fig. 2 below. The framework consists of three levels; landscape developments, socio-technical regimes and niches, which will be elaborated below. These levels are analytical concepts that help understand the complex dynamics of socio-technical changes. Changes in socio-technical configurations does not easily come about, because elements in the socio-technical regime are connected and influence each

other. This is also why new technologies that do not match the existing institutional framework often struggle to break through. The goal of the theory is to understand this inertia and how it can be overcome. According to Geels (2002) heterogeneous elements of the socio-technical regime causes stability and are created and reproduced by activities of actors within the regime. However, the stability is somewhat dynamic, so that innovation may still occur incrementally.

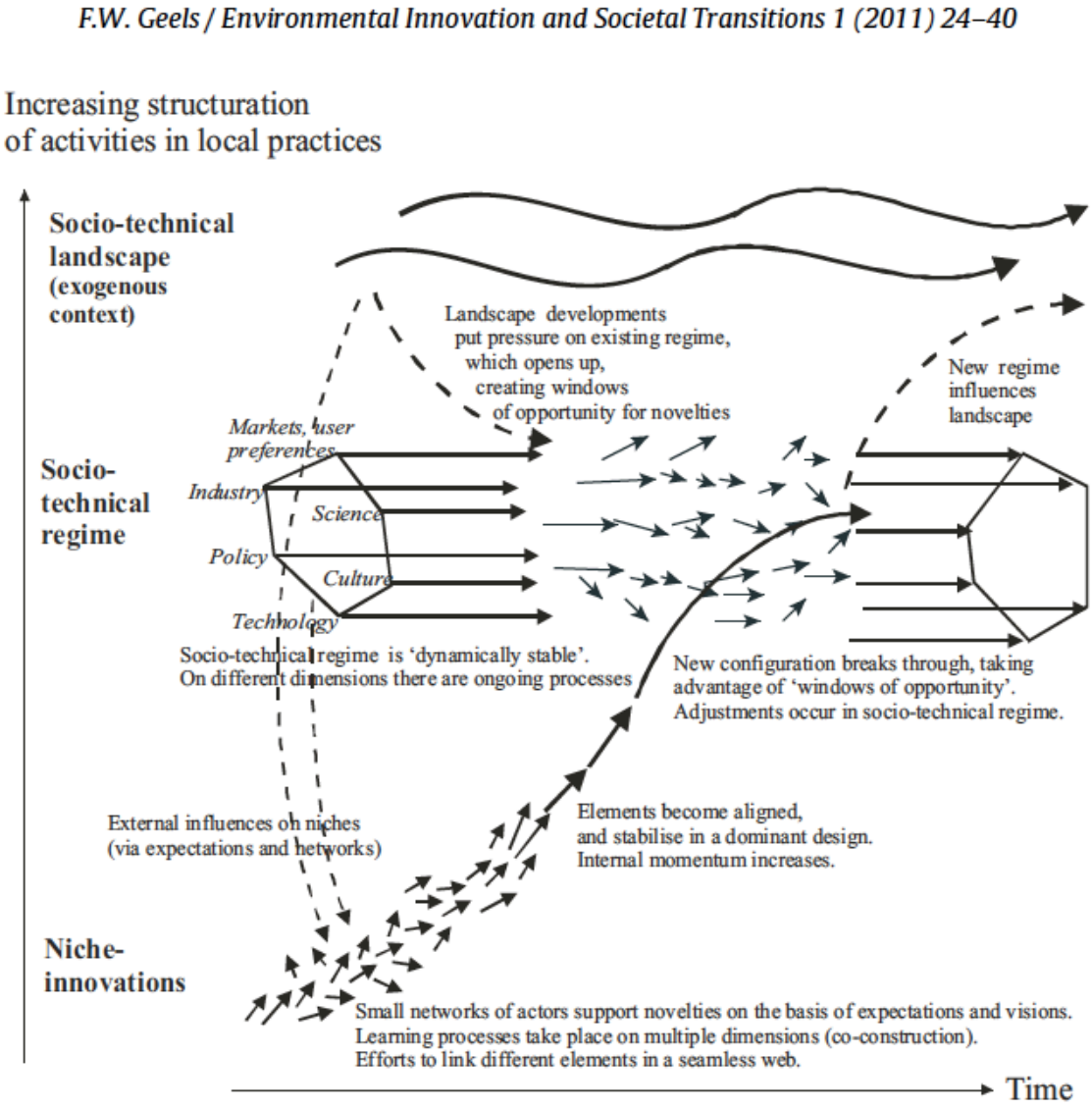

Fig. 2 Multi-level perspective on transitions (Geels, 2011, p. 28)

The three levels of Geels' (2002) multi-level framework can be described as a nested hierarchy. On a macro level are socio-technical landscapes, on a meso level a patchwork of regimes, and on a micro level novelties.

They are connected in that niches are embedded within regimes and regimes within landscapes. Consequently, niches are heavily influenced by both regimes and landscape developments. Below a description of the three levels of Geels (2002) framework will follow.

The macro level socio-technical landscapes consists of a number of factors and deep structural trends that are relatively hard to change. Examples of such trends are environmental issues, cultural values, wars, emigration, oil prices and economic prosperity. It is within this external context that actors interact. The external factors of landscapes are not easily changed, but change can happen over time, and these slow developments of landscapes may put pressure on existing regimes and niches and provide openings for novel technologies. This is also what is described as 'windows of opportunity'.

Socio-technical regimes are the outcome of cognitive and organisational routines and consists of a semi-coherent set of rules supported by different social groups. These regimes ensure coordination of the activities and thus account for the stability of social-technical configurations. Social-technical configurations are thus stable, but can change incrementally. Within the socio-technical regime are different dimensions, i.e. markets, industry, policy, technology, culture and science (Geels, 2002, 2011). These dimensions each have ongoing processes that align and influence each other but are also influenced by landscape developments.

Niches are the source of radical innovations, which thrive here since they are protected from the selection criteria in a normal market in the regime. Niches act as incubators for radical innovation and are important because they allow for experimentation and learning processes and lay out the space to build social networks to support innovations. However, niches are influenced by existing regimes and landscapes that provide the context for innovations and consequently influence the processes within niches. These elements of radical innovations may become aligned and then stabilise into a dominant design that can take advantage of the 'windows of opportunity' created in the socio-technical regime by pressures from landscape developments (Geels, 2002).

The transition from niche to regime level happens gradually and innovations follow a path of a cumulation of niches which happens when innovations are used in different domains or markets (Geels, 2002). Also landscape developments seem to create many niches. Breakthrough of radical innovation can happen in add-

on or hybridisation mechanisms. In add-on mechanism, new technology is linked to existing technology to solve a particular problem. Hybridisation mechanism describes when new technology break out of a niche because of market growth.

Also, reconfiguration processes in regimes happens first of all gradually when step by step new regime develop from old ones (Geels, 2002). Theory relates the elements of the regime in a cascading dynamic, arguing that changes in one element set of changes in other elements which then trigger further change. Reconfiguration processes thus take place on all dimensions in the socio-technical regime. In this manner the otherwise stable regime can become destabilised by problems, such as demographic changes or environmental problems, and the configuration can become loose and create opportunities for radical innovation to move from niche level and be included in the socio-technical configuration. When developments at multiple levels of the framework link up and strengthen each other reconfigurations can happen. Consequently, the success of innovations rely on processes on both landscape and regime levels and can be said to be context dependent.

Geels' (2002, 2011) theoretical multi-level perspective can be applied in this thesis as a guiding theoretical framework for analysing the transition from the current socio-technical configuration the linear economy to another, i.e. the circular economy. This theory will help set the focus on how the inertia in the transition towards the circular economy can be overcome. In this context the circular economy can be seen as radical innovation that is currently developing in niches by experimentation, development of networks and learning processes. We experience a developing pressure from landscape developments, in particular environmental problems such as emissions, overloads of waste and plastics, deteriorating biodiversity and decrease of available raw materials and natural resources (Webster, 2017). These pressures are opening a window of opportunity for the circular economy in technological niches to break through and over time become a new socio-technical regime. However, taking all of the dimensions of the socio-technical regime into consideration is a very elaborate element of analysis, which requires some delimitations (Geels, 2002). This thesis will thus focus on a few dimensions, i.e. the policy, culture, market and industry dimensions.

The policy dimension is a relevant element of analysis in relation to the chosen case since initiatives to support the circular economy in the construction and demolition sector have already been initiated from both the EU Commission and from the Danish government (European Commission A, 2018; European Commission B,

n.d.; Miljø- og Fødevareministeriet, 2018). The culture dimension is relevant since the transition requires a shift in "how things are done", which is related to culture, including norms and values of DACC and its member organisations. Finally, it can be argued that the dimensions of markets and industry in this case is best analysed in combination because the markets for the DACC are in fact construction clients and the construction and demolition industry, why separating the two dimensions would be pointless.

5.2) Theory of stakeholder identification and salience (Mitchell, Agle, Wood, 1997)

Mitchell, Agle and Wood's (1997) stakeholder theory can be applied in order to specify 'who and what really counts'. Via this theory a stakeholder analysis can show what stakeholders of DACC and members of DACC are latent, expectant and definitive, and whether managers within the organisation has a matching idea of which stakeholders are salient. It is relevant to analyse if the stakeholders hold power, legitimacy and urgency, in order to determine how policy and market + industry dimensions discussed above are affected by both landscape developments and niche innovations.

This theory defines stakeholders as "any group or individual who can affect or is affected by the achievements of the organisation's objectives" (Mitchell, Agle and Wood, 1997, p. 854). It argues that stakeholders can be identified in classes according to possession of the attributes 1) stakeholder power to influence, 2) the legitimacy of the stakeholder's relationship, and 3) the urgency of the stakeholder's claims (Mitchell, Agle, Wood, 1997, p. 854). According to this theory, stakeholders who posses these variables are the ones that should be paied attention to.

The three attributes, power, legitimacy and urgency, are not stable but variables for any stakeholder relationship. Also, the attributes cannot be perceived as objective or true. Rather they are an expression of multiple perceptions and can be seen as a constructed reality. Stakeholders may hold one, two or all three of these attributes, but only ones possessing all three are salient stakeholders, i.e. those stakeholders to which the managers of the organisation should pay close attention. Even if stakeholders objectively can be identified as holding all three attributes, it relies on the organisation's management to determine what stakeholders are salient, and therefore should be given managers' attention. Consequently, the stakeholders that managers perceive to be highly salient will be the ones who gain managers' attention.

Latent stakeholders are the ones who possess one of the three attributes, power, legitimacy or urgency. With these stakeholders salience will be low, and managers are likely, due to limited time and energy, to pay little or no attention to this type of stakeholder, if they even recognise that they exist. *Expectant stakeholders* are the ones who possess two attributes. With these stakeholders salience will be moderate. Because this type of stakeholders possess two attributes, it is likely to lead to an increase in the organisation's responsiveness to the stakeholders claims. Therefore, it is more likely that the managers and the expectant stakeholders engage. *Definitive stakeholders* possess all three attributes and have a high level of salience. Accordingly, managers are more likely to pay attention to the interests of these stakeholders. It is worth noting that these typologies are not fixed, why an expectant stakeholder can become a definitive stakeholder if it has the chance to obtain the missing attribute (Mitchell, Agle, Wood, 1997).

The theory on stakeholder identification and salience is particularly useful in relation to this thesis, since it provides a tool to identify relevant stakeholders and understand the relationship that those have with the organisation (Mitchell, Agle, Wood, 1997). Also, it is important to note that since the categorisation of stakeholder types is dynamic, i.e. varies from time to time and from issue to issue, it provides the this thesis with a unique perspective on stakeholder relations, in the current time in relation to the transition towards the circular economy in the Danish construction and demolition sector from the point of view of DACC and its members.

5.3) Knowledge communication problems between experts and decision makers (Eppler, 2007)

The focus of the analysis in this thesis will be on DACC and how communication issues with stakeholders affect the organisation's role as expert for construction clients and other actors in the construction and demolition industry. In more novel knowledge areas such as the circular economy, DACC have to acquire knowledge from institutions such as the European Commission, the Danish Government and VCØB. In this process DACC takes the role of decision maker in deciding what sort of knowledge should be handled, accumulated and presented towards member organisations. Afterwards, DACC becomes the expert within the given area and the role of decision makers in this step are with constructions clients in charge of either a demolition or construction site.

