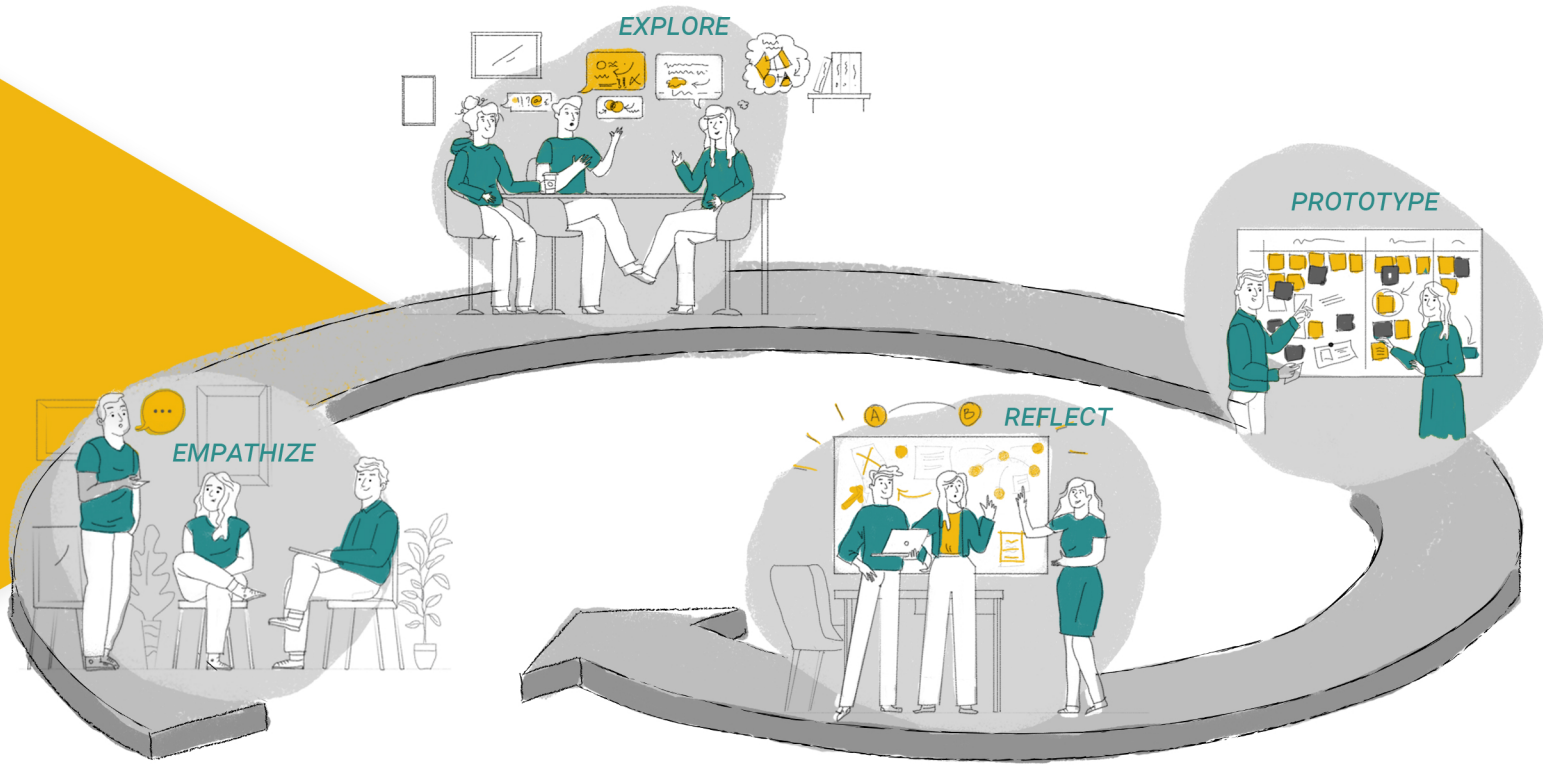
REALIZING CIRCULAR AMBITIONS WITHIN THE BUILT ENVIRONMENT

MASTERS THESIS

A DESIGN THINKING APPROACH



TU Delft Copper8

by

JUAN JENNIFER D'COUTHO

GRADUATION THESIS

Delft University of Technology

Realizing Circular Ambitions within the Built Environment: A Design Thinking Approach

By

Juan Jennifer D'coutho

in partial fulfilment of the requirements for the degree of
Master of Science
in Construction Management and Engineering
at the Delft University of Technology

Thesis defended publicly on October 20,2020 at 2 PM

AUTHOR

Name	Juan Jennifer D'coutho
Student ID	4828267
E-mail	juandcoutho@gmail.com
Telephone Number	+31626978645

GRADUATION COMMITTEE

Chairman (TU Delft):	Prof.dr.ir. M.J.C.M. Hertogh Professor, Faculty of Civil Engineering and Geosciences (CiTG)
Supervisor (TU Delft):	Dr. DFJ Schraven Assistant Professor, Faculty of Civil Engineering and Geosciences (CiTG)
Supervisor (TU Delft):	Dr. JL (John) Heintz Associate Professor, Faculty of Architecture and Built Environment
Supervisor (Copper 8):	Noor Huitema Co-founder, Copper 8
Supervisor (Copper 8):	Floris van Haagen Consultant, Copper 8

Electronic version of the thesis is available at https://repository.tudelft.nl/

PREFACE

This thesis was conceptualized through a chain of random events that have occurred in the past two years. Looking back at it I am able to connect the dots and would not have had it another way. It was in my early days at TU Delft that I was introduced to the concept of design thinking and it spiked my curiosity then. Considering my background in architecture and the creative edge within myself, the topic of design thinking was best suited as it provided me the flexibility to still design and create while following a management course. This thesis is a culmination of nine months of challenging work but quenches the overarching questions within me. Being conscious about the world we live in, I intended to contribute towards the field of circularity and was able to understand it closely, while also examining its potential interaction with design thinking.

Though my search and exploration for my graduation thesis began more than a year back, it was in the month of February 2020, where I embarked to conduct my graduation thesis at Copper 8. This report serves as the written documentation of the results of the graduation thesis which was conducted over a period of nine months consisting of 32 hours per week. After months of research, I believe I have found a way to bring the topic of circularity and design thinking closer within the building sector. I hope that the potential of this can be tapped by practice in the near future to realize projects with greater circular ambitions & with innovations the sector has not seen so far. Before presenting the results of this research I would like to take the time and space to express in writing my deepest gratitude to all those who have guided me in this endeavor.

First and foremost I would like to thank my graduation committee of the TU Delft for their guidance through the process. I am deeply indebted to both Dr. Daan Schraven and Dr. John Heintz (my first and second supervisors) equally. Daan and John brought different things on the table and surprisingly one's approach complemented the others. Every meeting of mine with John put me in a tough spot forcing me to introspect on a particular line of thought while Daan helped me break it down and gather my thoughts in an organized manner. Their patient advice, attention to detail, and rigorous assessment has been a guiding light through a journey I was unclear about. I would further like to thank my professor, Prof. Dr. Marcel Hertogh. Though my time spent with him was short, he gave me the confidence to work in a creative manner and his appreciations for my illustrations kept me motivated through the process.

I am also deeply indebted to the team of Copper8. The past nine months would not have been possible if Noor Huitema and Floris van Haagen had not given heed to my initial research proposal. The energy and spiritedness that Noor brought with her were incomparable. She always instilled in me the confidence to embrace the uncertainty that was encompassed within this thesis topic and a trait I shall take along with me for life. Floris on the other hand was my pillar of support through it all. His sincere interest in helping me, his openness, and the amount of time he has spent with me to cultivate this thesis has been a real blessing. A special thanks to Eline for all her support during the validation session and the random brainstorms I have had with her, which has helped develop this research. I would also like to thank the rest of my colleagues at Copper8 for their optimistic attitude towards my research. Copper8 was not just an organization where I did my graduation research but became family in the last nine months. Doing the majority of the thesis during a pandemic became possible only with their continuous encouragement and check-ins.

The journey of developing and nurturing this topic was a roller coaster ride, emotionally and mentally, for which I was blessed to have an army of family and friends to support me. The army was a combination of friends that have become family in TU Delft and family from back home. A note to record names of my friends & family who have in their own ways stood by my side: Purvi, Soumik, Sai Pranay, Illma, Naeema, Nithin, Harsh, Priyanka, Mridula, Malavika, Anjali, Yashwitha, Abilasha, Lester, Aunty Helen and Aunty Diphna. They have all helped me at different stages in different ways from proofreading, sketching, ideating, providing me guidance and sometimes just to put a smile on my face at difficult times. I cannot fail to mention a note of gratitude to them all and shall forever be greatful for all their support. Research writing was and is not yet one of my strengths. But I was lucky enough to make friends with Adithya who has spent days and nights to help me out with the writing from my first research proposal to the final report. My gratutude towards him is beyond what can be recorded here. In fact, it was one of my brainstorm sessions with him that led me to think deeply regarding this topic. To end the long-lasting thanks, my partner, Rajha Surya, has from a faraway land taken part in this roller coaster ride with me. Thank you for cheering me up when I was not able to see the light at the end of the tunnel and for all the never-ending guidance with the illustrations & design.

Everything I am today, I owe to my parents, George and Eunice. They have worked endlessly and kept aside their dreams to ensure that I am able to pursue mine. Through the journey they tried helping me in their own little ways: my father would send me motivational quotes every day to keep my morale high, while my mother would never fail to ask if I needed help with the research, despite being loaded with her own office work. I am forever grateful for their selflessness, love, patience, immense support and care. Thank you for believing in me and being there through it all.

Wishing you a pleasant read!

Juan Jennifer D'coutho
Delft, October 2020

EXECUTIVE SUMMARY

INTRODUCTION

In recent years, the amount of resources consumed and the waste generated by the built environment has been growing at an alarming rate. The impacts of this are seen within our environment and felt by many. It can be said that the need to achieve circularity within the built environment is at its peak right now. Circular Economy action plan 2050 in the Netherlands, recognizes that by 2050 the design, development, operation, and management are required to incorporate circular principles to achieve a sustainable environment. Within the current situation, it is observed that an upwards of 95% of the demolition waste is not reused at the same or higher level. Construction clients have been more conscious of their ambitions and have acknowledged the need to transition to a circular environment. However, such a need and such an acknowledgment is a mere step and does not aid in stimulating innovation, creativity and co-creation sufficiently (ten Dam, 2020).

The initiation and the pre-preparation phase for a circular building allow for greater flexibility for thinking and re-thinking the entire process of a circular building from the beginning to the end of life phase (re-use of components to identifying methods of disassembly). A conventional construction project involves tedious, long and capital intensive procurement of "new" materials. The addition of circular ambition to this will escalate the trade-offs which have to be made between quality, price, sustainability and durability. Along with this the team is riled with a plethora of opportunities (re-use of components to methods of disassembly) to lead to different final outcomes, unlike a regular project where the project team can choose between well-understood options. In addition to the crucial trade-offs, the term circularity is perceived subjectively by stakeholders. Developing a consensus on the meaning of circularity and further operationalizing the ambitions can be remarked to be a daunting task. Further, the topic of circularity is still novice in the construction industry and has the potential for high levels of innovation. To summarize, the addition of circular ambitions within the projects demands an environment of learning, exploration, ideation and experimentation. There is a need for flexibility and iteration to be instilled within the conventional strategies. Implementation of a Stage gate or Waterfall approaches as a solution might not be an optimal solution. The lack of a commonly accepted strategy has resorted both clients and practitioners to try various methods thereby creating ambiguity regarding the process in the initiation. This could result in increasing the time spent upfront in trying to create a process for each project individually.

Witnessing these problems, the current research focusses on addressing the gap that there lacks a commonly accepted strategy to realize shared understanding and ambitions which are vital to incorporate circular principles within the built environment. The gap is explored within the solution space of design thinking. Design thinking offers a way of thinking that introduces integrated views and thinking in alternate scenarios (Martin, 2009). Further, design thinking is a framework that integrates creative and analytical modes of reasoning, as well as various hand-on tools and techniques (Liedtka, 2015). Although design thinking overcomes the challenges of a conventional approach, it cannot be directly applied in practice. Within the scope of the research, a strategy is developed in which it becomes clear how the various design thinking methods available in theory can be implemented in the initiation phase.
Thus, the aim is to provide actionable knowledge through the development of a strategy that incorporates design thinking attributes. This designed strategy should eventually assist clients and consultants execute the initiation phase based on their context and project. To achieve this objective the main research question is formulated as follows:

"How can design thinking methods be implemented in the initiation phase to realize circular ambitions within the built environment? "

METHODOLOGY

A design-based research approach seems well befitting the objective of this study to design a strategy using design thinking methods for the initiation phase of circular built environment specifically. Out of possible approaches under this umbrella, the 'Double Diamond' model is applied as it appears particularly suitable because it does not focus only on design solutions, but also on the actual problem prior to developing the solution (Design Council, 2007). The double-diamond method provides a creative process that alternates between diverging and converging steps to explore and understand the current practice. Semi-structured interviews with both clients and consultants of three case studies were undertaken to collect descriptions of the current practice. Through this analysis best practices and further opportunities were highlighted regarding where design thinking attributes can be incorporated. The collaborative process with clients and consultants realized through interviews and analysis led to the design of a conceptual strategy for the initiation phase. This was then validated using a panel consisting of multi-disciplinary professionals to provide feedback on the novelty, applicability and feasibility of the designed strategy.

RESULTS

The analysis of the interviews from the three chosen case studies concluded with the key takeaways for the initiation phase as highlighted in **figure i**. The three case studies highlight that the principles of design thinking have been dormant within the processes conducted within the initiation phase. It was observed, activities such as interviews and brainstorms were a part of the processes conducted by the interviewees for their respective projects. These activities can be said to capture certain attributes of design thinking which include creativity & innovation, human-centeredness, ability to visualize, gestalt view, abductive reasoning and blending intuition & analysis.

Through the current research, additional opportunities for the conscious application of design thinking were identified. These included the core of design thinking attributes such as problem-solving, iteration and experimentation, tolerance to ambiguity & failure. The strategy that is then designed incorporates the attributes of design thinking along with the lessons learned from the case studies. This designed strategy counters the challenges that were highlighted by the interviewees of the case studies.

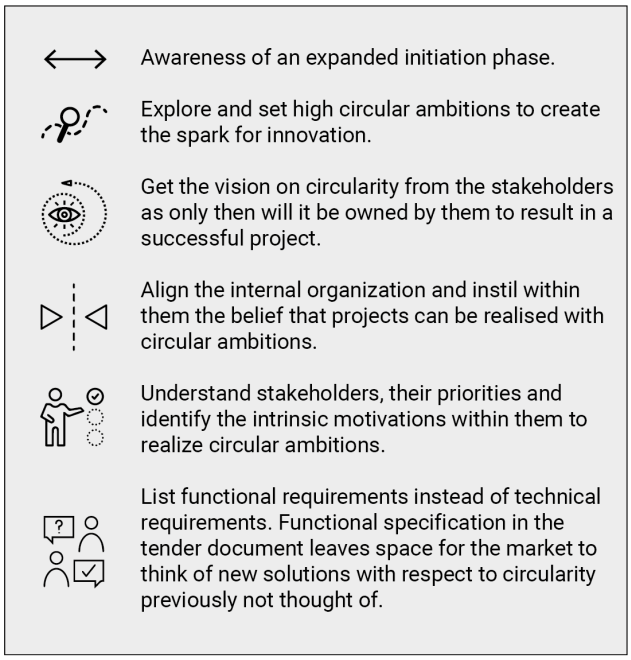


Figure i: Key takeaways from the key case studies

In tandem with the inputs from the analysis and the information gathered through literature, a conceptual initiation strategy was designed. This includes sub-phases of exploring, aligning, ideating, prioritizing and reflecting. They have been consciously placed in a manner to bring in moments of divergence and convergence to the process alternatively in line with the concept of design thinking. For each of the sub-phases activities was further defined such that they assist in fulfilling the purpose of that particular sub-phase as seen in **figure ii**.

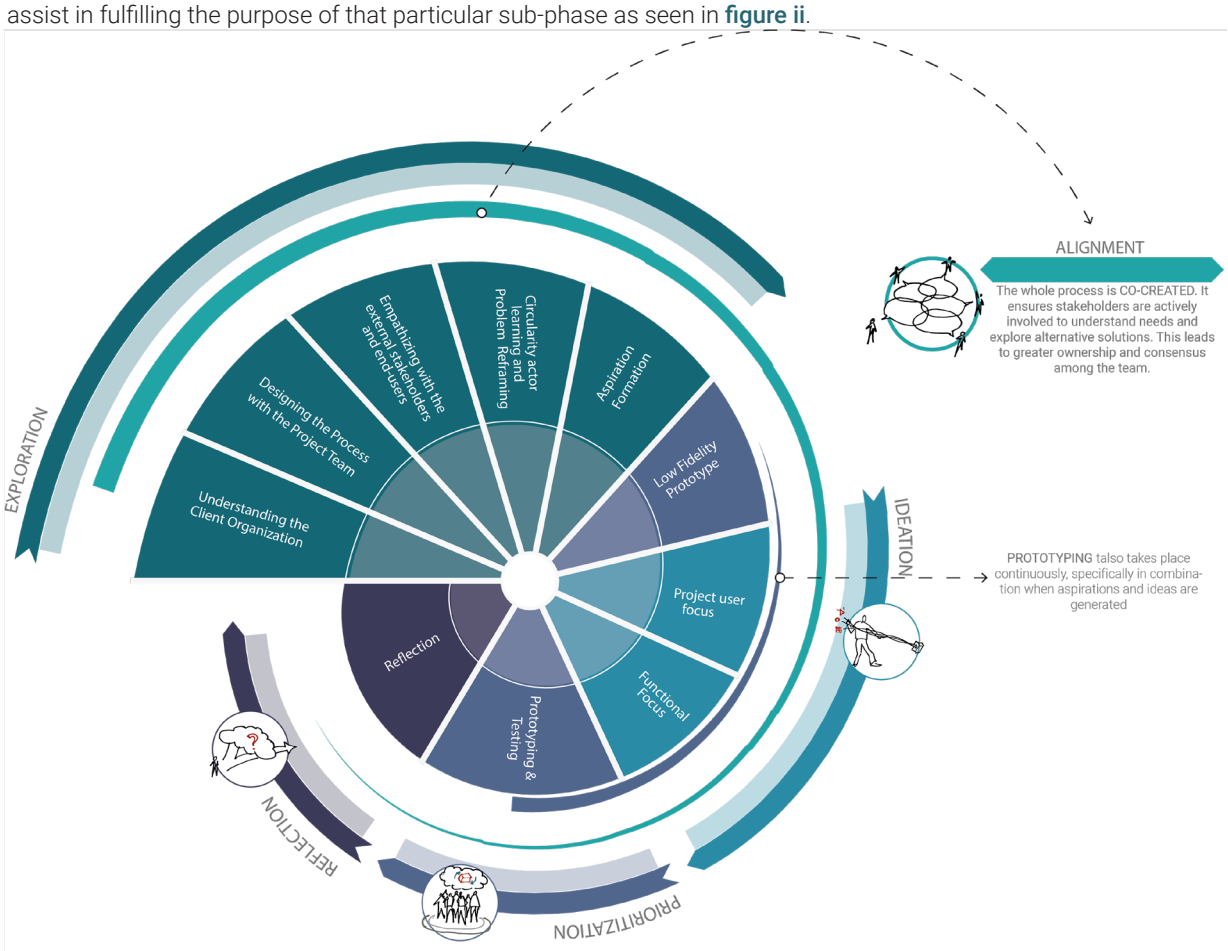


Figure ii: Final designed strategy illustrating the sub-phases with their respective activities (own figure)

Through the developed strategy, a shared sense of understanding of the goals and ambitions will be created. Such an approach can be said to aid in realizing the circular ambitions of the commissioner. The outcome of the strategy is that the clients with circular ambitions can use this strategy to refer and proceed. Using this strategy will also result in an exploration of other potential possibilities that are present within the project environment (For example, a project begins with the need to build a new building to accomodate growing staff. However, through exploration the team understands that they can meet their needs through the expansion of the existing building). Additionally, it serves as a structure that can be used by consultants for solving the client's dilemma in the process of realizing circular ambitions. This strategy can be said to reduce the time spent upfront to design a process for the initiation phase of the project as there is more clarity on the matters to be addressed, the set of requirements.

The strategy attempts at bringing order to the chaos by creating clarity within the initiation phase by prescribing design thinking attributes as a way to realize circular ambitions.

LIMITATIONS AND RECOMMENDATIONS

The limitation of the research stems from the indicative nature of the results. It was an ex-post analysis. Owing to the constraints set by the pandemic and unavailability of an on-going project which was at the initiation phase, the researcher was unable to personally observe the process. This implies that the data which was used was produced by external organizations (such as Alliander, RHDHV, Copper8, WRIJ). Such a nature of data depends heavily on the observations, recollections and the perspective of the organizations themselves. Further, concerning the time available to complete the research it was not possible to test the final designed strategy on a live case. A design strategy requires cycles of testing and iteration to make it more efficient and feasible. Therefore, the current designed strategy presented within the document should be iteratively applied in the initiation phase and modified according to the boundary conditions of the user.

The designed strategy does not follow the strategy "one strategy fits all"; it comes with a set of disclaimers. Firstly, it is not recommended to forcefully push the application of the strategy onto a team as that could lead to resistance from the stakeholders towards the strategy. Subsequently, the application of the strategy is highly contextual and greatly depends on the people involved and their usage from a behavioral point of view. Besides, the maturity level of the team in terms of design thinking attributes plays a key role in the success of the strategy. Based on the maturity levels the strategy can be rolled out in phases. Slowly, as they begin to see new and undiscovered perspectives they begin to accept the altered process better. After that reflect on what works with the stakeholders and scale it up in case of acceptance and enthusiasm. The key lies in rolling it out in stages.Another possibility for its application could be through getting the team to create their own process using the strategy as a guideline and the design thinking attributes as a boundary. This ensures ownership and co-creation of the process among the individuals involved.

Future research could take up an action research methodology to facilitate the iteration cycles that this research was not able to complete.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DEFINITIONS AND ABBREVIATIONS

BUILT ENVIRONMENT	Man-made structures, features, and facilities viewed collectively as an environment in which people live and work.
STRATEGY	A long-range plan for achieving something or reaching a goal, or the skill of making such plans.
PRACTITIONER	Someone involved in a skilled job or activity.
POST HOC	Occurring or done after the event.
DESIGN THINKING	A humancentered innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and concurrent business analysis (Lockwood, 2009).
'WHAT-THING'	Object, service or system

EU	European Union
CE	Circular Economy
DT	Design Thinking
PM	Project Manager
CM	Construction Management
SQ	Sub-questions
RQ	Research-questions

1 | INTRODUCTION

A global crisis shocked the world in the year 2020. But in a few decades, the same description could fit another global crisis if we continue to exploit the earth's finite resources. Despite being aware of this dynamic situation, projections on 'The Limits to Grow' written in 1972 was revaluated by the Melbourne Sustainability Institute and found that very little has changed over the last forty-five years (Turner, 2014). An abundance of cheap natural resources has facilitated for this consumption and production pattern to endure (Zimmann et al., 2016). In comparison with all the sectors, the largest resource footprint with 38.8 billion tonnes is used for the construction and maintenance of the building industry (M. de Wit et al., 2020). Apart from this, construction demolition wastes are among the most voluminous streams, accounting for almost 30% of all waste generated in the European Union (European Commission, 2018). Although the last few years have seen improvements in the energy efficiency of buildings and sustainability innovations, the built environment continues to be designed around the linear 'take-make-dispose' model (Acharya et al., 2018).

The circular economy provides a framework of solutions to transition towards a circular 'make-use-return' model that focuses on minimizing waste and maximizing the value retention of resources. The model is suitable to be adopted within a high-growth and high-waste sector such as the built environment. Within the built environment, the circular economy is more than just materials, as it also aims to realize an economic system where humans do not damage the biosphere and attention is given to realize a minimum social foundation for everyone, thereby making it complex (van Oppen et al., 2018). To aid in a transition toward a circular economy in the built environment, both clients and customers play an important role by explicitly demanding for circular products. However, previous research shows there is no one significant method to follow post demanding the incorporation of circularity within upcoming projects, making the process ambiguous.

To implement circular approaches, the built environment is responding through the development of new technologies, business models and partnerships. Further, the transition towards circularity requires systems thinking and new approaches in the way we design, build, operate and maintain circular buildings (Acharya et al., 2018). Greater opportunities are achieved when circular economy thinking is incorporated into strategic decision making in the initiation phase of projects.

As concluded by many researchers, the beginning of the building process is an important moment to aid in the implementation of circularity, as it offers room to change and adapt (Gerding, 2019; Wamelink & Bennekom, 2010). This begins with the clients having a key role in defining the vision for development and setting up the project requirements to achieve circularity (Leising et al., 2018). Even if clients are willing to take steps towards projects that incorporate circular principles there lies a vagueness in defining the client's demand and for the vendors to accomplish them. This makes it unclear how to proceed with a project aiming to incorporate circularity. Research by Kirchherr, Reike and Hekkert (2017) gathers and analyses 114 definitions of the circular economy. The understanding of circularity is broader than the term of a definition and is required to be determined based on the project scope and context making each project in the built environment unique. Although there exist frameworks that offer principles and philosophies they do not demonstrate how stakeholders in the built environment can change the ways in which they build to enable the required transition (Acharya et al., 2018).

Both clients and practitioners require a process to cope with the ambiguity they experience during the initiation phase. This research proposes the use of design thinking to aid in creating a process that assists in defining the scope and requirements for a project with circular ambitions. In conjunction this research aims on analysing the method of design thinking, a formal creative problem-solving, to conceptualize a strategy to identify the scope with the intent to foster innovation. Design thinking is seen as appropriate in dealing with ambiguity and complexity (Beckman & Barry, 2007) while also providing an experimental approach towards learning (Guldmann et al., 2019). Design thinking is known as a process to maximize learning as a deliberate uncertainty reduction strategy (Beckman & Barry, 2007).

1.1 PROBLEM ANALYSIS

Each building consists of a different combination of materials with varying life cycles that interact dynamically with each other in space and time. This results in every building being unique and therefore complex to analyse. In addition to the complexity of the building, the fragmented structure of the building industry makes it even more difficult to incorporate circularity within the built environment. While current research to achieve circularity in the built environment often focuses on the technical aspects of building projects, the difficulty in applying circular thinking is also likely to be related to the procedural aspects of the project (Gerding, 2019).

The possibility of implementing a circular building is highest in the initiation and mainly during the pre-preparation phase. This is due to the fact that the start of the building process provides for changing and adapting the project to eventually make an impact (Wamelink & Bennekom, 2010). While the scope for innovation is the highest in the conception and design stages (Noktehdan et al., 2019), the cost of incorporating changes is the lowest, making it possible to allow for changes and innovations (Noktehdan et al., 2019). To achieve a building with circular ambitions it is necessary to establish a commitment among the project team in the initiation phase if the project intends to achieve circular ambitions. In addition, the initiation and pre-preparation phase offers a plethora of choices in terms of both the means and the ends. For example, it provides the choice of designing a demountable building (defining the reuse and recycling of the components for the future) or designing based on the use of secondhand components, that is the reused components from another building as seen in figure 1. Figure 1 schematically represents the linear building process versus the circular building process.

This research focuses on the initiation and preparation phase as it offers room for preparing the beginning and end of life of the building. To incorporate maximum inputs and innovations during the initiation phase of the project, requires changes to the way in thinking, collaborating and financing according to researchers of Arup (Acharya et al., 2018; Zimmann et al., 2016). Further, Adams, Osmani, Thorpe and Thornback (2017) go on to indicate several barriers that are inherent in the conventional organization of the building process that hinder the transition towards circularity. These include lack of awareness and knowledge of circular building processes among clients and designers, a fragmented supply chain and lack of considerations and incentives at the start and

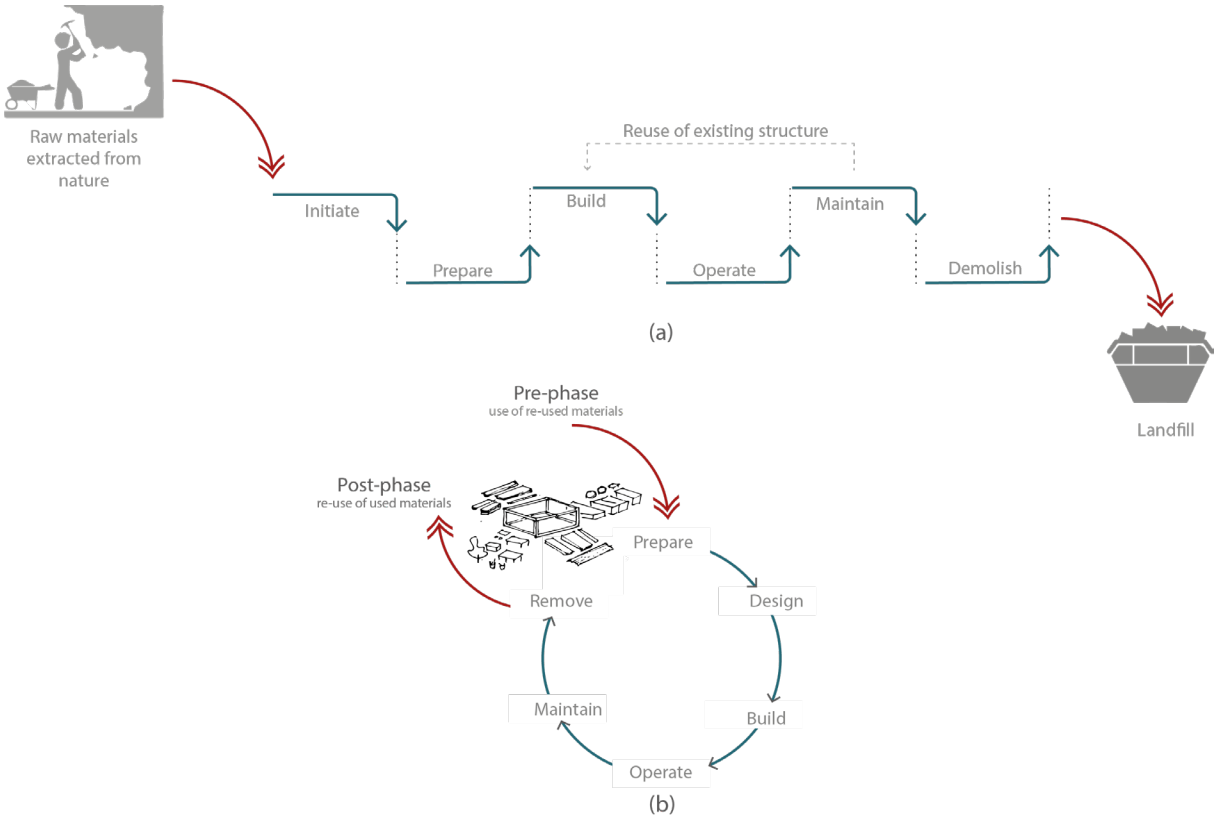


Figure 1: (a) linear building process (b) circular building process [based on Durmisevic (2010) & Crowther (1999); (Ghisellini et al., 2018)], (own figure)

end phase of the building's life time (K. T. Adams et al., 2017). Further the need for innovation and ideas based on the project context and unclear definitions of circularity as stated in the introduction is seen as challenges in the transition towards circularity.

When a new project is initiated it is designed based on acquiring 'new' materials. As a result, the project has complete freedom in terms of materials used and their dimensions. In addition, the management team in the initiation phase decides on a project scope and focuses on time, cost and quality. When circularity is added to the equation a different approach is required as the team has to make concessions between quality, price, sustainability and durability demanding a more flexible and iterative approach. Apart from this, the project at the start has options of thinking in many ways from the re-use of components to identifying methods of disassembly. The final choice is context-based, but it needs to be identified by the stakeholders based on their business strategy for a fulfilling result. The vast range of choices to choose from and learning required at the start adds to the uncertainty and complexity that already exists in developing a built environment (Buhl et al., 2019). In a "traditional" project the team can simply choose between well-understood options, whereas in a circular project one has to consider a wide variety of different options that lead to different outcomes and through a process choose the preferred option.

Further, as previously mentioned each building is unique with a different set of stakeholders and requirements; finding a consensus among them on the meaning of circularity for the project, the final goal and the means of achieving it could be challenging. Therefore, a traditional method to manage the initiation phase may not work for all projects, requiring the adoption of processes that allows for learning, exploration, ideation and experimentation. Also it is imperative to develop a shared understanding of CE, and consensus on shared ambitions, goals, and means within the project team., Given the lack of processes to provide the suitable environment as described previously and shared understanding required to achieve circular ambitions, the method of design thinking is seen suitable for the initiation phase because design thinking offers a way of thinking that introduces integrated views and thinking in alternate scenarios (Martin, 2009).

Scholars have pointed out to design thinking as an approach for developing innovative solutions to sustainability challenges (Buhl et al., 2019), while some have used design thinking to develop circular business models (Guldmann et al., 2019). However, the opportunity to leverage the initiation phase of projects with circular ambitions by applying design thinking remains under examined. Further, design thinking is not a rigid process but a framework that integrates creative and analytical modes of reasoning, as well as various hand-on tools and techniques (Liedtka, 2015). As a result, it cannot be directly applied in practice and will require interpretations in order to translate scientific insights into practical methods.

Therefore there is a need to develop a strategy in which it becomes clear how the various design thinking methods available in theory can be implemented in the initiation phase by clients and consultants. This will provide an environment of learning, exploration, ideation and experimentation to recognize shared understanding and ambitions that are required to realize built environment projects with circular ambitions. The following statement summaries the problem described above: *There lacks a commonly accepted strategy that provides for understanding, exploration, ideation and experimentation to realize shared understanding and ambitions that is seen as necessary to incorporate circular principles in the built environment. Due to the lack of this commonly accepted strategy clients and practitioners have resorted to trying various methods thereby creating ambiguity regarding the process in the initiation. Further, there has been no post-hoc evaluation and learning from the methods tried in previous projects.*

1.2 RESEARCH OBJECTIVE

In order to realize a more circular system, it is paramount that the circular way of thinking: 'make-use-return' is enforced into the market, where clients and consumers play a crucial part by explicitly demanding circular products. However, the barriers and challenges hinder the transition, while also creating an environment of complexity and uncertainty as this domain is still unfamiliar to the majority. From previous research, design thinking is known to provide solutions of similar contexts. Therefore, this research aims to explore the application of the design thinking process to the initiation phase of circular building projects. Further, it will focus on the creation of a strategy using design thinking to provide an environment of understanding, exploration, ideation, and experimentation to realize shared understanding and ambitions required by clients and practitioners to shape a circular project.
To accomplish this research objective the following sub-objectives are required to be fulfilled:

- Analyze the need for an altered initiation phase required for a project with circular ambitions in comparison to traditional projects without circular ambitions. In conjunction, the changes and improvements required in terms of the

processes realized in the current initiation phase of buildings with circular ambitions are highlighted.

- Identify design thinking methods that can be applied with stakeholders in the initiation phase to assist in developing a shared understanding of CE, and realizing shared ambitions, goals and means within the context of a circular built environment.

- Provide actionable knowledge through the development of a process to eventually assist clients and practitioners execute the initiation phase based on their context and project.

1.3 RESEARCH QUESTION(s)

The findings of this research could assist in improving the applicability of circularity in the built environment with more clients being able to demand for it as well as define it from their perspective. In line with the problem statement and the research objective, the main research question can be framed as:

"How can design thinking methods be implemented in the initiation phase to realize circular ambitions within the built environment? "

To support the realization of the research question the following sub-questions have been formulated:

1. What are the differences and challenges in the initiation of a project with circular ambitions in comparison to a regular project without circular ambitions?

2. What is the core of design thinking?

3. How to analyze current practice and further design a strategy for the initiation phase that incorporates design thinking principle attributes?

4. Which changes and improvements are required in the current practice of the initiation phase of projects to more successfully realize circular ambitions within the built environment?

5. Which design thinking attributes can be applied in the initiation phase to provide for a strategy for projects with circular ambitions?

1.4 RESEARCH SCOPE

Determining the scope of the research is crucial to clarify the domain in which the research will take place to eventually provide for more focussed knowledge within that domain. This research is being carried out in collaboration with Copper-8 for a targeted duration of 28 weeks, with 32 hours of work per week, which itself sets certain scope constraints.

Copper-8 has, since 2012, been assisting manufacturing and construction clients to initiate sustainable breakthroughs in their projects and have been front runners in the topic of circular economy.

The research will focus on circular projects within the built environment. Within the built environment the research focuses on buildings. As this is still quite broad the proposed research targets the initiation phase of the project. The phase includes the 'permanent organization' (the organization which initiates the project and desires a certain outcome from the project). This can also be referred to as the clients along with their internal stakeholders and the consultant who guides the process to achieve the desired outcome. Figure 2, highlights the phase that the research focuses on. During this phase, the project is required to define and develop measurable goals and ambitions for circularity according to its project context that is in conjunction with the organization's intrinsic motivation. Since it is the consultant (the expert in circularity) who has to facilitate the initiation process, this research is

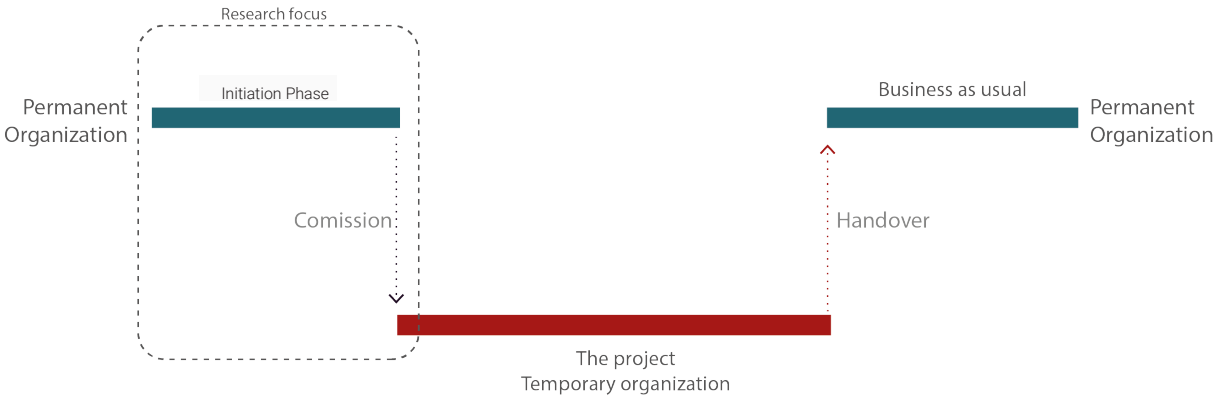


Figure 2: Project's front-end: The relationship between the permanent and temporary organization (Research focus), Based on Williams (2019), (own figure)

conducted from the consultant point of view, in this case from the perspective of Copper8. At the moment, the organization has designed a work session that takes place in the initiation phase ('ambition phase' as described by Copper-8). These sessions include discussions with internal and external stakeholders to determine the ambition and associated preconditions that ultimately become an integral part of the procurement guide at a later phase. However, these methods have been developed through trial & error; and experience gained through the eight years of working in the field of circularity. Hence, through academic research, there is the possibility to improve these strategies (work sessions) used to define scope and ambition thereby coping with the complexity faced by the clients.

1.5 RESEARCH DESIGN

To answer the aforementioned research question(s), the following research design is formulated. To begin with, there is a need to identify if there are necessary changes to be made in the current initiation process and the possible alterations required to realize a circular built environment. Following the identification of the improvement needed the research design should facilitate the design of a strategy. Therefore a combination of theoretical and empirical input is required. A methodology that fits the established goal is design-based research. This is seen as apt as it is aimed to improve practices through analysis, and iterations that are based on collaborations with researchers and practitioners in a real-world setting to conclude in a design.

In order to operationalize the design-based research, a double-diamond method is adopted. Chapter 3 (Research Methodology) will further elaborate on the use of the double diamond model. The research applies primarily qualitative research as it focuses on interpretations, opinions and experiences (Baarda, 2014) that assist in identifying the improvements required to further design a strategy. Quantitative analysis as such seems inappropriate as the scope of the research limits the number of projects to investigate, which consequently lowers the statistical relevance of quantitative results.

1.6 RESEARCH RELEVANCE

The proposed research is initiated by a problem that is observed in practice in addition to the gap observed in literature on the lack of strategy to facilitate the initiation phase to develop built environment projects with circular ambitions. The following section elaborates more on this.

1.6.1 SCIENTIFIC RELEVANCE

The interest in the topic of circular economy has been gaining traction among researchers over the past years. At the current state, research indicates that there are at least 114 definitions on the topic of 'circular economy' (Kirchherr et al., 2017). This results in ambiguity and difficulty among companies to apply the principles in the projects and processes (Ellen MacArthur Foundation, 2013; Mentink, 2014). It implicates a gap between the theory and application of the principles developed within practice. Though there is a vast amount of literature on the topic of circularity, most of it focuses on the materials and less attention has been given to the alteration of the process that is required for its implementation. In the past few years, there has been research identifying a need to make changes to the conventional process of delivering a building project in order to achieve circularity. These changes include; change in the conventional way of thought, alteration to collaboration and organizational setup, the requirement of flexibility and the room to explore and ideate (Leising et al., 2018; Venselaar, 2019; Versteeg Conlledo, 2019). However, none of these provide a tool that includes the changes required to assist clients towards transition. Earlier research has included design thinking methods to develop an approach for innovative solutions to sustainability challenges and others to develop circular business models (Buhl et al., 2019; Guldmann et al., 2019). This research is unique as it will (1) indicate which changes and improvements are required in the initiation phase in comparison to the conventional process (2) investigate how design thinking methods can be implemented into this phase to provide for the changes (3) set up a way so it will be applicable in the built environment and in accordance to the strategies available that focus on materials. In this way the research aims to close the gap by developing a strategy that can be used by clients and practitioners who aim to incorporate circularity into their projects, but find it ambiguous initially.