Since a vital activity of today's specialised workers is communicating professional knowledge, studying communication problems between experts and decision makers becomes interesting (Eppler, 2007). What is typically an issue in communication between expert and decision maker is knowledge asymmetry. The expert of a given area often have more knowledge than the person who has to make a strategic decision on a complicated issue within the organisation. In general, issues of communicating professional knowledge in organisations start when the decision maker needs to communicate his needs for an analysis to the expert. The decision maker needs to convey his knowledge needs and constraints to the expert, in order for her to approach the assignment efficiently. But, the expert also face challenges in communicating some specialised information to the decision maker, when both are often under significant time constraints.

Knowledge communication is defined as "the deliberate activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal or non-verbal means" (Eppler, 2007, p. 291). Barriers to knowledge communication are divided into three categories: 1) knowledge communication problems of decision makers, 2) knowledge communication problems for experts, and 3) problems relevant for both decision makers and experts (Eppler, 2007). Concepts are included in these categories if they specifically can be associated with problems of interpersonal, professional knowledge transfer, describes an issue that effectively influences the quality of knowledge transfer, and is an acknowledge concept that is cited by multiple authors. The categorisation of knowledge communication problems is implemented to better understand the issues that hinder successful transfer of relevant knowledge from expert to decision maker (Eppler, 2007). Therefore, this article can be used to guide future research since it provides a micro level perspective on knowledge transfer and can be helpful in identifying problems that hinder knowledge communication between experts and decision makers where a gap in knowledge and authority is present. The following section will go through some of the knowledge communication concepts that is found most relevant in relation to this thesis.

The first category 'knowledge communication problems for decision makers' include concepts such as 'decision problems', 'defensive routines', 'micropolitics of knowledge', 'information overload', 'ASK problem', 'inert knowledge' and 'Cassandra syndrome'. The concepts will be briefly explained below. *Decisions problems* have previously been researched by Russo and Shoemaker (1989) and refer to taking

shortcuts and shooting from the hip, when the decision maker trust that he can make an instant decision in a complex issue without any further research. Argyris (1990) identifies *defensive routines* in decision making, which include mechanisms or habits to not accept new knowledge. *Micropolitics of knowledge* is explained by Lazega (1992) as the discrediting of an expert's knowledge due to decision makers' divergent agenda or the lack of formal authority with the expert. *Information overload* is a problem in which the decision maker cannot combine new knowledge in the process due to an overload of complicated information (Eppler, Mengis, 2004). The *ASK problem* happens when a decision maker does not have a base of knowledge in order to know what to ask for (Belkin, 1980). *Inert knowledge* describes a situation where the knowledge that decision makers have obtained does not come to mind when it is needed to make a complex choice (Whitehead, 1929). Finally, the *Cassandra syndrome* describes a situation in which the decision maker disregards the expert's information because he faces other pressing issues, and only when the situation has become much worse he will start following the expert's recommendations (Mikalachki, 1983).

The second category 'knowledge communication problems of experts' describes communication barriers such as 'knowledge sharing hostility', 'curse of knowledge', 'terminology illusion' and 'projectionism'. The term *knowledge sharing hostility* describes when communication fails due to experts' reluctance to share knowledge because of micropolitics or a bad relationship with decision makers (Husted, Michailova, 2002). The *curse of knowledge* takes place when experts struggle to articulate knowledge or paraphrase it so that decision makers can relate (Hinds, 1999). The barrier called *terminology illusion* describes when experts overestimate the level of decision makers' understanding of specialised language and the notoriety of certain terms (Rambow, 2000). Lastly, *projectionism f*rom experts leads to an assumption that the decision makers already have an identical understanding of a complex issue. This results in communication that is not tailored to the knowledge level of decision makers (Cantoni, Piccini, 2004).

The third category 'knowledge communication problems for decision makers and experts' cover concepts such as 'communication biases', 'common knowledge effect' and 'lack of common ground'. *Communication biases* are concepts such as saying-is-believing and shared reality bias. The saying-is-believing effect will lead to a sort of automatic persuasion where the listener does not critically reflect on what has been said, but automatically believes the other part. Also, experts and decision makers may suffer from the idea that they have a shared reality in which you consider your message to provide accurate information on the topic since it

is shared with the other part (Higgins, 1999). Gigone and Hastie (1993) identify a *common knowledge effect.* This can be described as the tendency of a group to disregard unique information because the group has a preference for shared information. Finally, the barrier called *lack of common ground* refers to the situation in which decision makers and experts assume to have shared beliefs about the world. This is often not the case, and this misinterpretation makes communication more difficult (Olson, Olson, 2000).

Also this article relates to the theoretical framework of the thesis; Geels' transformation theory (2002, 2011). The analysis conducted on the background of Eppler's (2007) identification of knowledge communication problems will operate on a policy dimension, on a market and industry dimensions and in a cultural dimension. Identifying factors that hinder effective knowledge communication will thus contribute to an understanding of how different dimensions within the socio-technical regime affect each other and understand the inertia of transition towards a circular economy.

5.4) Thinking, Fast and Slow (Kahneman, 2012)

The application of Kahneman's theory will be relevant in that it give a perspective on how the mind works in the two systems and what implications this has for decision making. Combined with the theory on communication problems (Eppler, 2007) it will allow an insight into the processes within DACC and its member construction client organisations. Primarily, the focus will be on the processes that happens when DACC works to collect new knowledge on the circular economy, and in analysing how construction client organisations process this new knowledge they acquire from DACC and other experts.

In his book, Thinking Fast and Slow, Daniel Kahneman (2012) introduces two mental models, two cognitive modes of thinking, labelled system 1 and system 2. System 1 is associated with automatic thinking, it operates rapidly, with no or little effort and provides no sense of intention or control. System 2 is associated with concentration and attention to mental activity. It operates complex mental processes and is experienced as choice or agency. These two systems of the brain are interesting because we identify ourselves with system 2, a rational and reasoning self that can make choices and decisions on what to do, but Kahneman (2012) argues that the automatic system 1 plays a huge role in our everyday cognitive activity such as decision making.

In the following, operation of both systems will be elaborated. In general the automatic activity of system 1 effortlessly compute impressions and feelings that are the foundation for the deliberate choices and precise beliefs of system 2. System 1 can generate patterns of ideas, but just system 2 can build thoughts in a systematic slower series of steps. Thus, system 2 tends to take over when you need to overrule the impulses from system 1 (Kahneman, 2012). System 1 operations can for example be activities such as turning your head against a loud noise, driving a car on an empty road or understanding simple numbers or sentences. Some of these system 1 activities we are born with, others we learn through continued practice since system 1 can adopt associations between certain ideas or social situations. This type of knowledge is stored in the brain and accessed effortlessly and without intention, sometimes even involuntarily. Operations of system 2 are very diverse, but have in common that they require focus and are disturbed if concentration is interrupted (Kahneman, 2012). Examples of system 2 thinking is when you need to focus on a specific person in a noisy or crowded room, when you search your memory to identify a surprising experience, fill out your tax form or when you need to certify the validity of a complicated argument. What these situations have in common is that focus is needed to accomplish the tasks, if you are distracted you will perform worse.

Cooperation of the two systems is usually very efficient. Both systems are active when we are awake. System 1 is running on autopilot and system 2 is most of the time running in a lazy mode, working as little as necessary. System 1 generates inputs; impressions, feelings, intuition for system 2. Most of the time system 2 adopts the impressions and suggestions from system 1 without any or with few alterations. But, system 2 takes over when system 1 runs into trouble and when complicated processes is needed to solve a problem. System 2 is thus activated when a situation is identified that does not fit with system 1's world view or when it identifies a mistake about to be made. Hence, the cooperation of the two mental systems works to optimise performance and minimise energy use and generally works efficiently (Kahneman, 2012).

Some of the basic assumptions about the operations of system 1 and system 2 are vital to keep in mind when discussing this theory. First, system 2 is able to alter some functions of system 1, by programming the instinctive processes of memory and focus (Kahneman, 2012). For example, you can instruct yourself to look for a certain coloured jacket on a busy ski slope, in order to identify a family member more quickly. Second, the control of your focus is shared by system 1 and system 2. It is difficult to do several activities at once, if they require some effort, because you only have a certain amount of attention that can be given to activities.

Consequently, you will not be able to pay attention to several things at once. Third, this limited amount of attention span also means that focusing on an intense assignment can make you blind to other stimuli that would otherwise attract your attention. Fourth, besides being sometimes blind to some stimuli, humans are also blind to their own blindness, i.e. we do not think that we overlook information or miss inputs in complicated situations. Fifth, system 1 sometimes make systematic errors do to biases. For instance system 1 sometimes unconsciously tends to answer more simple questions than the ones that were asked, and has poor understanding of statistics and logic. Finally, system 1 has cannot be switched off on purpose, which can have implications for decision making (Kahneman, 2012).

According to theory, humans are not entirely logical reasoning creatures and how the mind works has implications for decision making in almost any aspect of our lives. In the following part, a few biases and heuristics, those that are most relevant to this thesis, will be briefly explained.

First, an *affect heuristic* can influence people's decisions because they let their feelings, likes and dislikes towards something determine their opinions and world views (Kahneman, 2012). When a person dislikes a thing, situation or person, he will probably believe that the risk associated with it are high and the benefits are low. Before system 2 was described as playing a part in searching one's memory, planning, choice and complex computations. But when it comes to attitudes or feelings, system 2 is more likely to be a defender of what system 1 has already come up with. Hence, system 2 will search for arguments and data that supports the existing beliefs, without the intention to question them. System 2 thus sometimes becomes undemanding and accepting of system 1's suggestions. However, this does not mean that the mind is completely closed to new information or reasonable arguments. Moral, attitude and beliefs can be changed to some degree (Kahneman, 2012).

Second, a *confirmation bias* comes from the way system 1 and system 2 works (Kahneman, 2012). For example, the initial attempt to understand or believe a simple sentence is an automatic response from system 1 and includes an interpretation that suits the situation best. Scientists have found that when system 2 is otherwise engaged or even just lazy, the first hand impressions of system 1 are more likely to be accepted as they are. This is seen for example when tired and weary people are more likely to accept empty arguments from commercials (Kahneman, 2012). Also, the associative memory may contribute to this confirmation bias,

as it searches for confirming evidence. Theory claims that it is human nature to seek evidence that is likely to confirm our existing beliefs and world views, even if this is done by uncritically accepting suggestions from system 1 (Kahneman, 2012).

Third, another story about the associative mechanisms of the brain is that it only presents activated ideas and thoughts. Since system 1 does not directly operate with memory or deep thought processes, data that is not readily available might as well not even exist. System 1 creates the most possible story by sorting in the available information, but cannot include information that is does not have at hand. System 1's success is dependent on the coherence of the story it manages to tell. In this way, system 1 is not sensitive to either quality or quantity of the evidence that is bases intuition or impressions on. Consequently, when it has little information to access system 1 quickly jumps to conclusions. This is also known as an *availability bias* in that it operates with what evidence is readily available (Kahneman, 2012). Realising that system 2 is often lazy or busy and system 1 is seeking consistency, a lot of our instinctive and spontaneous beliefs will be applied without much question. But, as mentioned above, the processes of system 1 thinking never ceases, why it also influences the more important decisions. However, this is not all bad. Kahneman (2012) argues that this is also the explanation of how we can think fast and act quickly in a complex world. And most of the time, the story that system 1 puts together is coherent and true enough that it works and can lead to reasonable action (Kahneman, 2012).

Finally, in general people are fighting harder to avoid losses than they do to realise gains (Kahneman, 2012). For example, this loss aversion explains much of the processes that happen when institutions undergoes reforms or when organisations want to restructure or reorganise themselves. Since this type of change almost always result in winners and losers, it normally includes some grandfather clauses that secure current stakeholders. The loss aversion is a strong conservative influence that favours a minimum of change from the status quo with both individuals and institutions. This *status quo bias* means that generally humans have a preference for keeping things the way they already are, rather than risking potential losses. This principle is not only bad, as it is what keeps us stable in many everyday situations such as marriages and jobs (Kahneman, 2012).

Summing up, Kahneman (2012) presents a theory on how the processes of the mind works relating it to two distinct systems of thought. System 1 is responsible for the quick, effortless responses of the brain, and system 2 is responsible for memory, choice, careful considerations and computations. In the way the two interplay, a number of biases, effects and heuristics is produced (Kahneman, 2012). This section has elaborated on a few of them, i.e. the affect heuristic, confirmation bias, availability bias and status quo bias. These systems of thought and biases are examined in the analysis of the case, to understand the conscious and unconscious thought processes that potentially harm the process, when construction client and DACC are implementing circular economy decisions in their construction or demolition work.

In relation to Geels (2002) transformation theory, this part of the analysis will operate primarily on the cultural dimension of the current socio-technical regime. By analysing potential biases of construction clients it can be related to their decision-making processes and will help identify current cognitive barriers to the transition towards a circular economy. Also this theory will be applied in the analysis of DACC's transformation process from decision maker to expert and the process of accumulating new knowledge of how to work towards a circular economy in the market and industry. The identification of such mental challenges within DACC, construction clients and other experts will help explain the inertia in some dimensions of the current socio-technical regime and possibly identify what hinders a window of opportunity for the circular economy to break through.

5.5) Synthesis of theory and matrix

This thesis applies Geels' transformation theory as a theoretical framework. The author has chosen to limit the analysis to those dimensions that are particularly relevant for the transition to a circular economy in the Danish construction and demolition sector, i.e. policy, market and industry and culture dimensions. In this analysis, it must be considered that policy, culture and market and industry dimensions are connected to each other and develop together, but they also have individual dynamics (Geels, 2002). Accordingly, taking different stakeholders to DACC and to construction client members into consideration is important, in order to understand the nature of the relationships between actors in different dimensions and to further analyse the communication between them in relation to the emergence of the circular economy. This interaction between dimensions is relevant to understand the multidimensional nature of sustainability transitions and the dynamics of structural change (Geels, 2011). Mitchell, Agle and Wood's (1997) stakeholder theory will thus contribute

to the analysis and the understanding of dynamics happening in the dimensions by applying concepts that allow to navigate in stakeholders, to describe those relationships in a systematic way, and to estimate the power, legitimacy and urgency of various stakeholders.

The two theories of knowledge communication problems (Eppler, 2007) and cognitive biases (Kahneman, 2012) will both be applied in the analysis in order to cover the most relevant challenges to the transition. The combination of these theories will allow to identify which communication issues and cognitive challenges are present in the policy, market and industry and culture dimensions**.** Matrix 2.1 constitutes the synthesis of Geels theory on transformation (2002, 2011), Eppler's theory on knowledge communication problems (2007) and Kahneman's theory on cognitive biases (2012). The theory of knowledge communication problems (Eppler, 2007) will by applied in the two first rows and provide understanding of how the policy and the market and industry dimension is affected by different communicative issues within the three categories: 1) decision makers, 2) experts and 3) decision makers and experts. Kahneman's (2012) theory on cognitive biases is primarily applied in the third row, i.e. the culture dimension, because biases and heuristics can be related to culture, norms and values and symbolic routines. Matrix 2.1 also takes into consideration the double role that DACC has in contributing to the circular transition. DACC is analysed as a decision maker in the policy dimension due to the work DACC does in collecting knowledge on the circular economy and in its role as participant in political projects. But, also analysed as an expert in the market and industry dimension due to DACC's role in providing its member organisations with knowledge of how to become more circular.

By combining the theories of stakeholders (Mitchell, Agle and Wood, 1997), knowledge communication problems (Eppler, 2007) and cognitive biases (Kahneman, 2012) the analysis seeks to explore both the internal dynamics of the policy, market and industry and culture dimension as well as the influence among and co-development of the dimensions. The analysis will be conducted by applying matrix 2.1 as a guiding theoretical tool that combines multiple theories, and will provide understanding of how communication problems are contributing to the inertia of the current socio-technical regime that might hinder the circular economy to break through in the Danish construction and demolition industry.

Knowledge communication problems → **Dimensions of the socio-technical regime**	*Communication problems for decision makers*	*Communication problems for experts*	*Communication problems for both*
Political dimension	**1)** DACC • Decision problems • Defensive routines • Micropolitics of knowledge • Information overload • ASK problem • Inert knowledge • Cassandra syndrome	**2)** Experts on the circular economy • Knowledge sharing hostility • Curse of knowledge • Terminology illusion • Projectionism	**3)** DACC + experts • Communication biases • Common knowledge effect • Lack of common ground
Market + industry dimension	**4)** Construction clients • Decision problems • Defensive routines • Micropolitics of knowledge • Information overload • ASK problem • Inert knowledge • Cassandra syndrome	**5)** DACC + construction clients with experience in circular projects • Knowledge sharing hostility • Curse of knowledge • Terminology illusion • Projectionism	**6)** Construction clients + DACC • Communication biases • Common knowledge effect • Lack of common ground
Culture dimension	**7)** Construction clients Cognitive biases • Affect heuristic • Confirmation bias • Availability bias • Status quo bias	**8)** DACC + construction clients with experience in circular projects + other experts on the circular economy Cognitive biases • Affect heuristic • Confirmation bias • Availability bias • Status quo bias	**9)** Construction clients + DACC Cognitive biases • Affect heuristic • Confirmation bias • Availability bias • Status quo bias

Matrix 2.1 Theory - communication problems and cognitive biases in different dimensions

6) Analysis

6.1) Stakeholder analysis

This first part of the analysis will be concerned with answering sub research question one. It will briefly identify which stakeholders are relevant to DACC and to members of DACC in relation to the circular economy, and how the relationship of these stakeholders affects the work with circular initiatives in the construction and demolition industry. The analysis will be conducted on the basis of the theory of stakeholder identification and salience (Mitchell, Agle and Wood, 1997) that have been outlined above. Consequently, the analysis will identify if stakeholders are latent, expectant or definitive in the context of working the circular economic initiatives. The stakeholder analysis is delimited to only include stakeholders that can be identified from the primary data collection and are limited to the most relevant ones from participants point of view. In the following section first relevant stakeholders of DACC in relation to the work with the circular economy in the industry are identified, followed by relevant stakeholders to members of DACC.

6.1.1) Stakeholders of DACC

First, an important stakeholder to DACC are its member organisations, who are primarily construction client organisations. In relation to the work with circular initiatives, DACC's members are definitive stakeholders because they hold both power, legitimacy and urgency over DACC. The employee in charge of sustainability and circular economy in DACC points out in the interview that the purpose of DACC is to take care of its members interests (interviewee 1). The member organisations are also part of the economic foundation of the work that DACC does, lending members legitimacy over the organisation. Members hold power over DACC because they influence the agenda, and because the organisation is dependent on members to participate in networks and committees in order to acquire knowledge about industry practice. It was pointed out that this type of knowledge is essential to the work of DACC (interviewee 1). Members also hold some urgent claims over the organisation due to the influence on agendas of the organisation, since one of DACC's goals is to develop tools and guides for its members (interviewee 1).

Second, the Danish government and Danish authorities are another definitive stakeholder to DACC. It was evident from interviews that DACC is commenting on drafts for legislation on sustainability in the industry (interviewee 1, interviewee 5). However, if not invited to the political scene, this function of DACC would not exist, i.e. Danish authorities have some power over interest organisations such as DACC by deciding who can

participate in hearings and provide an opinion on draft legislation and strategies. Authorities and the government have a legitimate claim over DACC since they determine the rules of the game in the industry. They can also require DACC's members to fulfill certain standards in relation to sustainability and the circular economy. Political authorities also hold an urgent claim over DACC because both the organisation and its members are expected to comply with the strategies and legislation from the authorities. The close relationship that DACC has to the government is also evident from the fact that DACC participates in the government's Climate Partnership, which was established in 2019 (Bygherreforeningen E, 2020).

Third, the EU is categorised as an expectant stakeholder to DACC because it holds both legitimacy and urgency to the organisation. Legitimacy comes from the involvement in EU projects such as City Loops in which DACC and six other EU countries participate (interviewee 1). This collaboration is also important to DACC in order to acquire knowledge about the circular economy (interviewee 1). The EU also has some urgent claims in funding these projects, and in general in influencing the political agenda in relation to the circular economy in member countries. Also the EU is perceived as a leading actor within the circular economy, and that Danish construction clients, and thus DACC, must gain knowledge from the EU (interviewee 4).

6.1.2) Stakeholders of members of DACC

First, Danish political decision makers of the government and the city councils are identified as definitive stakeholders to members of DACC in relation to the circular economy. The political environment in general has a lot of influence on the construction and demolition industry and holds both power, legitimacy and urgency over DACC members. It does so because political decision makers determine the conditions under which Danish construction clients work with circular initiatives, they control the budgets for public construction clients, and decide on local planning and distribution of potential construction grounds. Also, the Danish government has proposed a strategy for the industry in relation to implementing circular initiatives (interviewee 5). This was made clear by a large construction client who stated that the MUDP (Miljøministeriets Udviklings- og Demonstrationsfond) funds were one reason that the company were able to initiate the circular economy project, Circle House (interviewee 6). Also, construction clients feel some political pressure to comply with initiatives from the voluntary sustainability class, because demands for sustainability in construction and demolition might become mandatory from 2024 (interviewee 4).

Second, DACC is categorised as an expectant stakeholder to its members. The organisation holds both legitimacy and urgent claims over member construction clients, but cannot directly exercise power over them. A construction client pointed out that DACC's workshop and seminars worked well for knowledge sharing on the circular economy (interviewee 3). Also, several of the interviewees pointed out that DACC could become a central player in distributing knowledge and tools for implementing the circular economy in the industry (interviewee 2, interviewee 3, interviewee 4, interviewee 5, interviewee 6).

Third, partners in the industry who are also working with the circular economy can be seen as expectant stakeholders. Other construction clients, architects, engineering companies and producers of construction materials are described by several interviewees as crucial for working with circular projects (interviewee 1, interviewee 5, interviewee 6). They hold both legitimacy and urgency over the construction client companies. Also, it was stated that the circular construction project Circle House was only possible because the company Lejerbo collaborated with partners who really wanted to push the circular economy agenda (interviewee 6). Networking with industry partners on the area of circular economy is thus seen as vital for the concept to catch on in the industry.

Consequently, to DACC both its member organisations and the Danish government and authorities were identified as definitive stakeholders, and the EU as an expectant stakeholder. To members of DACC, Danish political decision makers in the government and in local authorities were identified as definitive stakeholders, while DACC and other partners in the industry working with the circular economy are identified as expectant stakeholders. It is evident from this analysis and from the interviews that a great number of industry actors can be identified as either definitive or expectant, i.e. with high influence on DACC and its member organisations. In general interviewees stress that the work they do with circular initiatives depends on networking and collaboration with partners who are also interested in this agenda (interviewee 1, interviewee 2, interviewee 6). Construction clients who are working with the circular economy in construction projects are highly dependent on both the political sphere and industry partners, and DACC is highly dependent on both political actors and on other members of the industry. In relation to Geels' (2002, 2011) transformation theory, it can be argued that the political, market and industry dimensions, in relation to the circular economy in the construction and demolition sector, very much influence each other. This is also why the circular economy in

this industry cannot be implemented by single actors alone, but demand that players from different dimensions participate in developing circular economic initiatives.

6.2) Analysis of communication problems and cognitive biases

The following and major part of the analysis will focus on sub-research questions 2 and 3 regarding communication problems and cognitive biases and how those influence the transition towards the circular economy in the Danish construction and demolition sector. It will be organised according to the theoretical framework and the theory matrix 2.2 below, which was developed in the theory section of the thesis. Hence, the analysis will first touch upon the communication problems in the political dimension, the market and industry dimension, and finally cognitive challenges in the culture dimension.

Knowledge communication problems → **Dimensions of the socio-technical regime**	*Communication problems for decision makers*	*Communication problems for experts*	*Communication problems for both*
Political dimension	**1)** DACC	**2)** Experts on the circular economy in the construction and demolition sector	**3)** DACC + Circular economic experts
Market + industry dimension	**4)** Construction clients	**5)** DACC + construction clients with experience in circular projects	**6)** Construction clients + DACC
Culture dimension	**7)** Construction clients	**8)** DACC + construction clients with experience in circular projects + other experts on the circular economy	**9)** Construction clients + DACC

Matrix 2.2 Analysis - actors subject to analysis in different dimensions

6.2.1) Cell 1: Communication problems for decision makers in the political dimension

Within the political dimension, DACC's role as decision maker is mostly played out in the organisation's role as participant in EU projects, as commentator to EU and Danish legislation and strategies on the circular economy and as participant in the Danish Climate Partnership, which is under the auspice of the Danish government. The analysis found that within the area of communicating about the circular economy and the work with circular initiatives, challenges in DACC lead to some degree of decision problems, inert knowledge, ask problem and information overload.