1.6.2 PRACTICAL RELEVANCE

In recent years, there has been a growing concern to achieve a circular economy in the built environment owing to the amount of resources it uses and waste the industry generates. This has also been recognized by the Circular Economy action plan 2050 in the Netherlands, that by 2050 the design, development, operation, and management is required to incorporate circular principles to achieve a sustainable environment. In order to achieve these ambitions and create a condition to facilitate transition the CE action plan of EU and Netherlands identify the need to co-create, develop knowledge and innovate among other instruments, namely; fostering legislation and regulations; creating market incentives; financing and

international cooperation (European Commission, 2020; Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). To facilitate the development, the dissemination and exchange of knowledge in networks there requires a supporting process, as the current process focuses on a linear system and is not in line with the principles of CE. Over the past years, construction clients have acknowledged the need to transition and have demanded for circularity through procurements. Although this is a step forward it does not stimulate innovation, creativity and co-creation sufficiently (ten Dam, 2020). Innovations are a key driver in this transition and so understanding of how to create these innovations is needed (te Velde, 2018). Further, to complete the transition, actionable strategies and guides are required, which this research aims to provide.

1.6.3 SOCIETAL RELEVANCE

Expanding on the current consumption rates, by the year 2050 the world would be consuming as if there were three Earths (European Commission, 2020). The extraction and use of raw materials have a negative impact not only on the environment but also make contributions to the emission of CO2 (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). The urgency to transform into a circular economy is one of the changes required to tackle climate change. The ambition for the Cabinet in the Netherlands is to realize a CE by 2050 with an interim objective of a 50% reduction in the use of primary raw materials by 2030 (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016).

The construction industry is seen as a high resource intensity in comparison to the other sectors. The current situation is such that (>95%) of the demolition waste is not reused at the same or higher level (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). The bulk of the material is reused at the same material and not reusable after one life cycle. This 'saturation' generates an incentive to develop more circular uses for construction materials that this research aims to contribute towards. The negative effects of the construction industry are identified among the various sectors with both EU and the Netherlands. The research on a broad perspective aims to reduce this negative effect and accelerate the transition towards a regenerative growth model. Consequently to provide a system where it gives back to the planet more than it takes to result in a sustainable society for the current and future generations.

1.7 REPORT OUTLINE

Chapter 1 sheds light on the broader context and the relevance of the research, highlighting the main problem that is being focussed within this research. In addition, the chapter presented the research objective, scope, question(s) and research design. The first chapter set a basis for the research, following which the Chapter 2 moves on to present a theoretical background on the differences and challenges of a project with circular ambitions compared to a project without circular ambitions to answer the first sub-question. Chapter 2 also identifies design thinking characteristics and core principles from theory to answer the second sub-question. Further, chapter 3 goes on to identify a research method that is seen as apt to gather and investigate further data in relation to the application of design thinking methods in the initiation phase. Chapter 4, elaborates on the analysis of the interviews to diagnose the changes and improvements required in the current practice of the initiation phase to answer sub-question 4. While the second half of the chapter elaborates on the development and validation of the strategy to improve the current practices through the incorporation of design thinking principles (sub-question 5). Chapter 5 postulates a discussion to critically analyze the designed strategy. Finally, chapter 6 concludes on how the design thinking methods can be incorporated into the initiation phase to serve the needs and changes required for a built environment with circular ambitions. Figure 3, illustrates the report outline in conjunction with the proposed research questions.

Figure 3: Report Outline (own figure)

2 | THEORETICAL BACKGROUND

This chapter provides an answer from literature to the first and second sub-research questions that have been formulated as:

- What are the differences and challenges in the initiation of a project with circular ambitions in comparison to a regular project without circular ambitions?
- What is the core of design thinking?

Before elaborating on design thinking and its application/ opportunities in the initiation phase of circular building projects, the need for change is elaborated in paragraph 2.1. This pertains to a different approach that is required in developing a circular project in comparison to a traditional project, with no circular ambitions. Further, it identifies the challenges and the complexity involved with identifying the right way forward to achieve circularity in the end product. This identifies the need for transition from rational and analytical thinking (the paradigm in management) to a way of thinking that introduces integrated views and thinking in alternative scenarios (abductive reasoning).

In paragraph 2.2 the concept of design thinking, in general, is defined, with an elaboration on the phases involved in design thinking and their tools. Paragraph 2.3 a short explanation of how these phases can be incorporated into the existing initiation phase of projects is prescribed. Lastly, in 2.4 a conclusion is drawn to the development of the theoretical framework.

2.1 THE NEED FOR CHANGE

The building sector is responsible for about 40% of primary energy use, 26% of material resource use and 35% of waste generation (Eurostat, 2017; BIO Intelligence Service, 2014). This indicates the need to reduce waste and responsibly deal with the assembly of components and materials. The industry is creating a huge negative impact, thus making it one of the most relevant sectors to implement circular economy. Shifting ways from a linear economy model that was an outcome of the industrial revolution developed for over more than 200 years requires a transition in the process. Achieving this transition in the building industry is relatively complex taking into account the high product complexity, the duration of the functional lifecycle of various elements and the highly fragmented industry (Amory, n.d.; BIS (Department for Business, Innovation and Skills), 2013; van Oppen et al., 2018). Over the past years construction clients have acknowledged the need to transition and have demanded for circularity through procurements. Although this is a step forward it does not stimulate innovation, creativity and co-creation sufficiently (ten Dam, 2020). Innovations are a key driver in this transition and so understanding of how to create these innovations is needed (te Velde, 2018). Further, to complete the transition, actionable strategies and guides are required (Versteeg Conlledo, 2019).

2.1.1 WHAT IS CIRCULAR ECONOMY?

With the current rate of consumption, the world would be consuming as if there were three earths (European Commission, 2020). The concept of CE is developed to change this pattern of consumption and production that puts the planet in significant burden. The circular economy concept has been gaining traction by both practitioners and scholars because it is viewed as an operationalization for businesses to implement the concept of sustainable development (Kirchherr et al., 2017). This has led to it being interpreted differently, leaving no single group with the undisputed authority to define what CE means (Gladek, 2017).

Of the number of CE definitions, the CE definition established by Ellen MacArthur Foundation (2012) is identified as most employed: *"[CE] an industrial system that is restorative or regenerative by intention and design. It replaces the 'end of life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems and within this, business models"* (Ellen MacArthur Foundation, 2012, p.7). Further, the definition established by Kirchherr (2017) has been formalized after analyzing 114 definitions and encapsulates both the core principles and aims of the circular economy: *" A circular economy describes an economic system that is based on business models which replace the*

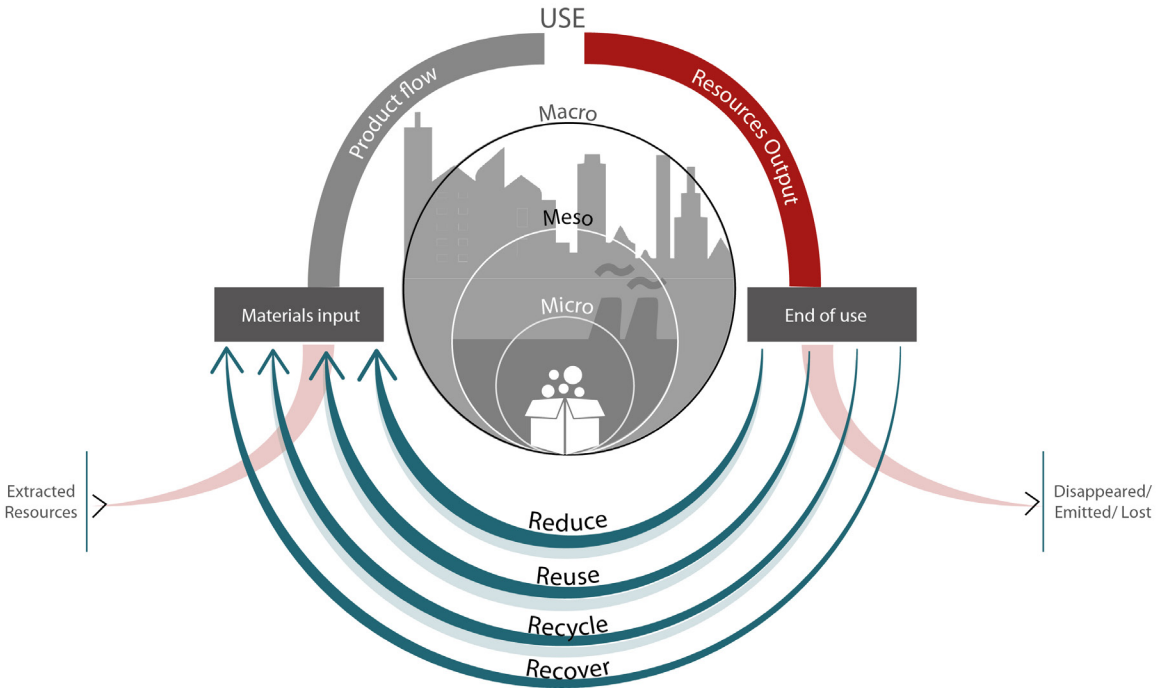


Figure 4: Description of the circular economy (own figure)

'end of life' concept with reducing, alternatively reusing and recovering materials in production/ distribution and consumption processes, thus operating at the micro-level, meso-level and macro level, with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations" (Kirchherr et al., 2017, p.225). Figure 4, details this through a simple infographic. Keeping the main aim in mind CE can be defined as *"all economic systems with closed materials loops/ extending the service life of goods"* (Mentink, 2014, p.14). The implication of closing the material loops has the potential to minimize the extraction of material from nature and the emissions of waste to nature (Mentink, 2014).

From a practical perspective, defining the circular economy is extremely context-dependent as trying to achieve at a micro (product, companies, consumers) level is different from that of a macro (city, region, nation) level. To facilitate the transition, it is particularly important that all project stakeholders decide on the key points that are specific to the project (van Oppen et al., 2018) based on the core principles established. The three main principles of CE as identified by the Ellen MacArthur Foundation are listed below (Ellen MacArthur Foundation, 2017).

1. Design Out of waste and pollution: Waste is a consequence of decisions made in the design stage. It is required to change our mindset in viewing waste as a design flaw and to ensure waste is not created in the first place.
2. Keep products and materials in use: To ensure that products and components are designed so they can be reused, repaired and remanufactured. It addition, ways to avoid materials landing up in the landfill after use should be thought of.
3. Regenerate natural systems: Everything is to be seen as food for something else. Return valuable nutrients to the soil and other ecosystems to enhance natural resources.

Achieving a circular economy in business is more complex than just applying the principles of circular economy as established by the Ellen MacArthur Foundation (Mentink, 2014). It can be seen in Appendix A that provides a visual overview of the concept of CE by Mentink (2014) how thinking in systems to achieve circularity also requires increasing collaboration, increase in the exchange of information, innovation and collaboration with customers.

2.1.2 CURRENT STATUS OF CIRCULARITY IN THE CONSTRUCTION SECTOR

The ambitions set in the coming years to achieve circularity within both national and international levels are high. The EU aims to scale up CE from front-runners to the mainstream economic players to achieve climate neutrality by 2050 and decouple economic growth from resource use (European Commission, 2020). To transition towards a regenerative growth model the EU will strive to reduces its consumption footprint and double its circular material use in the coming decade (European Commission, 2020). In

line with EU circular economy action plan, the Dutch government has set up a program that aims at achieving a CE in the Netherlands by 2050. As part of achieving this, the Cabinet aims to realize a 50% reduction in the use of raw materials by 2030.

Due to the high intensity of resources used in the construction sector, it has been identified among four other sectors within which circularity is aimed to be achieved in the coming years. The introduction of CE in the construction sector creates opportunities to cut down raw materials used and reduce waste through innovation (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). The construction sector is distinguished as Commercial and Non-residential Building (C&NRB) and Soli and Civil Engineering on the other hand. Over the past years, the reuse of C&NRB construction and demolition waste is far-reaching (>95%), however, this consists mostly of downcycling (use of the material at a lesser value than the original) (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). For instance, this reuse involves construction rubble being granulated to be used as foundation material in S&CE. At a particular point in time the need for this foundation material is expected to decrease to thereafter reach saturation, requiring the sector to develop more diverse uses for materials in this sector (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). This has led to the formulation of the following visions within the construction sector in the Netherlands: "By 2050, the construction industry will be organized in such a way, with respect to the design, development, operation, management, and disassembly of buildings, as to ensure the sustainable construction, use, reuse, maintenance, and dismantling of these objects. Sustainable materials will be used in the construction process, and designs will be geared to the dynamic wishes of the users. The aim is for the built-up environment to be energy-neutral by 2050, in keeping with the European agreements. Buildings will utilize ecosystem services wherever possible (natural capital, such as the water storage capacity of the sub-soil)" (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016, p.59).

The main aim in the coming years would be to shift from the downcycling that is practiced currently (recycling) to upcycling where the elements and components are improved through quality and performance as seen in figure 5. The following three questions are to be considered to achieve a circular economy for the construction industry. (Ministry of infrastructure and the environment & Ministry of economic affairs, 2016).

1. How can we minimize the use of construction materials?
2. How can we meet the remaining material requirements as sustainably as possible?
3. How can we meet the material requirements as efficiently as possible?

In order to achieve these ambitions and create the condition to facilitate transition the CE action plan of EU and Netherlands identify the need to co-create, develop knowledge and innovate among other instruments, namely; fostering legislation and regulations; creating market incentives; financing and international cooperation (European Commission, 2020; Ministry of infrastructure and the environment & Ministry of economic affairs, 2016). To facilitate the development, the dissemination and exchange of knowledge in networks there requires a supporting process. The realization of the questions put forth above is possible when circularity is thought of as an added goal in the initiation of the project.

Figure 5: Transition required from Downcycling to Upcycling (own figure)

2.1.3 EXPLORED POTENTIAL WITHIN THE INITIATION PHASE

The initiation phase (also known as the front-end of the project) of the project is seen as the vital 'shaping' part of a potential project (Morris, 2016). The two important components of this phase include the principal players and the primary process, where 'ideation' is the crux of the latter part (Kock et al., 2016). When developing a building project with circular ambitions the beginning of the building process is an important phase to aid in the implementation of circular principles. This includes the initiation and preparation phase that provides room to steer towards circular ambitions (Gerding, 2019).

Though in the initiation phase of a building process the uncertainty is elevated it has a significant potential to explore and exploit possible opportunities to make an impact (Wamelink & Bennekom, 2010). The start of the building process provides for changing and adapting the project to eventually make an impact (Wamelink & Bennekom, 2010). While the scope for innovation is the highest in the conception and design stages (Noktehdan et al., 2019), the cost of incorporating changes is the lowest, making it possible to allow for changes and innovations (Noktehdan et al., 2019) as seen in figure 6. The initiation phase is key in defining the project and is the place where goals according to sustainable and circular ambitions can be incorporated into the project. It is understood from previous projects with circular ambitions that the 'start' and 'end' phase of the building's lifetime need to be rethought, including a process to thereby aid in closing the cycle (Gerding, 2019). To achieve a building with circular ambitions it is necessary to establish a commitment among the project team in the initiation phase if the project intends to achieve circular ambitions. In addition, the initiation and pre-preparation phase offers a plethora of choices in terms of both the means and the ends. For example, it provides the choice of designing a demountable building (defining the reuse and recycling of the components for the future) or designing based on the use of secondhand components, that is the reused components from another building. The final choice is context-based, but it needs to be identified by the stakeholders based on their business strategy for a fulfilling result.

When a new project is initiated it is designed based on acquiring 'new' materials. As a result, the project is provided with complete freedom in terms of materials used and their dimensions. Also, the management team in the initiation phase decides on the project scope and focuses on time, cost and quality. However, when designing and managing for a project that is required to keep their materials in a loop, a different approach that is flexible and iterative is required. The following section briefly compares the initiation phase of a project without circular ambitions against a project that aims to incorporate circular ambitions. This analysis is done based on existing literature to identify if there is a need to think in a totally different way that drifts away from standard analytical and decision-making procedures followed in project management. Knowing the differences and dynamics required for a project with circular ambitions further provides insights to guide the design of a strategy required to achieve the transition towards a circular built environment by the year 2050.

2.1.3.1 DEVELOPMENT OF A PROJECT WITHOUT CIRCULAR AMBITIONS

The built environment is designed in a manner that it uses finite resources and non-renewable resources as building materials (Ellen MacArthur Foundation, 2013). Once the building lifetime has expired the building is demolished and waste is generated that is sent to landfills after possible materials are salvaged for re-use as seen in figure 1(a).

"A construction project is an endeavour in which human, financial and material resources are organised in a novel way to undertake a unique scope of work, of given specification, within constraints of cost and time, so as to achieve beneficial change defined by

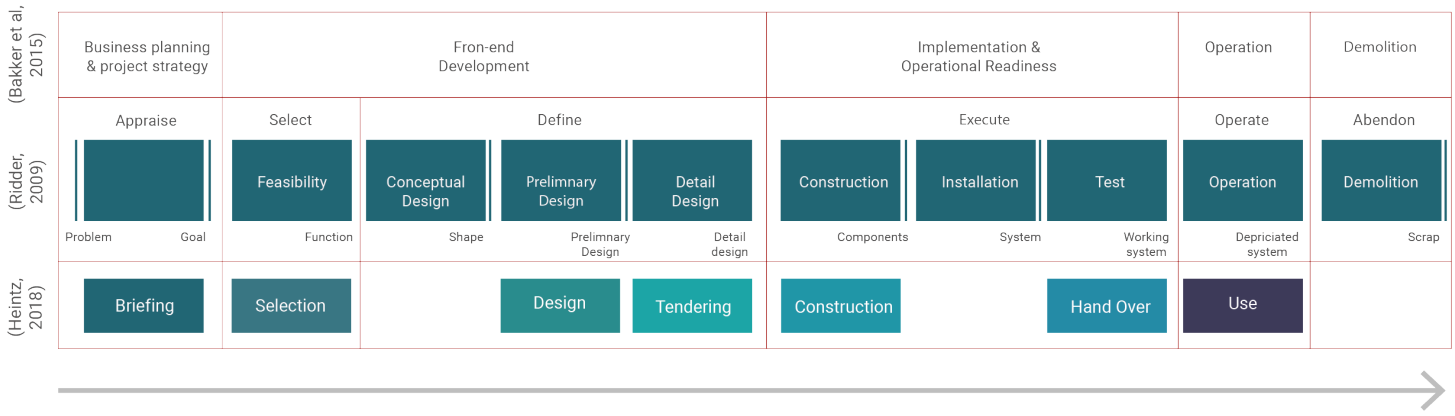


Figure 6: Life cycle stages [Bakker et. al. (2015), Ridder (2009), Heintz (2018)]

quantitative and qualitative objectives" (Bakker & De Kleijn, 2015, p.3). The process of a construction project is divided into phases that have been laid out in figure 7 as described by (Bakker & De Kleijn, 2015; Heintz, 2018; Ridder, 2009). A project begins when a particular organization has a desire to achieve a particular outcome (Williams et al., 2019). The organization which initiates the project is referred to as the 'permanent organization' (Williams et al., 2019) which is generally either the client, owner or user that aims to build, renovate or transform a building. The project begins with framing of an opportunity that takes place in the initiation phase (Bakker. 2015).

From the literature, it is clear that certain activities or events take place during the initiation phase and this has been illustrated through figure 8 which is an expansion of figure 7. The main activities include the advancement of the initial idea, first estimates of costs and benefits are made, conceptual alternatives are developed and stakeholders are identified (Williams et al., 2019). In addition to this, a rough program of requirements is indicated along with conducting feasibility studies (Gerding, 2019). This phase is facilitated within the permanent organization that consists of subgroups who shape and define the project (Williams et al., 2019). The role of this phase includes what the project is to achieve, establishing its feasibility and shaping the project's success (Williams et al., 2019). The characteristic of this phase for most construction projects is that uncertainty is most elevated, however, tends to reduce as information is collected over time (Samset & Volden, 2016). The project is required to have goals that line up with the strategic plan of an organization to ensure its importance (Williams et al., 2019). A traditional project management process attempts to achieve the identified output based on the 'iron triangle' of cost, time and quality (Basu, 2014). The objective here is to ensure the goal that is established is achieved. To establish this the process of most projects consists of formalized standard procedures for analysis and decision during the initiation phase. For example, these include using decision gates, analytical tools and estimation procedures (Gerding, 2019). Using the technical and spatial requirements for the building the end- product can be envisioned, the 'what-thing'. While on the other hand the use of PM tools (analytical, estimation procedures) the 'how-working principles' is established. A traditional project with no circular ambitions generally has an insight into the 'what' and the 'how' providing a direction for development which is illustrated as a sketch in figure 9.

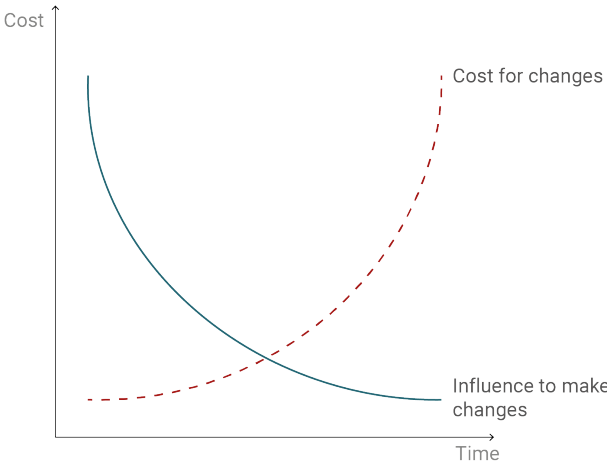


Figure 7: Influence on and cost to change in the building process, adapted from Bakker et al. (2015)

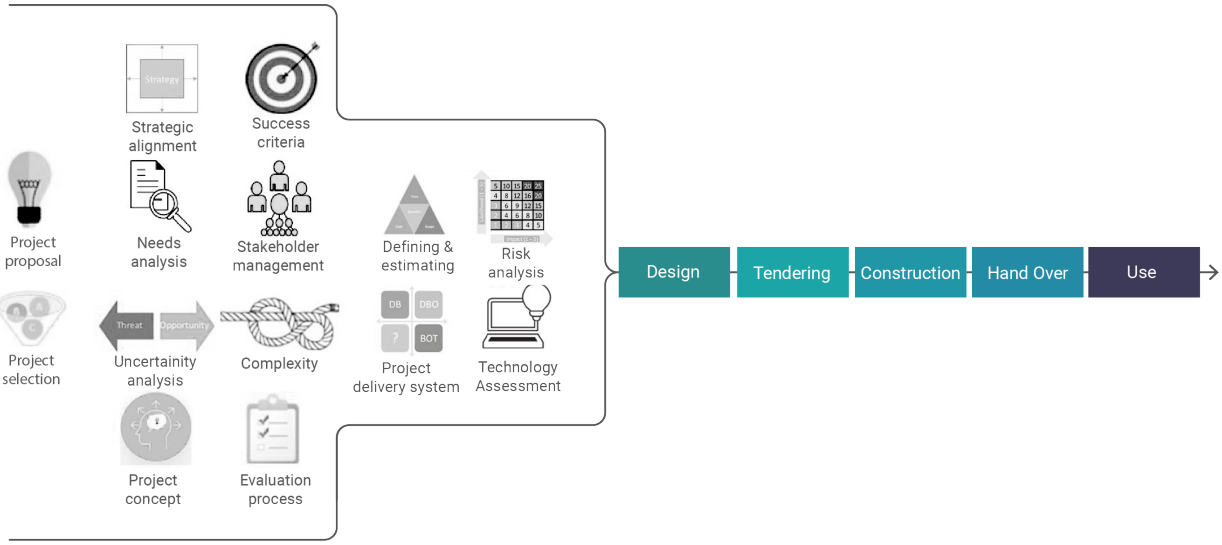
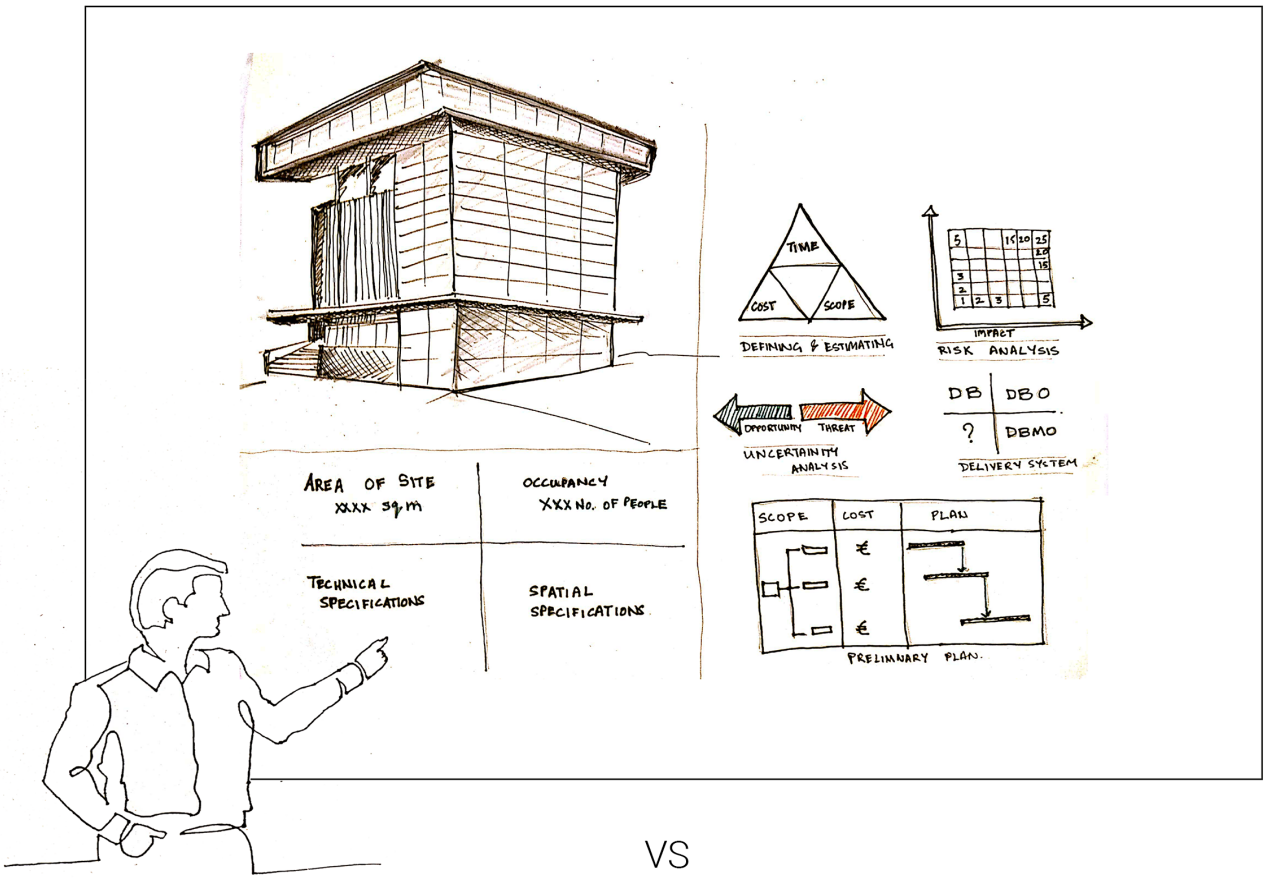


Figure 8: Overview of the activities involved in the initiation phase, adapted from Samset (2010), (own figure)



VS

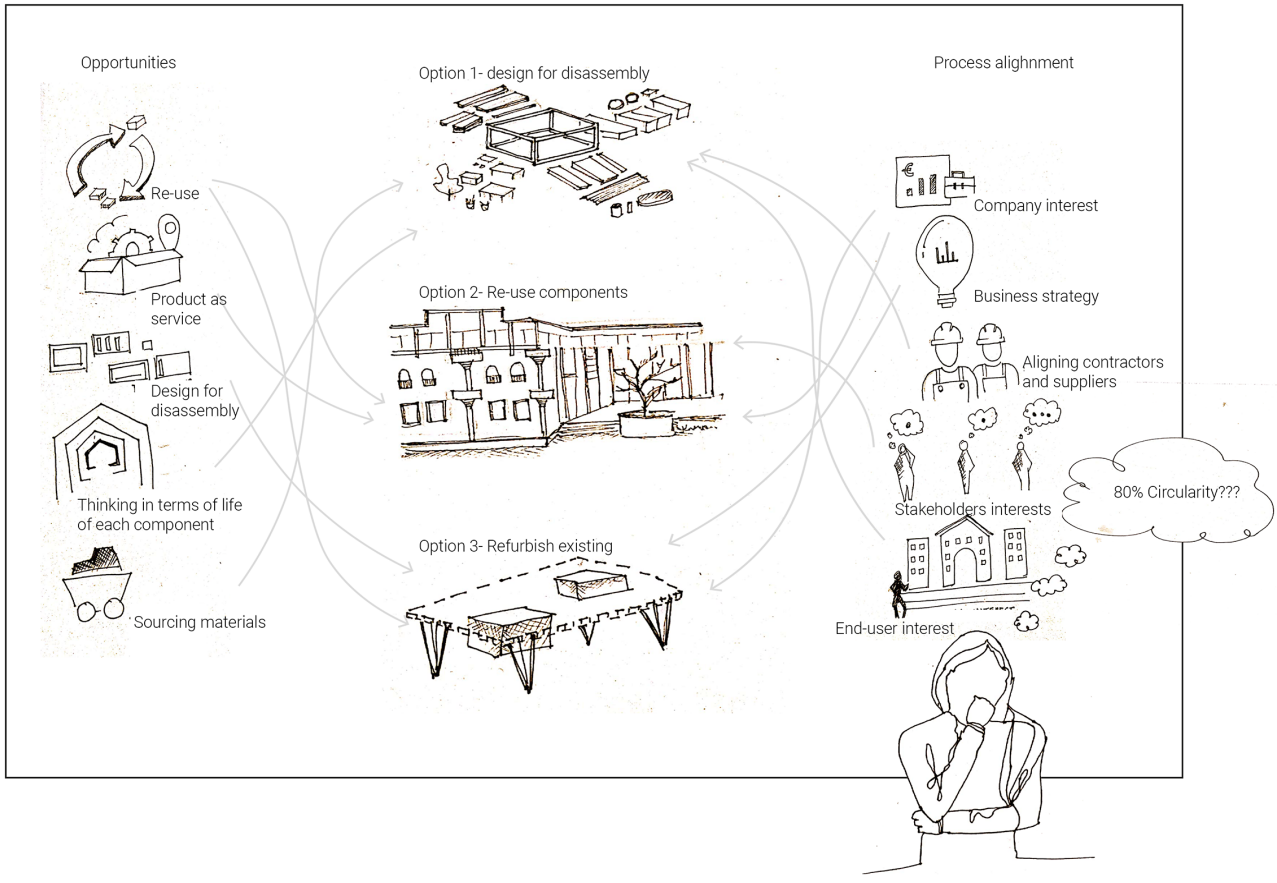


Figure 9: Projects without circular ambitions vs. projects with circular ambitions (own figure)

2.1.3.2 DEVELOPMENT OF A PROJECT WITH CIRCULAR AMBITIONS

As we move into the circular domain and aim to include circular ambitions within the building project, the challenges are even larger, as a whole new layer is added (Pelgrom, 2020). When an additional layer is added there is a change in dependencies and dynamics within the collaboration chain. In practice, it requires creating trust, motivation and understanding the context, as a new human dimension is added to adopt a new circular proposition (Pelgrom, 2020).

Achieving circularity in the construction industry is different from other sectors due to the high level of product complexity, high functional lifecycle and varying lifespans (van Oppen et al., 2018) of the various systems, components and elements (Asrani, 2019). Considering the conventional building process as described above, decisions regarding the implementation of circularity should take place in the initiation and preparation phase of the project (Gerding, 2019). This allows for choices to be made through the building's life cycle. As seen in figure 9, the start of the project offers a plethora of options to achieve circular principles and each of these results in a different product. This makes visualizing the end result of the project the 'what-thing' difficult. However, the final choice is context-based, but it needs to be identified with everybody who is involved in the project to have it emerge from the group (Pelgrom, 2020). This creates shared ownership among stakeholders to therefore move forward and realize circular ambitions within the project. It requires to take into account the organization, the current strategy, the people, the system in place, the process and the culture (Pelgrom, 2020). The whole realization and development becomes multi-dimensional with the newly added layer.

REQUIRED CHANGES IN THE INITIATION PHASE ESTABLISHED THROUGH PREVIOUS RESEARCH

Previous research by scholars have indicated that the traditional project procedures require adjustments to incorporate for circular ambitions (Gorgolewski & Morettin, n.d.; Kozminska, 2019; Leising et al., 2018; Pomponi & Moncaster, 2017; Versteeg Conlledo, 2019). Various suggestions that highlight these differences to support the realization of circular ambitions are described ahead.

The research by Versteeg Conlledo (2019) that compares traditional project management to management for buildings with circular ambitions, highlights on the following four points. Out of 13 of the interviews conducted by her 11 of them believe changes need to be made to deliver circular construction projects. (1) The conventional way of thought needs to be forgotten when working on circular projects; (2) To deliver circular construction it is required to abandon the traditional model where responsibilities are separated among individual parties; (3) a different approach is vital which consumes more energy by all parties involved; (4) flexibility is important in circular construction projects. Previous to this research, Marieke Venselaar from TU Delft analyzed the management process of circular projects. The conclusions made from her research were that (1) the project manager is required to bring in expertise from elsewhere; (2) the project must be granted room to explore and experiment to achieve circularity.

Kozminska (2019) and Gorgolweski & Morettin (2009) emphasize the importance of definition and commitment towards environmental goals by the client and design team in the initiation phase. Further, these goals are to be included in the brief and specifications. According to Meijers (2020), this could help in bringing together the project team and guide them through the process towards the specified details. Through a research-based on circular contracting and tendering van Haagen (2018) proposes that these goals need to be defined in an open, functional and performance-based manner instead of a closed technical manner that usually takes place in a regular project. Consequently, Pomponi and Moncaster (2017) emphasize the engagement of all involved which is considered as the key in achieving a circularity ambitions in the project.

Specific of re-use projects Kozminska (2019) postulates that an iterative approach that is adapted during the design and construction process leads to successful development projects with re-used components. Though the design is iterative in nature adding the ambition of re-using components increases the number of iterations Addis (2011). Kozminska (2019) also highlights the need for a flexible process that takes place in a collaborative approach with experts from diverse disciplines.

The research by Leising, Quist and Bocken (2017), states that for integration other complementary actions are required through the process. This includes the ability of the client to define the project requirements with circularity. Further, higher-order-learning (changing problem definitions, norms, values, convictions and goals of actors) is identified through the research as essential to achieve collaborative approaches. Through the research Leising (2018) develops a collaborative tool from the perspective of the initiating party and describes adjustments in different project phases. For the initiation phase, the tool suggests the development and preparation

of a vision at the start. During this phase, the client organization is required to take leadership to develop a vision for the product based on which the collective process is created instead of just specifying requirements that usually take place in a traditional approach. Collective aims are crucial instead of detailed specifications and distributed responsibilities (Leising et al., 2018). However, the collaboration tool proposed by Leising (2018) can for each phase be further deepened. On the same lines of creating vision Versteeg Conlledo (2019) suggests it should be developed by the project team. Besides, van der Helm (2009) recommends that this vision should provide for motivation, inspiration and direction.

Van Oppen (2018) provides focus on three points in addition to those described above. This includes understanding the 'why' aspect that underlines why the organization wishes to make this journey. Secondly, providing for circularity actor learning during which the basic concept of CE and methods of achieving it are elaborated to ensure the project team is on the same page of understanding to avoid the 'tower of babel'. Lastly, developing a working definition of circularity for the specific project. Since the circular economy is extremely context-dependent, the circular possibilities for a large city will differ from those of a building. Therefore to facilitate a transition for that particular project the key stakeholders must decide on key focal points for that particular project (van Oppen et al., 2018).

In conclusion, table 1 provides a summary of all the different approaches in comparison to a traditional process, that is required to take place in the initiation phase from past studies taken up by various researchers.

From the above descriptions, it can be summarized that the addition of circular ambitions to the project will lead to significant adjustments to the traditional approach in building projects. A major change to incorporate these differences would be commitment and recognition for an extended initiation phase.

The extended initiation phase of projects with circular ambitions entails the requirement of providing for flexibility, possibility to explore and experiment, space for ideation, understanding the intrinsic motivations and need for collaboration between the multi-disciplines. In brief, the provision of these characteristics in the initiation phase helps to form a brief in the initiation phase of the 'what-thing' and the 'how-working principles' which were earlier unknown. A project with an added circular dimension begins with the aspiration of value and as it proceeds it identifies the 'what' and the 'how' in consultation with the stakeholders involved as illustrated in figure 10.

Section 2.2 speculates on how the attributes the design thinking could provide for the above-mentioned requirements. The following section entails the challenges faced in the initiation phase identified through literature. Chapter 4 provides deeper insight into the challenges experienced by clients and consultants in the initiation phase through their experience that has not yet been captured by literature.

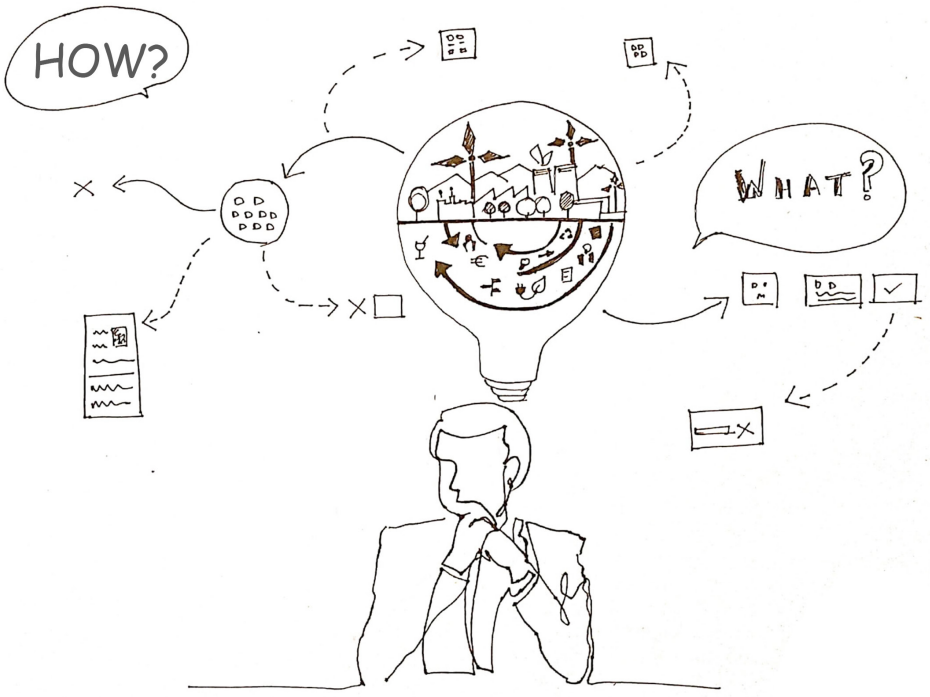


Figure 10: Projects with an added circular dimension, beginning with the project value with unknown 'what' and 'how' (own figure)

Table 1: Overview of required approach in the initiation phase of projects with circular ambitions from literature

Difference in approach	Author(s)
An approach where responsibilities are not separated among individual parties.	(Versteeg Conlledo, 2019)
Collaboration and wider engagement of all stakeholders are considered key to realize circular ambitions.	(Leising et al., 2018; Meijers, 2020; Pomponi & Moncaster, 2017)
Flexibility is important in circular construction projects.	(Meijers, 2020; Versteeg Conlledo, 2019)
Grant room to explore and experiment to achieve circularity.	(Venselaar, 2019)
Definition and commitment towards environmental goals by the clients. These goals are to be defined in an open, functional and performance-based manner. Later they need to be included in the brief and specifications.	(Gorgolewski & Morettin, n.d.; Kozminska, 2019; van Haagen, 2018)
An iterative approach to be adopted during the design and construction process.	(Addis, 2011; Kozminska, 2019)
Higher-order-learning, that includes changing problem definitions, norms, values, convictions and goals of actors.	(Leising et al., 2018)
Preparation of a vision/ ambition at the start to be developed by the project team collectively.	(Leising et al., 2018; van Oppen et al., 2018; Versteeg Conlledo, 2019)
Understanding the 'why' aspects that underline why the organization wishes to make the journey towards a circular economy. Providing for circularity actor learning to ensure the project team is on the same page. Developing a working definition for circularity according to the context.	(van Oppen et al., 2018)

2.1.3.2.1 CHALLENGES ENCOUNTERED IN THE INITIATION PHASE FROM THEORY

The key aspects of applying circular economy across a building life cycle have been identified through past research. However, in practice, though the past years have seen many front-runners trying to reach sustainable goals, it is yet to reach the mainstream economic players. This lack of wide-scale adoption can be a result of the challenges and barriers present in the system. Out of the many challenges faced, a few of them have been identified for which the research focuses to develop an enabler.

LIMITED AWARENESS, INTEREST AND KNOWLEDGE

Significant challenges relating to lack of knowledge and interest among clients, suppliers, customers and internal stakeholders are identified as a major challenge (K. T. Adams et al., 2017; Hart et al., 2019). It can be viewed as the crux of the problem and without progress on this, specifically the lack of interest the progress will be slow (Hart et al., 2019). From past research surveys, it is established that in the medium and large-sized organizations the lack of knowledge was greater than in smaller companies (K. T. Adams et al., 2017).

However, companies of all sizes believed that awareness, in the beginning, could act as an enabler (K. T. Adams et al., 2017). A possibility in this context also relates to the lack of clarity on what the circular economy entails and the confusion between terms such as reuse and recycling require greater precision in practice. This is seen as part of company culture and personal believes. This has the capability to decide on the speed of transition and is seen as a challenge to overcome when organizations or people remain unconvinced or uninformed (Circle Economy, 2017).

LACK OF EXPERIENCE AND EDUCATION

Designers, contractors and project managers are rarely experienced or educated to design and build with re-use components (Kozminska, 2019; Pomponi & Moncaster, 2017; van der Sande, 2019). This negatively influences the process and therefore education on the topic and guidance through the process by experts who have had experience is needed.

LACK OF CLARITY WITH CE DEFINITION AND FRAMEWORK

There are at least 114 definitions of the term 'circular economy' that are currently in use (Kirchherr et al., 2017). This causes ambiguity and often leading to misuse. More importantly, it is unclear what the goal is. Additionally, there is no consensus on which R-strategies can be given the label as circular (van der Sande, 2019). This could result in hindering the transition towards a circular economy (van Oppen et al., 2018).

On the other hand, the circular economy is highly context-dependent. That is, circular focus points for a large city differ from those of a product. Hence, the organization is also required to choose different circular economy principles for the project that are context-specific (van Oppen et al., 2018).

AVERSION OF RISKS

Aversion to risk is predominant in the construction industry as failure can lead to fatalities and excessive economic costs (van der Sande, 2019). Therefore, clients are hesitant to adopt circular solutions in their project as the addition of circularity to the equation requires the organization to make concessions between quality, price, durability and sustainability. Hence, they prefer to stick to the conventional 'known' way of working (van der Sande, 2019).

INTRA-ORGANIZATIONAL CHALLENGES

Required resources such as time and money are not made available, thereby making it difficult for organizations to adopt circularity (van der Sande, 2019). In addition, organizations find it difficult to adopt as departments within the organization are not willing to cooperate (van der Sande, 2019). Realization and application of change within the organization and way of working/ collaboration is required for the application of circular ambitions within projects.

CHALLENGES RELATING TO FRAGMENTED STRUCTURE (INTER ORGANIZATIONAL)

The fragmented structure of the industry is one of the core issues when implementing new or different strategies (BIS (Department for Business, Innovation and Skills), 2013). Research findings show that it is difficult to apply circular economy principles due to the lack of a holistic approach and the silo approach of undertaking design, construction and management (K. T. Adams et al., 2017). The implementation of CE in building projects requires a different form of collaboration among organizations.

LACK OF BANDWIDTH COMPOUNDED BY AN ABSENCE OF COHERENT VISION FOR THE INDUSTRY

Participants in the construction industry are in confusion if CE is an overarching framework to guide decision making and if so, how it relates to other frameworks such as sustainable development and their supporting tools (Hart et al., 2019). Stakeholders in the value chain are unfamiliar with how the CE principles work in the built environment and thus sharing of knowledge within the industry based on developments within the domain could solve the challenge.

COMPLEXITY AND CONFUSED INCENTIVES

This includes lack of accountability and split incentives, with a sequence of decision-makers being divorced from the consequences of their choices; fragmented supply chains and a multiplicity of actors with perverse or conflicting incentives (Hart et al., 2019, p.622).

The following section elaborates on the design thinking approach and its characteristics to analyze if it could work as one of the solutions in providing a process for the initiation phase.

2.2 DESIGN THINKING

The challenges identified in section 2.1.3.2.1 relate to lock-ins in terms of value creation and structures that result in organizational inertia (Chesbrough, 2010). Consequently, there is a need for a process to support organizations in taking up projects with circular ambitions. Adopting a design approach could be a promising approach to address the differences in the initiation phase identified and the challenges. The design approach is also known as 'Design Thinking' and these terms and interchangeable (Dorst, 2011a; Roberts, 2018). The design approach is about creating change in an unpredicted world (de Wit, 2019). This approach assists in creating and reshaping the world in designing- products, technologies, processes, policies and systems that once did not exist. It could be suitable to use this approach while developing projects with circular ambitions as we do not know the end product of it (circular building) as well. Through a design approach, the team avoids a 'premature selection' of the solution by providing an environment that allows for exploration.

The advantage of applying this process to the initiation phase of circular building projects is that it emphasizes the future, learning, experimenting, creativity and innovation (de Wit, 2019). This environment is specifically needed when designing for circularity as an organization is still exploring and the domain is still relatively new. Also, the result of this approach will be unique and context-specific that it cannot be transferred to other situations (Roberts, 2018). It could be beneficial as developing a project to include circularity is highly contextual and requires methods that aid this process. The following characteristics of the design approach provide speculations to use it in the initiation phase of circular projects:

- The design approach provides solutions to problems that are multi-faceted in nature while also taking into account the life cycle and providing attention for integration. (Joore & Brezet, 2015; Lawson & Dorst, 2009).
- The design approach provides methods that allow for a combination of both rational-analytical and creative thinking (Hekkert & Dijk, 2017; Lawson & Dorst, 2009).
- The design approach provides methods to search for novel ideas that support non-routine, irregular and ill-structured processes (Dorst & Cross, 2001).

As explained in section 2.1.3.2 there is a need to involve a variety of actors in the initiation phase all of whom have varying perspectives and individual goals creating a multi-faceted problem. The design approach mends with this situation well. Besides, the design approach focuses on integration and further helps in the development of solutions that incorporate recent trends and developments (de Wit, 2019). This is seen as relevant taking into account the newness and rapid development taking place in the domain of circular economy. An exploration of design thinking could lead to a structured strategy that focuses on the process to develop possibilities and consensus within the initiation phase. Previously, the Ellen MacArthur Foundation and IDEO presented several tools based on design thinking to guide circular innovations that are organized into four themes namely understand, define, make and release (IDEO & Ellen MacArthur Foundation, 2017).

The advantage of design thinking in a management context is that a 'decision attitude' is replaced with a 'design attitude in problem-solving (Boland & Collopy, 2004). They go on to expand that in case of a decision attitude towards problem-solving it is assumed that alternatives are easily formed, but the decision to choose the best option is difficult. While in case of a 'design attitude" it is difficult to create good alternatives, but once you have developed an opinion the decision can be made easily. As a result, many business and management organizations prefer 'design thinking' to address complex and open-ended challenges (Stacey et al., 2000). Dealing with the development of a circular building can be seen as an open and complex problem as one cannot foresee what it will eventually be or there is no ultimate method or design for a circular building. This still requires exploring and development. To deal with complex and open problems leads to a particular interest in the way designers create 'frames' and the way designers deal with it in their field of practise (Heintz et al., 2016). To apply in another field of practice (initiation phase of buildings with circular ambitions) calls for a clear definition, knowledge and a toolbox. To begin with, the following section goes on to define the core of design thinking and its application by Dorst (2011).

2.2.1 THE CORE OF DESIGN THINKING AND ITS APPLICATION

To get a grasp of the complex and puzzling field of design practices, it is necessary to first realize the need for which they have been developed (Dorst, 2011a). The core of design thinking can be linked to the basic reasoning patterns, that are used by humans use in problem-solving. Using the different settings of knowns and unknowns different settings are compared in the equation described below. However, the equation changes subtly in the end in the case of design. Here the end product is 'value' and replaces the term 'result' which is a statement of fact (Dorst, 2011b).

(a) WHAT (thing) + HOW (working principle) leads to RESULTS (observed)

(b) WHAT (thing) + HOW (working principle) leads to VALUE (aspired)

Different reasoning patterns have been termed based on the form of problem-solving, and the knowns and unknowns at the beginning. Dorst (2011) has termed these as deduction, induction, abduction-1 and abduction-2. Each of these reasoning patterns consists of 'what', 'how' and an end 'result'/ 'value'. These varying patterns further elaborated below were established through the research by Dorst (2011).

Deduction: The 'what' and the 'how' are known in the equation. This allows the result to be predicted. For example, stars are in the sky (what), and the laws of nature that govern their movement are known (how), then their position at a particular point of time can be calculated (result).

WHAT (thing) + HOW (working principle) leads to ???

Induction: Here the 'what' and the result is known. By- proposing hypotheses it is possible to find the working principle (how). Within science, these hypotheses are then subjected to experiments and to falsify or accept them. For example, stars are in the sky (what), after a certain period of time their position is observed(result), then various hypotheses are formed to culminate how fast they moved (how).

WHAT (thing) + ??? leads to RESULTS (observed)

When the outcome of the process is in terms of value, the reasoning pattern is termed as abduction which comes in two forms (Dorst, 2011b).

Abduction 1: Here aspired value that the team wishes to create and the working principle (how) are known and will further help to perceive the missing 'what'. Finding the 'what' (object, service, system), defines both the problem and the potential solution. Designers and engineers often come across this circumstance where they create a design through a known working principle and aspiring for a set scenario of value creation the end product is required to achieve. Many organizations come across this form of 'closed' problem solving on a daily basis (Dorst, 2006).

??? + HOW (working principle) leads to VALUE (aspired)

Abduction 2: It is more complex compared to the other problem-solving forms as at the start only the end value that is to be achieved is known. The challenge is to create a 'working principle: how' and the 'thing: what' in parallel. Here, two unknowns are to be identified hence, making the process different from conventional problem solving (Dorst, 2011b). This challenge is mostly associated with design (Roozenburg & Eekels, 1995) and represents the open, complex problems for which organizations are seeking new approaches.

??? + ??? leads to VALUE (aspired)

Framing: In a problem situation such as abduction-2, experienced designers create a frame to tackle the complex creative challenge of coming up with both a thing and its working principle to thereby obtain the aspired value (Dorst, 2011b). The reasoning behind framing is (Dorst, 2011a, p.525): "if we look at the problem situation from this viewpoint, and adopt the working principle associated with that position, then we will create the value we are striving for".

WHAT + HOW leads to VALUE

FRAME

As described by Dorst (2011), the core of design thinking is characterized by abduction, which implicates that design thinking is solution-oriented. In abduction, searching and experimenting assist in arriving at the desired situation. Through the process, the problem is reframed following which experiments with a number of possible solutions are tried to observe which of them achieve the desired outcome (aspired value). This searching and experimenting is a distinctive feature for applying design thinking in the initiation phase of circular projects, in order to provide an environment of understanding, ideating, experimenting and exploring required. The process of framing taken up in the Abduction-2 process distinguishes the design thinking practice from conventional problem solving such as induction, deduction and abduction-1. According to Dorst (2011), framing is a special thing that design practices could bring to other organizations that tackle open and complex problem situations. The core challenge of design thinking that a thing (object, service, system) and a working principle are to be created simultaneously. The double creative step underlined has led designers to come up with concepts for the 'what' and 'how' and test them in conjunction (Dorst, 2011a). Through the performance of this complex creative feat, the problem and solution are developed parallelly.

The application of the abstract process of design thinking can be described in four sequential steps as formulated by Dorst (2011):

1. Understanding of the problem situation through which the complexity of the issue is recognized following which the team is able to define the aspired value.
2. The complex problem can be approached by working backward. The team begins with the only 'known' in the equation which is the aspired value that needs to be created. After reasoning backward the team adopts or develops a frame which is actually a form of induction (reasoning back from consequences).
3. After a promising or credible frame is suggested, the team moves from induction to abduction 1, to thereby create a 'thing' (object, system, service) and complete the equation. It is important to note that only for equations that are completed will testing their merit be possible.
4. The following step consists of reasoning forward. Here, a deduction is used to see if the combination of the 'thing' and 'working principle' together perform well enough to create the intended value. Consequently, only after the assessment of its combination to lead to the aspired value can it be accepted as 'definitive'. Prior to this, the frame was only a possible way forward.

Later in chapter 4, these steps when applied to the design problem could help in arriving at a structured strategy that assists clients and consultants in the initiation phase.

2.2.2 THE FRAME CREATION MODEL

The process of creating frames can provide a new perspective to approach open, complex, dynamic and networked problems (Dorst, 2015). Creating new frames leads to novelty and innovation. For the creation of frames Dorst (2015) has created a model that consists of nine steps (**figure 11**) and had been briefly described below. These steps help to develop the problem situation, recognize a broader context, build a deeper understanding of the problem and consequently come up with a new approach to the problem (Dorst, 2015).
Each of the steps is explained briefly as described by Dorst (2015):

ARCHAEOLOGY

An in-depth investigation of the apparent problem including the earlier attempts to solve it. An investigation is done of not only what happened, but also what could have happened if an alternative path was taken. Provides a deep understanding of the past history of the problem.

PARADOX

After analyzing the actions that led to the problem situation, investigation on the initial problem definition is carried out by trying to answer the lead question "what makes the problem hard to solve?". Here the deadlock that keeps the problem from moving forward is identified. The paradox could be expressed through a series of "because" statements.

CONTEXT

To create a sense of freshness and energy the next step of the frame creation process includes an exploration of the key stakeholders who have been involved or those who will be necessary participants during the implementation of a possible solution. Their behavior and the strategies they employ are carefully examined.

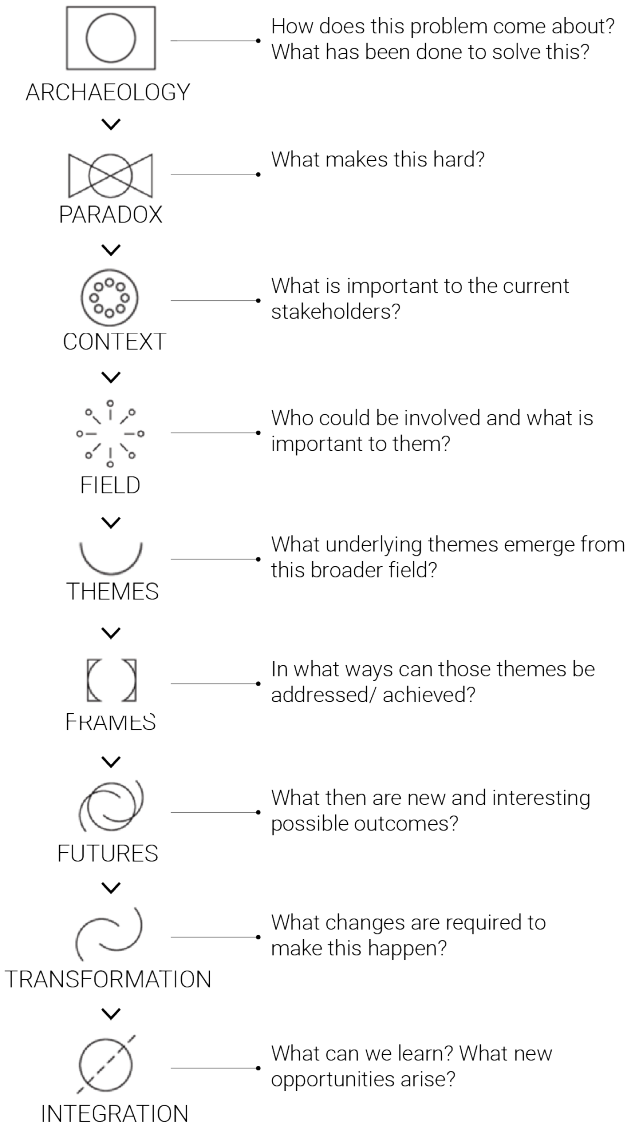


Figure 11: Frame creation model based on Dorst (2015), (own figure)

FIELD

A field is created by considering all potential players who could be connected to the problem or solution, actively or passively at a particular point in time. While mapping the field of stakeholders their power, interest and values are understood. The exploration and formation of the field focus on deeper, universal values that might inform the formulation of themes in the next step. The emergence of new parties through field exploration provides opportunities that have not been thought of before.

THEMES

Through the theme analysis, the deeper factors that determine the needs, motivations and experience of the players are understood. These are generally hidden and it could be difficult to make it explicit. In theme analysis descriptions of experience, finding patterns and filtering are done until a core insight is brought out.

FRAMES

Following the in-depth analysis of the broader field, common themes are highlighted that were earlier not present in the original paradox. Identified themes that are common among many players are particularly interesting to explore as they are attractive to a network of partners. The frame created can be formulated as a pattern of relationships that could lead to valuable outcomes. It can be approached through a series of "as if" statements. That is "If the problem is approached as if it is..., then...".

FUTURES

Through playful explorations, it is observed how the various frames generated might work. This is developed as a form of 'thinking forward' exercise which is part of the abduction described in the previous section. The frame and the solution idea corresponding it are a viable future only if they spark interest and commitment among the parties who are required to take them forward.

TRANSFORMATION

The frames and solutions postulated are then critically evaluated during this step based on feasibility over a time frame. It is not a 'hard review' but more an exploration of changes that are needed within the organization to execute them. The end result of this step includes a business plan, transformation agenda and a strategy.

INTEGRATION

As part of the last step of the frame creation process the suggestions proposed need to be well integrated into the broader context of the involved organization. As explained above and illustrated in the figure, the process of frame creation is described as a linear model. However, in practice the consecutive steps are followed as a guideline but going forward, backward and skipping over steps is common (Dorst, 2015).

The process of framing begins with an understanding of the problem to be solved but does not get fixated rather is further developed. By understanding the interests and important values of the actors the problem is reformulated that provides for an entirely new perspective on approaching it. The process requires a lot of interaction among the various actors (Dorst, 2015) that eventually play an important role in providing good solutions (Deuten & Rip, 2000). This process of problem-reframing is re-interpreted in chapter 4 to fit the initiation phase of building projects with circular ambitions.

2.2.3 PRINCIPLE ATTRIBUTES OF DESIGN THINKING

Through the process of frame creation, a number of characteristics are highlighted that are otherwise not captured through a linear problem-solving process. The following section provides a comprehensive overview of the principle attributes associated with design thinking along with their associated tools as described by literature. The different principles and varying experiences one would gain through the use of design thinking are elaborated in **Table 2**.

Table 2: Principle attributes of design thinking

DESIGN THINKING ATTRIBUTE	DESCRIPTION	AUTHOR(S)
CREATIVITY AND INNOVATION	Design thinking is an approach that addresses product, process and business model innovation. The production of a novel use of ideas by a group of people is a key attribute and outcome of design thinking as described through literature and commentary by expert practitioners. Attributes such as prototyping, trial and error approach and the adoption of an abductive logic are means that design thinking provides to generate novel ideas and innovate.	(Amabile, 1988; Deserti & Rizzo, 2014; Liedtka, 2011; R. L. Martin, 2009)

USER-CENTEREDNESS AND INVOLVEMENT	User or human-centeredness is a fundamental characteristic of design thinking and is also occasionally referred to as participatory or co-creative design. This attribute ensures that end users have influence and can render their perspective in the informing, ideating and conceptualizing projects in the early phases. The feature of 'empathy' is identified as the prime mode to emphasize this attribute. Empathy includes understanding the perspective of another which comprises identifying behavior, physical and emotional wants and needs and deducing what they see as meaningful. By doing this the facilitators shift from their point of view to imagine solutions that encapsulate both expressed and unexpressed needs.	(Brown & Katz, 2009; Glen et al., 2014; Liedtka, 2015; R Martin, 2011; Sanders & Stappers, 2008)
PROBLEM SOLVING	Design thinking has been known for solving problems, specifically 'wicked' problems. A 'wicked' problem can be understood as one which is ill-formulated, has confusing information, where the clients and decision-makers conflict with each other and where the whole system is confusing. Design thinking can be suggested as a different approach to typical linear problem solving by not fully resolving it and providing the required space to explore.	(Buchanan, 1992; Churchman, 1967; Roger Martin, 2010)
ITERATION AND EXPERIMENTATION	Design thinking has been defined as an iterative approach that is accomplished by the characterization of trial and error learning and testing of a range of solutions with the direct and indirect project stakeholders. This process is aided through the task of creating sketches, mock-ups and prototypes. The activity of prototyping allows stakeholders to learn about the strength, weaknesses and future possibilities of a particular idea. It is also seen as a way to explore, experiment and develop further rather than fixing on a particular solution.	(Beverland et al., 2015; McCullagh, 2013; Seidel & Fixson, 2013)
INTERDISCUPLINARY COLLABORATION	Innovation and problem solving are brought about by getting people together from varying departments and organizations. The logic behind this is that a multi-disciplinary team can figure out the complexity by taking into account the technical, business and human perspective of the problem.	(Beverland et al., 2016; Brown & Katz, 2009; Glen et al., 2014)
ABILITY TO VISUALIZE	Design thinking provides the flexibility to transition from abstract thinking to visualize ideas and then think based on those visualizations to expand on the innovation. The ability to visualize concepts and ideas caters as a guide instead of a deterministic option. The creation of sketches, prototypes, or storytelling serves as a means of visualizing alternative solutions which creates a real and vivid feel for the ideas.	(Boni et al., 2009; Carlgren et al., 2016; Verganti, 2017)
GESTALT VIEW	A defining characteristic of the design thinking framework is the ability it provides to get a deeper understanding of the problem context and identify relevant insights. The process is not just oriented towards a product or service but is a holistic gestalt from the experience of a variety of people. A gestalt view here is not only the sum of the perceptions but the conceptualization and representation of problems which includes understanding problems, including end-user needs and environment, social factors, market and emerging trends. The inputs from these assist in challenging the original problem to later incorporate the findings and re-phrase the problem in a holistic fashion. Users are seen as resourceful actors to realize this attribute.	(Drews, 2009; Gruber et al., 2015; Holloway, 2009)
ABDUCTIVE REASONING	As explained in the frame creation model, this form of problem-solving provides an imagination of 'what might be' rather than 'what is'. It draws the path to realize an argument with the best explanation through the creation of new insights. Through this form of reasoning, the existing frames are reframed in addition to challenging existing practices and assumptions.	(Dorst, 2011b; Roger Martin, 2010)

TOLERANCE TO AMBIGUITY AND FAILURE	Through iterative cycles of trial and error experiments, there could be a failure of ideas, however, this is considered as valuable learnings as it is identified in the early stage with the opportunity to improve before the rigidity sets in during realization. The attitude of embracing uncertainty and early failure is the key to continuously iterate towards improved solutions and innovations.	(R. S. Adams et al., 2011)
BLENDING ANALYSIS AND INTUITION	The application of design thinking does not disregard analytical thinking but tends to blend with the intuitive way of thinking. It combines the felt knowledge about patterns (intuition) with an evaluation of the relevance and usefulness of knowledge (rationality) to have a dynamic balance between the opposing elements.	(Roger Martin, 2009, 2010; Stephens & Boland, 2014)

2.2.4 DESIGN THINKING TOOLS AND METHODS

In relation to the attributes presented, authors also highlight several tools common to the design thinking practice. Eight tools and methods which have had the highest in literature are selected. In practice, the quantity of the number of tools being used is not of importance but the linkage between each of them is what matters (Seidel & Fixson, 2013). The description for each of these tools along with their relationship to the different attributes of design thinking is elaborated in **Table 3** below.

Table 3: Design thinking tools and methods

Tools and methods	Description	Relationship to Attributes	Author(s)
Ethnographic methods	This method includes activities such as observation, use of diaries and representation tools such as personas and journey maps. It is used to get a deeper 'under the skin' understanding of the design problem.	• Fosters empathy and human-centeredness through involvement. • A combination of data obtained from observation can be combined with quantitative data that relates to the blend analysis and intuition attribute. • Provides a gestalt view through the understanding of the problem. • Through data gathered 'what if?' scenarios can be developed to enable the abductive form of reasoning.	(Beckman & Barry, 2007; Micheli et al., 2019)
Personas	Following the understanding of the user, the tool of persona is used to communicate the findings. It provides a shared and consistent understanding of the people observed. Helpful in visualizing key stakeholders.	• Through empathy provide for involvement and user-centeredness. • Assist with means to visual key stakeholders. • Provides for a gestalt view • A boundary-spanning object for collaboration.	(Boeijen et al., 2020; Micheli et al., 2019)
Journey maps	The experience of the stakeholder is tracked and described not only what is encountered but also the deep intuitive responses of the experience.	• Through empathy provide for involvement and user-centeredness. • Assist with means to visual key stakeholders. • Provides for a gestalt view • A boundary-spanning object for collaboration. • Enables iteration and experimentation when different stakeholder's journeys are used to test.	(Dalton & Kahute, 2016; Micheli et al., 2019)
Brainstorming	It is particularly facilitated for ideation. It is a collaborative process that highlights the search for solutions that might not have evolved through an individual thought process.	• Used for interdisciplinary collaboration. • Since the brainstorming sessions withhold judgment of ideas generated it enforces iteration and experimentation. • Broad conceptualization fosters abductive reasoning and the blending of analysis and intuition.	(Micheli et al., 2019; Seidel & Fixson, 2013)

Mind maps	Ideas and aspects around a topic are mapped out to bring structure and clarity to the problem. It is a collaborative sense-making technique. Provides a team-based process to structure insights from the ethnographic research and develop a common mind among the team members.	• Provides the ability to visualize and structure complex systems. • The mapping of concepts of multiple stakeholders provides a gestalt view. • A boundary-spanning object for collaboration and communication.	(Liedtka, 2015; Micheli et al., 2019)
VISUALIZATION	Drawings, pictures and storytelling and visualization techniques that clarity the characterization of the idea to be able to provide for critical feedback. This also assists in enhancing the imaginative abilities of the decision-makers.	• Drawings and sketches serve as a communication tool to enhance abductive reasoning. • Quick visualization facilitates the ability to iterate and experiment. • Provides for the ability to visualize during ideation. • Captures the current and desired state that fosters user-centeredness and gestalt view. • A boundary-spanning object for collaboration and communication.	(Glen et al., 2014; Liedtka, 2015; Micheli et al., 2019)
PROTOTYPES	To showcase to the users/ stakeholders the concepts to further be able to evaluate and decide which course to take. Generally used to express the idea which could contribute to reframing the problem.	• The physical means for iteration and experimentation. • Encourages failure at an early phase of development. • Provides for the ability to visualize during ideation. • A boundary-spanning object for collaboration and communication.	(Dalsgaard, 2014; Micheli et al., 2019)
FIELD TESTING		• Fosters ideation and experimentation • Encourages failure at an early phase of development.	(Micheli et al., 2019)

2.3 CONCLUSION: ATTRIBUTES OF DESIGN THINKING AS A POSSIBLE SOLUTION TO CREATE AN ALTERED APPROACH

Investigation through literature into the changes required in the initiation process highlight the following: collaboration and wider engagement of all stakeholders, flexibility in the process, room to explore and experiment, an iterative approach, higher-order learning (includes problem definition, understanding the conviction and goals of actors), preparation of vision and ambitions collaboratively and lastly understanding the intrinsic motivations. All of these requirements can be established through the design thinking framework as its attributes provide these inherent qualities.

With this proposition of matching the changed requirements of the initiation phase for a building with circular ambitions and the attributes of design thinking, the research continues to investigate the current practice in the initiation phase. Later the insights from the investigation are used to design the strategy in combination with the design thinking framework.

3 | RESEARCH METHODOLOGY

This chapter describes the research methodology that is adapted to analyze current practice in the initiation phase of projects with circular ambitions and the improvements required based on current practices. These findings are further used to design a strategy using design thinking methods that merges with the activities and events that are required to take place in the initiation phase. This is done keeping in mind the aim of the project. Section 3.1 provides an introduction to the methodology that is seen as appropriate to fulfill the research goal. Section 3.2 describes how the chosen methodology is applied to the research. As a whole, this chapter provides an answer to the third sub-question that has been formulated as: *"How to analyze current practice and further design a strategy for the initiation phase that incorporates design thinking principle attributes?"*

3.1 DESIGN-BASED RESEARCH

With the objective of designing a strategy using design thinking methods specific for the initiation phase of a circular built environment, design-based research is seen as fitting. Qualitative research is carried out, since it is descriptive in nature and focuses on interpretation, experience and opinions (Baarda, 2014). The crucial aspect of design-based research is to use theory to design the needed interventions and to develop these for an application purpose. To realize the optimal result, collaboration with participants from practise takes place. Design-based research can be defined as follows: "design-based research is a research methodology aimed to improve educational practices through systematic, flexible and iterative review, analysis, design development and implementation, based upon collaboration among researchers and practitioners in real-world settings, and leading to design principles or theories" (Wang & Hannafin, 2005, p.2). Since the thesis aims to apply design thinking methods in the initiation phase of building in practice, there is a need to combine findings from theory along with the findings from practice. This research methodology is also characterized by an iterative process.

The design-based research methodology includes various methods of which the 'Double Diamond'

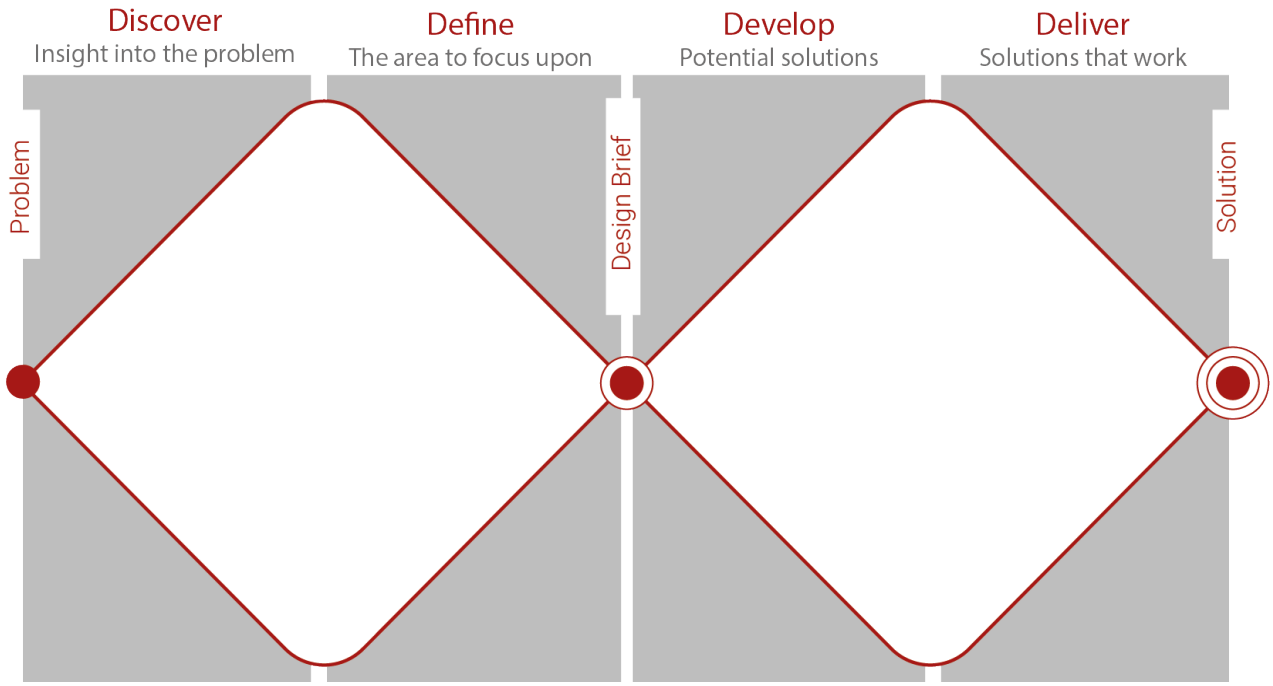


Figure 12: Double Diamond Method Skeleton(Design Council, 2007)

method founded by the British Design Council is applied. This is seen as apt among the various models that the design-based research methodology includes as it does not focus only on design solutions, but it gets more into the actual problem prior to developing the solution as an output (Design Council, 2007). The double diamond model is used to formulate a process, that is divided into four stages: the discover, the define stage, the design stage and the deliver stage as seen in **figure 12**. The two diamonds provide for a process of exploring and discovering new ideas - the divergent phase; followed by taking a focused action – the convergent phase (Design Council, 2007). Through the process, the four key principles are kept in mind (1) begin with understanding the people that will use the strategy (the challenges, needs and aspirations); (2) develop a shared understanding of both problems and ideas through visualization; (3) work together to co-create (4) iterate diligently to identify errors and further build the ideas (Design Council, 2007). The following sections elaborate more on the application of the double diamond for the research.

3.2 APPLICATION OF THE DOUBLE-DIAMOND METHOD

This research has followed the theoretical line of the double diamond model as seen in **figure 13**. The first part of the research is encapsulated by the first diamond where the problem analysis takes place. Here the required changes in the initiation phase of projects with circular ambitions are identified along with the diverse perspectives of the stakeholders involved during this phase. This further delivers an overview of what changes and improvements are required in the activities and events pertaining to the initiation phase of circular built environment projects. The overview of changes and improvements overlapped along the project life cycle is used to design the strategy that uses design thinking methods to facilitate the changes required in comparison to the traditional process. At this stage, the process also includes iterations with practitioners that would use the strategy. The strategy is further redesigned based on the outcome of the iterations and evaluations. The research concludes with a validation of the strategy carried out by a group of experts that has been described further in section 3.2.4.

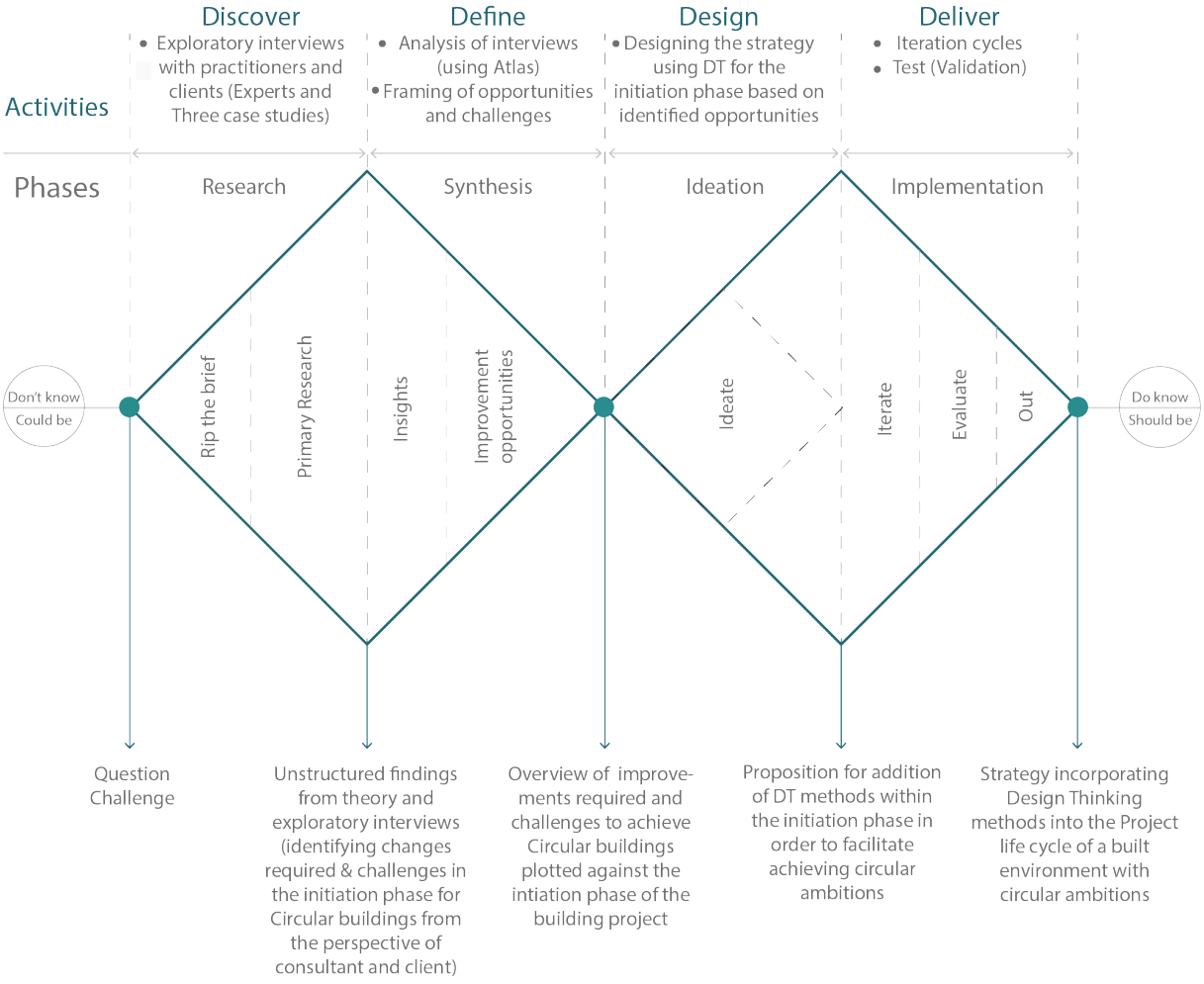


Figure 13: Application of the Double Diamond Method for the Research Methodology (own figure)

3.2.1 THE DISCOVER STAGE

To identify the problem, literature research is combined with understandings of the practitioner's perspective (Reeves, 2006). The first step of discovery involved an exploration of the process taken up by the practitioners in the past during the initiation phase. Along with this, the challenges, lessons learned and improvements required in the altered initiation phase are also underlined. The aim of this first step is to explore the changes and improvements required in the initiation phase to realize the highest levels of circularity for the project. With the aim of reducing the gap between theory and practice, the problem analysis involves understanding the perspectives of stakeholders involved in addition to the theoretical background study. This begins with the selection of key people whose perspectives need to be analyzed. Since the research focuses on the initiation phase the following perspectives are identified as relevant: the permanent organization (the client and internal organization stakeholders) and the consultant perspective (Circularity expert guiding the initiation process). The research is conducted in coordination with Copper8 (front runner as a circularity consultant in the market) who have completed projects within the built environment that entail circular ambitions. Therefore, projects undertaken by Copper8 are taken as case studies to collect data. The perspective of the various stakeholders involved is determined by conducting semi-structured interviews. To collect data from a broad perspective three case studies are chosen. Prior to the interviews that were specific to the case, three interviews with experts (consultants) are conducted. Each of these experts has had significant experience consulting the initiation phase of buildings with circular ambitions. Since, there is no fixed process prescribed or followed by projects, the interviews with the experts assisted in defining themes that the initiation phase of circular projects can be divided into. These themes formed a basis to later analyze the cases. As illustrated in figure 14, the interviews consisted of understanding the perspectives of both clients and consultants ranging from projects of varying scales.