Decision problems and inert knowledge

First, because of a lack of resources for internal and external communication, there is no clear structure of communication in DACC in relation to the circular economy (interviewee 1). This lack of structure and resources for communication and knowledge sharing means that processes concerning working with circular initiatives happen very unstructured, informally and casually (interviewee 1). It also entails that new information on the circular economy in the industry is shared only by chance, when employees of DACC participate in various work groups. In this way the knowledge that is shared often seems fragmented (interviewee 1). These issues with lack of structure and resources for communication and knowledge sharing suggests that decisions in regards to working with the circular economy is characterised by employees that are forced to shoot from the hip or take shortcuts, i.e. decision problems. Another effect of this type of fragmented and unstructured knowledge sharing is inert knowledge, meaning that new knowledge about the circular economy might not come to mind when needed.

Ask problem

Navigating within the organisation DACC can sometimes be difficult because it is characterised as a fragmented organisation that exists of different departments. Departments in DACC work with sometimes similar topics, but have different target groups, different perspectives and are employed by different people (interviewee 1). This fragmentation of the organisation complicates the knowledge sharing and lead to that people in one department does not know what others working with similar topics are doing on other departments (interviewee 1). This has a negative effect on the level of sharing and inspiring each other within DACC (interviewee 1). What this also entails for DACC is, even though several of the employees share an interest for working with the circular economy, they do not always knows who to ask for help, or does not

have the knowledge to know how to ask for input that relates to development of guides or tools that enable circular initiatives.

Information overload

In DACC employees point to a number of issues that can lead to information overload. In general searching for information on the circular economy is drowning people in information and they do not know what information to use (interviewee 1). This also applies when employees search for knowledge using Google:

"*If you go and look up the circular economy, you will get billions of hits right? It is completely chaotic*" (interviewee 1, own translation, p. 8).

Besides the confusing results from searching the internet, it is pointed out that the number of analysis and reports about the circular economy in the construction industry is overwhelming. Both because there are so many and because new issues are published frequently (interviewee 1). There is a general need for a system or a specific place where knowledge can be easily found when searched for (interviewee 1), which does not exist today (interviewee 3). These characteristics that participants used to describe their work with the circular economy, points to a problem with information overload, meaning that they struggle to use and combine new knowledge on the circular economy.

6.2.2) Cell 2: Communication problems for experts in the political dimension

In relation to expert communication problems in the political dimension, interviewees mentioned that they have used or come across the following experts and institutions: VCØB, a Danish think tank on the circular economy in the construction and demolition sector, the EU, the Danish authorities and the Ellen MacArthur Foundation.

Terminology illusion

Generally, there is a lack of overview, a lack of transparency and a need for more information on how to document and validate the circular economic initiatives in the construction and demolition sector (interviewee 4). In the current situation, it is not possible to upscale the work with circular economy in the industry

(interviewee 4). And, in relation to working with EU materials on the circular economy, some very specialised language is used, and it is necessary for players in the industry to be familiar with this jargon (interviewee 6). Using reports from the Ellen MacArthur Foundation, it is pointed out that even if reports are useful looking at the more general societal perspective, knowledge from this expert on the circular economy is hard to apply directly to the work in practice (interviewee 5). This suggests that there is some degree of terminology illusion among experts on the circular economy, meaning that experts sometimes overestimates the understanding of the specialized language used to communicate about circular initiatives in the industry.

Projectionism

The assumption that others share the same knowledge can also be found somewhat in relation to the circular economy. For various actors in the construction and demolition secor such as construction clients and craftsmen, who will be working with this topic on a daily basis, communication is sometimes perceived as too academic (interviewee 4):

"*I really think it is important that you do not make it [the circular economy] too academic, but rather try and make it more practical. By making a collection of cases, for example*" (interviewee 4, own translation, p. 37).

Also, it is criticised that VCØB does not include a large enough scope of the circular economy in their knowledge sharing, making it more complicated to gain an overview of the more general knowledge on the circular economy from them (interviewee 1). Further, VCØB have not processed the knowledge that they share on the circular economy enough for construction clients to use (interviewee 1). This points to a tendency for projectionism from experts on the circular economy, i.e. a tendency to assume that all actors across the industry share the same knowledge about how to implement circular initiatives in their construction projects.

Curse of knowledge

With the Danish authorities it is pointed out that in relation to the circular economy, there is a tendency to communicate about initiatives as if they are something completely new. Rather than having a focus on what processes that are already in play and can be used as a part of the circular economy (interviewee 5). If focus could be shifted into doing more of what we already know how to, circular initiatives could be implemented

more easily (interviewee 5). Also, there is a need for authorities to develop a short-list of materials that are well suited for circulation in the construction and demolition industry (interviewee 4). Since there are thousands of materials going into construction processes, actors such as construction clients need overview of information on materials (interviewee 4). In relation to the scientific research that is done on the subject of circular economy in the industry and the research results, one participant stated that:

"*A lot of scientists are really good at doing research, but are lousy communicators*" (interviewee 1, own translation, p. 8)

This points to the communication problem curse of knowledge in the industry, which entails that experts struggle to articulate knowledge so that others can relate.

No knowledge sharing hostility

According to theory (Eppler, 2007), experts can have communication problems in that they do not always wish to share the knowledge they have on a specialized subject due to for example politics or bad relationships. However, the analysis points to the exact opposite in the case of knowledge communication from experts on the circular economy in the construction and demolition sector. When participating in EU projects project manager at DACC states:

"*Everybody is open and interested in getting inputs and testing theories, so I think [sharing] works well*" (interviewee 1, own translation, pp. 11-12).

This point also seems to apply to other industry experts, who are characterised as very willing to share knowledge concerning the circular economy in construction and demolition.

6.2.3) Cell 3: Communication problems for both in the political dimension

Lack of common ground

The communication problems for both experts and decision makers in the political dimension points mostly to a lack of common ground. An example of this comes from the interaction that many industry players have with

the EU. For example, the EU has developed a REACH-list that tracks chemicals that could potentially be dangerous, which can be used to cross check if construction materials are toxic (interviewee 4). The EU have initiated projects that focus on analysing our current building as materials banks for future construction work (interviewee 5). Also, both DACC and other actors are involved in EU experiments with circular initiatives (interviewee 1, interviewee 2). However, a problem for both experts and decision makers can be the lack of common ground due to the fact that EU projects and project managers are well ahead of Danish players in relation to the circular economy in the industry (interviewee 6).

Communication biases

In general it seems that actors in the industry find that working with circular initiatives is characterised by unstructured and chaotic processes.

"*There is no room for [...] administrative processes or work procedures, everything happens in one big chaos*" (interviewee 1, own translation, p. 10).

In combination with the lack of common ground mentioned above, this could point to problems with communication biases, meaning that collaboration across the industry is characterised by people assuming to share reality, rather than being aware of the potential gap in knowledge depending on your position or origin.

6.2.4) Cell 4: Communication problems for decision makers in the market and industry dimensions

Decision makers in the market and industry dimension in relation to the construction and demolition sector are primarily construction clients. During the process of constructing new or renovating older buildings, construction clients are faced with endless choices such as choice of materials, pursuing certification standards and economic aspects. Many of these decisions relate to the sustainability aspect of the building and the circular economy. Focus of the following section will be on construction clients and the communication problems they face in working with circular initiatives in practice.

Decision problems

In the process of constructing a building or renovating, construction clients are generally under some pressure mainly on time. Because of this pressure, people do not always enjoy trying out new initiatives because they

do not feel like they can achieve as much as they can compared to their normal routine (interviewee 3). Also, there is no specific place to look for, for example, a short-list of materials that are well suited for circulation or other circular processes, making collecting information on this subject slow and inconvenient (interviewee 4). It is also pointed out that construction clients need to be better educated within the area of circular economy to make better and faster decisions on the subject (interviewee 4). Further, a challenge to construction clients are the issues relating to the fact that circular economy is often referred to as the same as recycling. The concept of recycling seems more known to people, who then tend to use it as a shortcut to achieve circularity, when this is not the case (interviewee 5). In relation to this a participant concluded that:

"*There is a need for a reality check in this business [with circular economy]*" (interviewee 5, own translation, p. 48).

Finally, there is a need for available examples of circular construction projects for construction clients to compare their own projects to and to be inspired from (interviewee 5). All these challenges point to the fact that construction clients face serious decision problems, in that they risk making hasty decisions or taking shortcuts in relation to implementation of circular initiatives.

Defensive routines

From participants it is implied that there is a need for construction clients to be actively more involved in meetings than usual, in order to keep focus on circular economy (interviewee 2). Some construction clients even do not want to participate in the discussion of implementing circular initiatives because they do not consider themselves part of the agenda (interviewee 3). Also, some experience that the concept is being forced upon them, or they just do not engage in discussions because it is of no interest to them (interviewee 3). Other reasons for defensive routines in construction client decision making are that people think of circularity as being very far away from their professional competencies, some think of it as taking up too much time or being too complex a process (interviewee 3). Another aspect of the communication problem is the fact that barriers are built in the industry because of how actors speak about circularity. Some statements are now considered as true, because they have been told numerous times, which creates a barrier to obtaining new knowledge:

"It is expensive to build sustainably, full stop. And when this has been repeated 50 times, it becomes a fact to many people, even if it is not really true. And it will stay with them no matter what knowledge they can gather along the way" (interviewee 5, own translation, p. 58).

Finally, some construction clients are scared that they will get in trouble, if the circular initiatives do not work out as well as planned (interviewee 6). Others just do not believe that the circular economy is developed well enough to be fully implemented yet. This is evident from a statement from a large construction client who already built one of the only circular projects in Denmark, but is still sceptical:

"I understand why people in the industry say that it [circularity in construction projects] can not be done, it is not something easy to do. No, it is not really doable" (interviewee 6, own translation, p. 70).

All of the challenges described above seem to imply that a lot of the communication around circular initiatives are characterised by decision problems, meaning that construction clients are prone to take short cuts or shooting from the hip.

Micropolitics of knowledge

Some communication problems also come from micropolitics of knowledge. This can be seen for example when construction clients feel like they have to put themselves at risk in order to work with circular initiatives (interviewee 4). Also, changing routines is hard for some people because it also entails changing some of their professional competencies (interviewee 3). Some craftsmen directly disregard the need to work with recycled materials because they think of them as more expensive or of worse quality (interviewee 3). In these situations interview participants experienced that some actors in the industry disregard expert knowledge on the circular economy because they personally have a different agenda.

Information overload

Understanding the procedures and material processes is hard and takes time for construction clients, not least because information is spread in various places. Two interview participants both pointed to this challenge:

"The construction client needs to understand how material processes are connected. Where we can best contribute [to the circular economy]. And we can not get around the fact that they will only find out if they take the time to get acquainted with it" (interviewee 2, own translation, p. 21).

"It is also because there is a lot of knowledge concerning all different kinds of topics [within the circular economy], and it is really hard to figure out when something is useful and when it is not" (interviewee 3, own translation, p. 25).

Besides, there are a lot of parallel tracks to consider within the circular economy. And some construction clients are simply for or against implementing circular initiatives making no room for partially implementing circularity in projects (interviewee 4). However, there is a need for making room for testing and partially implementing initiatives at the moment, but many construction clients become too fixed on either or (interviewee 4). Also, people experience that they are required to make decisions about a lot of new materials that they do not know much about yet (interviewee 4). One participant describes this issue the following way:

"I get phone calls from a lot of different producers, who offer us all sorts of materials [...] but I am not a complete specialist on materials and I get asked everything from tiles to rubber strips to windows. It is a jungle really" (interviewee 4, own translation, p. 38).

These communication challenges described above suggest that construction clients are often faced with information overload in relation to their decisions on whether to implement circular initiatives or not, because the circumstances in the industry mean that they have trouble combining new knowledge on the subject with old knowledge.

Ask problems

As was mentioned previously, some construction clients feel that they do not have enough knowledge on the circular economy, meaning that construction companies are hesitant to initiate new processes (interviewee 4). This is not only the case in single organisations, but is seen across the construction and demolition industry (interviewee 4). Another challenge that points to ask problems in the industry is the lack of practical circular construction projects. Construction clients struggle to find examples of contractual terms and who is accepting

what risk (interviewee 5). This in turn can mean that construction clients do not have enough knowledge on the subject to know who or where to ask for more information on the circular economy.