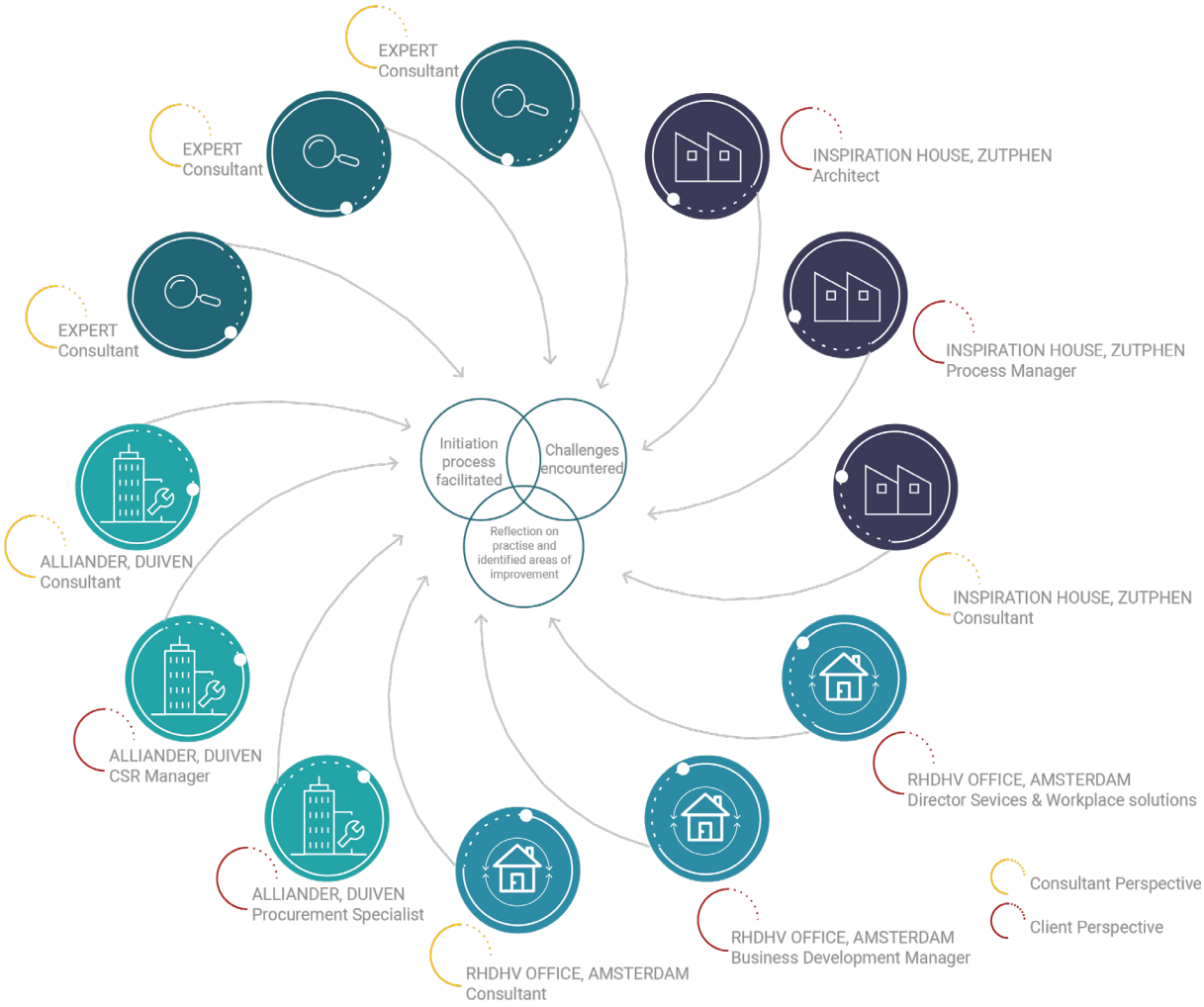


Figure 14: Overview of the interviews conducted with different perspectives, along with type, scale of project and details investigated (own figure)

3.2.1.1 CASE SELECTION

The selection of cases is crucial as empirical findings depend on the details of the case. The case is required to be selected such that every case results in similarities or contrasts but for predictable reasons (Gustafsson, 2017). Unrelated or incomparable cases would make comparison and generalization impossible. The cases were screened based on the type of project, scale, complexity, availability of information and access to stakeholders. In relation to the scope of the research the following criteria are used for the selection of cases:

1. Since the aim of the project is to analyze buildings with circular ambitions, the building is required to have begun with circular ambitions among the project team. Consequently, it is also seen if these ambitions have been realised in the end result of the building.
2. Within these projects, commercial and non-residential building projects are specified as a criteria. As specified in section 2.1.2 commercial and non-residential buildings are being demolished and downcycled as foundation materials. Therefore, it is in this section of buildings that the research aims to create an impact, to shift from a downcycling practice to an upcycling practice.
3. The project is required to be executed in the Netherlands. Projects from different countries make it hard to compare taking into account the varying laws, permits, cultures and ways of working between the different countries.
4. Lastly, it is required that the project is completed to be able to scrutinize the process followed to realize the building.

The cases are selected using the above-mentioned parameters from a pool of projects completed by the partnering company, Copper8 who have over the last few years completed many projects with circular ambitions in its portfolio. There is a need to analyze multiple cases so that variations, best practices and generalizations could be extracted. Keeping in mind the duration of the research the number of cases was limited to three, which are as follows:

Case I: Alliander Head Quarters, Duiven, Netherlands

Case II: Royal HaskoningDHV Office (Contact), Amsterdam, Netherlands

Case III: Inspiration House, Waterschap Rijn en Ijssel, Zutphen, Netherlands

Detailed description of each of these cases and the stakeholders interviewed for them are elaborated in the following section.

Case I: Alliander Head Quarters, Duiven, Netherlands (source: RAU Architects)

Case II: Royal HaskoningDHV Office (Contact), Amsterdam, Netherlands (source: RHDHV)

Case III: Inspiration House, Waterschap Rijn en Ijssel, Zutphen, Netherlands (source: Copper8)

Figure 15: Overview of cases selected

3.2.1.2 CASE DESCRIPTION

This section describes the background of the cases selected according to the criteria enlisted in section 3.2.1.1. It emphasizes the uniqueness of each case along with the background and roles of the interviewed stakeholders of the project.

Case I: Alliander Head Quarters, Duiven, Netherlands

The new headquarters for Alliander is a renovated office building situated in Duiven, Netherlands. The project included the redevelopment and renovation of an existing cluster of buildings into a 24,000 m2 head office, housing more than 1500 workers. Initially, the project began with the request for a new building to house 1500 workers. However, following a market consultation with all the project stakeholders, it was decided to renovate the existing buildings in order to accommodate the staff. Connectivity, circularity and energy positiveness were the three main themes that the project began the development with. The end result is a building that reutilizes more than 80% of the raw materials from the original structures and the newly added structures and designed in a way that they are fully re-constructible in the future. In addition, the building is fitted with solar panels and underground water for thermal storage. The structure is energy positive and also actively redistributes excess power to the local grid.

For this case three interviews were conducted, one from the consultant's end and two from the client's end who was involved in the initiation phase.

- **Alliander HQ: Consultant (Initiation and tender phase), Copper8:**

The interviewee has been working as a consultant in Copper8 for 8 years and has been devoted to the topic of sustainability and circularity since the start of the interviewee's career. The role of the interviewee for the project was to select the right parties and guide the collaborative process to develop the new office for Alliander. This was to be done, keeping in mind the ambitions that were set for the development through the process of market consultation.

- **Alliander HQ: Corporate Social Responsibility Manager, Alliander**

The interviewee has been working for 10 years in Alliander as the Corporate Social Responsibility Manager. As the CSR manager, they are responsible for the carbon footprint, reaching the circular economy goals and maintaining diversity within the work environment of Alliander. For Alliander, Duiven the interviewee was one of the members who initiated the project and was also one of the main project team members till the procurement phase. He/ she played a major role in organizing the first market consultation that led to the themes and ambitions for the project.

- **Alliander HQ: Procurement Specialist, Alliander**

The interviewee was working with Alliander for 11 years and was responsible for the procurement of business services. During the project of Alliander, the interviewee's role was to facilitate the procurement process together with the facilities department who was the initiator of the project. The interviewee has been on board with projects that have no circular ambitions (traditional projects) as well as those that aim for circularity in the final product. The Alliander, Duiven project was the first project that was procured by the interviewee and the interviewee's team with circular ambitions in mind.

Case II: Royal HaskoningDHV Office (Contact), Amsterdam, Netherlands

The RHDHV office at Amsterdam is a garage that has been developed into an office space and is also famously known as the Contact. Since the office was only to be used for 5 years, it was a requirement from the beginning that they would develop the office within an already existing structure. The total area of the current office is approximately 1800 metres square and provides for a healthy workplace for 180 employees. From the initiation of the project four themes were identified, for it to be energy neutral, built with as many circular materials as possible, multifunctional in use & built and lastly to provide a space that keeps in mind the health and well-being of the employees.
For this case three interviews were conducted, one from the consultant's end and two from the client's end who was involved in the initiation phase.

- **RHDHV Office, Amsterdam: Consultant (Initiation and tender phase), Copper8**

The interviewee has been working as a consultant in Copper8 for 8 years as a sustainability and circularity consultant, with 16 years of experience in circularity within the built environment. For the project, the interviewee was the inspirator and project leader for the tender with the responsibility of guiding the team through the selection process for a partner who would develop the office in line with the ambitions identified in the initiation phase.

- **RHDHV Office, Amsterdam: Business Development Manager, RHDHV**

The interviewee was working with RHDHV for 8 years as the Business Development Manager that involves acquisitions and tender management. The interviewee initiated the project together with the facilities department and was responsible to decide the scope and ambitions of the project on behalf of the employees at Amsterdam. At a later stage, the interviewee took the role of the quality controller for the sustainability ambitions, to keep a check on the realization of the ambitions identified at the start.

- **RHDHV Office, Amsterdam: Director Services and Work Place Solutions, RHDHV**

The interviewee has been working as the director of services at RHDHV for 13 years and is responsible for the accommodation of the staff within offices and the development of interesting work environments. For the project in Amsterdam, the interviewee was also one of the initiators of the project. As the director, the interviewee had the responsibility of identifying ways on how to develop and whether the team could influence the process of making the project more sustainable and circular.

Case III: Inspiration House, Waterschap Rijn en Ijssel, Zutphen, Netherlands

The Inspiration House by WRIJ located at Zutphen is developed to receive visitors who come to view the 'Kaumera' extraction installation at Zutphen and to support the story of the installation. The innovative installation in Zutphen purifies the incoming residual water from the dairy industry and uses this as a source for the extraction of raw materials (the Kaumera biopolymer). The unique feature of this project in comparison to the other two is that it started off as a traditional project with no circular ambitions and at a later stage the project wanted to realize circular ambitions. This was done to reflect the function of the installation on the building which was 'from waste flow to raw materials. The project then identified three main themes that needed to realize in the final building, that is the reuse of materials, the use of bio-based materials and energy neutral. The major challenge within the project was that the contracted parties were not selected to specifically keeping in mind the circular ambitions of the project. In addition, the timeline and tight budget added to the challenge of maintaining the circularity ambitions for the project.
For this case three interviews were conducted, one from the consultant's end and two from the client's end who was involved in the initiation phase.

- **Inspiration House, WRIJ: Consultant (Initiation and tender phase), Copper8**

The interviewee has been working as a consultant in Copper8 for more than a year. For the project, the interviewee's role was to guide in setting up the tender process for the construction of that building that serves as a house for the Kaumera extraction keeping in mind WRIJ's ambition in the field of sustainability and circularity. The interviewee took up a second role post the tender that was similar to an engineer to support and solve what was intended initially as the process did not turn out as expected.

- **Inspiration House, WRIJ: Policy Advisor and Process Manager, WRIJ**

The interviewee has been working as a process manager at WRIJ for 4 years. For the project, the interviewee was the initiator for the addition of circular ambitions for the building and was also responsible for the transition agenda of the circular building. In addition, the interviewee is responsible for writing the program for circularity for WRIJ in the upcoming years.

- **Inspiration House, WRIJ: Architect, Schoots Architecten**

The interviewee has been an architect for Schoots Architecten and was the lead architect for the project. The first concept designed by the interviewee was not based on circularity and was more inclined to provide for aesthetics and showcase the use of the Kaumera extracted. At a later stage, circular ambitions were forced into the project that made it a challenge as the interviewee had lost the freedom to design.

3.2.1.3 DATA COLLECTION METHODOLOGY: SEMI-STRUCTURED INTERVIEWS

Of the two methods of qualitative interviews (unstructured and semi-structured interviews), a semi-structured interview is chosen (Bryman, 2012). Semi-structured interviews are preferred as more specific issues can be addressed. Additionally, it is preferred as the exploration involves data collection from more than one case study (Bryman, 2012). A semi-structured interview requires the preparation of an interview guide that identifies the relevant topics. The order of the topics, the formulation of questions and answers are not determined beforehand (Baarda, 2014). To allow for a thorough examination and secondary analysis of the data, all interviews are audiotaped following which they are fully transcribed. The interviews are planned for a duration of 45 to 60 minutes. The interview is divided into three parts, with the first part taking place in the beginning and the second and third parts overlapping each other. Prior to this the research topic and theory of design thinking are introduced with its aspects, to identify through the interview if applying the methods in the initiation would be beneficial. The interview protocol that is used is shown in **Appendix B**.

Introduction:

- What is your role in your organization and what was your role through the project?
- What is your organization's role in the transition towards circularity?
- What is your understanding of circularity in the built environment?

Topics:

- Identification of ambitions
- Identifying the stakeholders involved
- 'Permanent organization' (client) knowledge levels
- Organizational collaboration and ideation process
- The process facilitated to shift from intangible to tangible requirements for procurement purposes
- Events/ activities/ exercises in the initiation phase that led to success/ failures
- Challenges encountered through the process
- Methods of tackling situations of ambition reduction through the process

Reflection on current practices:

- Lessons learned post the process
- Identified possibilities of improvement for the future perspective

The interviewees are chosen by expert sampling, which is a form of purposive sampling as the participants are identified based on their expertise and experience within the field of research (Langford, 2012). As stated earlier the clients and consultants of three different projects of varying scales are taken to get sufficient insight into how the process of initiation is facilitated and what improvements do they require (**figure 14**).

3.2.2 THE DEFINE STAGE

Deriving qualitative data from interviews take the form of a large mass of unstructured textual material that is not straightforward to analyze, unlike quantitative data analysis (Bryman, 2012). In order to provide for some structure, the analysis uses Computer Assisted Qualitative Data Analysis (CAQDAS), using Atlas. ti. The key process is that data is broken down into component parts which are given codes (Bryman, 2012). Codes are generated as and when new topics come up during the analysis of the interviews, instead of identifying categories and codes prior to analysis. This helps the researcher to avoid pre-conceived order of the data and to stumble upon surprises that were initially not seen. The steps followed for the analysis of the interviews are elaborated below.

Step 1

Following the process of 'open coding,' the transcribed interviews were broken down, examined, compared, conceptualized and categorized into data (Bryman, 2012). This process yields concepts that are later grouped into categories. The coding at this stage was done with an open mind to generate codes necessary to encapsulate the data.

Step 2

The following step consisted of reflecting on all the quotations and the corresponding codes assigned to them. It included writing down comments and memos to the established codes. This served as an explanation of why the particular code was established and what is its relation to the other codes.

Step 3

The next step entails for 'axial coding' that is a set of procedures after open coding where data is put back together in new ways by making connections between categories. For this, the themes defined through the analysis of the expert interviews are used to group the codes established through the previous step 'open coding'. Based on the themes defined from the expert interviews, code groups were formed into which the open codes were categorized into.

Step 4

Step 4 entailed the transformation of the categorized data into an organized description. **Appendix D**, provides case wise insight into this description.

Step 5

Subsequently, inter-case analysis is carried out on similar subjects. For example, the initiation process taken up by respondents from the Alliander case was compared to the process taken by the respondents of the other two cases. Best practices along with the tools used were observed, analyzed and highlighted.

3.2.3 THE DESIGN STAGE

The define stage prompted the combination of results to provide a comprehensive list of tools, requirements, practices, issues and suggestions. The analysis of the best practices from the initiation phase that is currently practiced (case analysis) served as an outline for the design of the strategy. The best practices from the three cases are laid out along with the challenges the interviewees phased and the lessons learned by the interviewees during their execution. This served as a base following which opportunities to incorporate attributes of design thinking were established such that it would reduce the challenges and provide a robust process.

The designed strategy is laid along the lines of the design thinking framework. Every section of the strategy is established based on a goal to be achieved, a specific reason the needs to be fulfilled in the initiation phase and pertains to specific design thinking attributes. The strategy is crafted to be used specifically for the initiation phase of built environment projects with circular ambitions.

Following the development of the strategy, tools from the design thinking tools and methods are identified for each section to foster the goal established for that particular section.

The strategy was developed in co-creation with the users (clients and consultants) through the results of the analysis and rounds of informal discussions with the consultants.

3.2.4 THE DELIVER STAGE

Since the research aims to improve practice through analysis, feedback on usability and applicability depends on the expertise and experience of the respondents. Therefore, the process chosen for validation is through an 'expert panel'. For this relevant experts are gathered to share the workability of the strategy from their perspective.

The session is arranged with a multi-disciplinary panel with the highest available experience and expertise. The experts are invited for a three-hour session that consists of discussing the research context and designed strategy. Six experts were invited for the session, out of which four experts were present on the day of the session, in the attempt to keep the number to a minimum to facilitate a corona proof session. The experts ranged from project managers that have worked with circular ambitions, consultants providing advice on guiding projects with circular ambitions and experts who have used design thinking for circular/sustainable product design in the past. The intention is to have a diversity of disciplines to enable a discussion between the experts and gain

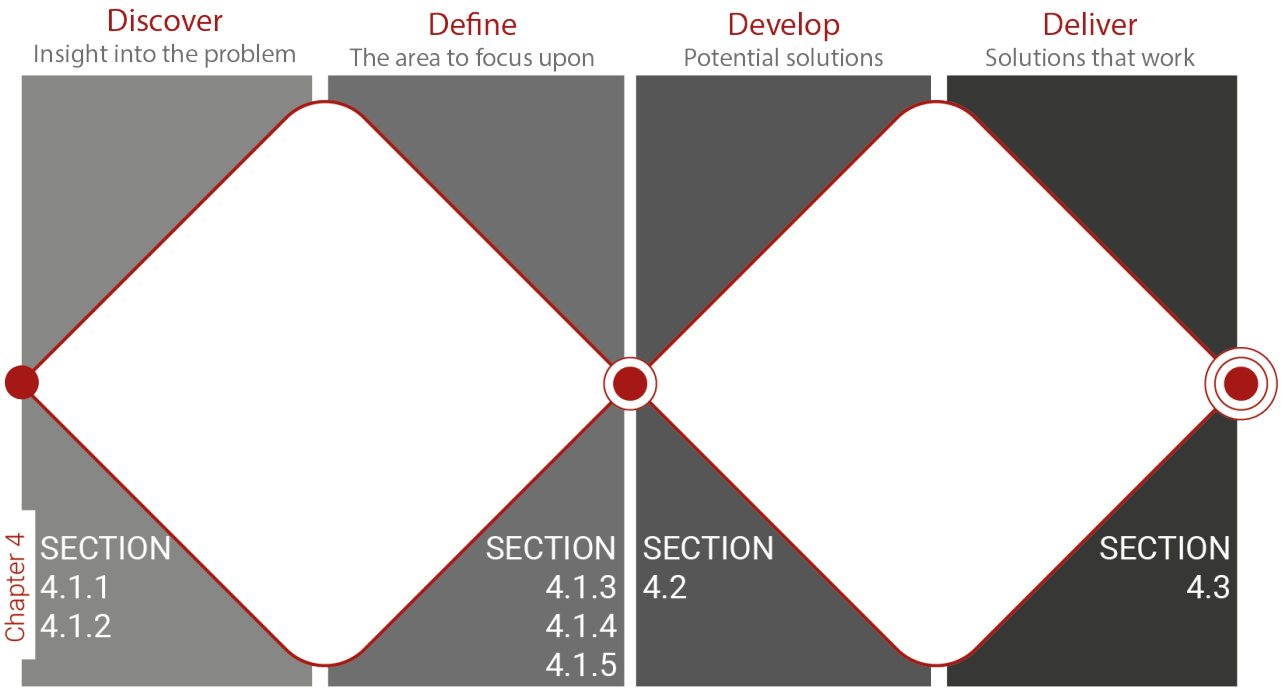


Figure 16: Chapter 4 illustrated over the double diamond methodology (own figure)

a varying perspective from all the stakeholders generally involved in the initiation phase. The experts involved during the validation were not be involved in the research beforehand in order to maintain independence with respect to research findings. The aim of the session was to understand from the experts how they see themselves using the strategy, the usefulness of it during the initiation phase and if according to their expertise there were possibilities of improvement. The validation session was divided into three parts. The first, where the experts were taken through the process of the research until then and how the strategy was designed. The second was to validate each section of the strategy and the third was to validate the usability of the tools selected for each section. The session ended with a conclusion on the feedbacks from experts based on which the strategy was further iterated.

Figure 16 illustrates the structure of the following chapter along with the double diamond research methodology.

Validation Session

4 | RESULTS AND ANALYSIS

In line with the method of the double diamond elaborated in the last chapter, the analysis and results of the interviews are combined in the following chapter to arrive at the designed strategy. This chapter presents the results of the interviews and case studies to gain insight on the best practices, challenges and opportunities of improvements possible within the initiation phase. It would later guide the design of the strategy that aims to incorporate the attributes of design thinking. This chapter is divided into two main parts. The first (section 4.1) answers the fourth research sub-question ***"Which changes and improvements are required in the current practice of the initiation phase of projects to more successfully realize circulars ambitions within the built environment?"*** from the practice point of view based on the cases analyzed. Consequently, section 4.2 and section 4.3 answers the fifth research sub-question ***"Which design thinking attributes can be applied in the initiation phase to provide for a strategy for projects with circular ambitions?"***. Section 4.2 illustrates the development of the design strategy, while section 4.3 details the insights and conclusions from the validation session to arrive at the final validated strategy.

4.1 MAJOR INSIGHTS (INTERVIEW ANALYSIS)

Major insights from the interview analysis are divided into two main sections.

- The first, section 4.1.1 consists of discoveries from the expert interviews which included consultants who guide the initiation phase of built environment projects. These sets of interviews were organized not specific to a case but to get a more general insight taken up by them. Since there is no fixed process or prescribed process that projects in the past have followed for the initiation phase, the expert interviews were used to define themes (the core content of the initiation phase) that the initiation phase of a circular project can be divided into.
- Second, section 4.1.2 dives deep into the selected cases. The cases provide insight into the process followed in their initiation phase which was later segregated into the themes identified from the expert interviews during analysis. The challenges encountered and lessons learned by the team along their experience were highlighted and later used as input to design the strategy.

The following paragraph 4.1.1 characterizes the insights of the expert interviews into 4 main themes along with their explanation.

4.1.1 INTRODUCTION OF THEMES (EXPERT INTERVIEWS)

A brief introduction of the expert interviewees is described below before the interview findings are illustrated.

Expert 1 (CSLT_1): The interviewee has been working as a consultant in Copper8 for almost 4 years. The interviewee has been involved in multiple built-environment developments that aimed to include circularity and sustainability into the project. The period of involvement was during the initiation phase and went on until procurement.

Expert 2 (CSLT_2): The interviewee has been working as a consultant at a Copper8 for almost 2 years. The interviewee has been involved in the initiation phase of manufacturing and construction projects to make a sustainable impact.

Expert 3 (CSLT_3): The interviewee has been working as a consultant at Metabolic for approximately 6 years. The interviewee is involved in the management of the consulting team that engages with cities and the built environment.

Through the analysis of their interviews, four main themes were identified based on which the three case studies can be analyzed and compared with each other. The four themes include understanding the client organization, circularity learning and establishing the vision, identifying opportunities, agreement and feedback. The main concepts of the theme are described below in Table 4. A detailed description of the analysis along with the challenges encountered and activities facilitated corresponding to that particular theme is shown in **Appendix C**.

Table 4: Identified themes in the initiation phase for projects with circular ambitions

THEME	DESCRIPTION	HIGHLIGHTED QUOTES
UNDERSTANDING THE CLIENT ORGANIZATION	For a project with circular ambitions, the focus is required to shift towards the process and the way people work to eventually be able to describe the desires of the end-product. During the first session or interaction with the employees of the client organization, it is prescribed by the experts to **find out about the people**, which includes understanding what is important to them, what is their personal driver, why do they think they are part of the group, what is their connection to circularity and what is the current process followed by them in their work. As part of understanding the client **identifying the 'why'** on an individual level is important. For example, why does the company see the need to add circular ambitions or why does the individual see it necessary in the coming years. Especially with sustainability and circularity the ideas and the team energy comes from the collective why. Understanding these aspects from the organizations-end, assists in **preparing for future sessions** and also **mapping out the internal stakeholders**. For example, there might be some people who are very enthusiastic and open to creative sessions to explore all possibilities, while others who resist the process and are driven through quantities and charts. All of these help in the preparation to understand what the group needs prior, and how can they intervene, anticipate and prepare.	*"The end product is not set from the start. So, in a lot of projects, and that's how I like to do them, things happen that one did not know upfront. But it's always important that one keeps communicating with their clients, about what is the end product they need or what they think is important for them. It's always good to keep one's eyes and ears open to understand what the client needs."(CSLT_2)* *"Especially in sustainability, why people are doing it, the idea and the energy from people comes from the why. People need to be intrinsically motivated to do it. If you can make people understand you're why, the what and how are generally less interesting. The what and the how are generally subject to change. But the why is generally fixed for people. "(CSLT_2)*
CIRCULARITY LEARNING AND ESTABLISHING THE VISION	Before the team decides on which of the circular principles will be incorporated into the project and at which level, the concepts need to be understood among the members to get them leveled. According to the interviewed experts from their past experience in projects, not everyone within the team was well versed with the topic of circularity. The main focus of this actor learning is to **gain insight on circular solutions** and develop an understanding of how the organization can shift from linear to circular thinking. The sessions during this phase by the consultants focused on providing knowledge, experiences and inspiration to the team. Once the team is acquainted with the subject they are well informed to decide on a broad level how it could be applied in their project. This provides the project with a **broad scope** that is required for the transition but also provides room for the expertise and new technology that the stakeholders work together to develop. During this phase, the **themes for the project can be chosen** and can be at a very conceptual level. The team is allowed to dream and go as high as they can with the objectives, not just thinking where they want to go, but also how far can they go. Getting the **vision from the client is the core** here.	*"Most people do not know and they ask consultants because they do not know. So the consultant should share their principles, knowledge and experiences as inspiration before they let them brainstorm because otherwise, it will be much less effective." (CSLT_1)* *"Ambitions are the key factors of the project and that is the hard part. Because normally one needs a lot of time for that part while people are not getting really hard conclusions." (RO_CSLT)*
IDENTIFYING OPPORTUNITIES	To facilitate the transition from intangible to tangible ambitions, **goals are identified that can be integrated into the building system**. This involves developing the functional specifications for the project and not technical specifications so that it provides the contractor with greater freedom to innovate and explore, yet concrete enough to specify in the procurement process. There are two aspects through	*"One then translates their objectives to goals and make it measurable. One does not just say where they want to go, but how far do they think they can go that specific project. Then you can list the range of interventions By taking it through in this way*

	which these tangible goals can be developed. The first being through **the involvement of the end-user** in the process. The second way to devise tangible ways ahead is to **establish smart goals for the themes** that were defined during the vision formation. Before this is done also formulate an understanding of the current state of the infrastructure which is to be developed. Following this, a large number of ideas and goals are collected based on the themes with the participation of experts and project team members. These goals established act as targets to achieve the vague and dreamy vision that would be defined ahead of this. The goals give a list of ideas however from this it is required to calculate the potential impact of each of these and check their feasibility to see if they are implementable or need to be dropped. A large number of goals need to be **brought down to a few and prioritized** to have the right start for the project.	*which is more analytical. What is important is I can show that my goals are realistic and attainable." (CSLT_3)*
AGREEMENT AND FEEDBACK	As part of this theme, a **reality check** is performed with stakeholders to see if they are comfortable with their ambition level and check if they are applicable for the context of the project. It is important that everyone involved so far gives feedback to avoid resistance at a later stage.	*"If there are certain differences in understanding or perceptions, one would want to get that leveled. The ideas are collected interpreted and prioritized to put it down in a memo. This is then shared with the participants to get an agreement for them if that was what they wanted and what they actually felt." (CSLT_2)*

4.1.2 CASE ANALYSIS OVERVIEW

As part of further exploring the initiation process, three cases were identified and analyzed taking into consideration the client and consultant's experience. The following section establishes a comprehensive overview of the process followed by the different cases using the framework of the themes established above. **Appendix D** provides an in-depth description of the process along with the challenges encountered and exercises facilitated for each case.
Each of the cases had its own process however it was possible to divide the process executed into the themes established above that served as central topics for the analysis. An overview of the process executed by each of the cases in correspondence to the established themes is described in **Table 5** below. The cases having different process was seen also as a challenge during the interviews as there was no consistent process available that the organization could use as a guide for projects with similar ambitions. For all the three cases, it was the first time that they were trying to realize a building project with circular ambitions. As reflected by all the interviewees from the client's end, they were aware that they needed a different process to realize these ambitions in comparison to the process taken up for previous projects. The process followed by them previously included specifying the scope and technical specifications that resulted in a tender document that was later used for the purpose of procurement. Individuals from all three cases were aware right from the start that they had to develop a new process as the project proceeded. In addition, they were not able to envision what the end product would look like for the ambitions they had formulated. All three cases had a different start which in hindsight did have an effect on the amount of exploration and level of circularity they were finally able to achieve.

Alliander Head Quarters, Netherlands
The project began with the ambition of developing an 8-storey, BREEM excellent building. However, through the process guided by the consultants which included interviews, brainstorm sessions (world-café method) and involvement of the surrounding stakeholders and end-users they were able to re-define the initial question. Through the consultation, the problem was redefined to state that it was a housing problem and not a building problem. This re-iteration of the problem was crucial in the development of new concepts and influenced the ambition.

Royal HaskoningDHV Office, Netherlands
On the other hand, the RHDHV Office in Amsterdam began with the question of how they could practice what they preached to their clients in terms of sustainability in the real estate. The core team had first listed down a number of ambitions to be achieved through the project. With the onset of the participation of the consultants, they came to the conclusion that the initial ambitions set were too many. Through adding a certain amount of fuzziness and exploration (interviews and analysis) the team was able to relate its main ambition to the mission of the organization. This previously hidden intrinsic motivation was the key to realizing the ambitions.

Inspiration House, Netherlands

Unlike the previous two cases, the Inspiration House project had a very different start. The project began as a development of a regular building without any circular ambitions. The initial design concluded with a visualization of the upcoming building also providing confidence among the team of what the final building would look like. The initial design had already gotten its approval from the stakeholders making it difficult to get the team to think away from it. The opportunity to explore and identify various possible smart goals had gone past. Nevertheless, the process to develop and realize circular ambitions began with a stakeholder scan to get the enthusiasts and decision-makers on board. Following a session on inspiration from past buildings with circular ambitions, the team had to select their preferences. This leads them to develop the vision 'from waste flow to raw materials' which was in line with the purpose of the extraction unit on site. In terms of circularity, this meant re-using elements and components within the new building. Over the course of the project, the time and budget took precedence over the circular ambitions set for the project, which led to the ambitions getting diluted and difficult to achieve. Though the circular ambitions were set for the project not everyone had the same priority and end goal. To forcefully realize the ambitions set calculations were made to see how the current quantities and use of materials can be reduced. An iteration of the initial design was made in consultation with the architect. Further, a list of all the elements and components were made and there were groups of people searching how these can be replaced by a reused component. In addition unlike the other two projects, the ambitions set initially were not used in the tendering stage to find partners who resonate with the established ambitions.

Key takeaways from all three cases combined together include the following.

1. Awareness of an expanded initiation phase.
2. The Initiation phase is of utmost importance to explore and set high ambitions that may not be easy to achieve. However, the high ambitions set creates a spark for innovation through the process. Specifically for the topic of circularity where not all the possibilities and opportunities have been discovered yet. Further, the set ambitions are also to be used to find external stakeholders along the process that align with the ambitions set.
3. Get the vision from the stakeholders as only then will it be owned by them to result in a successful project.

Table 5: Process followed by each case in the initiation phase in correspondence to the four themes established

CASE STUDY	UNDERSTANDING THE CLIENT ORGANIZATION	CIRCULARITY LEARNING AND ESTABLISHING THE VISION	IDENTIFYING OPPORTUNITIES	AGREEMENT AND FEEDBACK
Alliander Head Quarters	**Interviews** to understand the ambitions of people for the upcoming project.	Internal consultation (**world-café method**) with a multi-disciplinary to determine the ambition. Kept the board involved by getting them to facilitate interviews with the stakeholders surrounding the office to understand their ambitions as well.	Understanding the end-user for the 'new way of working' within Alliander through **interviews**.	Reflection among the core team.
Royal HaskoningDHV Office	**Interviews** and analysis of documents to understand why the organization wishes to incorporate circular ambitions.	Learned about circularity through **presentations** given by experts. Discussions with internal stakeholders & end-users to understand their interest regarding personal and organizational propositions through **surveys**.	Determined the required output specifications through a **discussion** with core members.	When the contractor got in, the ambitions were **re-prioritized** to align with the contractors.
Inspiration House, WRIJ	**Stakeholder analysis** to search for people with commitment, open-minded people and people enthusiastic about innovation.	Understood circularity through completed inspirational buildings through a **presentation**. The internal stakeholders **choose 5 concepts** they found interesting from the inspirational buildings, to set the ambitions.	Development of **a list** incorporating the various elements and components that can be reused for the visualization that already existed.	

4. Align the internal organization and instill within them the belief that projects can be realized with these ambitions.
5. Understand stakeholders, their priorities and identify the intrinsic motivations within them.
6. List functional requirements instead of technical requirements. The functional specification in the tender document leaves space for the market to think of new solutions previously not thought of.

4.1.3 BEST PRACTICES FROM THE INTERVIEW ANALYSIS

Through the cases analyzed certain exercises facilitated have been accentuated. These exercises have been accentuated as their facilitation has had a striking influence on the degree of success on the project. Some of these included tools and methods of design thinking but were used not with the aim of applying the design thinking method to the process. While the other exercises do not fall under the design thinking practice but are necessary when trying to realize circular ambitions (example: Circularity actor learning).
The highlighted exercises have been categorized into the corresponding themes as illustrated in **figure 17**. All of them were not executed in one single case. Rather they are put together as a combination of all the three cases. The following paragraph describes each exercise along with their potential, in relation to the themes.

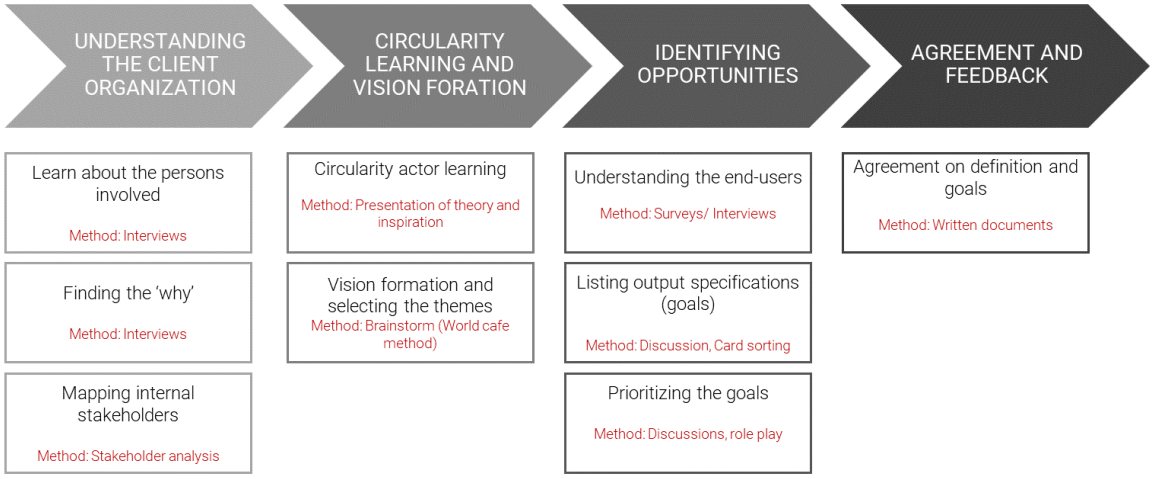


Figure 17: Compilation of best practices from all three cases (own figure)

UNDERSTANDING THE CLIENT ORGANIZATION:

Learn about the persons involved: In the case of Alliander, the process of exploring alternative solutions began with the consultants understanding the client project team better through interviews. The interviews were conducted to better understand the personal ambitions of the upcoming building among the board members, the future residents of the building, sustainability managers, technology managers and the managers that were responsible to develop a 'new way of working' among the employees. The course of the project shifted from having a solution in mind (a new 8-storey building) to a process that diverges further to explore the client organization, the end-user along with personal commitment. Different possible scenarios were later sketched out using this information. In order to create a process that fits the organization, interviews were conducted to get a feeling of what can be done with the team. Sometimes the organization is open-minded and comfortable to go ahead with a creative process. While at other times the organization consists of people who require more structure or proof of the advantages of including such ambitions in monitory terms. Learning about the individuals within the client organization helped to develop the process ahead to prevent them from becoming the biggest break on the whole process. Alliander as an organization was open-minded and focussed on developing the end result through a process. However, this was not a process they as an organization was accustomed to.

Finding the 'why': During the inception of the RHDHV office, there were a number of ambitions listed down by the client organization. However, a strong link with the stakeholders or organization was missing. However, the consultant believed that finding the link was crucial to ensure the ambitions last through the realization of the project. For this the consultant decided to take a step back and carry out interviews to find out the intrinsic motivation of the client organization. Through a lot of talking, interviews and analysis of documents a connection of the ambitions was found

with the mission of the company. The missing link was that the company had a strong mission on sustainability but the question for the project to the market was not in line with the mission of the company.

Mapping internal stakeholders: For the case of the Inspiration house, a stakeholder analysis was conducted to understand the client organization and to form a team that would take part in developing the ambitions for circularity. Through the analysis, the consultants were searching for people with commitment, open-minded people, and people enthusiastic about innovation. In addition to these, they also identified people among the organization responsible for decision making to try and get them as well into the process. The main aim of the analysis was to search for people who would enable the transformation because trying to incorporate circularity into the project is difficult.

CIRCULARITY LEARNGING AND ESTABLISHING THE VISION:

Circularity Actor Learning: Before the teams could make their choice on the ambitions, understanding on the topic of circularity was provided in all three cases. The session consisted of sharing information on what is circularity, what is a circular building, what is the difference between a circular building and circular economy. For the RHDHV office and Inspiration house, in addition to the theory, few inspirational examples were also shown to the teams. Each example was used to explain the different possibilities such as re-use, disassembly, cradle to cradle, etc. All of these were not a 100 percent circular building but incorporated the principles of circularity in many different ways. The inspirational buildings were used to get the team thinking in different directions.

Vision formation and selecting the themes: In order to set the vision and ambitions for the Alliander project, an internal consultation was organized. The consultation was arranged in a free form not having a central assumption of what the final result of it could be. The consultation was formalized to identify the need for the project according to the organization. It was organized for a three-hour session with approximately 20 people, all of whom were experts from the company itself. It was a combination of a bunch of experts that were brought together and this created a new away of approaching the problem. The format for the consultation was similar to the world café setup with drawing boards in every corner of the room. Before the consultation, the project was to build an extra building in addition to the 5 existing buildings in the available free space. However, towards the end of the exploration the housing problem boiled down to a solution where there was no need of building a new building, but that the housing problem could be solved by the expansion of the current buildings. Through the consultation, the aim was redefined to state that it was a housing solution and not a building solution they were looking for. This re-iteration of the solution created the development of new concepts and influenced the ambition.

IDENTIFYING OPPORTUNITIES:

Understanding the end-users: To be able to develop goals that fit with the organization, the RHDHV project involved its end-users through the initiation process. This was done by facilitating a questionnaire to determine the user-profile and their personal choices. The questionnaire consisted of 30 questions for which the employees had to give an answer regarding their current situation within the organization and indicate the extent to which they see that proposition important for the future of the organization. The questions ranged from the opinions on the use of sustainable transport to the level of comfortability in the workplace provided by the organization. It was aimed to understand the current whereabouts of the organization along with establishing those propositions that the employees so important for the future. The result of the questionnaire were two spider diagrams, one relating to the current situation and the other relating to the desired situation.
The Alliander case on the other hand used interviews with the end-users to assist in developing the functional specifications. Through the interviews, they were asked to describe their ideal work environment and were also included in testing groups further on in the process.

Listing out specifications: During the ideation process of the RHDHV project there were a lot of discussions on how to establish detailed goals for the previously identified themes. Through these discussions, the team ended up defining the output specification instead of the input specifications which helped them to proceed further (functional instead of technical).
The exercise of using solutions cards for the purpose of listing out specification was also an interesting method mentioned by one of the experts. This was conducted by having 50 to 100 cards with different solutions along with a few blank ones and the team was asked to pick 8 to 10 cards that they saw as most important to achieve for that particular project.

Prioritizing the goals: An exercise that is often followed by one of the experts to help in prioritizing was role play. Each stakeholder was put in each other's shoes and then according to that person's role they choose the goals. This

allowed them to look at the priorities from a different person's perception. It also helped in leveling individual goals and priorities that are generally aligned to the stakeholder's position.

AGREEMENT AND FEEDBACK

For the case of Alliander constant reflection cycles on how the project is developing was a key factor in realizing the high ambitions set initially. Along with this, agreements and feedback sessions helped to understand each other and check if they had the same view on how the project was evolving.

4.1.4 CHALLENGES AND LESSONS LEARNED WITHIN THE BEST PRACTICES

In hindsight, the cases analyzed had some challenges. Further, the interviewees described ways through which they could have done it better or was a lesson learned by them that they could execute in an upcoming project with similar ambitions. **Tables 6**, summarizes the challenges and lessons learned from the cases analyzed in association with the themes.

Table 6: Challenges and lessons learned through the analysis of the cases

THEME	CHALLENGES	LESSONS LEARNED
UNDERSTANDING THE CLIENT ORGANIZATION	• To find what intrinsically drives or motivates the stakeholders involved (the personal belief and interests of the individuals). • To find a fitting process for the team. • For the involved stakeholders from the clients end to gain trust in the process as they were not equally enthusiastic about a changed process in executing the initiation phase. • A changing team composition. This did pose a challenge for the consultants as getting people enthusiastically involved is a process.	• Align stakeholders at an early stage.
CIRCULARITY LEARNING AND ESTABLISHING THE VISION	• To get the internal organization aligned and install a belief for the project among those who have doubts. • Not everyone within the team was well versed in the topic of circularity. Most of them had a vague outline and knew the basic principle but were not experienced with the details and its practical application. • New and unknown topic. Hence, choosing between options becomes difficult. • To get the vision from the stakeholders as only then will it be owned by them to result in a successful project. • The challenge here is that the stakeholders do not see hard conclusions yet and begin to get weary of the process • To manage the different perceptions and to try and get them leveled.	• Ambition should be intrinsically engraved. • Set a high ambition at the start to spark innovation. The vision along with the ambitions not only provides an aim of the future but also assists in selecting external stakeholders that resonate with the vision. Setting the ambition too high may seem impossible to achieve, but only then will the team be working towards something. • Not be general with the ambition but should be defined such that they are specific to the organization and also fit well. This makes it easier during the execution phase because every decision can be based on 'the why' the project is doing it in a particular way.
IDENTIFYING OPPORTUNITIES	• Identify the end-user preferences. • To see value in including the end-users. • Difficulty in shifting from tangible to intangible ideas. • To get the stakeholders to think away from the initial design or inspirations provided. • To be able to prioritize the goals.	• Ensure the end-users are involved and take into account their suggestions. • Explore all possibilities with no preconceived notions. • Set goals that are realistic and measurable. • Describe the output instead of the input as there are more ways to achieve the output criteria than looking at it from an input perspective.
AGREEMENT AND FEEDBACK	• Different stakeholders have diverse perspectives and goals as stated above.	• Constant reflection cycles on how the project is developing. Check if the team had the same view on how the project was evolving. • Every time a new phase is entered and new people get involved in the project, an explanation of the project from the beginning needs to be given. The reason to do this is that it assists in changing their mindset instead of them just being told what needs to be done. The client is also required to think in their mind and understand what is important to the newly added stakeholders.

The design of the strategy in the following sections aims to combat these challenges and add the lessons learned into the defined strategy for future project use.

4.1.5 OPPORTUNITIES WITHIN THE BEST PRACTICES TO INCORPORATE DESIGN THINKING ATTRIBUTES

Though the cases used design thinking unconsciously, not all the attributes of design thinking were tapped to gain maximum benefit. The following section postulates on establishing further opportunities through which the attributes of design thinking can be captured. In addition, it goes on to explore how these opportunities could reduce the challenges and incorporate the lessons learned. From the analysis of the interviews, tools and methods of design thinking as identified in literature were highlighted. These were then used to determine the attributes of design thinking that were being encapsulated through the process unconsciously. **Table 7**, illustrates a cross-comparison between the methods used and the attributes (according to Table 3) to later establish the opportunities on how the untapped attributes could assist in the initiation phase. The box shaded grey in the table is the attribute that a particular tool provides.

Table 7: Tools and methods used in correspondence to the design thinking attribute it provides

DESIGN THINKING ATTRIBUTES	TOOLS AND METHODS USED			
	INTERVIEWS	BRAINSTORMS	ROLE PLAY (STORYTELLING)	STAKEHOLDER MAPPING
CREATIVITY & INNOVATION				
USER(HUMAN)-CENTEREDNESS & INVOLVEMENT				
PROBLEM-SOLVING				
ITERATION AND EXPERIMENTATION				
INTERDISCIPLINARY COLLABORATION				
ABILITY TO VISUALIZE				
GESTALT VIEW				
ABDUCTIVE REASONING				
TOLERANCE TO AMBIGUITY AND FAILURE				
BLENDING INTUITION & ANALYSIS				

Since the process already captures certain attributes, opportunities were identified within the process through which the other core attributes could be realized. These could help in creating a wholesome process. The process includes the changes required in the initiation phase identified through literature (Table 1), while also trying to nullify the challenges highlighted above. Apart from paving a way to insert the principal attributes, ways to incorporate lessons learned are also thought of in the following section. As illustrated in **figure 18,** opportunity points are inserted to capture the other attributes. These include problem-solving, iteration & experimentation, tolerance to ambiguity & failure and the ability to visualize.

The following section re-works on the process, to provide a structure and provide for maximum exploration required in the initiation phase.

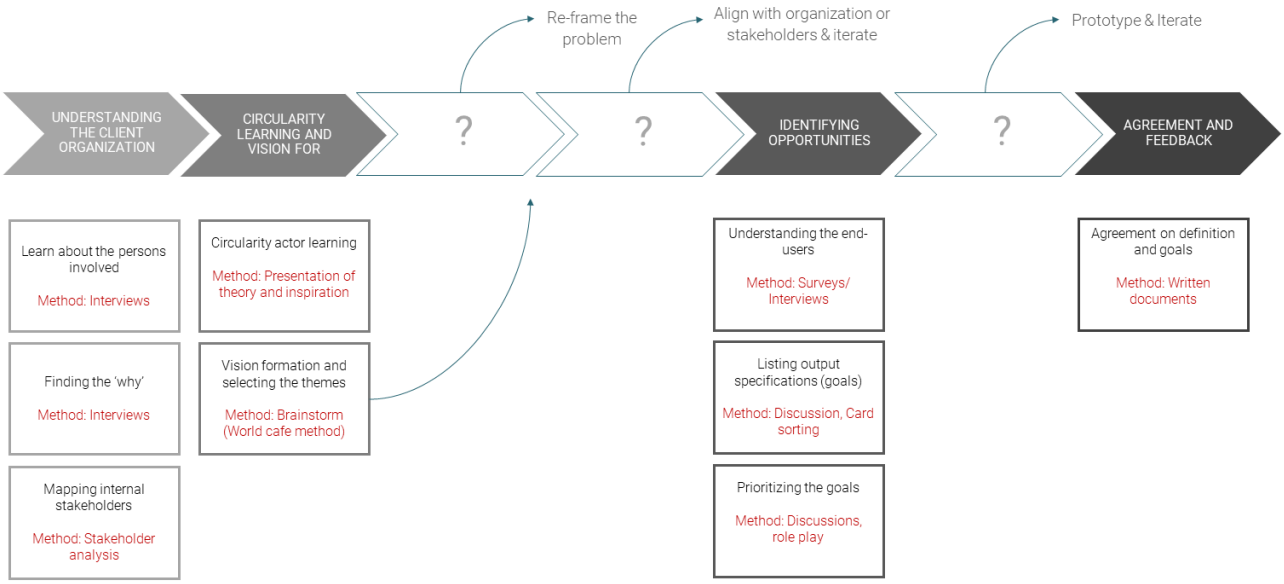


Figure 18: Opportunities within the current practice process (own figure)

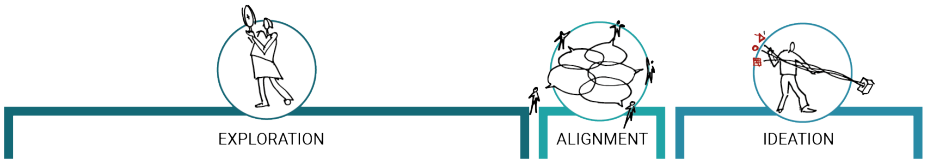
4.2 DESIGN OF THE INITIATION STRATEGY

Together with the inputs from the analysis and the information gathered through literature on design thinking the following strategy was designed. The initiation phase has been improved and further provided with structure. It includes sub-phases of exploring, aligning, ideating, prioritizing and reflecting. They have been listed in a manner to bring in moments of divergence and convergence to the process alternatively in line with the concept of design thinking. In the development of the design strategy the following sub-phases are defined:

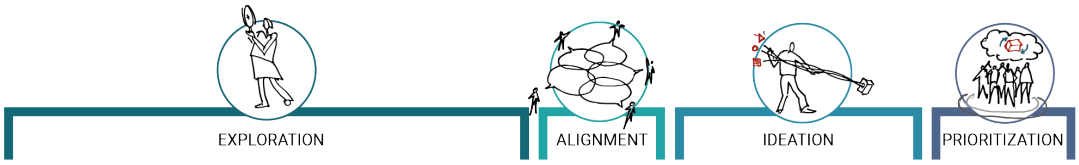
I. The sub-phase of exploration allocates time for the team to understand the problem that is trying to be solved. It provides space and methods not focusing on fixing the problem but to understand and develop it. This includes understanding the actors involved, their aspired values and what do they find important (Dorst, 2011a). Through this process, the organization realizes what and why they find something valuable that leads to a re-formulation and varied perspective to the problem along with the possible solution for it. It grants the team more freedom to explore for a fitting solution. The sub-phase combines the themes (section 4.1.1) of understanding the client organization and circularity learning & vision formation all of which assist in understanding the problem and developing alternative solutions. As a whole, it is established to cater to divergence within the team that could lead to interesting innovations and aspirations.

II. The following sub-phase: alignment, is highlighted as a need from the analysis of the case interviews. In addition, it provides the team space for reflection with respect to the broad ideas thought of so far through the process. "If ambitions of the project aren't linked to some internal ambition of a person then it is really hard to

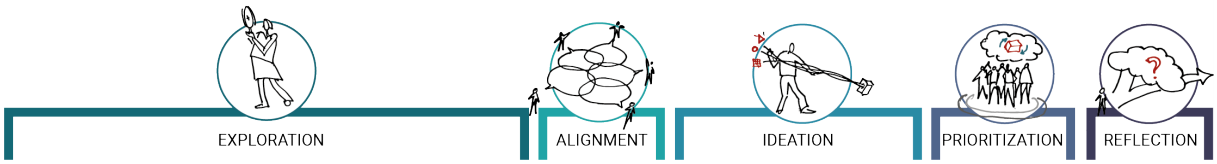
get it in the project. So you have to touch something in somebody to get the job well done." (RHDHV Consultant, 23rd April 2020). With this in mind, the sub-phase provides a point where the aspirations established in the previous phase can be checked for alignment with the aspirations of the individuals involved at the beginning of the exploration sub-phase. Carrying out this check will ensure that the aspirations are realized during the execution phase since it is linked to the people or the organization's goals.



III. During the next sub-phase, the team focuses on generating ideas following the analysis and synthesis of observations made in the previous sub-phases. This sub-phase has been provided in line with the design thinking process and in-line with the requirement established through the interviews. "One then translates their objectives to goals and make it measurable. One does not just say where they want to go, but how far do they think they can go that specific project. Then you can list the range of interventions" (Consultant Metabolic, 29th April 2020). It incorporates the participation of end-users along with the team ideating on smart goals. The focus here is to establish functional specifications instead of technical specifications. The process also allows the team the opportunity to shift from intangible to tangible goals during this sub-phase.



IV. The subsequent sub-phase is established to ensure the ideas gathered in the previous sub-phases are prioritized. A large number of goals need to be brought down to a few and prioritized to have the right start for the project. In sustainability and circularity, the intervention takes place at the cost of something else, hence prioritization of goals based on organization preferences needs to be done to avoid making the project impossible to realize. "The initiation phase is a key factor. When one has 20 ambitions and if they can manage to make it from 20 to 4 or 5 key ambitions then they do have the right start for the project. If it stays at 20 or more or a little bit less then it's all over the place and one does not get anything really good because everything is a little bit."(RHDHV Consultant, 23rd April 2020). This sub-phase has been highlighted as a requirement during the analysis of the interviews. It aims to use the principle attribute of prototyping and experimenting along with visualization in order to assist the team in prioritizing.



V. The final sub-phase is established for the team to reflect on the procedure, work, involvement of stakeholders and if the initial mindset still lives. The reflection and learning step is an integral part of design thinking that captures the attribute of 'tolerance to failure' and 'ability to iterate' if required.

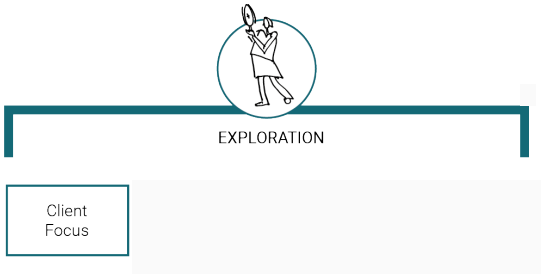
4.2.1 CONCEPTUAL STRATEGY DESIGN

The following sections explain in depth the activities that are to take place within the sub-phases established above. The activities have been defined such that they assist in fulfilling the purpose of that particular sub-phase. Each of them has been explained below along with the goal of that activity, the purpose it aims to achieve and which attribute of design thinking it captures. Further, for each activity, certain design thinking tools have been selected. The explanation of these tools is provided in Appendix E. The designed strategy is later validated with experts from practice in the following section. Inputs from the validation session are used to re-iterate the strategy using the suggestions from experts to result in the final initiation strategy. Through the design process, there are some activities that were already practiced in the cases analyzed and were highlighted in section 4.1.3. However, when a new activity is introduced into

the process as explained below, the activity is shaded. The initiation strategy incorporates the following activities in correspondence to the sub-phases:

EXPLORATION | CLIENT FOCUS (USER)

Similar to the beginning of the frame creation this activity focuses on a deeper analysis of the stakeholders involved from the client organization. These include their needs, motivations and experiences.



Goal	The goal here is to get an insight into the priorities of the stakeholder. Their personal drivers, the current process followed in work and their connection to circularity. Further, the aim is to understand from them about 'why' does the company/ individual see it necessary to add circular ambitions and why is that particular individual necessary to be part of the project team. These detailed, human-centered observations help to identify the right stakeholders from different departments required for collaboration based on their role and task. Consequently, the innovators (those comfortable with taking a risk with the altered approach), the adopter (those who make things work) and decision-makers are highlighted to be involved through the process.
Why?	To develop a suitable process, understand the intrinsic motivation and to identify the stakeholders to be involved or kept in contact through the course of the project.
Design thinking attribute	Human centeredness (Empathy) Interdisciplinary Collaboration
Tools selected	Explorative interviews, empathy map, Ask 5X Why, Context mapping, Stakeholder map, an Ecosystem map

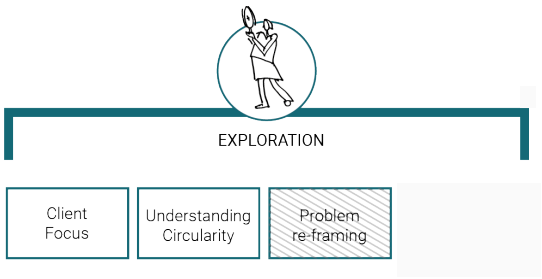
EXPLORATION | CIRCULARITY CONCEPT UNDERSTANDING

To tackle the challenge of getting the team equally well-versed with the topic and to develop a belief this activity is consciously provided for. Subsequently, the team is more familiarised with the topic on an equal level to be able to make choices together in the later phases.

Goal	The goal is to provide knowledge, experience and inspiration to the team. Through the process, the belief within the team regarding the subject and the possibility of achieving it is also raised. The possibility of completing a project with circular ambitions within time and budget is also highlighted through examples.
Why?	To get the concept understanding among everyone leveled and for the team to understand all the possibilities. The team will then be able to make choices among themselves and all aspire for goals that they were early not aware of the possibilities of achieving them.
Design thinking attribute	Ability to visualize and learn
Tools selected	Circular flows theory, Inside out Application (not design thinking tools)

EXPLORATION | PROBLEM RE-FRAMING

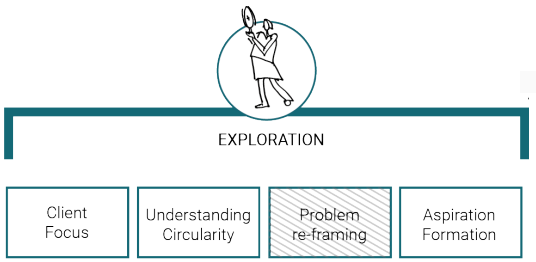
This activity aims to capture the core of design thinking to find a solution that actually solves the problem situation. Following the understanding of the problem and the nature of the stakeholders involved a solution that synthesizes the problem is explored (Heintz et al., 2015).



Goal	To identify the 'need' through the process of exploration and delve into the possible solutions. Since the team is familiar with the possibilities of circularity and the varying levels, the team can explore other possibilities that were earlier not considered.
Why?	All computations and combinations need to be explored in relation to the problem. It is focused on analyzing the problem while developing various solutions to provide for the searching and experimenting nature inherent in design thinking in contrast to choosing between ready-made options as presented.
Design thinking attribute	Abductive reasoning Gestalt view Problem Solving Ability to visualize Experimenting and iteration
Tools selected	The problem statement, how-might we, Visualization of the current process, Mind Map

EXPLORATION | ASPIRATION FORMATION

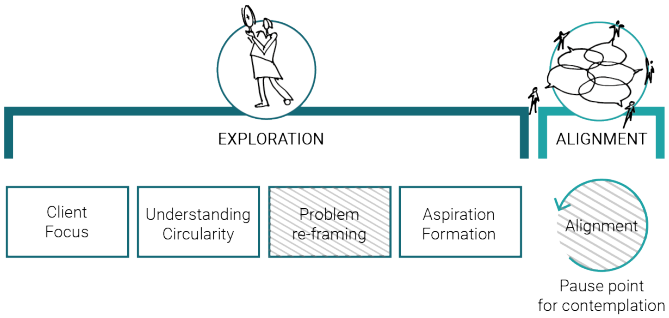
It provides the space and drives required to raise the team's ambition. It allows raising the client's ambitions as sometimes the clients are not familiar with or confident with all the possibilities. Provides a space for the stakeholders to formulate ambitions greater than they thought they could. The attribute of visualization assists in interpreting people's pre convictions and heightens ambitions.



Goal	To be able to dream and aim for as high as possible without being restricted by practicalities. Through the process, the ambitions and objectives are explored. Lastly, the aim is to develop them by the stakeholder to create a sense of ownership.
Why?	At this point, the project is still in its initial development and has the ability to assimilate the vague ideas of the stakeholders. In addition, high aspirations are set to spark innovation through the project. It also serves as guidance to analyze stakeholders required to get involved in the project by looking out for similar aspirations among the external stakeholders.
Design thinking attribute	Creativity and innovation Ability to visualize Tolerance to ambiguity
Tools selected	Storytelling Design Principle, Vision cone, Synthesis wall

ALIGNMENT

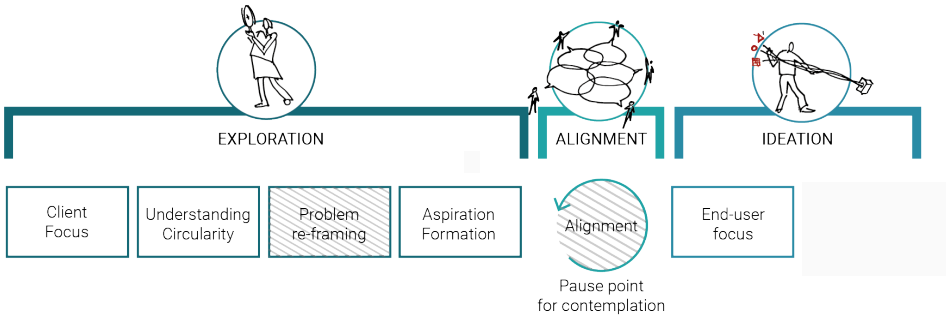
A conscious space to provide for alignment was not practiced previously. However, was seen as a requirement during the analysis of interviews. It provides the team a moment for reflection in conjunction with the solution and aspirations being explored.



Goal	To analyze the alignment of the solutions and aspirations developed with the desires of the stakeholders and organization that were observed during the client focus step. This ensures that the team and its member are in alignment to avoid resistance at a later phase of the project.
Why?	To reconfirm the alignment of the aspirations with the organization or individuals. This ensures that circularity aims are still a priority and would not be dropped in the future when budget and planning could take priority over the project realization.
Design thinking attribute	Iteration Gestalt view Interdisciplinary collaboration
Tools selected	Emotional response card, Define success, Issue cards, Offering Map

IDEATION | PROJECT USER FOCUS

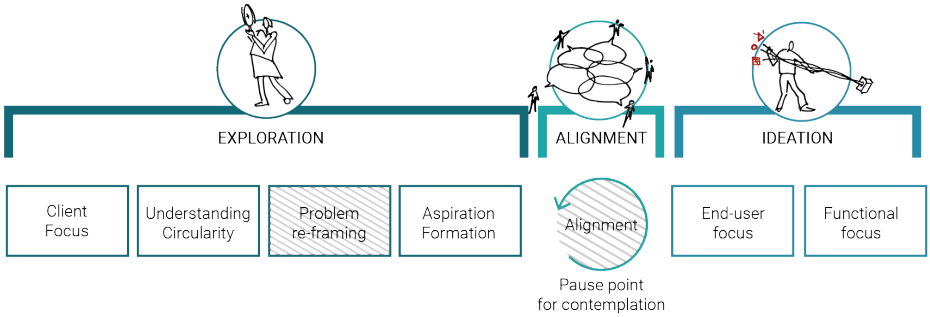
Ideation allows one to shift from intangible to tangible goals. Through the analysis, there were two projects that insisted on involving end-users at the same time and were also reluctant as they could not see value in including them in the initiation phase. However, client end interviewees from the RHDHV case reflected on the project and realized it would have been beneficial if the end-users were included way ahead, so they (the end-users) see value in the final project.



Goal	Understand end-user priorities, their existing conditions, problems and how they envision the project. This could also help with establishing functional specifications.
Why?	To specify qualitative aspects, understand the context and for the end-users to see value in the final project.
Design thinking attribute	User-centered Involvement Visualization
Tools selected	Explorative interviews, empathy map

IDEATION | FUNCTIONAL FOCUS

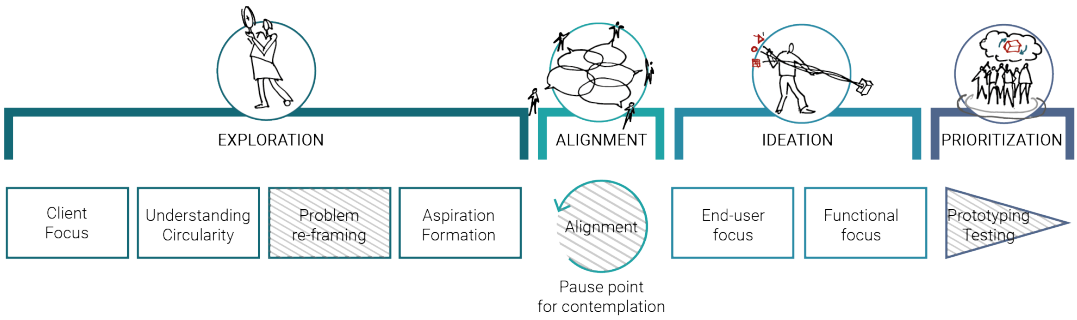
Establishing functional goals allows for innovation and iteration at a later stage.



Goal	Set tangible, smart, context-related goals for the aspirations set. To be able to generate a large number of ideas without any pre-conceived notion.
Why?	To have concrete ideas to achieve vague aspirations.
Design thinking attribute	Creativity and Innovation Ability to visualize Interdisciplinary collaboration Gestalt view Tolerance to failure
Tools selected	Brainstorm, System map to highlight opportunities, Card sorting, Roleplay

PRIORITIZATION

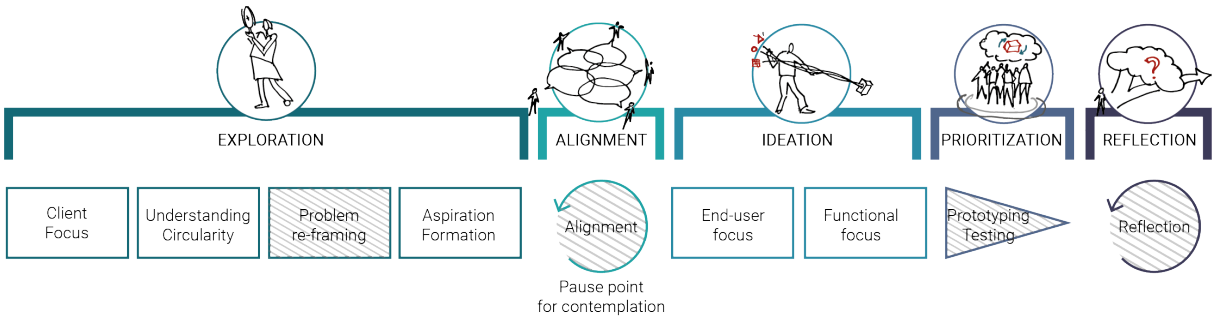
This activity captures the prototyping and testing attributes of design thinking into the process.



Goal	A large number of goals are brought down to a few through feasibility, tests and alignment with the intrinsic motivations among stakeholders and end-users,
Why?	In circularity, the intervention could take place at the cost of something else. Prioritization based on the organization or individual preferences assist in having it impossible to realize. Further, it also focuses on a few goals to realize them well, instead of it being all over the place.
Design thinking attribute	Iteration and Experimentation Blending analysis and intuition
Tools selected	Solution interview, Evaluation matrix, Issue card, Filed experiment, Testing with internal and external stakeholders, Exploration map

REFLECTION

The reflection and learning steps are an integral part of design thinking that captures the attribute of tolerance to failure and the ability to iterate if required.



Goal	Reflect on the process, the involvement of stakeholders and mindset.
Why?	To keep improving through the process and also make sure the stakeholders are aligned including their perspectives taken into account. Helps reduce resistance during execution.
Design thinking attribute	Gestalt view Iteration Tolerance to failure
Tools selected	Lessons learned, Roadmap implementation

The practice of the initiation phase so far took place in a linear fashion. However, the essence of design thinking lies in its ability to iterate and be flexible. These have also been requirements established by previous research to be incorporated within the practice to realize circular ambitions. Flexibility provides the user with the possibility of going back and front according to needs. Further, it allows the team to go back to the previous activity when the team changes or when new stakeholders are added. The interview analysis highlighted this as a lesson learned by the completed projects. It provides the newly added stakeholder equal ownership of the process and end-result desired.

To capture this essence and highlight it, the activities established above have been consciously re-illustrated. The loop is sketched to focus on the feature of flexibility and iteration through the process, every time a new possibility is discovered.

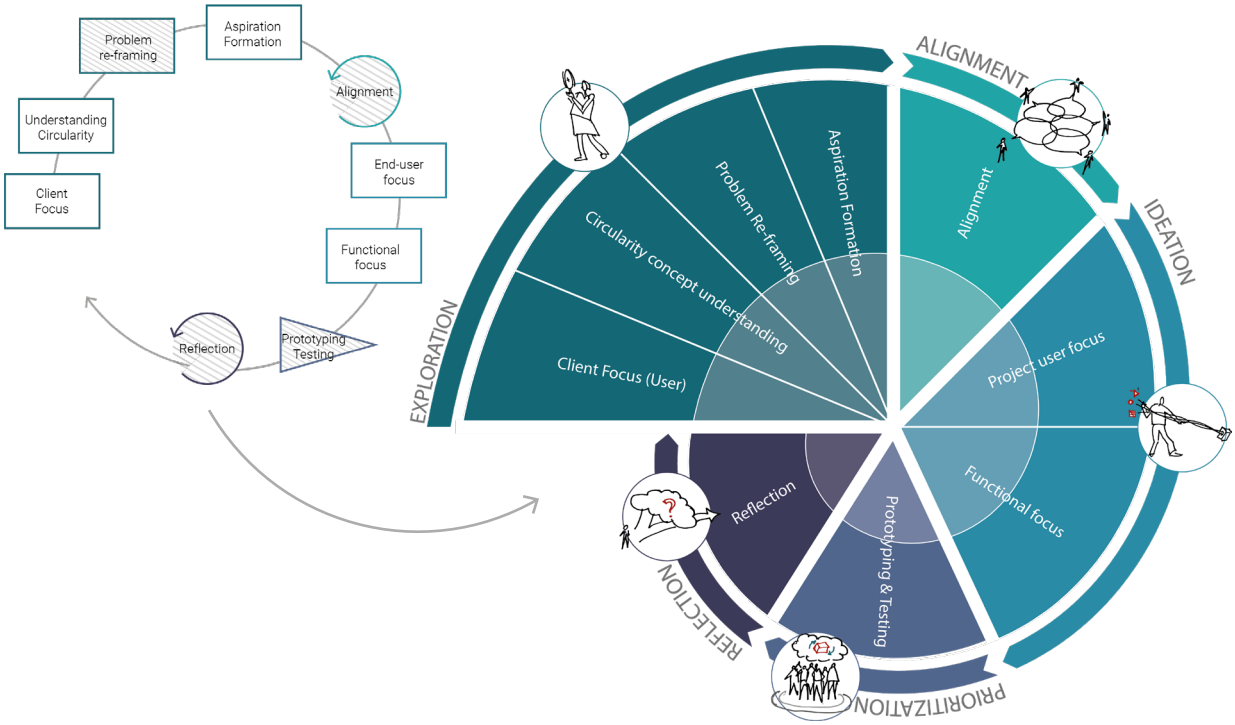


Figure 19: Conceptual strategy designed for the initiation phase of building projects with circular ambitions (own figure)

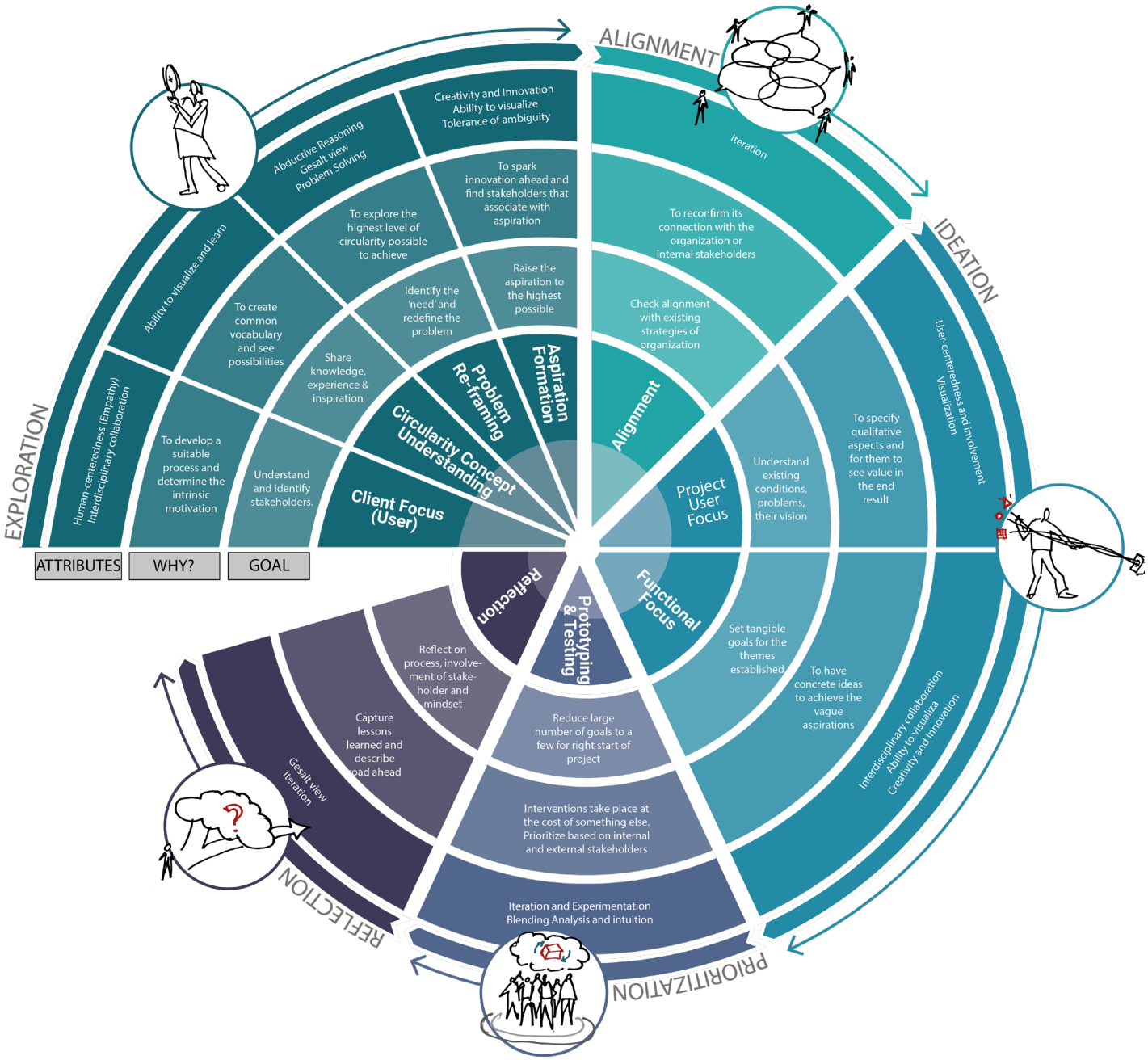


Figure 20: Conceptual initiation strategy explaining the goal, the reason and the attribute of design thinking that each activity captures (own figure)

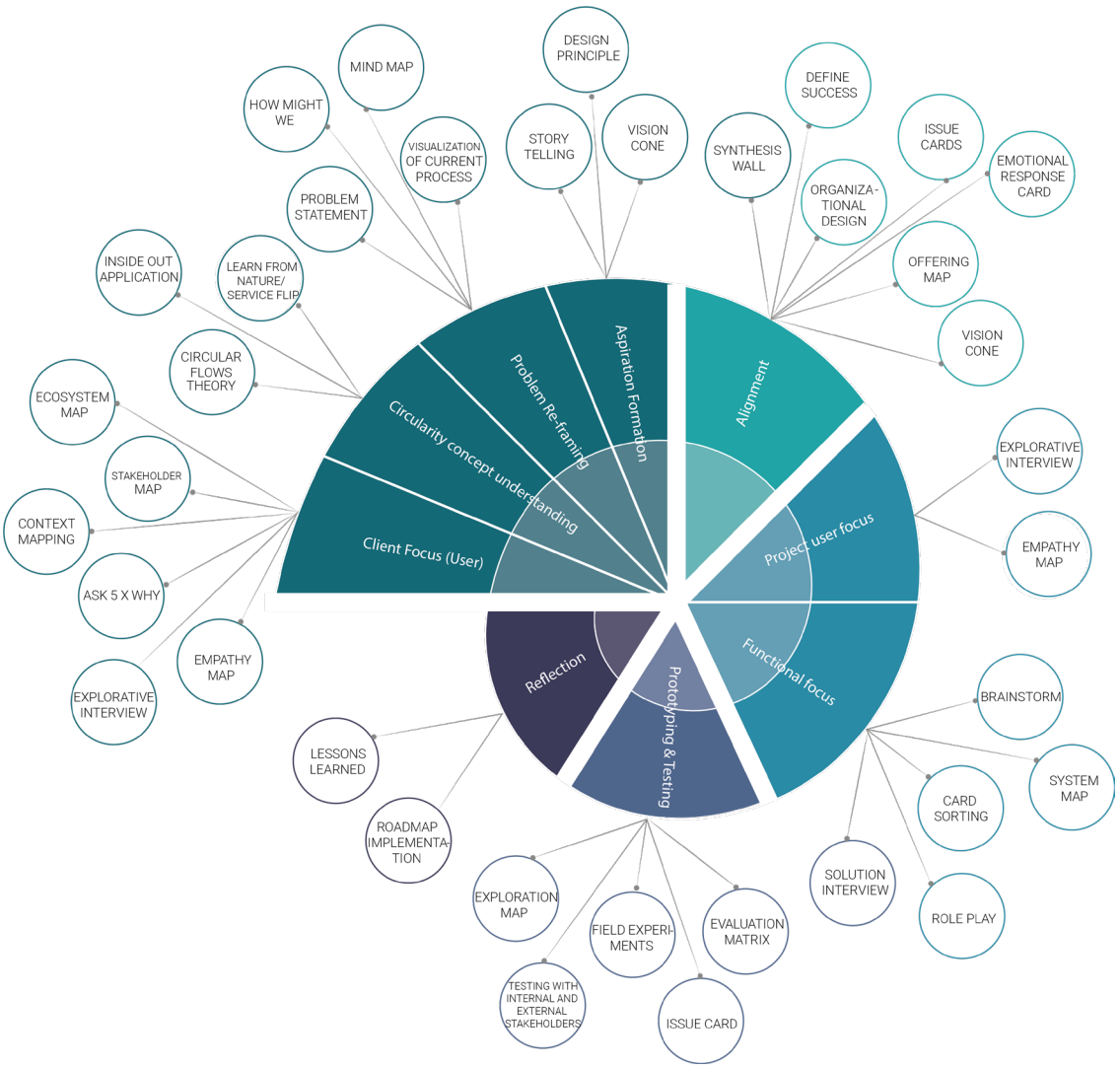


Figure 21: Initiation strategy along with the potential design thinking tools that can guide in establishing the goal for an activity (own figure)

4.3 VALIDATION OF THE DESIGNED STRATEGY

As part of the last phase of the double-diamond method and owing to the orientation towards practice, the concluding step of the design process included a validation session with experts. Following the design of the strategy, a session was organized with experts (in person) to provide feedback on the novelty, applicability and feasibility of the designed strategy. The process and feedback received have been elaborated in this section.

The logistics and experts involved in the session are detailed out in section 3.2.4 (The Deliver Stage). The session began with presenting the research context and explanation of the designed strategy. Consequently, the validation of the whole strategy took place in two phases. First, the sub-phases along with their activities were validated. Secondly, the tools that were chosen from the design thinking tools were validated. To conclude the session, the major potentials and scope for improvement were conclusively agreed upon by the experts that attended the session.

For the first section of the validation process, experts were given individual handouts through which individual feedback was gathered. Each of the experts was to provide their evaluation for each of the activities illustrated. An open discussion was facilitated subsequent to them filling in the handouts. During the open discussion, each expert had to go through their top three challenges following which the researcher along with the experts cohesively ideated on ways to overcome the challenge. Major potentials within the design were also highlighted during the open discussion. In general, the experts were expressive and debated with each other regarding the challenges and potentials which was beneficial for the research as it provided for enhanced iteration. The handout that was given to the expert to fill in along with their feedback (formatted in the form of a table) has been attached in **Appendix F**. **Table 8,** gives an overview of the outcomes for the first section of the validation session.

Table 8: Overview of outcomes of the validation (conceptual initiation strategy)

SUB-PHASE	ACTIVITY	HIGHLIGHTED POTENTIALS	CHALLENGES	SCOPE FOR IMPROVEMENT (VALIDATION)
EXPLORATION	CLIENT FOCUS	• This can lead to some magical findings and also help with building trust with every single person interviewed including trust within the team members. • A focussed search for intrinsic motivation is interesting. • Stakeholder mapping is important to connect interests at the point and avoids a clash later on the process.		• Functional and project user focus occurs too late in the current process. Specifically during aspiration formation, if the project group remains as the project group they begin to ideate in a technical direction. Therefore to add spark and energy in the project group the preliminary understanding of the dreams and aspirations of the end-user is necessary to spark functional thinking. It sets off a different perspective for the exploration phase. It becomes difficult for the project team otherwise to think away from technicality. • Try to incorporate a way such that all stakeholders are involved in understanding what the needs are. They include needs from end-users, suppliers, government, etc. If the are people involved from the different layers and understand the needs, personal expectations could be dropped. So take the process in a way that it is done in collaboration and co-creation. The idea of co-creation is that every stakeholder has a valuable perspective to add and it ís not that the problem is re-framed following which there is a need to convince others. • It needs to be acknowledged that everyone in the project team is accustomed to a particular way of working. Hence, adding a step to design the process in the exploration phase would help in a gradual transformation to working with an altered process. The boundary conditions could be set using the designed strategy, e.g. it needs to be human-centered, focus on the end-user. • A pause point for alignment following problem re-formation is necessary. It could be that alignment is seen as a continuous process. If the changed scope is not aligned with the stakeholders within the organization it would be difficult to proceed.
	CIRCULARITY CONCEPT UNDERSTANDING	• Creating an understanding of the topic helps to bring the stakeholders involved on the same level in terms of knowledge of the topic. • Necessary and can be used to align stakeholders.	• Showing the team one particular direction could lead to influences in the outcome (confirmation bias).	
	PROBLEM RE-FRAMING	• The process of exploring the problem is interesting. If everyone in the team gets a sense of the problem then the job is almost done. Normally there is a solution, but an exploration into the problem and behind the problem, what the needs are is often missed at the starting point.	• Re-framing the initial problem in an organization can be politically sensitive and it also depends on the stakeholders involved in the process. In the case of people with power being married to the initial solution, reframing can be sensitive and might hurt their ego. • Depends on who is on-board in the project and where the interests are. Problem re-framing can have a lot of impacts but might need some extra work on getting everyone on board (which is in the model but not until alignment).	
	ASPIRATION FORMATION	• People most often are not the best at envisioning, they stick to what they know or what they have seen. A very powerful potential in this step is here when people can start seeing alternative reality and bring in the difference. A point where everyone can open up.	• Challenge however is that a lot of people still 'dream' in technical ideas 'what' and that it might be sparking some more functional dreams to add user's wishes and experience (step ideation) to fuel the aspiration from a functional value perspective. • Risk of dreaming too long.	
ALIGNMENT	ALIGNMENT	• Has the potential of ensuring organizational commitment towards aspirations.	• Existing strategies should not determine which innovation should be introduced as innovation always clashes with existing strategies and policies.	• Need not be the only alignment with existing strategies but can also be aligned with envisioned strategies or with the ambassadors who are trying to push for change. It requires emanation power or a motivation to deviate from previous methods of working and their outcomes. Thus, this can be found with individuals or within the mission of the organization. Should be made a continuous process as it captures the sense of co-creation.