Inert knowledge

In stressing the need for construction clients to participate extraordinarily in meetings to keep focus on the implementation of circular initiatives, a participant implies that other parties can quickly forget these new initiatives and fall back into old routines if not reminded of the circular agenda (interviewee 2). The same point is exemplified by another construction client who has experienced a plumber who did not consider the focus on energy efficiency and bought a specific pump because he had a favorable procurement contract for it (interviewee 3). Finally, as it was pointed out above there is a general issue in the industry with accepting specific statements about sustainability in the industry as final truths (interviewee 5). These points suggests that construction clients suffer from inert knowledge in regards to the circular economy, meaning that new knowledge does not always come to mind when needed and thus hinders development of the circular economy.

Cassandra syndrome

Communication problems stemming from Cassandra syndrome are also present in the industry. Even if construction clients are willing to discuss circular options for their projects, they tend to prioritise other agendas such as quality and price (interviewee 2). A large public construction clients puts it very clearly:

"We do not approach a construction project and state that it must be 100% circular because [...] it is a very high priority for us that it is not too expensive, because funds will then be taken from the elder care and other welfare" (interviewee 2, own translation, page 22).

Another example of this challenge is that construction clients struggle to make decisions on circular initiatives because of the lack of incentive to experiment. Decisions are often guided by the fact that construction clients are unsure of the documentation of circulated materials, and have the alternative new material, which they know everything about and with which they trust the documentation (interviewee 4). This suggests that expert knowledge on circularity is disregarded due to other pressing issues.

6.2.5) Cell 5: Communication problems for experts in the market and industry dimensions

Experts on the circular economy in the market and industry dimensions are the organisation DACC, but also construction clients who have worked with circular economy in experiments and projects have been included, since these individuals and organisations are people in the industry who have collected the most practical knowledge on the subject.

Curse of knowledge

In the industry, knowledge about the circular economy tends to become distant and hard to communicate because there is a lack of governance and transparency in for example certifications (interviewee 4), which is pointed out in the quote below:

> *"There is a need for some clear rules of the game, some governance, transparency in certifications, [...] which can be combined with communication about upcycled materials to make the subject more familiar to end users and other actors"* (interviewee 4, own translation, p. 36).

There is a general perception from interviewees that the industry struggles with the concept of circular economy because there are numerous definitions and thoughts on the subject (interviewee 4). Also, some construction clients perceive the circular economy as something too academic to actually apply in their daily work (interviewee 4). Finally, the way actors communication about the circular economy in the industry also implies that experts struggle with the curse of knowledge:

> *"People talk about it [the circular economy] as if we need to do something completely new, that we need to innovate every process over again. [...] But some things that are happening are already circular. [...] So it is both about doing something new, but also, and maybe even more importantly, we need to do more of what we are already doing"* (interviewee 5, own translation, p. 51).

These statements about how circularity is communicated in the industry suggests that expert knowledge on the subject is not communicated very well and that experts are subject to the curse of knowledge, meaning that they struggle to articulate knowledge so that non-experts can relate.

Terminology illusion

The need for clearer communication on what the concept of circular economy means in the construction and demolition sector, combined with the perception that it is sometimes too academic (interviewee 4), may be caused by communication problems that are related to terminology illusion. This means that experts on the circular economy overestimate the understanding of specialised knowledge with non-expert actors in the industry. Other examples suggest similar issues, such as when a participant mentions that he experience some confusion in the industry about the difference between setting a target and the means to achieve that target:

> *"The goal must be something else [other than circularity], the goal must be an increase in resource efficiency or to reduce climate change, and then the circular economy can be the means to achieve this"* (interviewee 5, own translation, p. 55).

Similarly, due to some differences in the level of knowledge on the subject, there is confusion about what can be considered recycling and what is reuse (interviewee 5). Some even discuss if the circular economy ranks under the umbrella of sustainability or if the circular economy is bigger than that (interviewee 5). These experiences from the construction and demolition industry suggests that there are some issues with terminology illusions from experts.

Projectionism

Also, communication problems stemming from projectionism can be related to the experience that there is some confusion about the concept of circular economy and its relation to sustainability in the industry (interviewee 5). This confusion may also come from actors having different levels of knowledge and different perspectives and a critical approach to how big potentials actually are by implementing circularity in construction and demolition projects (interviewee 5). Projectionism in this perspective can be found when players assume that others have the same knowledge of the circular economy as themselves, which does not seem to be the case, why communication is hampered.

No knowledge sharing hostility

As was pointed out in the analysis of the political dimension, the data on the market and industry dimensions also suggest that industry actors are very willing to share knowledge on their experience with circular

initiatives and projects. In general there is a perception of openness in the industry when it comes to sharing knowledge on the circular economy (interviewee 2, interviewee 3, interviewee 6). One large construction client who have worked with a circular project describes this very clearly:

"Yes, we have done a lot to make this transparent. We have had a lot of professional events on this, etc. It is not monopolistic knowledge. Really, we are very interested in this becoming industry knowledge" (interviewee 6, own translation, p. 69).

Followingly, the same participant explains that as head of a construction client organisation who have obtained knowledge on the circular economy, he feels obliged to share the experiences the company has had, so that other construction clients are not forced to start from scratch in their work with circular initiatives (interviewee 6). This willingness to share from experienced construction clients and other experts on the circular economy implies the opposite of what theory suggests in relation to knowledge sharing hostility.

6.2.6) Cell 6: Communication problems for both in the market and industry dimensions

Communication bias

Generally, there is a need for better communication across the construction and demolition industry and the value chain:

"We lack dialogue with each other and all the partners within a project, about what it [the circular economy] is, what it means for the way we think of construction, what it means for procurements etc. There are not many who discuss this across the industry, people discuss within their own group" (interviewee 3, own translation, p. 31).

Also, a challenge is that certain players talk about the circular economy as if it is something completely new, instead of conveying the message that this is also something that we have done before (interviewee 5). These experiences suggest that the discussion about circularity is hindered by communication biases, in this instance that industry actors with different backgrounds and levels of knowledge assume that they have a shared idea of what the circular economy is.

Common knowledge effect

There is a tendency to get stuck on just one type of process or solution in a construction project, thus disregarding other initiatives such as working to implement the circular economy (interviewee 4). Also, in regards to analysis and reports on the circular economy in the industry, it is often seen that barriers take all of the focus, leaving potentials of circularity to drown. This is seen for example in reports that discuss documentation of circulated materials (interviewee 5). This suggests that communication challenges due to the common knowledge effect exist in the market and industry dimension as well, meaning that some groups tend disregard some information on the circular economy because of a preference for other information.

Lack of common ground

However, what seems to be the most pressing communication problem in the market and industry dimension are related to a lack of common ground. As mentioned above it is stressed that there is a general lack of communication across the different partners in the industry (interviewee 3). Several participants also mention that there seems to be no clear definition on the concept circular economy (interviewee 4, interviewee 5, interviewee 6). In relation to the lack of definitions a participant explains that despite working with the circular economy for years:

"I have never met anyone in the construction industry who could give me an elevator pitch on what it [the circular economy] really is and a clear definition" (interviewee 4, own translation, p. 39).

Further, the industry has a need for clearer rules on documentation processes, i.e. what needs to be measured and how (interviewee 4). And this results in a need for transparent decision processes in order to educate employees of construction client organisations, who need knowledge to make better decisions on the subject (interviewee 4). Finally, a participant also pointed out that construction clients in general vary a great deal in size and experience, which can contribute to the lack of common ground:

"There are big professional construction clients and municipalities who build a whole lot, and who are part of the political system. And then there are a lot who build once or who build once every 20th year. They have a completely different starting point and level of knowledge and perhaps other agendas" (interviewee 5, own translation, p. 57).

These examples of different agendas, levels of knowledge and approaches to the circular economy implies that communication in the industry is complicated by misinformation due to a lack of common ground.

6.2.7) Cell 7: Cognitive biases and communication problems for decision makers in the cultural dimension

Decision makers in the cultural dimension are mostly construction clients or employees working in construction client organisations. This part of the analysis focuses on the mental processes of the individuals who are making decisions on how or whether to work with the circular economy in construction and demolition projects.

Affect heuristics

Since some construction clients do not consider the circular agenda as a part of their professional field, parts of the industry are not interested in discussing how to implement circular initiatives (interviewee 3). Others just do not find the subject interesting and thus do not consider to include circular initiatives in their construction projects (interviewee 3). Consequently, who are working with a circular agenda is very dependent on the individual decision maker:

> *"There are a lot of this [work with circularity] that are individually dependent, that is what interests you have and what you like to work with, and then some depends on the place you work"* (interviewee 3, own translation, p. 29).

Also, there is some fear and insecurity connected with experimenting with new circular initiatives in the industry. And these insecurities concerning potential extra risk for the individual or the company hinders working more with the circular economy in construction or demolition (interviewee 4, interviewee 5, interviewee 6). These statements suggest that there are some affect heuristics at play in the mind of decision makers, who seem to be somewhat guided by feelings, likes or dislikes in deciding on whether or not to work with circularity.

Availability bias

Generally, working with the circular economy in construction and demolition is a complex process (interviewee 4). And, when a lot of employees in construction client organisations are very busy, the incentive to try out new initiatives is low because they feel like they can not deliver the same results as fast as usually (interviewee 3), meaning that decision makers are pressured to operate with the knowledge that is readily available to them. Further, even experienced construction clients do not know where to search for readily available knowledge on circular initiatives (interviewee 4). This also means that construction clients do not feel competent enough to make decisions regarding the implementation of circular initiatives, and they feel like they are operating on a doubtful background (interviewee 4). These challenges to construction clients implies that availability biases influence employees who unintentionally choose to work with readily available knowledge, i.e. doing things the way they are used to.

Status quo bias

Similar mechanisms seem to influence construction clients to have a status quo bias, meaning that they prefer keeping things the way they are. Some reasons for this bias can come from construction clients who feel like they are pressured into implementing circular initiatives, even if it is none of their own interests (interviewee 3). But also from the perceived higher risk (interviewee 4), the complexity of understanding how circularity works best in the industry (interviewee 3) and the idea that these construction processes are more costly to the construction client (interviewee 5, interviewee 6).

6.2.8) Cell 8: Cognitive biases and communication problems for experts in the cultural dimension

Experts in the cultural dimension are both the construction client organisations that have already tested circular projects and gained knowledge about the processes from that, organisations in the industry such as DACC and VCØB, but also more generally experts such as researchers who communicate about the circular economy. This section identifies cognitive biases that affect the communication from these experts.

Affect heuristics

The most distinct statement that points to an affect heuristic for experts is related to research within the area of the circular economy. In a number of reports that analyse potentials and barriers of the circular economy in

the construction and demolition industry, barriers seem to take the main focus, even if benefits are also identified (interviewee 5). This suggests that experts who publish these reports on the subject can be influenced by an affect heuristic, meaning that the communication of that knowledge is unintentionally skewed because of feelings or dislikes about the concept of the circular economy.

Confirmation bias

An example that suggests a confirmation bias with experts on the circular economy is found in the discussion of the subject with a large construction client organisation. This organisation has expert knowledge on the subject because it has participated in construction projects with a primary focus on circularity. Despite working with circularity on a fairly high level, the managing director states that he understands the insecurities of industry and concludes that a circular project is not truly possible to build (interviewee 6). This statement implies that despite the organisation's experience, the experts on the subject are more likely to confirm the existing beliefs in the industry, for example that the circular economy is not ready for implementation.

Availability bias

A similar mechanism is implied in the data concerning an availability bias of an expert on the circular economy. A large municipality construction client, who are one of the leading construction clients when operating with circular initiatives, are frequently contacted by other players in the industry who want to cooperate on circular construction or demolition projects. However, it is not prioritised to participate in such projects by the construction client due to a lack of resources (interviewee 3). This points to the fact that even the most experienced construction clients in relation to implementing the circular economy, operate primarily with information that are readily available on a daily basis.

Status quo bias

Not a lot of statements from the data suggests that experts on the circular economy are influenced by a status quo bias, meaning that people have a preference for keeping things the way they are. However, one participant who have collaborated with a large municipality suggests that the majority of Danish municipalities will not favour working with circular initiatives:

"It is crucial to find a municipality where you can tap into a city council vision, and this can be done in Aarhus. And you could probably do it with 10 other municipalities. But there will be other municipalities in which that [circular] project would be met with a 'what the hell is this' response" (interviewee 6, own translation, p. 65).

6.2.9) Cell 9: Cognitive biases and communication problems for both in the cultural dimension

Affect heuristics

In general, players across the construction and demolition industry demonstrate that they associate working with circular initiatives in their projects with an increase in risk, potentially also an economic uncertainty and uncertainty about the material processes (interviewee 3, interviewee 4, interviewee 5, interviewee 6). Also there is a general assumption that the circular economy is not ready to be fully incorporated in projects yet and that it is not something that is easy to work with (interviewee 6). Accordingly, these perceptions suggest that actors across the industry are affected by some affect heuristics that allow feelings, likes and dislikes to determine how they perceive the circular economy.

Confirmation bias

There are certain communicative problems in the industry in general in relation to how the circular economy is perceived. Some statements, whether true or not, are repeated across the industry and thus become subjective truths to a lot of people, both experts and decision makers (interviewee 5). And, in combination with an industry that is characterised as both conservative and dogmatic (interviewee 4), actors seem likely to be influenced by a confirmation bias. This confirmation bias entails that people are more likely to accept or confirm statements that they have heard a number of times, rather than challenge them, because it demands a lot more mental energy.

Availability bias

The idea that implementation of circular economy is highly complex (interviewee 3, interviewee 4) may incline members of the construction and demolition sector to disregard new knowledge on the circular economy, in order to operate with information that is known and readily available to them. Another point that suggests that

actors can be affected by an availability bias, is that the industry in general lacks transparency in working processes that relate to the circular economy (interviewee 4) and that the industry is still short of a definition or short and concise description of the circular economy (interviewee 4). These issues implies that people working to implement circularity in projects are required to put in a lot of extra mental energy and work, which is challenging, meaning that automatically some will fall back and operate with knowledge that they already have.

Status quo bias

Describing the industry in general as not particularly willing to accept change or innovation (interviewee 4) is probably one of the clearest indicators of a status quo bias:

"The industry is also conservative and maybe even sometimes dogmatic" (interviewee 4, own translation, p. 36).

In combination with the perception of the circular economy as something new and overwhelming, rather than something that is already happening to some degree (interviewee 5), this bias seems to affect all types of actors across the industry. Consequently, it affects both experts and decision makers in the sense that they have an involuntary preference for keeping things the way they are, thus resisting change and innovations such as the circular economy in their daily decision making.

6.3) Key findings

The analysis set out to find 1) relevant stakeholder relationships of DACC and of members of DACC in relation to the circular economy in the Danish construction and demolition sector, 2) how knowledge communication problems affected DACC and construction clients in regards to the transition towards circular economy and 3) how cognitive biases influenced DACC, construction clients and other experts in relation to the transition towards a circular economy. This section will briefly summarise the key findings of the analysis. Interpretations, implications, limitations and suggestions for future research will be discussed in the following chapters.

The most interesting aspect of the stakeholder analysis is that stakeholders such as industry partners, authorities and DACC and member organisations respectively were identified as very important to almost all participants in relation to working with circular economic initiatives in the industry (interviewee 1, interviewee 2, interviewee 3, interviewee 5, interviewee 6). To DACC definitive stakeholders were member organisations and Danish authorities while the EU is an expectant stakeholder. To members of DACC definitive stakeholders were political decision makers, while DACC and partners in the industry working with the circular economy were identified as expectant. This relatively high level of power, urgency and legitimacy on actors in the industry stresses the mutual influence and dependence that actors have on each other across political, cultural, market and industry dimensions, but also across the value chain.
The communication problems and cognitive biases that were identified in the analysis has been summarised in matrix 2.3 below. In general, the data suggests that the most communication problems were found in the market and industry dimensions, and fewer communication problems were found in the political dimension, even if some relevant ones were also present.

In the political dimension, DACC in its role as decision maker and participant in political projects are mostly characterised by a lack of structure for communicating and sharing knowledge on the circular economy. Experts on the circular economy, VCØB, the Danish authorities, the EU and the Ellen MacArthur Foundation, are typically influenced by a lack of overview, lack of transparency and little available information. Also, in both categories, actors in the industry are not always aware or do not take into consideration that there is quite a different level of knowledge about the circular economy.

In the market and industry dimensions the analysis identified a number of communication problems with construction clients who play the role of decision makers. Construction clients in general perceive the circular economy as a very complex topic that involves many processes. Also the circular economy is characterised as being subject to time pressure, lack of overview of available knowledge and confusion about concepts. For some communication problems stem from the lack of interest in the implementation of the circular economy, a perception of financial and risk barriers or simply because construction clients may have a number of other important agendas to consider. Experts on the circular economy in the market and industry dimensions find the concept difficult to communicate across the industry and communication is also complicated by the differing level of knowledge that actors have. Both categories of actors were troubled by the uncertainty in

relation to documentation, a lack of a clear definition and identified a need for more communication across the industry.

However, one interesting point from the analysis stood out because the data suggested the opposite tendency than what knowledge communication theory found (Eppler, 2007). In relation to expert communication problems, several interviewees specifically pointed out that there is no knowledge sharing hostility in the industry (interviewee 1, interviewee 2, interviewee 3, interviewee 6). Both in the political dimension and in market and industry dimension, actors claimed to be extremely willing to share knowledge on the work with the circular economy. Examples of knowledge sharing on the circular economy is found with both the EU, Danish authorities, VCØB and construction clients who have experience from experimenting with circular projects. This has been facilitated in meetings with industry partners, workshops and in guides and collection of knowledge that was generated in testing circular constructions.

In relation to cognitive biases, the analysis suggests that for construction clients changing one's work processes to implement more circular initiatives in the construction and demolition industry is associated with some fears and insecurities. These affect how both decision makers and experts think about and work with the circular economy. Also, some actors just do not find the subject of great interest, which affects the ability of industry players to change by working to implement more of the circular economy. There are some predetermined biases that are difficult to be aware of and to consider in the daily work procedures in relation to implementing circular initiatives. The analysis suggests that the general perception of the circular economy and the way actors communicate about the circular economy influence these biases of industry actors. As a consequence, it is much more difficult to challenge biases than to confirm them, meaning that processes of change can be perceived as very slow from an outside point of view.

Knowledge communication problems → **Dimensions of the socio-technical regime**	*Communication problems for decision makers*	*Communication problems for experts*	*Communication problems for both*
Political dimension	**1)** DACC • Decision problems • Information overload • ASK problem • Inert knowledge	**2)** VCØB, EU, Danish authorities, Ellen MacArthur • Curse of knowledge • Terminology illusion • Projectionism • No knowledge sharing hostility	**3)** DACC + Experts on the circular economy • Communication biases • Lack of common ground
Market + industry dimension	**4)** Construction clients • Decision problems • Defensive routines • Micropolitics of knowledge • Information overload • ASK problem • Inert knowledge • Cassandra syndrome	**5)** DACC + construction clients with experience in circular projects • Curse of knowledge • Terminology illusion • Projectionism • No knowledge sharing hostility	**6)** Construction clients + DACC • Communication biases • Common knowledge effect • Lack of common ground
Culture dimension	**7)** Construction clients • Affect heuristic • Availability bias • Status quo bias	**8)** DACC + construction clients with experience in circular projects + other experts on the circular economy • Affect heuristic • Confirmation bias • Availability bias • Status quo bias	**9)** Construction clients + DACC • Affect heuristic • Confirmation bias • Availability bias • Status quo bias

Matrix 2.3 Results - Identified communication problems and cognitive biases in different dimensions

7) Discussion

7.1) Interpretations of data

In relation to the stakeholder analysis, it can be argued that the data suggest that actors in the industry across dimensions have a high degree of dependence and influence on each other. This relationship seems to come from the fact that development of the circular economy in the Danish construction and demolition sector is at a fairly early state. Because working with the circular economy is still new to many actors in this industry, 1) there is a need for political funds and support for certification and documentation, and over time there is a need for legislation that promotes the circular economy in order to ensure development. 2) There is a need for collaboration between construction clients who are testing circular initiatives and other actors in the industry. Construction clients expressed that they need inspiration from other Danish actors and they feel insecure of how to incorporate circularity when they have no examples of how others have done. 3) Data suggests that construction clients need a more clear and specific language and knowledge on the circular economy. This could come from industry organisations such as DACC who produce tools, guides and collections of examples and information. For example on materials that work well for circulation or suggestions on how to ensure that circularity is considered early in construction and demolition processes, in order for construction clients to become effective in their work with the circular economy and to ensure that it becomes an integrated part of work procedures and not just an add-on. Consequently, the stakeholder identified in the analysis to both DACC and member organisations play an important role in enabling the work with the circular economy. This need for collaboration across dimensions and stakeholders also points to the need for a systemic shift in order to fully incorporate the work with circularity in the Danish construction and demolition industry.

This relation between dimensions is relevant to consider in relation to the findings on communication problems since the analysis showed that political, market and industry and culture dimensions have a great influence on each other. Some of the same issues that were pointed out by participants were seen to influence more than one dimension. For example this was true for problems that lead to information overload, lack of common ground and inert knowledge. The analysis thus identified both individual problems for each dimension and problems that influenced more than one dimension.

The analysis found that the political dimensions was the one with the fewest communication problems that hinders the development of the circular economy. This is best explained because the actors of the political

dimension do more knowledge collection, research and discussions on the circular economy compared to other actors in the industry. This work allows for more time and effort to be put in the communication aspect of the circular economy. Also, actors such as DACC, experts on the circular economy and institutions are used to process new knowledge and perhaps also find it more interesting to consider alternative procedures to implement in the construction and demolition sector. These actors, however, still have some knowledge communication problems that affect how construction clients and other players perceive the work with circular initiatives. But the number of problems identified is higher for the market and industry dimensions. Further, the public construction clients pointed out that being influenced by the political system they experienced some pressure to enhance the work with circular initiatives. And the data suggests that public construction clients are more inclined to do so to a higher degree compared to the private ones.

Some of the more interesting communication problems were found in the political dimensions within the expert category. With experts who communicate on the circular economy in the construction and demolition sector problems related to terminology illusions, projectionism and curse of knowledge were identified. These communication problems can be related to the notion that the concept of circular economy is perceived as too academic for some actors. Construction clients and DACC employee point out that experts who communicate about the circular economy tend to assume that others have the same knowledge as them, making the concept difficult for others to grasp. This is very likely related to the feeling that people have when they claim that there are also terminology issues, meaning that there is some confusion about what the concept really includes and what it does not. Consequently, this problem seems to affect both senders and receivers since experts also struggle to precisely articulate the knowledge that they have on the circular economy. And these communication problems in combination seem to affect the ability for players to act on implementing circular initiatives and the ability to up scale it from single projects and experiments to bigger construction and demolition sites.

In the dimensions of market and industry, the analysis found that more communication problems affect the work with circularity compared to the political dimension. Actors who operate in these dimensions, construction clients in particular, identified a number of issues suggesting that communication problems are a part of what hinders the implementation of the circular economy in construction and demolition projects. These findings correspond well with findings from other dimensions, since for actors in the market and industry

dimensions, working with the circular economy is considered as a new trend that requires more consideration and research than what they normally do. Also, the analysis showed that the tools required to work efficiently with circular initiatives is not yet available and the process of obtaining new knowledge on the subject is unstructured, fragmented and in many cases coincidental.

A number of relevant communication problems were identified in the market and industry dimensions, but particularly the problems that can be related to decision makers, i.e. construction clients, seemed relevant and interesting. First, the results of the analysis pointed to some scepticism about the implementation of the circular economy. Decision problems, defensive routines and micropolitics of knowledge can be related to each other, and all implies that construction clients in general are influenced by a number of other agendas in their daily work, which leads them to have a preference for maintaining the normal routines in order to save time and money. This might also be why some construction clients find that the circular economy is not within their professional scope. Even those construction clients who are interested in new initiatives on the circular economy express that they are influenced by information overload, ask problems and inert knowledge. These communication problems also relate and influence each other since feeling that you are prevented from piecing together information on the circular economy, and not knowing who to ask for help can entail that the new knowledge that construction clients need on the circular economy, does not come to mind when needed. This is also reflected in many interviews since construction clients in general find the topic of the circular economy very complex to work with. Consequently, a number of different communication problems influence each other and complicates the implementation of the circular economy, both for construction clients who are sceptical towards the concept and to those who are interested in working to enhance circularity in their projects.