IDEATION	PROJECT USER FOCUS	• A positive addition to the process. User focus ideology connects functionality with ideology.	• Finding the connection between end-users and circularity. For example, tenants of social housing at the moment do not choose a house based on circularity.	• Begin understanding these views in the aspiration formation sub-phase. This has the potential to bring in perspectives that were not thought of earlier.
	FUNCTIONAL FOCUS	• The functional focus could help to get to think away from technical details and directly thinking of a solution. • It is a key factor that could ensure the final product is used in a long run. • Tangibility helps people understand.	• Losing focus on real needs.	
PRIORITIZATION	PROTOTYPING AND TESTING	• One of the most important steps. There are a lot of projects that end-up piling ambitions without thinking of the consequences and pushing those difficult decisions in the operational phase. Towards the realization phase, the ambitions change. Then the blame is on the execution however it could have been tested right at the start and choices made in the beginning accordingly. • Reducing goals helps create focus.		• Low-fidelity prototyping can be added right after aspiration formation. • Could also be viewed as a continuous activity.
REFLECTION	REFLECTION	• A core attribute of design is called "reflection in action". A reflection mindset is needed during the full process.		• Reflection needs to be brought forward or even highlighted as a continuous process.

Although some alterations were highlighted during the session to the strategy, the experts indicated that the captivating aspect of the designed strategy was how the process of design thinking was mended along with aspects of the construction industry and circularity. The strategy developed can be used as a starting point for organizations that aim to incorporate circular ambitions in their projects for the first time, and hence supports a circular economy on a meso level.

4.3.1 ITERATION OF THE INITIATION STRATEGY

At the end of the session, the final alterations required were highlighted and discussed with the attendees to reach a cohesive conclusion.

- The first modification was to add an activity of understanding the end-user during the exploration sub-phase. This suggestion has the potential to add a new perspective and assist the project team with problem re-framing.

- Secondly, a moment for the project team to create the process ahead. The strategy can be used as a reference that covers all necessary aspects, while they decide their own process ahead. Forcing a process among people who have not created it could lead to resistance.

- Thirdly, from the point, the team is formed (consisting of stakeholders from different layers) all activities take

place in collaboration. Doing the process in this manner will help every stakeholder understand 'the needs' and choices for the best fit solution will be made in co-creation.

- Fourthly, aspiration formation is to be combined with prototyping (low-fidelity) to avoid a huge pile of aspirations that become difficult to realize in the execution phase.

- Lastly, a reflection which is a core attribute of design thinking should be highlighted as a constant step that takes place after each step. This provides the team with a pause point to reflect if the solution prescribed relates to the question in hand, to ask the right questions (why do we need this, what are we here for) and practice 'reflection in action' along the process.

4.3.2 FINAL DESIGNED STRATEGY

Figure 22, illustrates the final strategy, incorporated with the modifications prescribed in the validation session. The modifications were suggested to make the strategy distinct and for it to be able to capture the desired result when it is applied in practice.

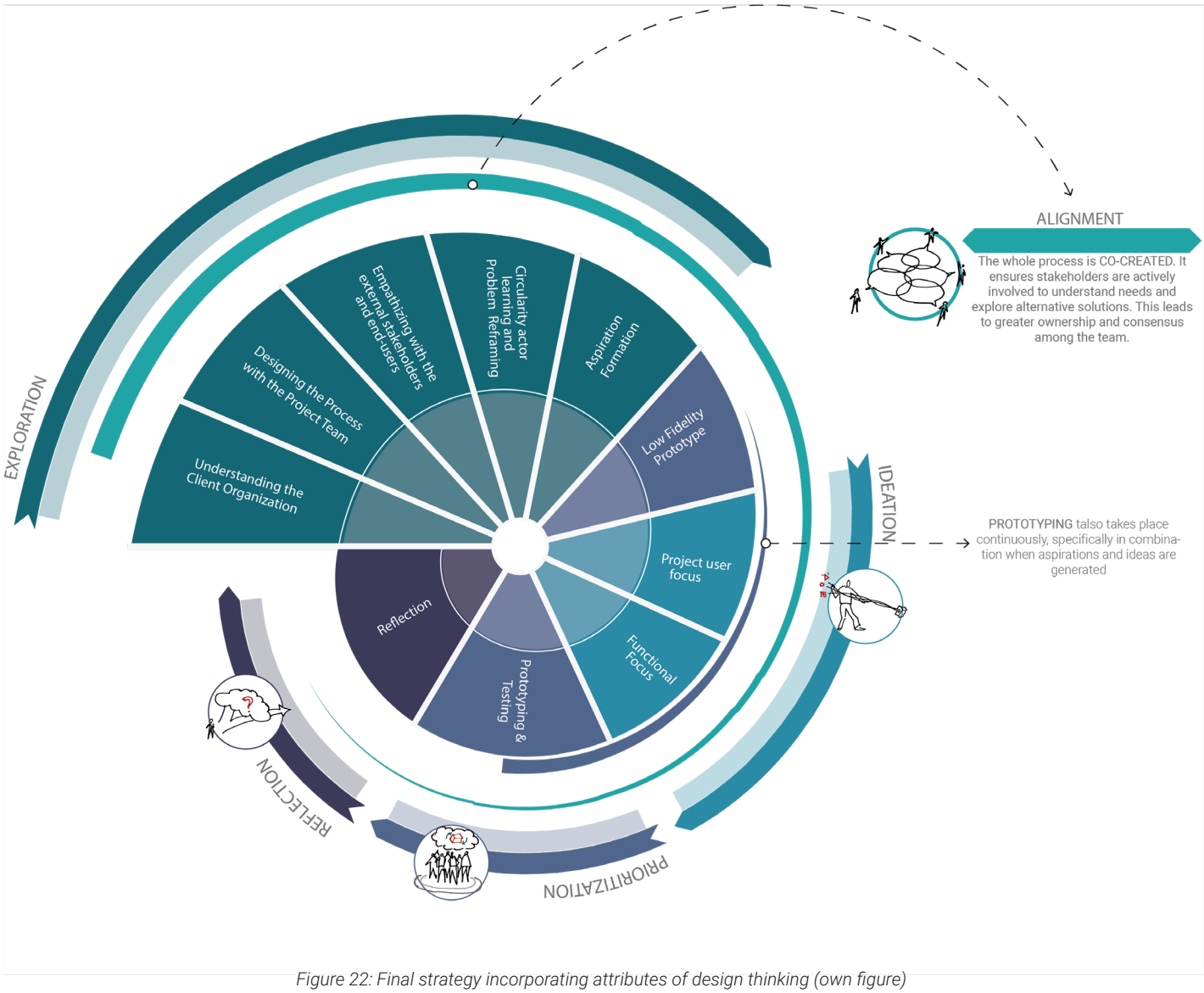


Figure 22: Final strategy incorporating attributes of design thinking (own figure)

5 | DISCUSSION

In the previous chapter, a strategy was designed for the initiation phase of buildings with circular ambitions that also incorporates attributes from the design thinking framework. Since the research is practice-oriented, this chapter discusses the implication of the designed strategy for both practice and science. Section 5.1 lays out the scientific implications of the research, while section 5.2 elaborates on the practical implications of the research.

5.1 SCIENTIFIC IMPLICATIONS OF THE RESEARCH

The research began with a gap that was defined as follows: "There lacks a commonly accepted strategy which provides for understanding, exploration, ideation and experimentation to realize shared understanding and ambitions that is necessary to incorporate circularity in the built environment. Further, there has been no post-hoc evaluation and learning from the methods tried in previous projects". Following the completion of the literature review on the initiation phase of buildings with circular ambitions, this statement can be confirmed. The body of existing literature highlights the features of change required and certain challenges. However, a combination of all the changes required and developed as a structured process with detailed activities that are required to take place has been non-existent. In addition, in-depth documentation of the process followed in the initiation phase of both successful and relatively successful projects has not been done previously. The term in-depth is used to highlight activities such as the workshops, interviews, surveys and sessions that were conducted to formulate and realize the circular ambitions. Besides, not only was the process documented but also the challenges and lessons learned through their interviewee's experience were extracted from the interviews. The challenges documented through this process overran those that exist currently in literature and also highlight other aspects that earlier have not been looked into. The research through documentation has thus contributed to the knowledge gap and is novel. It is considered novel in the sense that it is the first to provide an overview of the process, challenge, lessons learned along with insights into the exercises which have had a striking influence on the degree of success on the project.

Further, past literature has pointed out to design thinking as an approach for developing innovative solutions to sustainability challenges and to set the scope (Buhl et al., 2019), while some have used design thinking to develop circular business models and the innovation required for it (Guldmann et al., 2019) (Nancy Boken). However, the opportunity to leverage the initiation phase of projects with circular ambitions by applying design thinking was under-examined which is fulfilled through this research. In addition, design thinking is not a rigid process but a framework that integrates creative and analytical modes of reasoning, as well as various hands-on tools and techniques (Liedtka, 2015). As a result, it cannot be directly applied and requires interpretations in order to translate scientific insights into a process for another domain. These interpretations required for the application of design thinking in circular building construction were established through this research.

The research serves as a starting point to bring together a relatively fast and newly developing topic of discussion 'the circular economy in construction' and the tested and proven technique (to develop products that were earlier unknown) of design thinking. For future research, there isn't a need to re-invent the wheel to see the potential of the topics together. Instead, it can be taken forward to improve its applicability it practices through iteration cycles that would add to the body of literature. While this is carried out research providing comparisons on quantitative terms can also be performed to determine the extra or reduced effects of cost and time on using the developed strategy.

5.2 PRACTICAL IMPLICATIONS OF THE RESEARCH

The research is oriented towards practice aimed to fill the gap of not having a structured process at the initiation phase for projects that aim to incorporate circular ambitions. In order to fill this gap, semi-structured interviews were conducted in connection to three projects that have already realized circular ambitions within their projects. Both the client and consultant perspective was understood to establish the process that has been taken up by projects in the past. Through insight into what has been done a strategy was developed that incorporates design thinking attributes and can be used by both clients & consultants for future projects.

The strategy designed combines the best practices (from the cases analyzed) and the design thinking attributes to establish a structure that provides an answer to the changed approaches required at the initiation phase that were highlighted in the literature. The strategy provides details for application to the very minute detail. It is considered exemplary in the sense that it develops from broad sub-phases to activities that further have tools picked out to achieve the goal of the activity as well. Further, an explanation of the tool, the reason for that particular tool being chosen from the vast options of tools available and how to use it to the tool is also established. On the level of sub-phases, the sub-phase of exploration is what captures the core of design thinking and for the team to be able to ideate solutions that were earlier not given heed to. In foresight, it warns the team, to begin with, an open mind and go through it focusing on the 'needs' of all stakeholders involved and listening to the intrinsic motivations as this would help to avoid the drop of circular ambitions at the later phases.

APPLICABILITY OF THE DESIGNED STRATEGY IN PRACTICE

For its application in practice, the following paragraph first highlights the challenges that it tries to solve that were earlier inherent in projects and the cases analyzed. Previously, one of the main challenges faced by project teams was not knowing ahead what will be the process they should facilitate. They are aware of the fact that if they use the current existing linear process they may not get the best and most innovative outcomes from the team. The strategy established through this research deals with this challenge as it provides for better clarity regarding the tried and best practices that were carried out in previous projects. Applying the process or using it as an overview to create their own saves the team the 'trial and hit' approach that they were previously experimenting with. The design strategy in other words provides a leap from chaos to structure. If this were available at the start of the projects that were analyzed it could have reduced the confusion and levels of uncertainty at the start in terms of the process to be carried out. Further, it was mentioned by the interviewees that they had trouble convincing people to participate in the process and gain the trust of the board members as there was no clear sight of what the approach for the initiation phase was going to be. Participating individuals and board members were asked to follow blindly. The final strategy mitigates these challenges as the team now has a guideline at least, even if they do not plan to execute all of the steps. In addition, time spent on trying certain exercises and then going back to try something else as that probably did not work, can be erased. The project manager can use this to plan ahead and is forearmed with the key activities that have the potential in affecting the degree of circularity in the final result.

Other challenges that the strategy aims to mitigate are described ahead. Firstly, the challenge of not being able to truly understand what the stakeholders feel. This is reduced through the attribute of human-centeredness and the ethnographic tools (through empathy) provided by the design thinking framework. This also reduces the trouble in identifying the key inputs and values from the end-users. Secondly, the challenge of managing different perceptions could be reduced when everyone involved believes and participates such that the process unfolds in a co-created manner. Thirdly, the conscious moments provided to re-think the problem and aspiration formation can assist the involved stakeholders to think away from what is already known which was a challenge previously. When those activities are practiced in conjunction with visualization (simple sketches and storyboard) the options developed can be further enhanced. However, an activity such as problem re-framing though beneficial to reach the highest level of circularity possible could create ego clashes within an organizational setting. The research presumes that this challenge could be eased if, (1) the team consists of stakeholders from various layers of the organization (2) everyone involved is not focused on the implicit expectations of the outcome of the project but instead re-focuses on what the needs are. This way everyone shares the common understanding of what needs are and people can thus let go of their own expectations better.

Through the validation session and self-reflection of the researcher, certain aspects to be aware of for the application of the strategy in practiced were detailed out. To begin with, it is not recommended to forcefully push the application of the process for a project as that could lead to resistance from the stakeholders towards the strategy. Subsequently, the application of the strategy is highly contextual and greatly depends on the people involved and their usage from

a behavioral point of view. Also, the maturity level of the team in terms of the attributes also play an important role. For example, does the team already practice certain levels of prototyping or visualization in their daily work, or are all the attributes an entirely new insight for the stakeholders. Based on the maturity level the strategy can be rolled out in phases. In the sense, it could begin with getting the team to constantly reflect on their process by asking the question 'why' and 'what are they there for'. Consequently, add another attribute of design thinking into the process, for example, empathy towards the end-user. Slowly, as they begin to see new and earlier undiscovered perspectives they begin to accept the altered process better. Following that reflect on what works with the stakeholders and scale it up in case of acceptance and enthusiasm. The key lies in rolling it out in stages.
Another possibility for its application could be through getting the team to create their own process using the strategy as a guideline and the design thinking attributes as a boundary. This ensures ownership and co-creation of the process among the individuals involved. Similar to trying to create ownership for the ambitions the team should feel like they have created it together, each of them has value and thus would safeguard it through ups and downs that the project might come across.

Since the strategy success so highly depends on the people involved it is highly contextual and a generalized level of success it could result in is difficult to be hypothesized. Further facilitating the activities successfully will require expertise or someone comfortable in carrying out design thinking as it demands certain skills to bring people together and empathize with them.

For Copper8 the designed strategy has the potential to serve as a structure that can be presented towards a client or an organization aspiring to add circularity within their project but are still in the dilemma of how to carry on the process. In addition, it reduces the time spent upfront to design a process for the project as they are better equipped with the requirements that need to be addressed and the activities with the potential to result in better solutions. To conclude, it guides them in planning better ahead in comparison to having to revise the plan during the process if a particular activity was not sufficient as practiced currently. It can also be used by the project manager to foresee what is important and add it accordingly to the timeline and budget planning, instead of a 'hit and trial' method while executing. This would avoid the unnecessary act of trying to re-invent the wheel for every project.

5.3 REFLECTION ON THE DESIGNED STRATEGY

To conclude the discussion chapter, the researcher reflects on the designed strategy, to determine its interpretation and usage.

- **Scope of the designed research (buildings with circular ambitions vs. buildings without circular ambitions):** The designed strategy addresses the complexity and uncertainty of projects regardless of the circular ambitions. This implies that the strategy finds its relevance within the initiation phase of buildings with or without circular ambitions. The intrinsic nature of the strategy is to provide the user with the ability to be flexible, iterative and have the ability to prototype within the initiation phase. Further, it allows the strategy to find its relevance within projects, whenever the 'how' and 'what' remain undefined, such as projects with focus on innovation (i.e. a project consisting of uncertainty on the parameters of stakeholder ambitions, process requirements and end-result). Within the designed strategy, it is recognized that circular actor learning is exclusive for circular ambitions. Except for this sub-phase, the strategy allows the user to explore and ideate on potential necessities and requirements. Such exploration and ideation can be remarked, to develop clarity within the project team; thereby leading to an unambiguous way of conveying the ambitions, requirements, or necessities of the process and the end-goal. Finally, it is the thread of lack of clarity within the initiation phase which ties this strategy to a scope of generalization.

- **Interpretation of the design (fixed strategy vs. an open-ended strategy):** The strategy was designed with a mindset of being adaptable and modular. This implies that the strategy need not be applied in a forceful or an unbending manner. The order of the sub-phases within the strategy can be modified based on the requirements, complexities, and ambitions existing within the project environment. This modularity of the strategy can be compared to a LEGO block set. The sub-phases are the blocks and it can be rearranged to result in a new LEGO model. In this context, the sub-phases can be rearranged to meet the requirements of the user. The strategy is a collection of best practices incorporated with a few design thinking potentials. For each project, the team can begin with creating their own strategy using this design as an overview. They can then dynamically adjust it according to the project, people involved and their respective maturity levels of the design thinking attributes. The potential of this strategy lies within the initiation phase wherein extensive exploration and problem analysis

through different perspectives or lenses. It can be claimed that, if the strategy were to be as a close-ended solution, it may result in an additional burden. Ultimately, leading to resistance. Recognizing this, it is advised that the strategy is adapted based on the project environment and allows for greater exploration.

- **The novelty of the design (documentation of the best practices vs. application of design thinking):** The designed strategy can be recognized as a documentation of the best practices and other tools that have shown potential within the academic literature. The novelty of the design stems from the documentation of vast strategies and practices which have been primarily filtered for its applicability and feasibility within the initiation phase of projects consisting of circular ambitions. It is recognized that similar methods are employed by practitioners without tagging them as design thinking methods. However, it is plausible that the practitioners through their experience and learnings within projects have learned similar methods. The current strategy fills that gap, by providing decision-makers, clients and consultants from various backgrounds and experience, a modular set of tools that are relevant and beneficial for complex projects. This research re-establishes from analysis of practice on the activities in the initiation phase that will help clients understand their necessities better and find solutions accordingly. It builds a theoretical foundation of what consultants have been able to invent through the years of practice and further lays out a strategy for those who have not worked on a project with similar ambitions so far.

- **Potential of the design strategy (Mindset vs. application of tools):** The current strategy captures both the detailed applicability of a design thinking tool and the requirement of a broad change of mindset. Through the course of design and validation, it was recognized that the tools cannot occur without a change in mindset. It follows the thought of “one cannot exist without the other”. Within the validation session, it was observed that the application of design thinking is not bound to a set of tools within a toolbox. It requires broader acceptance, through a shift in mindset which needs to be accentuated through the senior or experienced consultants. The mindset to explore and develop clarity needs to trickle down from the upper management of the project environment.

6 | CONCLUSION

This research has addressed the issue of not having a strategy in a project to realize circular ambitions in the built environment within the initiation phase. Specifically, a strategy is needed to provide a way to understand, explore, ideate and experiment with possible solutions to achieve these ambitions. This study has posited that design thinking is a potential approach to create a strategy, as it proposes key contributions for such a strategy and describes the environment in which it can flourish. The main research question which has guided this study was: "How can design thinking methods be implemented in the initiation phase to realize circular ambitions within the built environment? "

The study departed with a literature study. Thereafter 12 semi-structured interviews were conducted with respondents selected either as thematic experts or for their participation in selected cases, followed by a session with a multi-disciplinary team for the validation of the designed strategy. In answering the main question, these steps were orchestrated by a design-based research called the double diamond methodology.

The report is structured so that each chapter subsequently answers one or two of the sub-research questions. Below the final answers to the research and sub-research questions are provided. Consequently, the research limitations and accompanying recommendations for future research and practice are discussed.

6.1 ANSWER TO THE RESEARCH SUB-QUESTIONS

This section starts by answering the sub research questions and finally addresses the main research question.

SQ 1: What are the differences in the initiation phase of a project with circular ambitions in comparison to a regular project without circular ambitions?

The observed differences between the two initiation phases include the following: firstly, collaboration and wider engagement of all stakeholders are considered key by Leising (2018) and Pomponi and Moncaster (2017) to realize circular ambitions. Collaboration assists in creating collective aims instead of detailed specifications and distributed responsibilities Secondly, flexibility and granting the room to explore is suggested by Venselaar (2019) to achieve circularity. Thirdly, the definition and commitment towards environmental goals by the clients were emphasized by Kozminska (2019) and Gorgolweski & Morettin (2009). These goals are to be defined in an open, functional and performance-based manner. Later they need to be included in the brief and specifications and could help in bringing together the project team and guide them through the process. Fourthly, higher-order learning, which includes changing problem definitions, norms, values, convictions and goals of actors is identified as necessary through the research by Leising (2018). Fifthly, according to van Oppen (2018) and Leising (2018), the project needs to start with the preparation of a vision/ ambition that is collectively developed. Consequently, van Oppen (2018) suggests that it needs to be understood 'why' the organization/ individuals wish to incorporate circularity and for the team to establish the meaning of circularity for that particular project as it is contextual. Lastly, Kozminska (2019) and Addis (2011) postulates that the design and construction process should adopt an iterative approach owing to the fact that exact materials cannot be specified as it depends on availability.
A major change to incorporate these differences would be commitment and recognition for an extended initiation phase.

Challenges within the initiation phase of projects with circular ambitions include limited awareness and interest, lack of experience and education, lack of clarity with the circular economy definitions, complexity and confused incentives, aversion of risks, inter and intra-organizational challenges.

SQ 2: What is the core of design thinking?

As described by Dorst (2011), the core of design thinking is characterized by abduction, which suggests that design thinking is solution-oriented. In design abduction, the starting point is that one only knows about the nature of the outcome and desired value to be achieved. The activities of searching and experimenting actually assist in arriving at the desired value. It describes a process through which a problem under study is reframed following which a number of possible solutions are developed to observe which of them achieve the desired outcome (aspired value). The activities of searching and experimenting are distinctive features of design thinking in the initiation phase of circular projects. These activities help to provide an environment of understanding, ideating, experimenting and exploring.

SQ 3: How to analyze current practice and further design a strategy for the initiation phase that incorporates design thinking principle attributes?

A design-based research approach seems well befitting the objective of this study to design a strategy using design thinking methods for the initiation phase of circular built environment specifically. Out of possible approaches under this umbrella, the 'Double Diamond' model is applied as it appears particularly suitable because it does not focus only on design solutions, but also on the actual problem prior to developing the solution (Design Council, 2007). The double-diamond method provides a creative process that alternates between diverging and converging steps to explore and understand the current practice. Semi-structured interviews with both clients and consultants of three case studies were undertaken to collect descriptions of the current practice. Through this analysis best practices and further opportunities were highlighted regarding where design thinking attributes can be incorporated. The collaborative process with clients and consultants realized through interviews and analysis led to the design of a conceptual strategy for the initiation phase. This was then validated using a panel consisting of multi-disciplinary professionals to provide feedback on the novelty, applicability and feasibility of the designed strategy.

SQ 4: Which improvements are required in the current practice of the initiation phase of projects to more successfully realize circular ambitions within the built environment?

First, the process of the initiation phase was documented (not been done previously) and then the challenges were identified, following a description of where improvements are possible.
The three case studies highlight that the principles of design thinking have been dormant within the processes conducted within the initiation phase. It was observed, activities such as interviews and brainstorms were a part of the processes conducted by the interviewees for their respective projects. These activities can be said to capture certain attributes of design thinking which include creativity & innovation, human-centeredness, ability to visualize, gestalt view, abductive reasoning and blending intuition & analysis.

Through the current research, additional opportunities for the conscious application of design thinking were identified. These included the core of design thinking attributes such as problem-solving, iteration and experimentation, tolerance to ambiguity & failure. The strategy that is then designed incorporates the other attributes of design thinking along with the lessons learned from the case studies. These attributes include problem-solving, iteration and experimentation and tolerance to ambiguity & failure. The first aspect of improvement was to insert the attribute of problem-solving into the model by incorporating a conscious activity of problem-reframing. Through the process of problem re-framing the needs (actual problem) are highlighted following which the team explores to establish a fit solution. This can assist the team in finding a way to realize the highest level of circularity that is in connection with the individuals involved and the organization. Secondly, the attribute of iteration, experimentation was incorporated through the activity of prototyping (prioritization). This was seen as an improvement as aspiration and ideas pile up at the start and get dropped during execution. A conscious effort of trying to quickly prototype the ideas would help to make the choice upfront in the process of which ideas can be taken forward. Lastly, visualization and co-creation were also ways in which current practice should be improved. Visualization has the ability to bring out instant ideas and true inner feelings of people (that were earlier challenging to find). While co-creation of the process and end-product with people from different layers in the organization would lead to greater ownership and greater consensus among the team.

SQ 5: Which design thinking attributes can be applied in the initiation phase to provide for a strategy for projects with circular ambitions?

Namely, all of the design thinking attributes established through literature are captured in the designed strategy and are of relevance. Each activity has been consciously designed to aid in bringing about different attributes to create moments of divergence, convergence and pause points for the team to reflect and iterate if required. The attribute of human-centredness is of great potential to understand the stakeholders involved in the client organization and the end-users. This process of empathy builds trust among the stakeholders and also helps create a process that fits well with the individuals involved. Learning about the end-users and empathizing with their situation creates new perspectives regarding the problem and solutions that were earlier not thought of. The attribute, ability to visualize helps the team with understanding the concept of circularity as well as to create belief in the possibility. At a later stage, it brings out the potential to analyze the data collected visually to identify patterns and spark new ideas. Abductive reasoning and problem-solving are key attributes that this strategy tries to facilitate through re-framing the problem that was not a conscious effort in analyzed current practice. This explores a fit solution for the team instead of trying to force a solution that is not connected with the problem or the organization. Since, the activity can be very sensitive in an organizational setting, using the attribute of collaboration serves to mitigate this risk, as the problem is re-structured, explored and suitable choices are made in consensus. Further, the process of prototyping that is consciously inserted post aspiration formation and post ideation of tangible goals facilitates the attributes of iteration & experimentation and tolerance of ambiguity & failure. From the validation session with experts, the practice of prototyping was seen as an opportunity to make choices and prioritize ideas upfront. The attribute of the gestalt view is captured at various points such as problem re-framing, reflection which provides a pause point to analyze the data collected from a wider perspective. Creativity and innovation though take place through the entire process, are boosted further through two activities that include aspiration formation and ideation of tangible goals. Lastly, the attribute of blending analysis and intuition is captured unconsciously while facilitating the above-mentioned activities.

6.2 ANSWER TO THE RESEARCH QUESTION

The aim of the research was to gain insight into the applicability of design thinking in the initiation phase of building projects with circular ambitions. For this purpose, the following main research question was determined:
RQ: How can design thinking methods be implemented in the initiation phase to realize circular ambitions within the built environment?

The strategy attempts at bringing order to the chaos by creating clarity within the initiation phase by prescribing design thinking attributes as a way to realize circular ambitions. Within the strategy subphases, activities and their respective tools are consciously placed to capture the various attributes of design thinking. The strategy was designed with a mindset of being adaptable and modular. This implies that the strategy does not need to be applied in a forceful or an unbending manner as something that is fixed or rigid. For each project, the team can begin with creating their own strategy using this design as an overview. They can then dynamically adjust it according to the project, people involved and their respective maturity levels of the design thinking attributes. The sub-phase of exploration captures the essence of design thinking wherein lies the activities of problem-reframing and extensive exploration through different perspectives or lenses. A close-ended solution may lead to an additional burden, ultimately leading to resistance. Recognizing this, it is advised that the strategy is adapted based on the project environment and allows for greater exploration.

The current strategy captures both the detailed applicability of a design thinking tool and the requirement of a broad change of mindset. Through the course of the research, it was recognized that the tools cannot occur without a change in mindset. The application of design thinking is not bound to a set of tools within a toolbox. Incorporating design thinking methods into the initiation phase requires broader acceptance, through a shift in mindset. This shift can be developed over time through repeated practice of the exercises prescribed and the team through the team realizing their potential gains, such that it eventually becomes a natural way of working, similar to that of designers.

Concluding, the result of this research – the strategy – helps practitioners in changing their mindset, while simultaneously providing them concrete activities and tools to actually implement design thinking. This strategy thereby functions as a guideline for practitioners to implement design thinking methods in the initiation phase to realize the circular ambitions. And as said before, for beginners in the field of circularity and design thinking, the strategy might be followed more closely, while more advanced practitioners might use the strategy more freely and use their own knowledge and experience to adapt the strategy as they find suited for the specific project and the project team.

6.3 LIMITATIONS OF THE RESEARCH

This research, similar to all researches, had certain limitations and constraints which also plays a role in the nature of the results achieved. The key limitations are discussed below:

- Analysis of the current practice of the initiation phase assisted in designing a strategy that can be used by both clients and consultants for future projects. The analysis was strongly based on case studies of recently completed projects that incorporated circular ambitions. However, the projects chosen for analysis were provided consultancy for by only one organization, whereas analyzing cases taken up by other sustainability consultants have to be looked into to draw a pattern for the initiation phase that can align with a wider range of projects. Since it provides only the processes and views taken up by one organization, this forms a limitation for the research.
- The buildings analyzed to facilitate the strategy design include commercial and non-residential buildings. Therefore, the applicability of the strategy for the initiation phase of other typology of buildings such as residential, institutional needs to be tested first.
- The data collected for the analysis of the cases use historical observation as the observational method. This implies that the data used was based on retrospective interviewing and the study of documents that were produced by others. Owing to time constraints and unavailability of an on-going project which was at the start of the initiation phase, the researcher was unable to personally observe the process. Hence, the data collected on the completed projects depends on the observations and recollections of others.
- The research is explorative and qualitative in nature that is based on the experience of the involved individuals. The experience of each of the interviewees is subjective. To reduce this limitation multiple interviews with experts intensely involved in the initiation phase of their project were conducted and their observations were also checked with other sources such as documents and web content. In addition, the final conclusions also depend on the analytical and design skills of the researcher. It could be that, if it was taken up by another researcher or if other experts were involved in data collection, the research might have concluded differently.
- The research provides an exploration of the method of design thinking and its integration into the initiation phase of projects. The success of the final designed strategy largely depends on how it is used by people and their actions to facilitate the initiation phase. The research has not examined or evaluated the applicability of the strategy from the behavioral point of view which remains a limitation of the research.
- With respect to the time available to complete the research it was not possible to test the final designed strategy on a live case. The testing could have provided practical observations on how it can be further improved and iterated for practice which can be seen as a limitation.
- The research methodology which adopts the double diamond method is not generally used for research within the civil engineering sector. It is however commonly used to within the industrial design sector to design and develop products. Due to the seldom use of this methodology in research, a considerable amount of literature could only be found explaining it. Since its application cannot be verified this remains a limitation of the research.

6.4 RECOMMENDATIONS

6.4.1 RECOMMENDATION FOR FUTURE RESEARCH

The research has adequately addressed the scope of design thinking in the initiation phase of buildings with circular ambitions, considering the designated time, resources and the effects of the COVID-19 for this research. The limitations indicated in section 6.2 are used as a stimulant to contribute recommendations for future research. Further, considering the wideness of both circular construction and design thinking the research serves as the start to future researches on combining the two topics. These have been summarized as follows:

- As highlighted in the limitations, the success of the final designed strategy largely depends on how it is used by people and their actions to facilitate the initiation phase. Hence, further investigation and iteration of the designed model through the form of an action research can yield details of the usability of it in practice. Through the observations made the applicability of the model can be evaluated from the behavioral point of view and re-iterated. An iteration of approximately three cycles corresponding to observations made could lead to an ideal strategy.
- There exist reports by various consultants on the business value of using design thinking for management. However, quantitative research on the precise impact (cost, duration, quality & safety) of design thinking practiced in construction can prove advantageous for the market to see quantitative value in the process. Therefore, it is recommended to do further research on how the strategy generates business value.

- Since the research takes into consideration projects taken up by one consultant, future research could analyze the applicability of the designed strategy on projects that have been done with different consultants and clients to compare its application within the same sector. In addition, it can be analyzed with other buildings beyond commercial and non-residential buildings that have been considered in this research.
- The strategy established through this research is based on the idea that the project is at the initiation phase and also takes into account the client and consultant perspective alone. Future research to scrutinize the design for additional changes needed for the applicability of the model in a different phase is required. This research should also take into account the effect of other perspectives (for example, contractor) when applying the design in that particular phase.
- The application of the strategy in practice might require certain changes/ requirements within the organization such as organizational structure, expertise. Research is required to be carried out to establish the preconditions required for organizations to adopt this altered way of thinking and doing to be able to fully adopt the design.
- Subsequent research possibility would be to study the application of the design from the project manager's perspective and the challenges they come across while trying to implement it. The design strategy is quite in contrast to the stage-gate process generally used. The process required for the transformation from the perspective of project management will provide for further insights on the usability and possibilities of improvement for the strategy.

6.4.2 RECOMMENDATIONS FOR PRACTICE

Practical recommendations are targeted towards the potential end-users of this strategy which include client organizations and consultants that assist clients to achieve circular ambitions within the developing building. Adopting the strategy that is designed through this research ensures that the ambition is connected either to the involved stakeholders or the organization. Through the establishment of this connection, the team is more likely to protect the ambitions and avoid them being dropped during realization when budget and planning could take precedence.

- Forcing the strategy as an altered process for the team to adapt could lead to resistance. Therefore, it needs to be rolled out based on the maturity levels of the team, that is introduced to the team in slowly. For example, begin with getting the team to keep questioning themselves about the 'why' and 'what' are they there for. Slowly, get them to get into the practice of trying to iterate the ambition/ aspiration they dream of through simple sketches or Lego exercises. Similarily, keep adding the attributes as layers. Through the stepped process see what works with people and scale it up bases on a reflection of their enthusiasm and acceptance.
- For project teams that are trying to incorporate circularity in their project for the first step, the strategy serves as a valuable overview. This is because it has been co-created with the process of successfully and unsuccessfully executed projects along with considering the requirements of an altered process. The strategy can serve as boundary conditions to design their own process. It is not required for the team to faithfully follow each step.
- Though it is not required to follow each step faithfully, there are certain sections that bring out the core of this process and is recommended not to be avoided. These include understanding the client and end-users at the start. This creates trust while also adding new perspectives that can spark fitting solutions that were earlier not thought of. In addition, the process of problem re-framing can help achieve the highest level of circularity that would be possible based on 'the need'.
- Problem re-framing as an exercise though is very beneficial considering a social aspect, it could be very sensitive in an organization setting. Therefore when this exercise is facilitated it should be made sure that stakeholders from the different layers are involved actively not only in this exercise but also in the previously established exercise (those that highlight what the needs are from different perspectives).
- While trying to execute the strategy highlight its attributes such as human-centeredness (empathy and trust), end-user focus, co-creation (that stakeholders from different layers are actively participating), iteration and prototyping.
- Project managers play an important role in realizing circularity in the construction project. In a project without circular ambitions the requirements and process are detailed. As a result, the project manager has a defined path to execute the project. While for a project with circular ambitions the steps need to be figured. In this scenario the strategy serves as a favorable process, it provides the project manager with what needs to be done to realize the ambitions. Thus, it can be used by the project manager to foresee what is important and add it accordingly to the timeline and budget planning, instead of a 'hit and trial' method while executing. This would avoid the unnecessary act of trying to re-inventing the wheel for every project.

7 | REFLECTION

The idea for the graduation topic was planted within the first year of my master's when I got to know of the topic of design thinking and was eager to research more on it. As mentioned in the preface it was a series of random discussions with my friends that led me to bring the two topics of design thinking and circularity together. Nurturing this topic began with a number of discussions with both my supervisors. I was warned by them regarding the open-endedness and vastness of both the topics. Nevertheless, being passionate about the topic I went ahead with it to take it up as a challenge for myself. Being a topic I had developed from scratch it required me to look out for companies that would be interested in this subject. At the very start, I had listed along with my supervisors two companies where we identified that there would be scope in doing this research with. After approximately two months of searching, I was thrilled to get a positive response from Copper8 which was one of the two companies in my priority list. Getting into their team as the first international ever was a proud win for myself.

Following this came the next challenge part which was to identify the scope and plot the methodology for the research. My initial journey planned for this research was very different in comparison to the path I finally went through. I started out my research by wanting to do it through an action research methodology. I clearly remember how excited I was to observe and study people while also dreaming about me implementing my designed strategy in a live case. I had charted out a plan to execute this research through my initial research proposal. Personally, not fond of changing my plans, I believed that my initial plan would be the way I execute the research no matter what. Surprisingly during my kick-off, I was advised by my entire committee 'Juan, embrace the uncertainty'. Clueless about how to interpret that statement then, I continued with my work anxiously, but somewhere in the back of my head kept replaying that statement. Now, as I reflect back, I can say that one statement had so much value and is something I would take with me for the rest of my life.

Then came the lockdown. The first month was lonely and difficult to get work done. At that point, I was still very determined and probably over-ambitious to continue my research as an action research but clueless on how to take it forward when no human interaction was possible. Following a meeting with my supervisors, where they told me that they could not see the light in the end of the tunnel, I suddenly decided to re-iterate my plan. I knew my main goal was to design a strategy. With this in mind, I took a stand and went ahead to plot my methodology as a design-based research.

The journey of completing this research was not a walk in the park as it may seem now. From the start, I was faced with challenges as it was the first time I was doing things such as semi-structured interviews, analyzing using the software Atlas, facilitating a validation session. Every step ahead seemed tougher than the previous. But I enjoyed myself working my way through it, seeing every uncertain circumstance as a new exciting challenge to me. There was never a day when I got up and felt 'oh no, not this again'. There were moments of proudness, while there were moments when I felt lost in this research world. But reflecting back, I think there were four things that kept me going. The first being my curiosity and eagerness to learn more and do better. The second being, the willingness to ask for help at times of difficulty without any hesitation. I would without any hesitation set up brainstorm or discussion sessions with my committee or friends when I found myself stuck at some point. Specifically, during the lockdown, I made it a point that I have a weekly discussion with my supervisor at the company so that there would be something for me to look forward to and push myself to work. Thirdly, was the advice from my committee at the start to embrace the uncertainty. I held on to that statement so tightly, specifically when the pandemic hit and taking into account that a research of this manner was highly dependent on external stakeholders for data and validation. Lastly, was another advice given by one of my supervisors, which was to keep my goal fixed but to draw out alternative plans to reach that particular goal.

Given a chance to do the research again or given more time I wish I could implement the strategy myself and learn how the users react to it. Also, realized through my validation session, that I as an individual enjoy facilitating workshops, so it would be interesting for me to try out the designed strategy. Further, being a perfectionist I found it extremely difficult to send the report ahead of the deadline to get feedbacks and would take till the very last second. I believe sending it more frequently would have helped me improve the content better. In addition to being a perfectionist, I am someone who prefers having things under my control and getting dates with committee, interviewees and experts for validation caused me high levels of anxiety and stress. When I reflect back now, I realize taking that stress for something, not in my control was completely unnecessary. Lastly, a constructive criticism from a reflection of myself, my committee and my friends would be to improve in my writing skills and to force myself to make short and clear sentences. I have the tendencies to keep writing as the thought runs through my brain.
During the processes, I felt there were days and nights of darkness. Whenever I hit a low I would remind myself about how far I had come and urge myself to see the possibilities ahead, embracing both the wins and disappointments. Looking back, I laugh at myself now, after all, it was just a master thesis that I was doing.

Looking back at my thesis journey, I would not have done it another way. I got to learn and work with an amazing group of individuals, so deeply passionate about changing the world. Through the past nine months, I have given it my best and have no regrets that I could have done more (maybe improved on my writting skills). In the end, I am happy with my results. However, if one gives me more time, I tend to keep working and improving.

REFERENCES

Acharya, D., Boyd, R., & Finch, O. (2018). First steps towards a circular built environment. Arup, Ellen MacArthur Foundation.

Adams, K. T., Osmani, M., Thorpe, T., & Thornback, J. (2017). Circular economy in construction: Current awareness, challenges and enablers. Proceedings of the Institution of Civil Engineers - Waste and Resource Management, 170(1), 15–24. https://doi.org/10.1680/jwarm.16.00011

Adams, R. S., Daly, S. R., Mann, L. M., & Dall'Alba, G. (2011). Being a professional: Three lenses into design thinking, acting, and being. Design Studies, 32(6), 588–607. https://doi.org/10.1016/j.destud.2011.07.004

Addis, W. (2011). Building with reclaimed components and materials: A design handbook for reuse and recycling. Earthscan.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. 123–67.

Amory, J. (n.d.). A GUIDANCE TOOL FOR CIRCULAR BUILDING DESIGN. 22.

Asrani, K. (2019). Investing in circular transformation. Delft University of Technology.

Baarda, B. (2014). Basisboek kwalitatief onderzoek: Handleiding voor het opzetten en uitvoeren van kwalitatief onderzoek. Noordhoff.

Bakker, H. L., & De Kleijn, J. P. (2015). Management of engineering projects: People are key. Nijkerk: NAP.

Basu, R. (2014). Managing quality in projects: An empirical study. International Journal of Project Management, 32, 178–187. https://doi.org/10.1016/j.ijproman.2013.02.003

Beckman, S. L., & Barry, M. (2007). Innovation as a Learning Process: Embedding Design Thinking. California Management Review, 50(1), 25–56. https://doi.org/10.2307/41166415

Beverland, M. B., Micheli, P., & Farrelly, F. J. (2016). Resourceful sensemaking: Overcoming barriers between marketing and de- sign in NPD. Journal of Product Innovation Management 33 (5), 589–609.

Beverland, M. B., Wilner, J. S., & Micheli, P. (2015). Reconciling the tension between consistency and relevance: Design thinking as a mechanism for brand ambidexterity. Journal of the Academy of Marketing Science 43 (5), 589–609.