This difference between the political and the market and industry dimensions can also be related to the theory on system 1 and system 2 thinking (Kahneman, 2011). In general, actors in the political dimension might be more inclined to engage in system 2 thinking, that is taking their time to consider a concept such as the circular economy and all aspects related to it. While actors in the market and industry dimensions are under more time and resource pressure in their daily work, when it comes to considering to implement new initiatives such as circular ones. Also, in these dimensions construction clients seem to have defined routines and work procedures that are difficult to change, suggesting that decisions are made primarily on the basis of system 1

thinking. Obviously, neither of the actors in these dimensions are dependent on only one system of thinking or the other. Decisions will always be based on a combination of both, but the context in which these decisions are made seems highly relevant to the findings of this thesis.

Finally, the findings suggest that the cultural dimensions of all dimensions might be the most difficult or slowest for changes to happen. The cultural dimension focuses on deeper mental processes and perceptions about how things are and should be done. Norms and values of actors such as construction clients in relation to implementing the circular economy are not easily changed, and might not even change even if political initiatives and work procedures in the industry shifts. Especially, the characterisation of the construction and demolition industry as conservative and dogmatic underlines this point. This correlates to what was found in the analysis, since all of the cognitive biases that interviews were coded for were found to some degree in all categories, i.e. decision makers, experts and both.

What is particularly interesting in relation to cognitive biases is that primarily they are unconscious, meaning that actors in the construction and demolition industry are mostly not aware that their thought processes to some degree hinders them to engage in new initiatives involving the circular economy. Like the communication problems described above, these biases influence each other and the way construction clients act. Also, they may be even more dominant when actors in the industry are under some pressure to operate as fast as possible. In these situations when for example construction clients are under pressure to make fast decisions they are prone to operate mainly with system 1 thinking, which does not allow a lot of mental energy to challenge the biases about circular economy initiatives. When construction clients find implementing circular initiatives complex it means that they have to challenge a potential availability bias, which makes them more inclined to operate with what knowledge they already have. This process may prove exhausting and resource heavy, thus enhancing the perception of the circular economy as complicated, i.e. a confirmation bias. Finally, both the affect heuristic and the status quo bias may enhance the perception of the circular economy in a negative direction, since this need for a systemic shift challenges the status quo in the industry and thus demands of construction clients that both mental processes and work procedures are revised.

Even if a lot of relevant communication problems were found in all categories of the political, market and industry dimensions, some communication problems could not be found from the data. The following section

will briefly elaborate on possible reasons for why these were not present in this case study. In the political dimension the analysis did not find data that suggests defensive routines, micropolitics of knowledge, cassandra syndrome, knowledge sharing hostility or common knowledge effect. Not finding anything that suggests defensive routines, micropolitics of knowledge or cassandra syndrome in DACC in the political dimensions does not seem surprising. DACC is an industry organisation that, among other things, make a living out of communicating knowledge from other experts to its members, and the organisation has a clear agenda on increasing sustainability in the industry. Consequently, not accepting new knowledge would be very uncharacteristic for DACC. Also, discrediting expert's knowledge on the circular economy or disregarding it due to other pressing agendas would seem to work opposite the organisation's wishes and goals for increasing the circular economy in the construction and demolition sector. The common knowledge effect, a potential problem for both decision makers and experts were also not found in relation to the work with the circular economy. Both political decision makers, experts and institutions in general seem very interested in pursuing a circular economy that could benefit the industry and the general environment. Finally, in regards to knowledge sharing hostility, the opposite trend was identified from the data. This finding also correlates well with the purpose of actors in the political dimension, and is illustrated in DACC's participation in circular EU projects and the Danish Climate Partnership.

In the market and industry dimension the only communication problem that could not be found was that of knowledge sharing hostility. Also in these dimensions the analysis showed a trend of the opposite, a willingness to share information on the circular economy. Experts, who are prone to this type of communication problem, are DACC and construction clients who have gathered experience in the field of the circular economy. In relation to DACC not finding any sharing hostility seems legitimate since the organisation is supposed to increase the knowledge of its member organisations. The same trend was seen with the experienced construction clients, who all claim to be very willing to share their experiences with other construction clients in the industry. However, despite the openness that participants have expressed, the author remains hesitant to claim that this is true for all of the experts in the industry, since sharing everything and helping competitors in general is not considered to be normal industry practice.

Consequently, communication problems and cognitive biases from the different dimensions and in different categories can be argued to be connected and influence each other in relation to the implementation of the

circular economy in the industry. A lot of the mechanisms that participants have identified and that implies communication problems and cognitive biases are similar across the industry and there is an interplay between issues in the industry that causes communication problems. In general actors seem to be willing to discuss the circular economy, but the identified communication problems complicates the implementation of circular processes in construction and demolition. This is potentially part of the explanation for why circularity is not more implemented in this sector. And it provides a good reason for construction clients and other actors to stress the need for networking, inspiration and knowledge sharing from other industry actors and experts on the circular economy. Since the political dimension has been identified to have fewer communication problems, it seems natural that pressure from the political dimension is inviting more construction clients and DACC to work increasingly with the circular economy. Over time this has potential to influence the market and industry dimensions, as well as the cultural dimension of the industry and change norms and values in relation to implementing more circular construction and demolition.

Looking at the cultural dimension and cognitive biases, it is important to consider that actors such as construction clients are not lazy or unintelligent for having communication problems or biases. Having some degree of biases are natural to humans because of the way our brains are designed to work, namely to automate the way we think to save energy. However, it is important that we recognise the power of system 1 and system 2 thinking and the biases that the two different modes of operation bring.

What was particularly interesting in relation to the cultural dimension was the divergence between the positive attitude that all of the participants displayed towards the circular economy, and the fears and insecurities that were associated with the concept nonetheless. At the first glance construction clients project the feeling that they are ready to do more of the implementation of circular initiatives. But, analysing the statements and descriptions of the industry in general a number of mental challenges present themselves, perhaps even unconsciously. What is mentioned most often is the fear of taking on an increase in risks associated with for example new materials or new procurement methods. Insecurities seems primarily to stem from perceiving circular initiatives as very complex or from not having an interest in the circular economy in general. This suggests that construction clients who have a positive attitude towards the circular economy struggle to follow through in practice because of for example an availability bias or confirmation bias. While those who have a less positive attitude towards the concept but are somehow pressured to work with circularity in their projects,

are influenced by for example a status quo bias and an affect heuristic. Either way, implementation of circular initiatives in the industry is challenged by the mental processes of players in construction and demolition.

What can be interpreted from the findings of the analysis on the cultural dimension is that when system 2 thinking is operational, it seems that construction clients are very positive towards changes and towards working to implement the circular economy in their industry. However, when system 1 is the primary mode of operation, in the daily faster decision making processes, it does not succeed in incorporating new processes and implementing new work procedures. This happens because it requires time and effort to do so because working with circular initiatives is a new area of expertise for construction clients. Also, there is little overview of the knowledge available on how to implement the circular economy, and actors in the industry in general are busy and do not have a lot of time to make decisions or investigate alternative options to their normal routines. One participant even characterises the industry as conservative and dogmatic, which implies that biases are even harder to shift or get rid of than in other industries who are generally more innovative. This argument is supported by the experience of construction clients being willing to share and discuss the circular economy in the construction and demolition process, but the lack of practical implementation. Also, construction clients who have some experience in the field of incorporating some circular initiatives on projects find it overwhelming and are not ready to implement more circularity on other larger projects. Consequently, the theory of system 1 and system 2 thinking provides a sound theoretical background and understanding for the trends that have been identified in the data.

7.2) Implications of findings

This thesis has added to research on the circular economy by providing a communicative perspective on the implementation of the circular economy in the Danish construction and demolition sector. Problems relating to communication and mental processes have been examined with a focus on communication between construction clients and experts on the circular economy. This adds to a gap in knowledge that is relevant to both the industry organisation DACC, construction clients, experts in the industry, as well as European and Danish authorities. The findings of this thesis have potential to support the implementation of more circularity in the construction and demolition sector, which would highly benefit the state of the climate since this industry has a massive negative imprint in relation to for example waste, CO2 and the use of virgin materials. Consequently, the use of more circular processes would even in smaller proportions have a positive influence

on the environmental health of the planet in the long run. The theoretical and practical implications will be discussed below.

7.2.1) Theoretical implications

Previous research on the circular economy has identified the lack of a clear definition and the lack of transparency that it entails as a barrier to the circular economy and as a risk for the concept to collapse (Kirchherr, Reike, Hekkert, 2017). Similarly, this thesis has found that practitioners in the construction and demolition sector struggle to define the concept, as well as finding a definition fit for use from institutions or experts. The study of 114 different definitions on the circular economy found that less than half of the definitions analysed incorporated a systemic perspective. Also, those that do only focus on the macro perspective and only few mentions the need for changes in the micro, meso and macro perspective (Kirchherr, Reike, Hekkert, 2017). The need for a systemic change perspective can be boiled down to this: "*The circular economy must be understood as a fundamental systemic change instead of a bit of twisting of the status quo to ensure its impact*" (Kirchherr, Reike, Hekkert, 2017, p. 229). This point is supported by the findings of this thesis as it takes a systemic approach to changes cf. Geels' transformation theory (2002, 2011). Findings of this thesis support the notion that political, market, industry and cultural dimensions influence each other, while affected by both landscape and niche developments. This was implied by the connection between communication problems and cognitive biases across all these dimensions. Also, the analysis found mechanisms that lead to these communication problems to have an influence on different actors across the industry. Further, earlier research points out that knowledge accumulation on the circular economy is increasingly difficult due to different understandings of the circular economy concept: "*If scholars are not aware of their conceptually different understanding of the circular economy, knowledge accumulation attempts may lead to misleading results"* (Kirchherr, Reike, Hekkert, 2017, p. 228). Findings of this thesis suggests a similar connection between knowledge communication problems and the differing level of knowledge on the circular economy in the construction and demolition industry. Consequently, when findings suggest that communication problems and cognitive biases hamper both the knowledge collection and the circular work in general in the industry, and complicates the understanding of the circular economy as demanding a systemic shift, it is in line with previous research that takes a more academic perspective (Kirchherr, Reike, Hekkert, 2017).

Other research on the circular economy finds that the most pressing barriers to its implementation are cultural ones, such as hesitant company culture and lack of consumer awareness and interest (Kircherr et al, 2018). The same study also finds that regulatory barriers, such as obstructing laws and regulations, hinders the development of the circular economy to some degree as it ranks 7th out of 15 barriers analysed (Kircherr et al, 2018). Within the Danish construction and demolition sector, the findings of this thesis are in line with this research on barriers to circularity. This study points to problems in the cultural dimension, cognitive biases, as being the most difficult ones to affect. It thus supports the argument that Kircherr et al posit on culture being deeply ingrained and thus difficult to overcome (Kircherr et al, 2018). Similarly, communication problems were found to be present in the political dimension, but to a smaller degree than in other dimensions, suggesting that barriers are still present in the political sphere, similar to what Kircherr et al's study finds (2018). Further, they argue that the circular economy cannot yet be considered mainstream: "*This findings suggests that the circular economy may still be a niche discussion among sustainable development professionals, despite the increasing attention received by the concept in recent years"* (Kircherr et al, 2018, p. 271). Similarly, the contributions of this thesis suggest that in construction and demolition, the circular economy is considered to be something that only exists in smaller projects, experiments or as a small part in bigger constructions. This came across both in the way that industry actors referred to the circular economy in general, and in statements from construction clients who have experimented with the implementation of circular economy in their projects. Accordingly, the findings from this thesis are similar to the findings of previous research on barriers to the circular economy (Kircherr et al, 2018), even if this study has a much more narrow approach in that it focuses solely on the Danish construction and demolition sector.

An alternative study on the circular economy found that it is barely implemented in practice, that barriers to the implementation are mostly identified in research and are rarely empirically based (Ritzén, Sandström, 2017). Further, research have found a general positive attitude towards the concept, but identified the most pressing barriers to the circular economy as structural barriers such as missing exchange of information, and also found that an organisational barrier is the superficial understanding of the circular economy (Ritzén, Sandström, 2017). The arguments underline the need for a communicative perspective in circular economy research. This thesis thus contributes with similar findings that are empirically based, in that the focus has been on specific actors of the Danish construction and demolition industry. Findings support that the circular economy is not truly implemented and only exists in the industry in smaller projects or experiments. Also,

participants in general expressed a positive attitude towards changing work processes to become more circular, but communication problems and cognitive biases were found to complicate the process. Part of these challenges included a greater need for knowledge exchange on the circular economy, as well as a clearer definition and better understanding of the concept in the industry.