BIS (Department for Business, Innovation and Skills). (2013). Supply Chain Analysis into the Construction Industry, A Report for the Construction Industrial Strategy. BIS, London, UK.

Boeijen, A. van, Daalhuizen, J., Zijlstra, J., Technische Universiteit Delft, & Faculteit van het Industrieel Ontwerpen. (2020). Delft design guide: Perspectives, models, approaches, methods.

Boland, R., & Collopy, F. (Eds.). (2004). Managing as designing. Stanford Business Books.

Boni, A. A., Weingart, L. R., & Evenson, S. (2009). Innovation in an academic setting: Designing and leading a business through market-focused, interdisciplinary teams. Academy of Management Learning & Education 8 (3), 407–17.

Brown, T., & Katz, B. (2009). Change by design: How design thinking transforms organizations and inspires innovation (1st ed). Harper Business.

Bryman, A. (2012). Social research methods (4th ed). Oxford University Press.

Buchanan, R. (1992). Wicked Problems in Design Thinking. Design Issues, 8(2), 5. https://doi.org/10.2307/1511637

Buhl, A., Schmidt-Keilich, M., Muster, V., Blazejewski, S., Schrader, U., Harrach, C., Schäfer, M., & Süßbauer, E. (2019). Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development. Journal of Cleaner Production, 231, 1248–1257. https://doi.org/10.1016/j.jclepro.2019.05.259

Carlgren, L., Elmqvist, M., & Rauth, I. (2016). Exploring the use of design thinking in large organizations: Towards a research agenda. Swedish Design Research Journal, 11(1), 55. https://doi.org/10.3384/svid.2000-964X.14155

Chesbrough, H. (2010). Business Model Innovation: Opportunities and Barriers. Long Range Planning, 43(2–3), 354–363. https://doi.org/10.1016/j.lrp.2009.07.010

Churchman, C. W. (1967). Wicked problems. Management Science 4 (14):, 141–42.

Circle Economy. (2017). A Future-Proof Built Environment. Amsterdam: Circle Economy and ABN AMRO.

Dalsgaard, P. (2014). Pragmatism and design thinking. International Journal of Design 8 (1), 143–55.

Dalton, J., & Kahute, T. (2016). Why Empathy and Customer Closeness is Crucial for Design Thinking. Design Management Review, 27(2), 20–27. https://doi.org/10.1111/drev.12004

de Wit, D. R. (2019). Enlarging the solution space in infrastructure planning processes. Delft University of Technology.

de Wit, M., Hoogzaad, J., & von Daniels, C. (2020). The Circularity Gap Report.

Deserti, A., & Rizzo, F. (2014). Design and the Cultures of Enterprises. Design Issues, 30(1), 36–56. https://doi.org/10.1162/DESI_a_00247

Design Council. (2007). A study of the design process. London: Design Council.

Deuten, J. J., & Rip, A. (2000). Narrative Infrastructure in Product Creation Processes. Organization, 7(1), 69–93. https://doi.org/10.1177/135050840071005
Dorst, K. (2006). Design Problems and Design Paradoxes. Design Issues, 22(3), 4–17. https://doi.org/10.1162/desi.2006.22.3.4

Dorst, K. (2011a). The core of 'design thinking' and its application. Design Studies, 32(6), 521–532. https://doi.org/10.1016/j.destud.2011.07.006

Dorst, K. (2011b). The core of 'design thinking' and its application. Design Studies, 32(6), 521–532. https://doi.org/10.1016/j.destud.2011.07.006

Dorst, K. (2015). Frame innovation: Create new thinking by design. The MIT Press.

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem–solution. Design Studies, 22(5), 425–437. https://doi.org/10.1016/S0142-694X(01)00009-6

Drews, C. (2009). Unleashing the Full Potential of Design Thinking as a Business Method. Design Management Review, 20(3), 38–44. https://doi.org/10.1111/j.1948-7169.2009.00020.x

Ellen MacArthur Foundation. (2012). Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur- Foundation-Towards-the-Circular-Economy-vol.1.pdf

Ellen MacArthur Foundation. (2013). Towards the Circular Economy. Ellen MacArthur Foundation. https://doi.org/10.1162/10881980677554532

Ellen MacArthur Foundation. (2017). What is the Circular Economy. https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy
European Commission. (2018). Construction and Demolition Waste (CDW). European Commission.

European Commission. (2020). A new Circular Economy Action Plan. 20.

Gerding, D. (2019). Talking circularity—The influence of actors on the building process. TU Delft.
Gladek, E. (2017). The Seven Pillars of the Circular Economy. http://www. metabolic.nl/the-seven-pillars-of-the-circular-economy/

Glen, R., Suciu, C., & Baughn, C. (2014). The Need for Design Thinking in Business Schools. Academy of Management Learning & Education, 13(4), 653–667. https://doi.org/10.5465/amle.2012.0308

Gorgolewski, M., & Morettin, L. (n.d.). The Process of Designing with Reused Building Components. 5.
Gruber, M., de Leon, N., George, G., & Thompson, P. (2015). Managing by Design. Academy of Management Journal, 58(1), 1–7. https://doi.org/10.5465/amj.2015.4001

Guldmann, E., Bocken, N. M. P., & Brezet, H. (2019). A Design Thinking Framework for Circular Business Model Innovation. 7(1), 33.

Gustafsson, J. (2017). Single case studies vs. Multiple case studies: A comparative study. 15.

Hart, J., Adams, K., Giesekam, J., Tingley, D. D., & Pomponi, F. (2019). Barriers and drivers in a circular economy: The case of the built environment. Procedia CIRP, 80, 619–624. https://doi.org/10.1016/j.procir.2018.12.015

Heintz, D. J., Lousberg, D. L., & Wamelink, H. (2016). Designing Project Management. 14.

Heintz, J. (2018). Learning in AR1R016. Design and Construction Management, AR1R016, TU Delft, Delft.

Heintz, J. L., Lousberg, L. H. M. J., & Prins, M. (2015). Re-designing project management: Steps towards a project management curriculum for a sustainable built environment. Going North for Sustainability: Leverage Knowledge and Innovation for Sustainable Construction and Development.
Hekkert, P., & Dijk, M. van. (2017). Vision in design: A guidebook for innovators. BIS.

Holland Circular Hotspot. (2018). Circular construction economy. Amsterdam: Holland Circular Hotspot.

Holloway, M. (2009). How tangible is your strategy? How design thinking can turn your strategy into reality. Journal of Business Strategy 30 (2/3), 50–56.

IDEO, & Ellen MacArthur Foundation. (2017). Circular Design Guide. https://www.circulardesignguide.com/

Joore, P., & Brezet, H. (2015). A Multilevel Design Model: The mutual relationship between product-service system development and societal change processes. Journal of Cleaner Production, 97, 92–105. https://doi.org/10.1016/j.jclepro.2014.06.043

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling, 127, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Kock, A., Heising, W., & Gemünden, H. G. (2016). A Contingency Approach on the Impact of Front-End Success on Project Portfolio Success. Project Management Journal, 47(2), 115–129. https://doi.org/10.1002/pmj.21575

Kozminska, U. (2019). Circular design: Reused materials and the future reuse of building elements in architecture. Process, challenges and case studies. IOP Conference Series: Earth and Environmental Science, 225, 012033. https://doi.org/10.1088/1755-1315/225/1/012033

Langford, R. (2012). Qualitative research methods, by Monique Hennink, Inge Hutter and Ajay Bailey. Critical Public Health, 22(1), 111–112. https://doi.org/10.1080/09581596.2011.565689

Lawson, B., & Dorst, K. (2009). Design expertise. Elsevier, Architectural Press.

Leising, E., Quist, J., & Bocken, N. (2018). Circular Economy in the building sector: Three cases and a collaboration tool. Journal of Cleaner Production, 176, 976–989. https://doi.org/10.1016/j.jclepro.2017.12.010

Liedtka, J. (2011). Learning to use design thinking tools for successful innovation. Strategy & Leadership, 39(5), 13–19. https://doi.org/10.1108/10878571111161480

Liedtka, J. (2015). Perspective: Linking Design Thinking with Innovation Outcomes through Cognitive Bias Reduction: Design Thinking. Journal of Product Innovation Management, 32(6), 925–938. https://doi.org/10.1111/ jpim.12163

Martin, R. (2011). The innovation catalysts (Harvard Business Review 89 (6), pp. 82–87).

Martin, R. L. (2009). The design of business: Why design thinking is the next competitive advantage.

Martin, Roger. (2009). The Design of Business: Why Design Thinking is the Next Competitive Advantage. MA: Harvard Business Press.

Martin, Roger. (2010). Design thinking: Achieving insights via the "knowledge funnel". Strategy & Leadership, 38(2), 37–41. https://doi.org/10.1108/10878571011029046

McCullagh, K. (2013). Stepping up: Beyond design thinking. Design Management Review 24 (2), 32–34.
Meijers, L. L. (2020). Project management in circular building projects: Developing a framework supporting the re-use of components. TU Delft.

Mentink, B. (2014). Circular Business Model Innovation: A process framework and a tool for business model innovation in a circular economy [Delft University of Technology]. http://resolver.tudelft.nl/uuid:c2554c91-8aaf-4fdd-91b7-4ca08e8ea621

Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing Design Thinking: Conceptual Review, Synthesis, and Research Agenda: Doing Design Thinking. Journal of Product Innovation Management, 36(2), 124–148. https://doi.org/10.1111/jpim.12466

Ministry of infrastructure and the environment & Ministry of economic affairs. (2016). A Circular Economy in the Netherlands by 2050. 72.

Morris, P. W. G. (2016). Reflections. International Journal of Project Management, 34(2), 365–370. https://doi.org/10.1016/j.ijproman.2015.08.001

Noktehdan, M., Shahbazpour, M., Zare, M. R., & Wilkinson, S. (2019). Innovation Management and Construction Phases in Infrastructure Projects. Journal of Construction Engineering and Management, 145(2), 04018135. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001608

Pelgrom, S. (2020, May). Accelerating the Shift to Circular—Webinar. https://www.liveworkstudio.com/videos/accelerating-the-shift-to-circular-webinar/

Pomponi, F., & Moncaster, A. (2017). Circular economy for the built environment: A research framework. Journal of Cleaner Production, 143, 710–718. https://doi.org/10.1016/j.jclepro.2016.12.055

Reeves, T. (2006). Design Research from a Technology Perspective. British Journal of Educational Technology. UK.

Ridder, H. D. (2009). Design and Construct in Civil Engineering (Lecture Notes CT5981).

Roberts, P. N. (2018). Wicked Problem Territory and the Design Strategy. 42.

Roozenburg, N. F. M., & Eekels, J. (1995). Product design: Fundamentals and methods. Wiley.

Samset, K., & Volden, G. H. (2016). Front-end definition of projects: Ten paradoxes and some reflections regarding project management and project governance. International Journal of Project Management, 34(2), 297–313. https://doi.org/10.1016/j.ijproman.2015.01.014

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. CoDesign, 4(1), 5–18. https://doi.org/10.1080/15710880701875068

Seidel, V. P., & Fixson, S. K. (2013). Adopting design thinking in novice multidisciplinary teams: The application and limits of design methods and reflexive practices. Journal of Product Innovation Management 30 (S1), 19–33.

Stacey, R. D., Griffin, D., & Shaw, P. (2000). Complexity and management: Fad or radical challenge to systems thinking? Routledge.

Stephens, J. P., & Boland, B. J. (2014). The aesthetic knowledge problem of problem-solving with design thinking. Journal of Management Inquiry 24 (3), 219–32.

te Velde, T. (2018). Unconventional thinking: A design strategy for transition in the Dutch construction sector [Delft University of Technology]. https://repository.tudelft.nl/islandora/object/uuid:13ca7d1f-893e-44fb-b0db-3173dc3c1845?collection=education

ten Dam, I. (2020). Build a crucial link in the circular economy. https://www.economicboardutrecht.nl/nieuws/bouw-cruciale-schakel-in-circulaire-economie

Turner, G. (2014). Is global collapse imminent?

van der Helm, R. (2009). The vision phenomenon: Towards a theoretical underpinning of visions of the future and the process of envisioning. Futures, 41(2), 96–104. https://doi.org/10.1016/j.futures.2008.07.036

van der Sande, L. (2019). In search of the barriers and drivers for the implementation of a Circular Economy in Dutch infrastructure projects. TU Delft.

van Haagen, F. (2018). Circulair Aanbesteden. TU Delft.

van Oppen, C., Croon, G., & de Vroe, D. B. (2018). CirCular ProCurement in 8 StePS. 152.

Venselaar, M. (2019). Managing processes of circular building project.

Verganti, R. (2017). Design Thinkers Think Like Managers. She Ji: The Journal of Design, Economics, and Innovation, 3(2), 100–102. https://doi.org/10.1016/j.sheji.2017.10.006

Versteeg Conlledo, A. (2019). Managing circular construction projects. TU Delft.

Wamelink, J. W. F., & Bennekom, H. A. van. (2010). Inleiding bouwmanagement. VSSD.

Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. Educational Technology Research and Development, 53(4), 5–23. https://doi.org/10.1007/BF02504682

Williams, T., Vo, H., Samset, K., & Edkins, A. (2019). The front-end of projects: A systematic literature review and structuring. Production Planning & Control, 30(14), 1137–1169. https://doi.org/10.1080/09537287.2019.1594429

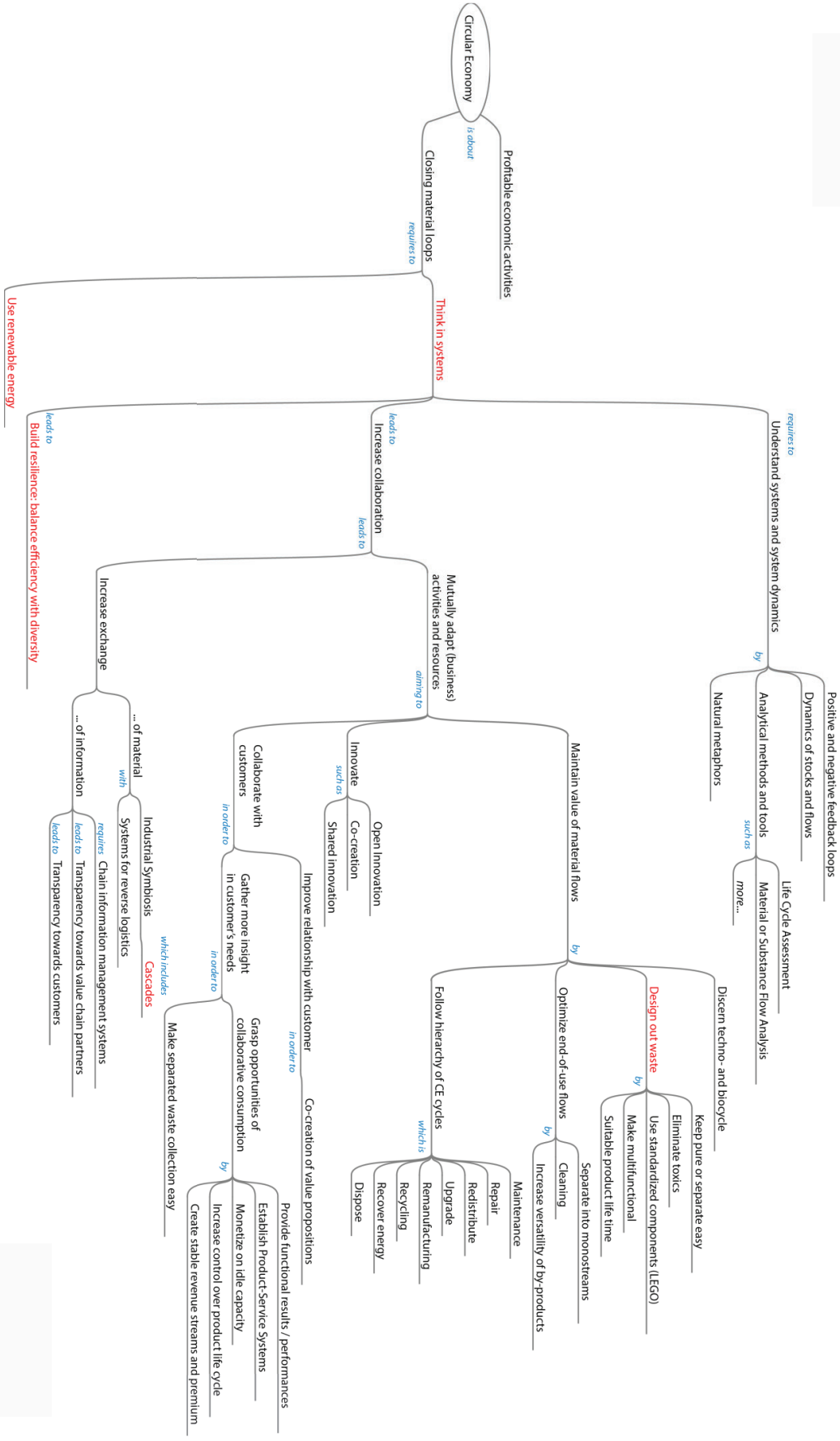
Zimmann, R., O'Brien, H., Hargrave, J., & Morrell, M. (2016). The Circular Environment in the Built Environment. Arup.

Illustrations:

(1) Illustrations used in the beginning of each chapter were taken from: https://stories.freepik.com/work

(2) Sketches used in the designed strategy were adopted from: Valkenburg, R., Sluijs, J., & Kleinsmann, M. S. (2016). Images of design thinking: Framing the design thinking practices of innovators.

APPENDIX A: Thinking in systems to Achieve Circularity (Mentink, 2014)



APPENDIX B: Interview Protocol (Semi-structured)

Date	
Name Interviewee	
Organization	
Designation & Project	
Name Interviewer	Juan D'coutho

(Ask for consent to record)

Introduction

- Second-year student of the Masters in Construction Management and Engineering.
- Currently doing my Graduation research thesis with Copper-8 on understanding the potential of design thinking in the initiation phase of circular construction projects.
- What is your position within the organization and how long have you've been working within this organization?
- Research Goal

In order to realize a more circular system, it is paramount that the circular way of thinking, 'make-use-return' is enforced into the market, where clients and consumers play a crucial part by explicitly demanding for circular products. However, the barriers and challenges hinder the transition, while also creating an environment of complexity and uncertainty. From previous research, design thinking is known to provide solutions of similar contexts. Therefore, this proposed research aims to explore the application of the design thinking process in the initiation phase of a circular building project. Further, it will focus on the creation of a strategy using design thinking through literature studies, in order to cope with the uncertainties and complexities faced in the beginning by clients and practitioners to shape a circular project.

Purpose of the interview

The purpose of this interview is to gain insight on the process taken up during the commencement of circular projects by both clients and practitioners to thereby identify the barriers/ challenges faced in practice.
Interview

Introduction:

- What is your role in your organization and what was your role through the project?
- What is your organization's role in the transition towards circularity?
- What is your understanding of circularity in the built environment?

Topics:

- Identification of ambitions
- Identifying the stakeholders involved
- 'Permanent organization' (client) knowledge levels
- Organizational collaboration and ideation process
- The process facilitated to shift from intangible to tangible requirements for procurement purposes
- Events/ activities/ exercises in the initiation phase that led to success/ failures
- Challenges encountered through the process

Reflection on current practices:

- Lessons learned post the process
- Identified possibilities of improvement for the future perspective

APPENDIX C: Expert Interview Analysis

The main concepts as described in section 4.1.1 are further elaborated in this appendix along with the challenges encountered and the exercise/ solutions applied during the corresponding themes by the experts. For most of the projects trying to incorporate circularity, the team was working with such new ambitions for the first time and hence were experimenting with the process. The interviewees gave insight into the process through which they identify the right ambitions and principles for the project. In addition, the interviews showed the various ways of how they went about preparing for the sessions with the clients, tackled the expectations of a different perspectives, identified opportunities within the building and concluded on a document for procurement purposes.

THEME 1: UNDERSTANDING THE CLIENT ORGANIZATION

The end-product for a circular project is not defined from the beginning as there can be many ways in which circular principles can be incorporated into the project. Through constant observation and communication with the client and internal stakeholders, the need for the end-product is determined. The focus is required to shift towards the process and the way people work to eventually be able to describe the desires of the end-product. In order to understand the internal stakeholders and their interests, it takes time as they first need to gain the trust of the consultants before they begin to describe what they really feel. During the first session or interaction with the employees of the client organization, it is prescribed by the experts to find out about the people, which includes understanding what is important to them, what is their personal driver, why do they think they are part of the group, what is their connection to circularity and what is the current process followed by them in their work. This helps with really understanding the company and persons within it to later prescribe on how a connection is going to be made between the company and the building being delivered. With respect to circularity, if a strong connection is not found or identified at the start it would result in circularity being pushed back during the realization phase when time and budget take precedence.

"The end product is not set from the start. So, in a lot of projects, and that's how I like to do them, things happen that one did not know upfront. But it's always important that one keeps communicating with their clients, about what is the end product they need or what they think is important for them. Because in the beginning if one defines the end product, halfway through there could be that something happened within the organization or there was a new insight or a new way of communicating in a modern way. It's always good to keep one's eyes and ears open to understand what the client needs."(CSLT_2)

Further, during the process of understanding the client identifying the 'why' on an individual level is important. For example, why does the company see the need to add circular ambitions or why does the individual see it necessary in the coming years. Especially with sustainability and circularity the ideas and the team energy comes from the collective why as people need to be intrinsically motivated. If the 'why' is understood the 'what' and 'how' come further. The 'what' and 'how' are subject to change through the process but the 'why' remains constant for the person and the organization which is deemed necessary to discover.

"Especially in sustainability, why people are doing it, the idea and the energy from people comes from the why. People need to be intrinsically motivated to do it. If you can make people understand your why the what and how are generally less interesting. The what and the how are generally subject to change. But the why is generally fixed for people. "(CSLT_2)

Understanding these aspects from the organization's end assists in preparing for future sessions and also mapping out the internal stakeholders. For example, there might be some people who are very enthusiastic and open to creative sessions to explore all possibilities, while others who resist the process and are driven through quantities and charts. A challenge that the consultant often face is identifying the right process ahead because one process does not fit all. Further, it is crucial to identify the internal stakeholder, as different departments within the organization have varying interests based on their role and task. Through analyzing who is involved, what is their role and how they are involved the right people can be determined, so through the process, there is no major opposition. As an external organization working their way through the organization, the experts found this process quite challenging, that is to determine the right people. In addition, the level of understanding and different levels of personal prioritization was difficult to manage. Through this process, the team for the upcoming activities can be determined. The number of stakeholders who will be involved is a key factor. From their experience there were cases where the company had a good internal structure and interest. But there are also organizations where there are so many different departments, people and interests that there is no once common goal.

All of these help in the preparation to understand what the group needs prior, and how can they intervene, anticipate and prepare. Preparation is important to guide people through the process. From past experience every project is unique and this helps finding a fitting process ahead, depending on the people and their way of working. In the past they understood the client organization through asking the organization lot of questions and one-to-one interviews. This was also done through organizing session with groups of people were they wrote post-its and lay them on a large blank paper. Another exercise was for people to pick up photos from a large pile of random photos and then explain how they that picture represents who they are. This exercise was developed more to understand what they feel, rather than what they said. It could also be about picking a picture that they related sustainability with.

"It is more about experimenting which work forms work well with which kind of groups. It needs to be given attention because not all work forms are suitable for all groups." (CSLT_1)

" Every project is unique and therefore one always needs to rethink on what will fit in it best. Sometimes it's even at the moment, during the session when the group is really tough or some conflicts arise. In this case it's good to think what the group needs and understand how one can intervene. This comes from both preparation and experience. It's always good to anticipate what could happen and prepare for it." (CSLT_2)

Table i: Understanding the client organization along with corresponding challenges, exercises and lessons learned

DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
During the first session or interaction with the employees of the client organization, it is prescribed by the experts to find out about the people, which includes understanding what is important to them, what is their personal driver, why do they think they are part of the group, what is their connection to circularity and what is the current process followed by them in their work.	• The internal stakeholders need to gain the trust of the consultants before they begin to describe what they really feel. As an external organization that joins the project, this can be described as a challenge. • To understand the personal belief and interests of the individuals that can later help to form the connection between the organization and ambitions.	• Understanding organization through asking the organization lot of questions and one-to-one interviews. • This was also done through organizing session with groups of people were they wrote post-its and lay them on a large blank paper. • Another exercise was for people to pick up photos from a large pile of random photos and then explain how they that picture represents who they are. This exercise was developed more to understand what they feel, rather than what they said.	
As part of understanding the client identifying the 'why' on an individual level is important. For example, why does the company see the need to add circular ambitions or why does the individual see it necessary in the coming years. Especially with sustainability and circularity the ideas and the team energy comes from the collective why.	• To really be able to understand the why from involved stakeholders.		
It is required for the consultants to find a fitting process ahead, depending on the people and their way of working. There may be some people who are very enthusiastic and open to creative sessions to explore all possibilities, while others who resist the process and are driven through quantities and charts.	• A challenge that the consultants often face is identifying the right process ahead because one process does not fit all. • The level of understanding and different levels of personal prioritization was difficult to manage.		
It is crucial to identify the internal stakeholder, as different departments within the organization have varying interests based on their role and task. Through analysing who is involved, what is their role and how	• As an external organization working their way through the organization, the experts found this process quite challenging, that is to determine the right people.		

they are involved the right people can be determined, so through the process there is no major opposition.

THEME 2: EXPLORING WITH THE TEAM

Since the circular economy is extremely context dependent, the circular possibilities for a large city will differ from those of a building. Before the team decides on which of the circular principles will be incorporated into the project and at which level, the concepts needs to be understood among the members to get them levelled. According to the interviewed experts from their past experience in projects not everyone within the team was well versed with the topic of circularity. Most of them had a vague outline and knew the basic principle but were not experienced with the details and its practical application. During this session, the basic concepts of CE and methods of achieving it are elaborated to ensure the project team is on the same page of understanding to avoid the 'tower of babel'. The main focus of this actor learning is to gain insight on circular solutions and develop an understanding of how the organization can shift from linear to circular thinking. The sessions during this phase by the consultants focuses on providing knowledge, experiences and inspiration to the team. They also support in creating a mind-shift change within the team to help them believe in the possibility of achieving. Generally, they would explain the principles following which they would provide the team with inspirations in the form of examples, each of which was done differently. The understanding of the principles allow them to incorporate it into their vision of the project at a later on stage. While the inspirations provide the team with opportunities for them to identify which of it could be a possible solution for their upcoming project. Alternatively, another exercise also done with a group of people is for them to pick up projects and explain what and why is that project inspiring to them on a personal level. This provides the consultants prior information to understand what is the level of understanding on circularity and sustainability in the group to further decide on what added knowledge will they need to provide the team with.

"Most people do not know and they ask consultants, because they do not know. So the consultant should share their principles, knowledge and experiences as inspiration before they let them brainstorm, because otherwise it will be much less effective." (CSLT_1)

Once the team is acquainted with the subject they are well informed to decide on a broad level how it could be applied in their project. This provides the project with a broad scope that is required for the transition but also provides room for expertise and new technology that the stakeholders work together to develop. Further, developing a working circular definition is optional with the team. Since, there exists at least 114 definitions of the term CE it is recommendable for the team to converge on a circular working definition, which means: what is circularity for that specific project. Following this the vision for the project is laid out by the team. During this phase the themes for the project can be chosen and can be at a very conceptual level. The team is allowed to dream and go as high as they can with the objectives, not just thinking where they want to go, but also how far can they go. Adopting an integrated strategy is the key at this stage, that is the ambitions need to be connected. In addition the vision needs to be made by the stakeholders themselves as only then will it be owned by them to result in a successful project. Getting the vision from the client is the core here. Similar to the exercise explained previously, the session would begin with a warm-up exercise, following which the team is allowed to choose from options or reflect on something proposed by the consultants. Sometimes the team is also provided with inspiration from other visions. The team would then be divided into smaller groups to write down a vision pitch after which they would vote. The vision and ambition set here is the key factor for the rest of the project. The challenge here is that the stakeholders do not see hard conclusions yet and begin to get wary of the process as it requires a good amount of time. Another challenge would be to manage the different perceptions and to try and get them levelled.

"The vision and objective may sound a bit dreamy. But setting housing as an objective is very normal. So why not also set energy production and nutrient recovery and all of these things also as a objectives as these are very hard sustainability objectives. So the objective is more conceptual and then you do the analysis and modelling and then you set the goals. I think one should always choose for an integrated strategy. So if one would just focus on materials and reuse and recycling you are going to lose out on other objectives." (CSLT_3)

"Ambitions are the key factors of the project and that is the hard part. Because normally one needs a lot of time for that part while people are not getting really hard conclusions." (RO_CSLT)

"There are many different stakeholders with many different opinions. But opinions are so engraved in their thinking that it is difficult to be able to change their opinions. So it's more like how does one take their opinions into account and how does one manage their expectations that's a different challenge than getting their desire's into the design." (CSLT_1)

The vision along with the ambitions not only provides an aim of the future but also assists in selecting external stakeholders that resonate with the vision, coordinating among heterogenous stakeholders and orientation for a unified action towards the future.

Table ii: Exploring with the team along with corresponding challenges, exercises and lessons learned

DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
The main focus of actor learning is to gain insight on circular solutions and develop an understanding of how the organizations can shift from linear to circular thinking. The understanding of the principles allow them to incorporate it into their vision of the project at a later on stage. Prior information can be collected to understand what is the level of understanding on circularity and sustainability in the group to further decide on what added knowledge will the experts need to provide the team with.	• According to the interviewed experts, from their past experience in projects not everyone within the team was well versed with the topic of circularity. Most of them had a vague outline and knew the basic principle but were not experienced with the details and its practical application.	• They would explain the principles following which they would provide the team with inspirations in the form of examples, each of which was done differently. • Alternatively, another exercise also done with a group of people is for them to pick up projects and explain what and why is that project inspiring to them on a personal level. This provides the expert on the level of knowledge among the stakeholders.	
There exists at least 114 definitions of the term CE it is recommendable for the team to converge on a circular working definition, which means: what is circularity for that specific project.			
During this phase the themes for the project can be chosen and can be at a very conceptual level. The team is allowed to dream and go as high as they can with the objectives, not just thinking where they want to go, but also how far can they go.	• The challenge here is to get the vision from the stakeholders as only then will it be owned by them to result in a successful project. • The challenge here is that the stakeholders do not see hard conclusions yet and begin to get wary of the process as it requires a good amount of time. Another challenge would be to manage the different perceptions and to try and get them levelled.	• Similar to the exercise explained previously, the session would begin with a warm-up exercise, following which the team is allowed to choose from options or reflect on something proposed by the consultants. • Sometimes the team is also provided with inspiration from other visions. The team would then be divided into smaller groups to write down a vision pitch after which they would vote.	The vision along with the ambitions not only provides an aim of the future but also assists in selecting external stakeholders that resonate with the vision, coordinating among heterogenous stakeholders and orientation for a unified action towards the future.

THEME 3: IDENTIFYING OPPORTUNITIES

To facilitate the transition from intangible to tangible ambitions, goals are identified that can be integrated into the building system. This involves developing functional specification for the project and not technical specifications so that it provides the contractor with greater freedom to innovate and explore, yet concrete enough to specify in the procurement process. There are two aspects through which these tangible goals can be developed. The first being through the involvement of the end-user in the process. The priorities of the end-users can be incorporated by interviews and observations that highlight on their existing conditions, problems and how they envision the developing project to be. Further, understand what circularity means to them, why could it be important for them as well how will it help them and later to combine these findings with the possible solutions. The challenge here is to ensure that the end-users are involved as it is time consuming and difficult to see the value of their participation at the start.

"One should have a good discussion first about where are we, what is here in terms of infrastructure, what type of people live here already, what are their problems and priorities, then one makes sure that although one starts with quantitative flow analysis, one also looks at the area and the people living there or that are going to live there and then combine these into the solutions." (CSLT_3)

The second way to devise tangible ways ahead is to establish smart goals for the themes that were defined during the vision formation. Before this is done also formulate an understanding of the current state of the infrastructure which is to be developed. The current state analysis assist in setting goals which will be possible to realise for that particular project. Visualization of the current state analysis is a powerful tool to trigger the team as well as to get them on the same page. Following this a large number of ideas and goal are collected based on the themes with the participation of experts and project team members. The solutions and goals that will be chosen need to be specific for the project. From the experience of the interviewees not all projects were able to collect a large set of ideas. There were few where only one solution was feasible and they had to go ahead with that. These goals established act as targets to achieve the vague and dreamy vision that would be defined ahead of this. While devising the goals the experts have highlighted on some recommendations. Firstly, devise goals such that they are realistic and attainable. Secondly, make the goals such that they are measurable. Thirdly, come up with a plan of how the goals can be reached. Lastly, do not fall into the trap of trying to achieve the same goal everywhere. Exercises and activities that have been used in general by the experts include brainstorms, where the team would openly discuss about solutions of come up with lot of ideas on how to change the current pattern. Alternatively, the world café set-up was also used that consisted of different themes labelled in different corners of the room and the teams would go around listing their goals for the themes in time intervals during an organized session. The exercise of using solutions cards was also practised in some cases. This was conducted by having 50 to 100 cards with different solutions along with a few blank ones and the team was asked to pick 8 to 10 cards that they saw as most important to achieve for that particular project.

"Circularity and sustainability need to be looked in a holistic fashion. These should always be your vision, but the question is how much can you achieve on each of these. There is a whole range of interventions that one can do in an area. The goals set are realistic and it does not mean that one finds circularity important, does not mean that every neighbourhood or building needs to be designed from re-used or renewable materials entirely. This should be based on the analysisl and also the context, what is suitable here, what is already present, if you have infrastructure.

One then translates their objectives to goals and make it measurable. One does not just say where they want to go, but how far do they think they can go that specific proeject. Then you can list the range of interventions By taking it through in this way which is more analytical. What is important is I can show that my goals are realistic and attainable." (CSLT_3)

The goals give a list of ideas however from this it is required to calculate the potential impact of each of these and check their feasibility to see if they are implementable or need to be dropped. The large number of goals need to be brought down to a few and prioritized to have the right start for the project. In sustainability and circularity the intervention takes place at the cost of something else, hence prioritization of goals based on organization preferences need to be done to avoid making the project impossible to realise. To assist in choosing goals that are in line with the organization's preferences asking 'why' and thinking profoundly of what the key role of the organization has helped the experts in the past. An exercise that is often followed by one of the experts to help in prioritizing was role play. Each stakeholder was put in each other's shoe and then according to that person's role choose their goals. This allowed them to look at the priorities from a different person's perception and also helped in levelling individual goals and priorities that is generally aligned to the stakeholder' role and position. To align and prioritize goals with respect to individual priorities was mentioned as challenging during this phase. In addition there were few projects where the team found it difficult to prioritize their goals which led to difficulties during procurement as there were few that were contradicting.

"The initiation phase is a key factor because then when one has 20 ambitions and iif they can manage to make it from 20 to 4 or 5 key ambitions then they do have the right start for the project. If it stays at 20 or more or little bit less then it's all over the place one does not get anything really good because everything is a little bit."(RO_CSLT)

Table iii: Identifying opportunities along with corresponding challenges, exercises and lessons learned

DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
To facilitate the transition from intangible to tangible ambitions, goals are identified that can be	• The challenge here is to ensure that the end-users are involved as it is time consuming and	• The priorities of the end-users can be incorporated by interviews and observations that highlight	

integrated into the building system. This involves developing functional specification for the project and not technical specifications so that it provides the contractor with greater freedom to innovate and explore, yet concrete enough to specify in the procurement process. There are two aspects through which these tangible goals can be developed. The first being through the involvement of the end-user in the process.	difficult to see the value of their participation at the start.	on their existing conditions, problems and how they envision the developing project to be.	
The second way to devise tangible ways ahead is to establish smart goals for the themes that were defined during the vision formation. Before this is done also formulate an understanding of the current state of the infrastructure which is to be developed. Following this, a large number of ideas and goal are collected based on the themes with the participation of experts and project team members. These goals established act as targets to achieve the vague and dreamy vision that would be defined ahead of this.	• From the experience of the interviewees, not all projects were able to collect a large set of ideas. There were few where only one solution was feasible and they had to go ahead with that.	• Exercises and activities that have been used in general by the experts include brainstorms, where the team would openly discuss solutions of come up with a lot of ideas on how to change the current pattern. • Alternatively, the world café set-up was also used that consisted of different themes labeled in different corners of the room and the teams would go around listing their goals for the themes in time intervals during an organized session. • The exercise of using solutions cards was also practiCed in some cases. This was conducted by having 50 to 100 cards with different solutions along with a few blank ones and the team was asked to pick 8 to 10 cards that they saw as most important to achieve for that particular project.	• Firstly, devise goals such that they are realistic and attainable. • Secondly, make the goals such that they are measurable. • Thirdly, come up with a plan of how the goals can be reached. • Lastly, do not fall into the trap of trying to achieve the same goal everywhere.
The goals give a list of ideas however from this it is required to calculate the potential impact of each of these and check their feasibility to see if they are implementable or need to be dropped. A large number of goals need to be brought down to a few and prioritized to have the right start for the project.	• In sustainability and circularity, the intervention takes place at the cost of something else, hence if the goals are not prioritized in this phase it would make it impossible to realize at a later stage. • Prioritizing goals with respect to individual priorities was mentioned as challenging during this phase. • In addition, there were few projects where the team found it difficult to prioritize their goals which led to difficulties during procurement as there were few that were contradicting.	• To assist in choosing goals that are in line with the organization's preferences asking 'why' and thinking profoundly of the key role of the organization has helped the experts in the past. • An exercise that is often followed by one of the experts to help in prioritizing was role play. Each stakeholder was put in each other's shoes and then according to that person's role choose their goals. This allowed them to look at the priorities from a different person's perception and also helped in leveling individual goals and priorities that is generally aligned to the stakeholder's role and position.	

THEME 4: AGREEMENT AND FEEDBACK

Different stakeholders have diverse perspectives and goals as stated above. Therefore it is required to have moments in between where the team cohesively agrees on the chosen themes, goals and path ahead. The stage helps identify if the stated goals and intentions are sustainable for the project and if the project is on the way to healthy abundance. As part of this stage perform a reality check with stakeholders if they are comfortable with their ambition level and check if they are applicable for the context of the project. It is important that everyone involved so far gives feedback to avoid resistance at a later stage. Generally, the experts have done this through written documents that conclude on the topics discussed during the group sessions. The stakeholders are then free to communicate their feedback and suggestions along with their agreement.

"If there are certain differences in understanding or perceptions, one would want to get that leveled. The ideas are collected interpreted and prioritized to put it down in a memo. This is then shared with the participants to get an agreement for them if that was what they wanted and what they actually felt." (CSLT_2)

Table iv: Agreement and feedback along with corresponding challenges, exercises and lessons learned

DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
As part of this stage perform a reality check with stakeholders if they are comfortable with their ambition level and check if they are applicable for the context of the project. It is important that everyone involved so far gives feedback to avoid resistance at a later stage.	• Different stakeholders have diverse perspectives and goals as stated above.	• Generally, the experts have done this through written documents that conclude on the topics discussed during the group sessions. The stakeholders are then free to communicate their feedback and suggestions along with their agreement	

APPENDIX D: Case Analysis

The following section summarizes the analysis of the three cases from the perspectives of the consultants and selected client-side stakeholders in the initiation phase. The selected stakeholders and their corresponding profile and role in the project are elaborated in Section 3.2.1.2 of the report. The themes identified through the analysis of the expert interviews in section 4.1 are used as central topics for the analysis. Each case illustrates what took place during the defined themes: understanding the client organization, exploring with the team, identifying opportunities and agreement and feedback. Along with the description of what took place during these themes for the project, the corresponding exercise was used for that particular theme as well as the challenge faced then is expressed.

The reference system as laid out in table 2 will be used for the analysis, for the ease of providing references to quotes.

Table v: Interview reference guide

Project	**Role in Project**	**Reference Code**
Alliander HQ, Duiven	Consultant	ALHQ_CSLT
Alliander HQ, Duiven	CSR Manager	ALHQ_CSR
Alliander HQ, Duiven	Procurement Specialist	ALHQ_PS
RHDHV Office, Amsterdam	Consultant	RO_CSLT
RHDHV Office, Amsterdam	Manager Business Development	RO_MBD
RHDHV Office, Amsterdam	Facility Services Manager	RO_FSM
Inspiration House, Zutphen	Consultant	IH_CSLT
Inspiration House, Zutphen	Process Manager	IH_PM
Inspiration House, Zutphen	Architect	IH_AR

CASE I: ALLIANDER HEAD QUARTERS

CASE INFORMATION

Year completed:	2015
Location:	Duiven, Netherlands
Project size:	24,000 meter square
Duration of the initiation phase:	Seven Months
Formal sessions of the initiation phase:	Interviews with end users, Market consultation with internal stakeholders, Interviews with suurounding stakeholders, Plenary sessions

INTRODUCTION

The project began with having an ambition of developing a new 8 story high, BREEM excellent building on a plot of land behind the existing office that was at that point lent out to a farmer. This ambition of theirs was completely different from the current building that has finally been developed. They had the idea of developing a sustainable project, for which the solution was prescribed without exploring the real need of the project or looking into the options that could be possible. The first step into this project was to re-frame that initial idea and the question but also to not just ask for a BREEM excellent building but go beyond that and find the reason behind wanting a sustainable building. This includes finding out what is behind it and what is sustainable for the employees of the organization.