7.2.2) Managerial implications

The following section will provide an overview of managerial implications for DACC in contributing to the implementation of the circular economy in the construction and demolition sector. First, the findings of the thesis suggests that supporting networking, knowledge sharing and strengthening communication among construction clients and experts on the circular economy would benefit industry actors and strengthen their abilities to make decisions in relation to the circular economy. As an industry organisation DACC has the network to facilitate this type of knowledge exchange. An example could be that DACC organises for a construction client who have experience in implementing circular initiatives to visit other construction client organisations who are interested in the subject, in order to share experiences and discuss which considerations are important in the process of implementing new procedures to increase circularity. Another idea for DACC is to facilitate a network of construction clients who meet on a regular basis to exchange ideas and new knowledge on the circular economy. In line with this work, DACC could collect information on the few circular construction projects that have been built in Denmark, or similar countries such as Norway or Sweden, to combine the knowledge from these into a publicly available example collection that could inspire construction clients, but also investors, architechs, advisors and engineers.

Second, it is important for DACC to increase the education of construction clients and other relevant industry actors such as construction client advisors within the area of the circular economy. DACC already has a well established department for developing courses, seminars and conferences, why it is an obvious step to take. It would thus improve the general knowledge of actors who are the primary decision makers in the construction and demolition industry, and enable them to make more informed decisions about how to become more circular in their daily work.

Third, providing construction clients and other industry players with a clear and concise definition of what the circular economy is and how to best implement it on construction and demolition sites, would be highly

relevant to the industry. This definition would have to be followed by a tool or guideline for the implementation of new work processes. Potentially, knowledge on this could be collected from the Ellen MacArthur Foundation and the thoughts behind the Cradle to Cradle School, the Performance Economy and potentially the Industrial Ecology School (Ellen MacArthur Foundation C, n.d.). Also relevant, but fragmented information seems to exist in the Danish think tank VCØB (VCØB, n.d.), and finally, the EU has a number of reports on circular initiatives and already have a set of guidelines that are applicable for the construction and demolition industry including models such as the Waste Hierarchy (European Commission A, 2018; European Commission B, n.d.). Combining this knowledge that already exists on the circular economy and making it more accessible to construction clients for everyday use could benefit the industry and rectify some of the reasons for communication problems and cognitive biases.

Finally, findings suggest that dimensions influence each other and that the political dimensions was the one dimension in which fewest communication problems were found, and there is potential for a spill-over effect into the market and industry as well as the cultural dimension. Consequently, DACC's network with political actors and political influence in Denmark and the EU must be used to work for an implementation of clearer and more structured documentation and certification processes in legislation. Increasing demands for certification and documentation of circular processes in construction and demolition would benefit the implementation because of an increase in transparency and governance in the industry. This would also make it possible for construction client organisations to use both as a guideline for the level of circularity, but also as a branding strategy in that they are able to document how much circularity is implemented in construction and demolition projects, which could make them more attractive to some investors, consumers and end-users.

7.3) Limitations

This study has a focus on the dynamics between decision makers and experts in the Danish construction and demolition sector, which is why construction clients and DACC have been the main target group of the analysis. In this sense the study is fairly narrow, since the industry in general involves a lot of different actors who all have an impact on the implementation of the circular economy in buildings and on demolition sites. A broad range of other players could therefore be relevant to consider as they may have different backgrounds, motivations and agendas than construction clients. This could include investors, architects, engineers, material producers, a number of craftsmen from different professionals such as plumbers, electricians, carpenters,

bricklayers and demolition professionals. The construction and demolition industry is thus a complex sector with a high level of different actors along the value chain. However, the scope of this study was the industry organisation DACC and their primary group of members who are construction client organisations. But, the implementation of the circular economy would benefit from future research that broadens the scope of analysis and takes some of these other relevant industry actors into consideration. It would be particularly interesting to include a communicative perspective that relates to the circular economy on site at construction or demolition sites, meaning a more in depth ethnographic study of for example communication between craftsmen and construction clients.

Another limitation to this study has been the type of participant who was selected for interviews. All participants previous to the interviews had expressed some interest in the work with the circular economy. Several of the participants were also somewhat involved in DACC in either the board or the sustainability committee. This was helpful to the study in the sense that participants found the subject interesting and were willing to participate in the fairly long interviews. However, it is possible that interviewees were somewhat biased and had a positive attitude in relation to working with sustainability in general, but also with the circular economy. The findings might have differed if more participants were interviewed who had not already worked with circular initiatives in construction projects. In this sense the study may not be completely generalisable to all construction clients in the Danish industry. But, the communication problems and cognitive biases that were found still provides the thesis with relevant challenges for DACC to consider, which can be used in identifying how DACC can contribute to the transition.

Even though participants chosen for interviewees were already fairly familiar with and had worked with the concept of the circular economy, it was of particular interest that there seemed to be some confusion about what the concept truly incorporates. Several of interviewees continuously referred to the term sustainability, despite an effort to keep the conversations centered around the circular economy (interviewee 1, interviewee 2, interviewee 4, interviewee 5, interviewee 6). Participants also expressed that in the industry in general actors have issues with the concept and often confuse it with recycling (interviewee 5). But, this seemed also true for some of the few construction clients who are already working with circularity, since most of the practical examples that interviewees gave during interviews concerned for example the recycling of soil or bricks (interviewee 1, interviewee 2). However, this conceptual confusion could have been even more pronounced if

a higher number of participants of different types and backgrounds had been included in the study. But, in this relation, the study is similar to previous research on the circular economy that have found recycling as the most common component of the circular economy definitions (Kircherr, Reike, Hekkert, 2017). Still, this poses a question of validity, when the most central concept to the thesis seems to be understood differently by the participants. However, the choice of research design and data collection have supported the analysis as well as possible, in that it allowed the examination of underlying assumptions and concerns and allowed for follow-up questions in relation to the circular economy. This concern should be considered in future research on the circular economy in construction and demolition.

8) Conclusion

By analysing the stakeholder relationships, communication problems and cognitive biases between construction clients and DACC in the political, market, industry and cultural dimensions, this thesis has shown how DACC can contribute to the transition towards a circular economy in the Danish construction and demolition sector.

The research has shown that actors in the industry and stakeholders to DACC and members of DACC are dependent on and influence each other to a high degree, why many of these relationships between industry actors and DACC can be characterised as vital in relation to making the industry more circular. The most important stakeholders to DACC in relation to the circular economy are member organisations and Danish as well as European authorities, while most important stakeholders to members organisations are DACC, other industry partners and political decision makers. These findings underline the necessity of a strong network in the industry in order to develop and share knowledge on the circular economy.

Knowledge communication problems were found to influence industry actors, in particular DACC and construction clients in their work with the circular economy. Findings suggest that both decision makers and experts in the construction and demolition sector are affected by various communication problems that complicates the transition towards implementing more circular initiatives. These hindrances are caused by a number of mechanisms in the industry such as a need for decision makers to have more knowledge on the topic, a more clear and concise language to discuss the circular initiatives, a more transparent industry in relation to both definitions, documentation and certifications, as well as a collection of available knowledge to

seek out on a daily basis when working with circularity in construction and demolition. However, the highest number of communication problems were identified in the market and industry dimensions, in which most construction clients take the role of decision makers.

The analysis also found that cognitive biases are likely to influence the transition towards a circular economy negatively with construction clients, DACC and other experts. It is also suggested that the cultural dimension is the slowest one to change because norms and values are deeply ingrained in the mental processes of humans. This is also explained by the theory of system 1 and system 2 thinking. The positive attitude towards implementing circularity in construction and demolition processes can be associated with system 2 thinking. The system that allows for logical reasoning and considerations of alternative options. However, most of the decisions from construction clients are subjected to some degree of resource scarcity and time pressure. Due to this most decisions in construction and demolition processes are made using primarily system 1, the system that does not allow for considering alternative options. Rather it has an unconscious preference for keeping things the way they are, for operating with knowledge that is readily available and is easily influenced by feelings and opinions. Despite a positive first-hand impression of willingness to change, these cognitive biases complicate the mental processes and thereby the actual decisions that affect how processes are run in the industry.

Consequently, this thesis suggests that DACC takes the following measures to contribute to the transition towards a circular economy in the construction and demolition sector: 1) Facilitate networking, knowledge sharing and strengthening communication among construction clients and experts on the circular economy by setting up network meetings, setting experts up with non experts and by making a collection of examples of circular projects. 2) Educate construction clients and other relevant industry actors to provide individuals and organisations with knowledge, for them to limit the reasons for communication problems and cognitive biases and thus make more informed decisions in relation to the circular economy. 3) Provide the industry with a clear and concise definition of circular economy, as well as a tool or guideline for how to best implement circular processes in projects. 4) Use the political influence of the organisation to pressure Danish and European authorities to demand documentation and certification for circular initiatives, thus ensuring more transparency and governance in the industry.

These research have contributed to a gap in knowledge in that they take a communicative perspective on the circular economy. This was done in a context of the Danish construction and demolition sector and thus provided case specific findings with a focus on the industry organisation DACC and its member construction clients. By doing this, the thesis has provided knowledge on a practical problem on which no previous research was done. It also contributes to the field of previous research which has a focus in the academic world and are less founded on empirical studies. Nonetheless, findings from the construction and demolition industry were very similar to what academics have proposed before. For example this study supports former research suggesting that the circular economy must be understood as a systemic shift, even if it is barely implemented in practice today (Kirchherr, Reike, Hekkert, 2017; Ritzén, Sandström, 2017). Findings also align with research that claims differing knowledge on the circular economy is making knowledge accumulation more difficult, potentially also due to the level of differing definitions of the concept (Kirchherr, Reike, Hekkert, 2017; Kircherr et al, 2018).

9) Future directions

Due to the nature of this thesis it is fairly narrow and does not have the scope to discuss the many more opportunities that exist for implementing the circular economy into the construction and demolition sector. However, it deserves attention that there are many more facets to the circular economy in relation to the industry than just recycling, which most of participants in the study mentioned. Looking at the cradle to cradle and the performance economy schools of thought and utilising the butterfly model from the Ellen MacArthur Foundation, going more into depth with various steps in implementing more circular processes would be very interesting (Ellen MacArthur B, n.d.; Ellen MacArthur C, n.d.). The field is wide and could include research that has a focus on for example the design phase in construction. This phase in particular is important in ensuring that buildings are fit for circular processes. It could include design for assembly, ensuring that as many parts of the construction could be fully utilised in other construction work. Or a focus on designing robuste buildings that are meant to last much longer than they do today, perhaps by ensuring that buildings are multifunctional so that they can more easily be used for other purposes without much work done if demands shift. Also, a focus could be better and more sustainable maintenance including how to ensure better repair processes that allow for long-life buildings. Another interesting part of construction that could be related to the circular economy is the installation of appliances such as pumps, ventilation systems, heating systems, lighting etc. In this relation doing research on product-as-a-service systems would be highly relevant to the

industry. Consequently, there are many different aspects of the construction and demolition sector that could benefit from future research on the implementation of circular processes since this is a highly complex industry with actors from various backgrounds and professions.

However, for the transition to become successful, it requires a systemic shift in the industry as a whole or at least in the majority of the sector. New business models as well as a shift in behaviour and attitudes towards the concept of the circular economy are necessary. An example of a new business model that draws many parallels to the performance economy is found in a lighting company called LEDlease. This dutch company provides LED lights as a service for which the customer pays pr. hour of light, do not buy the fixtures itself and have no costs associated with installation or maintenance. Doing research with a company of this sort could be interesting since it may provide new knowledge on how this type of business model affects consumers' attitude towards the circular economy, the motivation for change in the industry in general, and how new business models have success being implemented into more of the construction and demolition sector.

A similar aspect that could be relevant for research in the circular economy in construction and demolition is the general motivation and incentives for changing processes in the industry. Political intervention in the industry and the introduction of new incentive structures would be interesting to study. For example, implementing a higher demand for the use of circulated materials in legislation or introducing funds that support circular work processes. Currently in the Danish industry construction companies are invited to seek funding for sustainable constructions by the Danish government and by the industry association Real Dania (Trafik-, Bygge- og Boligstyrelsen, n.d.). A study of this voluntary testing of the sustainability class could provide insights into 1) if the funds are being used to support the implementation of the circular economy and 2) if the financial support in general will change the willingness and attitude of construction companies towards circular economy.

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