"Our first reaction was that of course this is a solution and is not a question. So basically the first involvement was to help them understand to re-frame the question so that there will actually be a question."(ALHQ_CSLT)

UNDERSTANDING THE CLIENT ORGANIZATION

The first exercise of the consultants with the client project team to understand them better was through interviews. The interviews were conducted to better understand the personal ambitions of the upcoming building among the board members, the future residents of the building, sustainability managers, technology managers and the managers that were responsible to develop a 'new way of working' among the employees. The course of the project shifted from having a solution in mind (a new 8 storey building) to a process that diverges further to explore the client organization, the end-user along with personal commitment. Different possible scenarios were later sketched out using this information. In order to create a process that fits the organization, interviews were conducted to get a feeling of what can be done with the team. Sometimes the organization is open-minded and comfortable to go ahead with a creative process. While at other times the organization consists of people who require more structure or proof of the advantages of including such ambitions in monitory terms. Learning about the individuals within the client organization helps develop the process ahead to prevent them from becoming the biggest break on the whole process. Alliander as an organization was open-minded and focused on developing the end result through a process. However, this was not a process they as an organization was accustomed to.

"Our first involvement was basically to do interviews in the organization to sort of better understand what the ambitions were with this building and we did that across the boards, we had interviews with the people that were going to be working at that location, sustainability managers, with technology managers, with managers who are responsible for the new way of working. So a very broad understanding and by having this process were we have a lot of commitment from the organization we were able to then, sketch different scenarios." (ALHQ_CSLT)

According to the consultant of the project, during the initiation phase, there is more than just focusing on the ambition and the tender document. One of the important things to pay attention to is to get the internal organization aligned and install a belief for the project among those who are resistant. For a project with circular ambitions the usual steps of initiation, preparation, tendering and contracting are taken up, however, each of these is further expanded in comparison to a project with no circular ambitions. During the project of Alliander the initiation and preparation took longer than anticipated. But according to the interviewees, this time was essential and they were convinced that the time spent during this phase will result in a project where the organization will benefit for the next 20 years. The end result was not known unlike other projects and they knew they had to opt for a different process due to this. In order to develop a functional question with which they could approach the market, a collaboration between disciplines of

the organization was seen as necessary. Collaboration between disciplines seemed apt to define what they wanted to achieve and how are they going to achieve it.

When the project was in its initiation phase not everyone was equally enthusiastic about the changing way of approaching the project or the importance of sustainability. To combat this the few people that initiated the project got together people who were quite involved in sustainability and also made sure that there was one team member from the different layers within the organization. Each of the selected employees was responsible in collecting information, persuading and informing their own level. The team believed that innovation processes did not need the input or commitment of a lot of stakeholders. With a fairly small group, the core team consisted of the manager of the HR department responsible for the new working conditions, the director of safety, the senior purchase professional, a member from the purchasing department and the person in charge of corporate social responsibility. All of them worked with one direct contact with the CEO. For approximately one year, five of these employees worked together for the initiation phase to eventually send out the procurement for the building. Each of them had a strong belief for the upcoming project, intrinsically motivated to establish sustainability and circularity as the final goal. They knew that they were not procuring a building but a facility that would make it possible for the workers of Alliander to contribute to the purpose of the organization. They sort out for a process where the end-users described what they wanted in the new building, which was an exercise normally not done for their past projects.

"When we did Alliander, Duiven project not everyone was equally enthusiastic about new ways of working or about the importance of sustainability. So, it's really important to have a good cross-section of all the internal stakeholders mixture so that you don't only speak with people who you know who have resistance but then you also speak to people who have ambitions or ideas." (ALHQ_CSLT)

EXPLORING WITH THE TEAM

The team knew that if they did what they always did, they would get the same result. That is making the specifications and asking the market what they had to offer. The greatest challenge during this phase was not knowing what the specifications were. For example, the interviewees said that listing criteria to realize energy neutrality was possible as it was done before. But when they had to list criteria for circularity it was quite new and unknown on how to specify.

Before trying to define circularity for the Alliander project, the team was given some theoretical basis for circularity so that they could get thinking about it themselves and also identify what would circularity be in relation to the Alliander project. The consultant for this case preferred not to use visualization (that is pictures of completed projects) as inspiration as they believed that it would result in the client team to begin thinking in terms of solutions rather than thinking freely.

"Providing a picture could limit the team to think in one direction and lose the opportunity to explore." (ALHQ_CSLT)

In order to set the ambitions for the project, an internal consultation was organized. The consultation was arranged in a free form not having a central assumption of what the final result of it could be. The consultation was formalized to identify the need of the project according to the organization. It was organized for a three-hour session with approximately 20 people, all of whom were experts from the company itself. The participants of the consultation included employees from the facilities department responsible for the buildings of Alliander, in-house architects, installation experts, innovation experts and trend-watchers. It was a combination of a bunch of experts that were brought together and this created a new way of approaching the problem. The format for the consultation was similar to the world café setup with drawing boards in every corner of the room. The problem was split into four parts. The first is that they need more space for employees. The second, that it needs to be circular. Third, the project needs to be carbon neutral. The last one was about finances in relation to the business case and the process that would need to be followed to reduce as much new construction as possible. Each of these was placed in different corners of the room, with the participants dividing themselves among each corner. After approximately 30 minutes they were asked to shift to the next corner to further elaborate on what the previous group ended for that topic and start again by adding new concepts to it. During the meeting, one of the attendees came up with the idea that the simplest way of building was to not build a new building at all. Before the consultation, the project was to build an extra building in addition to the 5 existing buildings in the available free space. However, towards the end of the exploration the housing problem boiled down to a solution where there was no need of building a new building, but that the housing

problem could be solved by the expansion of the current buildings. Through the consultation, the problem was redefined to state that it was a housing problem and not a building problem. This re-iteration of the problem at hand created the development of new concepts and influenced ambition. The process took the team about 3 to 4 months and what they found challenging was not having enough time for ideation and building up the ambition. Once the process was done, they realized that a very communicable ambition document made the rest of the process a lot easier. The ambitions during this session were set really high and the team knew they were not easy to achieve. They believed that if it was not set high there would not be a spark for innovation through the process. It was not possible for the interviewees to pin down points that led to keeping the ambitions intact till the end, but what they felt was that every member believed so strongly about the ambitions that were set by them for the project.

"It was a very pure form of a bunch of people that we brought together for the internal consultation and that created a new kind of way of thinking about our problem. We thought we need a new building but through the meeting, we redefined our problem. We just had to expand the old. It was transformed into a housing concept with a housing problem. But maybe the solution was not to build a new building but to expand the old building." (ALHQ_CSR)

"I think that the problem with innovation is that there is much too little time for ideation and building up your ambition and I think that the first internal consultation and the ambition document took us about 3 to 4 months. But once you have a very clear communicable ambition document the rest of the process will be a lot easier." (ALHQ_CSR)

Following the establishment of the ambitions, there were employees within the organization who were still wary about it. The core team had to proceed on persuading the people based on trust to keep their ambitions and realize it. This was a challenging act as according to them it demanded a lot of competencies to persuade people while also keeping them on board for the project. In order to get the board of Alliander involved with the project and also to understand the importance of the listed ambitions, a creative exercise was planned. The exercise was designed such that, the board members in groups of two had to interview the local stakeholders who had their office in the area of the building. The interview was down around the topics of the stakeholder's ambitions, circularity and energy neutrality. This was initiated to get them involved in the process and also align their perspective with the process followed. The information collected through these interviews would later feed into the 'area ambition' that aimed not only at making the final building circular but the whole area around it as well. Internal dynamics and differences in perception did make the process difficult. The core team at different points was required to make sure everyone was comfortable with the process being taken, including the board. The team as a whole looked for opportunities instead of threats through the project. Every member of the project team was well connected, positive and worked really hard to realize the ambitions. This was not something that they had agreed on paper but happened unconsciously as the team members were involved with their hearts and minds in the project. The ambitions were also not forced on them but were something they owned and developed through the process.

"It was the internal dynamic that was difficult and making sure everyone was comfortable with the tenders we proposed to publish. Including the board."(ALHQ_CSLT)

IDENTIFYING OPPORTUNITIES

Following the exploration, with the team, the project proceeded to understand more from the end-user perspective. Interviews were conducted with the technical employees (end-users) to get them on board. They were at first resistant to accepting the format of a new way of working. Through the interviews, they were asked to describe their ideal work environment and were also included in testing groups further on in the process. These groups were not too interested in the topics of circularity or energy neutrality but were more interested in knowing about the interior specifications of the work environment. The core team saw it imperative to get the involvement of the end-users ino the process. According to the interviewee's description, not including the end-users would be similar to missing out on a very serious stakeholder. The process of interviewing the end-users and getting to know their preferences was facilitated by the project team member who was part of the HR department. The Alliander project was the first to initiate new ways of working in the Netherlands that would include open desks and open spaces upfront.

"We spoke to a lot of, technical guys who were working at this location. In our interviews, we interviewed a lot of the geeks to get them on board with this way of working but they were definitely still resistant then." (ALHQ_CSLT)

"Yes definitely I think if you don't include the end-users you are missing a very serious stakeholder." (ALHQ_CSR)

According to the interviewees, if the project at the initiation phase is able to describe technical solutions on what they expect for circularity then the procurement can have technical specifications. But, in terms of technical details if the result and circular solutions are still unknown there is the freedom to specify functional specifications in the tender documents. The functional specification in the tender document leaves space for the market to think of new solutions previously not thought of. The team was clear that they wanted to take advantage of all the possibilities in the market and be surprised by what the market has to offer. There could be a lot of innovations and creative solutions that don't find their way to the market because the right questions are not being asked. If the procurement does not ask for innovations then the final result is a regular office. To avoid this their question to the market was functional, highlighting the main ambitions they wanted to see in the end result. There was no step in this project where the team collected or brainstormed on various technical solutions.

"If you are able to specify in detail what you expect based on circularity, then you can technically describe the solution thereafter. But if you don't know how the result will be technically and you don't know how the circular solution will be, then you can take the freedom to functionally specify your tender documents. Because the more functional you specify, the more you leave space for the market to surprise you with new solutions. But if you really technically specify in detail what the supplier should do, you don't get any surprises.
That is something we wanted in this project, to be surprised, take advantage of all the possibilities in the market, and there are a lot of innovations and creative solutions which don't find their way to the market because our questions are not being asked." (ALHQ_PS)

AGREEMENT AND FEEDBACK

Constant reflection cycles on how the project is developing along with agreements and feedback if they were all on the same page helped understand each other and check if they had the same view on how the project was evolving. Throughout the project, the opinions and interests of the future employees were taken into account and also asked for their agreement if they felt comfortable with it. The action to be taken was summarised but also a constant reflection was taken from the future employees throughout the project. The decisions were made by the core team based on the inputs of the employees.

CASE REFLECTION

Through the ambitions that were collected during the internal consultation and interviews, the core team along with the consultants tried to converge them into two main themes which were circularity and connectivity. Further for the purpose of the procurement, they asked the market to think of ways to provide for more working places to accommodate the employees. There was no direct solution given. In addition, certain ambitions need to be realized, which is circularity, connectivity, energy neutrality. They decided to keep the question open and allow the external market to come up with creative concepts. The final ambitions set out for the project before procurement include, circular building and construction process, positive energy balance, appropriate and future-proof working environment, relationship with the area.

The ambitions established were definitely high and through the process were not easy to achieve. The team believed that only if they were put high would it be possible to spark innovation. The stress of the ambitions getting diluted was present throughout the project as it is easier to find cheaper and quicker alternatives. To avoid this the team kept in touch with each other with constant reflection cycles to evaluate the project at different stages. They also laid down alternative plans to predict the end-result if a certain ambition was dropped or realized at a lower scale. According to the interviewees, what worked best to maintain the ambitions was constant contact with the project team, understanding each other's worries and collaboration to deliver a team effort. As a client, the Alliander team opened up to creativeness and innovation just by asking for something quite new.

"It is comfortable to ask for something that one is familiar with compared to something where the team does not know what the end result would be. Everybody wants change but nobody wants to change." (ALHQ_PS)

In conclusion, the interviewees specified on the following lessons learned after completion of the project. Creatingreate a different concept apart from the regular requires a change in the process according to the interviewees. Circularity is still in its nuptial stage and not everything on this topic has been discovered yet. Hence,

the project requires to make functional specifications instead of technical specifications towards the market. A start for this is to define the ambitions which is one of the most important activities. Ambition is required to be added instead of the project just being executed. If the ambition is not intrinsically engraved to make the world better and the focus is still on money and quality then realizing circularity will be difficult. However, adding this ambition to the project will make the process more difficult which means attention is needed to be given to competence as well as persuading people. In addition, finding the solution through the process requires interaction and collaboration between cross-disciplines to trust and share the right knowledge. Further asking the question why at every point was seen as necessary as things are made more clear with it. Lastly, in order to leave room for innovation, the question in the tender should be functional. For a circular building, it would not be possible to specify the specificity in full service. Specifying the headlines of the ambitions alone will allow for openness towards the market parties. Within the initiation phase ensure that the people selected are visionary and ambitious. It is wise to invest more time during the initiation and preparation phase.

"And the most important question throughout the whole project was to question why? Everything we said, everything we did, we asked the question, why? If you have a relationship with everybody in the project to discuss this 'why' questions, that's where you get answers with the answer 'why'." (ALHQ_PS)

Unlike energy neutrality when the project is trying to achieve circularity, it is similar to trying to achieve something new that is yet to be done and this makes it challenging. There is a certain amount of uncertainty that the project team needs to embrace because there are constant innovation and development for which the team is required to be open to ideas and interventions they did not know at the start. During the formation of the vision and ambitions, there were not many iterations as there was sufficient time taken for the preparation of the internal consultation to identify what is really needed and what does the team want. This includes finding answers to the why, what and how questions for the project.

The biggest challenge for the team through the process was to resist the urge to get back into their comfort zone and complete the project as a regular building without realizing the specified ambitions. The challenge was to stay out of the comfort zone, to be open to new ideas and new perspectives.

"When you add circularity to the equation it becomes different because the price is becoming another aspect and quality as well because when you look at the production phase of stuff, the quality of the product is better when you don't take circularity in mind. If you could produce virgin material, it is always easier, cheaper and quality is better. But when you want to add circularity to the equation you have to make concessions between, quality, price, sustainability, durability so it makes the subject more difficult. And that is something you have to be willing to do and you have to be prepared to make sacrifices because if you want to buy cheap good quality you can well generally get is fast. Circularity in the equation makes it a longer process, much more difficult process and the outcome is not always how you exactly want it to be." (ALHQ_PS)

Table vi: Complilation of the analysis for the Alliander Head Quarters

THEME	DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
UNDERSTANDING THE CLIENT ORGANIZATION	Interviews were conducted to better understand the personal ambitions of the upcoming building among the board members, the future residents of the building, sustainability managers, technology managers and the managers that were responsible to develop a 'new way of working' among the employees. Learning about the individuals within the client organization helps develop the process ahead to prevent them from becoming the biggest break on the whole.	• To find a fitting process and to get a feel of what can be done with the team. • To get the internal organization aligned and install a belief for the project among those who are resistant.	• The first exercise of the consultants with the client project team to understand them better was through interviews.	

	In order to develop a functional question with which they could approach the market, a collaboration between disciplines of the organization was seen as necessary.	• The end result was not known, unlike other projects. • When the project was in its initiation phase not everyone was equally enthusiastic about the changing way of approaching the project or the importance of sustainability.	• To facilitate collaboration the few people that initiated the project got together people who were quite involved in sustainability and also made sure that there was one team member from the different layers within the organization. Each of the selected employees was responsible in collecting information, persuading and informing their own level.	
EXPLORING WITH THE TEAM	Defining circularity for the Alliander project	• When they had to list criteria for circularity it was quite new and unknown on how to specify.	• The team was given some theoretical basis for circularity so that they could get thinking about it themselves and also identify what would circularity be in relation to the Alliander project.	
	In order to set the ambitions for the project, an internal consultation was organized. The consultation was arranged in a free form not having a central assumption of what the final result of it could be	• The problem with innovation is that there is much too little time for ideation and building up your ambition and I think that the first internal consultation and the ambition document took us about 3 to 4 months. But once you have a very clear communicable	• The format for the consultation was similar to the world café setup with drawing boards in every corner of the room. The problem was split into four parts. The first, is that they need more space for employees. The second, that it needs to be circular. Third, the project needs to be carbon neutral. The last one was about finances in relation to the business case and the process that would need to be followed to reduce as much new construction as possible. Each of these was placed in different corners of the room, with the participants dividing themselves among each corner. After approximately 30 minutes they were asked to shift to the next corner to further elaborate on what the previous group ended for that topic and start again by adding new concepts to it.	• The project requires to make functional specifications instead of technical specifications towards the market. A start for this is to define the ambitions which is one of the most important activities. Ambition is required to be added instead of the project just being executed. • If the ambition is not intrinsically engraved to make the world better and the focus is still on money and quality then realizing circularity will be difficult. • However, adding this ambition to the project will make the process more difficult which means attention is needed to be given to competence as well as persuading people.
	The core team at different points was required to make sure everyone was comfortable with the process being taken, including the board	• Following the establishment of the ambitions there were employees within the organization who were still wary about it	• The exercise was designed such that, the board members in groups of two had to interview the local stakeholders who had	

		• This was a challenging activity as according to them it demanded a lot of competencies to persuade people while also keeping them on board for the project	their office in the area of the building.
IDENTIFYING OPPORTUNITIES	Following the exploration, with the team, the project proceeded to understand more from the end-user perspective. The core team saw it imperative to get the involvement of the end-users in the process.		• Interviews were conducted with the technical employees (end-users) to get them on board. • Through the interviews they were asked to describe their ideal work environment and were also included in testing groups further on in the process.
AGREEMENT AND FEEDBACK			• Constant reflection cycles on how the project is developing along with agreements and feedback if they were all on the same page helped understand each other and check if they had the same view on how the project was evolving.

CASE II: ROYAL HASKONINGDHV OFFICE (CONTACT)

CASE INFORMATION

Year completed:	2017
Location:	Amsterdam, Netherlands
Project size:	1800 meter square
Duration of the initiation phase:	Four Months
Formal sessions of the initiation phase:	Sharing knowledge and experience from Market, Explanation of the desired work environment, Determining the ambition levels

INTRODUCTION

The project began with clients questioning themselves if they were practicing what they preached to their clients in terms of sustainability in the real estate. With this question in mind, the team decided to take up a new office in Amsterdam where they can realize sustainability in more detail and within the present context. Instead of finding a new office with well-fit amenities, they started developing the project with the question 'what will the people of the office be doing there and what is the future business of the office'. The challenge faced by the team at this point was that they were not able to imagine the end result for what they were asking.

"The starting point was practice what you preach; sustainability, doing something with the mission of the company, and enhancing societies together in Amsterdam. But I think this needed more depth further on in the project of what it actually means. We did not know what the result would be, of what we were going to ask."(RO_MBD)

UNDERSTANDING THE CLIENT ORGANIZATION

The client team initiated the process by listing down its ambitions for it. However, the interviewees reflected on the fact that these ambitions were too many in terms of number and also at some points contradictory to each other. Examples of their ambitions in the beginning included; an office next to the train station, an office that does not cost too much money per square meter, and an office that can be developed in an already existing structure. Before the consultant joined the team the first vision was established. Following this, it was identified by the consultant at that point, that there were too many ambitions. Also, the ambitions were was not connected with the internal ambitions of the internal stakeholders or the mission of the company. A strong link with the stakeholders or organization was seen as crucial to ensure the ambitions last through the realization of the project. To ensure this was incorporated into the project the consultant decided to take a step back and through interviews and analysis find out the intrinsic motivation of the client organization. Through a lot of talking, interviews, and analysis of documents a connection of the ambitions was found with the mission of the company. The missing link was that the company had a strong mission on sustainability but the question for the project to the market was not in line with the mission of the company.

"If ambitions of the project aren't linked to some internal ambition of a person then it is really hard to get it in the project. So you have to touch something in somebody to get the job well done." (RO_CSLT)

EXPLORING WITH THE TEAM

While proceeding with the development of the project the client found it difficult to choose between the choice of focussing on the process where the end-user was included or focussing on defining the final product. After several discussions, it was decided to go ahead with the preference of focusing on the process and not the product. Subsequently, the challenge was to get the internal stakeholders and end-users to choose between options as the topic was not too familiar among the people. Also, circularity in itself has different definitions of different levels that amplify the problem. Before proceeding with ways to increase their knowledge, the team went on to have a discussion with internal stakeholders, to understand their interest in adding a sustainable or circular ambition to the project. Another challenge while trying to get the internal stakeholders involved, was to make them feel confident to take part in the project. The stakeholders did not feel the confidence as it was not the usual procedure that was

followed by the company. Examples of how this project was different from their regular way of working include; the choice to focus on a qualitative ambition, the choice of combining the office with an artist, the choice of developing an office in a garage, the choice of putting circularity as a top priority, the way of contracting and the collaboration with the execution parties. For the consultant, on the other hand, the challenge during this phase was to get the internal stakeholders out of their traditional way of working because every time an unknown situation came up, people preferred taking the path that was familiar to them. Further, it was difficult to get a good connection with the clients and to outperform themselves. In brief, the hardest part was to get into the project and getting a place within the team for the consultant. To be able to form that connection was imperative as only after people feel comfortable and trusted would the internal stakeholders begin to express what they truly felt within themselves. If the project moves ahead without its vision or ambitions being linked to the internal ambition of the person it would be difficult to realize it at a later stage. During a regular project with no additional ambitions, the team looks for an already designed office to then accommodate people. In a regular approach, the end-user is hardly involved in the development of the office.

"We had several discussions on whether we were focusing on the process where we include the end-users or whether we should focus on a product. We ended up giving preference for choosing the process. We discussed the optimal working environment and tried to find a building to which we thought would add value."(RO_FSM)

"Some are not aware, so you need to make them aware or increase their knowledge to tell or have the discussion with them to understand what is their interest in doing this." (RO_MBD)

"They have a clear vision at first, but then we put a lot of fuzziness in there. Then after a couple of weeks and sessions it was clearer and they were like, ah, this way should work." (RO_CSLT)

The initial vision defined by the team was clear but was not strongly aligned with the company or the people. By adding in a few sessions of exploration and fuzziness into the project they were able to identify the ambitions that were really important to the team. As an example this included discussions of what was important to them, how would they describe the optimal office, what would they like to see in an office, what do they want to tell their client about the office. So a lot of interaction with the end-user of what is important to them helped the team to develop a different way of thinking. It helped them change the way they saw the development of a new office, from viewing it as an additional cost to seeing it as an added value for the business. This was the result of all of the discussions and sessions developed by the consultants which included involving different perspectives at every phase that also led to redefining the problem. But the constant challenge was not knowing the end result before achieving it.

As mentioned not everyone was comfortable with the process and this included the board of directors as well. They were not fond of the approach and the listed ambitions as they could not see what the end result would be. They were not afraid of themselves but more about what the employees would think about it. To combat this challenge a lot of end-users were included in the process for support. The end-users were involved at later stages in an interactive session and were also part of the design team. This gave the others also trust because they knew their colleagues were also involved. From the team's experience, it was established that having a stakeholder from the decision-making unit within the process is beneficial as their perspectives are also included right from the start. While establishing the ambitions, what makes it challenging is the difference between the client and the end-user because they have a certain scope and including end-users requires them to step over the scope. In this case, however, the client and the end-user were within the same organization. Another lesson learned and requirement established through the analysis was that the ambitions should not be general but should be defined such that they are specific to the organization and also fit well. This makes it easier during the execution phase because every decision can be based on 'the why' the project is doing it in a particular way. Additionally, it also allows us to align or find external stakeholders in future phases with these specified ambitions.

"To get a good connection with the clients and to really outperform ourselves by delivering vision documents that they really don't know what to expect, but do know what to expect in normal projects. So the hardest part is getting into a project and really getting your place in the team." (RO_CSLT)

"I asked for confidence from the board., I included a lot of end-users in the process so they support me and then you don't need to necessarily have the full support of the board, because it's often too different from this way of thinking." (RO_FSM)

IDENTIFYING OPPORTUNITIES

Once the link of the broad vision of the project was made with the mission of the company, next was to involve the end-users to understand their perspectives for the project and personal preferences. This was done to further prioritize the ambitions and to be able to choose the most fitting ones in relation to the end-user. This took place through an interactive session that began with providing an understanding of circularity (what is it and how it can help the mission of the company to be more sustainable) followed by a questionnaire to determine the user-profile and their personal choices. The questionnaire consisted of 30 questions for which the employees had to give an answer regarding their current situation within the organization and indicate to the extent to which they see that proposition important for the future of the organization. The questions ranged from the opinions on the use of sustainable transport to the level of comfortability in the workplace provided by the organization. It was aimed to understand the current whereabouts of the organization along with establishing those propositions that the employees so important for the future. The result of the questionnaire were two spider diagrams, one relating to the current situation and the other relating to the desired situation. The employees were asked to answer based on their own opinion and not as expected from the organization.

"We started with our aspirations and values. We started by briefly mentioning the company's mission: enhancing societies together, focussed on Amsterdam. So, what is enhancing society together in Amsterdam for the employees, what are they doing, what is the future look like for them and based on that we made a translation to what it could mean for the office and that decided what the 'what' became the thing". (RO_MBD)

"We had brainstorming sessions with the end-users. As an example, we had a discussion of what's important for them. How would they describe the optimal office? What would they like to see in an office? What do you want to tell a client about your office? What do you want to tell if you are on holiday and you want to tell someone where you work. Do you tell them about the projects we execute or do you tell them about the building you work in? So we had a lot of interaction with the end-users of what is important to them and it helped them in developing a way of thinking." (RO_FSM)

From identifying the aspired values, establishing a connection with the company's mission, and diagnosing from the employees their preferences (what does enhancing the society together mean for them, what are they doing and what is the future for them look like) a translation to what it could mean for the new office was defined. Through this process, there were themes identified that included the final building to be circular (use of re-used/ recycled/ upcycled materials and use of at least three building elements on the basis of lease/ loan contracts), smart and multi-functional use of space, health and well-being and lastly energy neutral. There was not a minimum level defined for each of these while they were established. To identify the possibilities within these themes a session of free-thinking was organized. However, the team did encounter a struggle in establishing goals for the theme of circularity, health, and wellbeing as they were not straightforward topics in comparison with defining goals for energy neutrality. Through a lot of discussions on how to achieve it, the team ended up defining the output specification instead of the input specifications which helped them to proceed further (functional instead of technical).

"We were also depending and stimulating each other to find the best solution from different perspectives. Becoming energy neutral is pretty straight forward but with circularity, it is not. We had a lot of discussions about how to achieve that. We ended up defining the output specifications instead of input." (RO_FSM)

Even after these themes were laid down it was still difficult as some of them contradicted each other. In addition, some of these themes were also difficult to concretize. Through further discussions with the management and marketing team, they were able to prioritize more. The discussion included understanding their perspective if they were inclined more towards sustainable results or entertainment and attraction of talent or was it focused on cost efficiency. It helped them determine the actual value of the project which assisted them to prioritize the themes to later approach the market. However, for the topic of circularity the team faced a challenge as this also depended on the market availability. A concluding remark by the team was that for projects such as these it is always important to describe the output instead of the input as there are more ways to achieve the output criteria than looking at it from an input perspective. Following this, a discussion with the market parties for possible contractors led to

prioritizing the themes further based on the expertise and ambition of the contractors. During these dialogues, it was understood that there were still too many themes and through the discussions, it boiled down to a few focused themes. From approximately eight tenders that came in, three were chosen to take part in the dialogue session. In order to analyze the ambitions of the contractors before selecting they were each asked to take part in creating a storyboard. The exercise consisted of writing a newspaper article describing the special features of the building in five years and along with the description of the perfect building. This exercise design in an abstract and free-thinking manner gave them the space to dream big, to escape from reality, and to get great ideas into the project. The exercise was identified as one of the processes that worked well with the project as it allowed to incorporate great ideas and also helped to find a partner whose ambition matched with that of the client 'someone who was willing to create a project that has never been done before'.

"By having conversations with us, what is really important, what is most important and what is less important. They did a workshop as well with some of our management, marketing department, and us to see what was the end goal. Was it focussing on the sustainable results as a goal on itself, was it focussing on the entertainment and attraction and talent, was it focussed on cost efficiency, what the actual value is. So that's what they helped us in. We had these goals and then we prioritized them on how could you make an approach to the market to actually realize it and this was the second step." (RO_MBD)

CASE REFLECTION

According to the interviewees, the initiation phase is important and also requires the team to set the bar for the rest of the project. Hence, an exercise in order to dream and escape from reality without being judged is necessary. As described by one of the interviewees, setting the ambition too high may seem impossible to achieve, but only then will the team be working towards something. If the project begins with regular ambitions then it would not be able to achieve something exceptional. Also with the topic of circularity, everything has not yet been defined and it requires projects to pioneer and develop new ideas in order to transition towards buildings with more circularity principles incorporated. Both the clients and consultants of the project resonated with the importance of the initiation phase and the need to explore, add perspectives of stakeholders, and also to embrace the vagueness inherent at the start.

"The big challenge for myself was not to know how the end result would look like. So we defined a process and we were running a project without knowing the end result. And even not being able to tell the story to an end-user, but all expect that you are the guide and you should know and we didn't know." (RO_FSM)

The process taken by the project can be described as iterative as the vision set by the initial project team was improved by adding in perspectives of the end-users and the extended internal stakeholders. This led to a set of themes, that was later reworked, prioritized, and shaped with the ambitions of the contractors as well. The project grew through the process. The individuals stimulated and depended on each other to find the best solutions from different perspectives. The effect of the initiation phase was extensive as they took a very different starting point and with the addition of every new party, they had to explain right from the start. They did this to ensure that every new party gets used to the idea and was as enthusiastic as the clients to participate and develop new ideas.

The contrary side of having high ambitions is that there were times in the project that they seemed impossible to achieve and would want to sort for a regular building that they were experienced with. In the initiation phase, there was one point that the team found it difficult to keep up to their ambitions. As the execution stage was approached the ambitions became harder to maintain because it got back to reality as the goals were also abstract. To combat this and concretize the goals the team formatted an excel sheet that had described the minimum and maximum requirement for each goal. As the project proceeded towards realization the team wished to go back to the ways they were familiar with. Therefore the team found it imperative to list down minimum conditions to avoid the goals from being dropped completely from the project.

In retrospection, the interviewees described the ambition as the key to the end result. The ambitions laid out were based completely on quality and not quantity (cost/ time). The interviewees from the client's end saw themselves as playing the main role for this project and for the projects to come in the future because if they do not ask for a circular/ sustainable project the contractors do not provide for it. Also with a wide topic such as circularity, it requires focus and full participation from the client's end.

In hindsight, the process followed for the project was not perfect but did have some aspects that the interviewees described as could have been done better or was a lesson learned by them for a similar project in the future. The first was to include the end-user at an even earlier stage. For this project, they were involved in the design phase and were also given an explanation of how the business ambitions of the people in Amsterdam were converted to the building. On analysis, it was found that after realization, the employees did not have the mindset to use this building as a means for the future business of the company. That is, to showcase to the company's clients what the company believes in and how they can bring about change. This mindset or seeing the value in the buildings could have been brought in by incorporating the employees right from the time the first goal was defined in the beginning. This would definitely make the process lengthier and expensive but the end effect would be bigger and better. However, this adds a collaboration challenge as everyone's perspectives will need to be incorporated.

Secondly, the construction industry has a conventional process, however, while approaching a building with circular ambitions it requires a change, that also requires asking the right questions to the market. Forming the question with which the client can approach the market was regarded as a challenge to the interviewee. Further, another challenge experienced by the team was that even if the contractor is on board it does not mean that all the people that are involved in the project from the contractor are also in line with these ideas. Not all of them were aware of their ambitions or experienced in building this way. The lesson learned from this by the team was that every time a new phase is entered and new people get involved in the project, an explanation of the project from the beginning needs to be given. The reason to do this is that it assists in changing their mindset instead of them just being told what needs to be done. The client is also required to think in their mind and understand what is important to the newly added stakeholders. In short, as the project moves from phase to phase and includes new stakeholders it requires the team to go back to the vision. In relation to this, another lesson learned is to align the stakeholders at a very early stage instead of inventing the wheel with a few people and then having a delay because it requires convincing the other stakeholders and the involved parties. Lastly, a project such as this with circular ambitions requires not only being shown the big dream but help in taking the first steps by the team.

"They helped us in a different way of thinking. They guided us through, that you can do this differently as well and then you have to expect the upcoming things. So it's mirroring, it's guiding its consulting, it's also developing discussions and having different perspectives at each development to make focus. But it hadn't been done before that was a challenge, you couldn't look at the end result before we achieved it. And that was really challenging and created a lot of uncertainty." (RO_FSM)

We really helped them with putting the energy and circularity goals in their course for the proposal because they were not really thinking about that one. They were really focussed on; okay 'we want to have an office next to the train station that doesn't cost us too much money per square meter, the regular stuff. They had about 20 or something ambitions or goals and we helped them to make it last.

Table vii: Complilation of the analysis for the Royal HaskoningDHV Office (Contact)

THEME	DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
UNDERSTANDING THE CLIENT ORGANIZATION	A strong link with the stakeholders or organization was seen as crucial to ensure the ambitions last through the realization of the project. To ensure this was incorporated into the project the consultant decided to take a step back and through interviews and analysis find out the intrinsic motivation of the client organization.	• The ambitions were was not connected with the internal ambitions of the internal stakeholders or the mission of the company. In addition, there were too many ambitions at this stage. The challenge was to bring it down to a few and bring a connection between the ambition and the organization.	• Through a lot of talking, interviews, and analysis of documents a connection of the ambitions was found with the mission of the company	• To align the stakeholders at a very early stage instead of inventing the wheel with a few people and then having a delay because it requires convincing the other stakeholders and the involved parties.
EXPLORING WITH THE TEAM	The process of getting the internal stakeholders and the end-users involved so based on their preferences choices can be made.	• The challenge was to get the internal stakeholders and end-users to choose	• Before proceeding with ways to increase their knowledge, the team went on to have a	• Exercises, in order to dream and escape from reality without

		between options as the topic was not too familiar among the people. In addition circularity in itself has different definitions of different levels that amplify the problem. • Another challenge while trying to get the internal stakeholders involved, was to make them feel confident to take part in the project. The stakeholders did not feel the confidence as it was not the usual procedure that was followed by the company.	discussion with internal stakeholders, to understand their interest in adding a sustainable or circular ambition to the project	being judged are necessary. • Setting the ambition too high may seem impossible to achieve, but only then will the team be working towards something. • Not be general with the ambition specification but should be defined such that they are specific to the organization and also fit well. This makes it easier during the execution phase because every decision can be based on 'the why' the project is doing it in a particular way.
	To be able to form a connection between the two parties was imperative as only after people feel comfortable and trusted would the internal stakeholders begin to express what they truly felt within themselves.	• The challenge during this phase was to get the internal stakeholders out of their traditional way of working because every time an unknown situation came up, people preferred taking the path that was familiar to them. • The hardest part was to get into the project and getting a place within the team for the consultant.		
	By adding in a few sessions of exploration and fuzziness into the project they were able to identify the ambitions that were really important to the team.	• The initial vision defined by the team was clear but was not strongly aligned with the company or the people.	• This included discussions of what was important to them, how would they describe the optimal office, what would they like to see in an office, what do they want to tell their client about the office. So a lot of interaction with the end-user of what is important to them helped the team to develop a different way of thinking.	
	Establishing ambitions with the end-users and internal stakeholders.	• As mentioned not everyone was comfortable with the process and this included the board of directors as well. They were not fond of the approach and the listed ambitions as they could not see	• To combat this challenge a lot of end-users were included in the process for support. The end-users were involved at later stages in an interactive session and were also part of the design team. This gave the others also trust because they knew	

		what the end result would be. • While establishing the ambitions, what makes it challenging is the difference between the client and the end-user because they have a certain scope and including end-users requires them to step over the scope.	their colleagues were also involved	
IDENTIFYING OPPORTUNITIES	To further prioritize the ambitions and to be able to choose the most fitting ones in relation to the end-user. This took place through an interactive session that began with providing an understanding of circularity (what is it and how it can help the mission	• Identifying the preferences of the end-user (future employees	• By facilitating a questionnaire to determine the user-profile and their personal choices. The questionnaire consisted of 30 questions for which the employees had to give an answer regarding their current situation within the organization and indicate to the extent to which they see that proposition important for the future of the organization. The questions ranged from the opinions on the use of sustainable transport to the level of comfortability in the workplace provided by the organization. It was aimed to understand the current whereabouts of the organization along with establishing those propositions that the employees so important for the future. The result of the questionnaire were two spider diagrams, one relating to the current situation and the other relating to the desired situation.	• Include the end-user at an even earlier stage. For this project, they were involved in the design phase and were also given an explanation of how the business ambitions of the people in Amsterdam were converted to the building. On analysis, it was found that after realization, the employees did not have the mindset to use this building as a means for the future business of the company. • This mindset or seeing the value in the buildings could have been brought in by incorporating the employees right from the time the first goal was defined in the beginning.
	Establishing detailed goals for the themes.	• The team did encounter a struggle in establishing goals for the theme of circularity, health, and wellbeing as they were not straightforward topics in comparison with defining goals for energy neutrality.	• Through a lot of discussions on how to achieve it, the team ended up defining the output specification instead of the input specifications which helped them to proceed further (functional instead of technical).	• For projects such as these, it is always important to describe the output instead of the input as there are more ways to achieve the output criteria than looking at it from an input perspective.
	Prioritizing themes.	• Even after these themes were laid down it was	• Through further discussions with the	

		still difficult as some of them contradicted each other. In addition, some of these themes were also difficult to concretize.	management and marketing team, they were able to prioritize more. The discussion included understanding their perspective if they were inclined more towards sustainable results or entertainment and attraction of talent or was it focused on cost efficiency.	
	To analyze the ambitions of the contractors before selecting they were each asked to take part in creating a storyboard.		• The exercise consisted of writing a newspaper article describing the special features of the building in five years and along with the description of the perfect building.	
AGREEMENT AND FEEDBACK	The process taken by the project can be described as iterative as the vision set by the initial project team was improved by adding in perspectives of the end-users and the extended internal stakeholders. This led to a set of themes, that was later reworked, prioritized, and shaped with the ambitions of the contractors as well. The project grew through the process.			• Every time a new phase is entered and new people get involved in the project, an explanation of the project from the beginning needs to be given. The reason to do this is that it assists in changing their mindset instead of them just being told what needs to be done. The client is also required to think in their mind and understand what is important to the newly added stakeholders. In short, as the project moves from phase to phase and includes new stakeholders it requires the team to go back to the vision.

CASE III: INSPIRATION HOUSE, WATERSCHAP RIJN EN IJSSEL

CASE INFORMATION

Year completed:	2019
Location:	Zutphen, Netherlands
Duration of the initiation phase:	Two Months
Formal sessions of the initiation phase:	Sharing knowledge on circularity, Relfecting on existing sustainable ambitions within WRIJ, Tender strategy for the realization of a circular building, Explanation Ambition Formulation

INTRODUCTION

Unlike the previous two cases, this project had a different start. The project began as a development of a regular building without any circular ambitions. The function of the project was to receive visitors who came to view the 'Kaumera' extraction installation at Zutphen. The innovative installation in Zutphen purifies the incoming residual water from the dairy industry and uses this as a source for the extraction of raw materials (the Kaumera biopolymer). The main goal at that point for the building was to include the extracted Kaumera as a building material in the project. The design was developed with the water authority and the architect keeping in mind the story they wanted to portray through the building. This story was related to Kaumera extraction. During the initial design process, the architect had the room to design with no constraints in terms of the materials that will be required for the construction. The process taking place in the extraction unit was the most important story that the building wanted to display. Attention at this point was given to the aesthetics and design of the building. The initial design concluded with a visualization of the upcoming building also providing confidence among the team of what the final building would look like. An environmental permit was also issued for the initial design following which the addition of circular ambitions for the project was proposed. At this point, the idea of starting again from a greenfield situation was dismissed. The question for the project had changed in the middle to add circular ambitions and at this point starting something completely new did not seem reasonable to the team. The plan ahead was to find ways of using the already existing design to which possible changes could be made to incorporate circular principles.

The first visualization of the building showcased the use of the material that was extracted from the Kaumera installation. For example materials such as cellulose or phosphate that were being recovered were used as materials within the building to showcase to the public on how these materials can be recovered and used.

"First of all, it has to be more like a show of a project in terms of aesthetics. The process in the factory was the most important part that they wanted to show. So first we made a design similar to an industrial building. We tried to make that as best as possible which was the design of the industrial plant alone. Circularity was not included at the time. But partially it was incorporated through the use of Kaumera which was a material they extracted from the new installation."(IH_AR)

The client team contacted the consultants as trying to incorporate a circular approach would require a different approach. According to the interviewee the different approaches included stronger collaboration, communication, and innovation.

"They asked us because the circular building needed a different approach because you need to work with contractors and clients very close. You need to facilitate communication during this procedure. It requires innovation. There is not a measurement which is 100% circular. They needed help in the process from pre-tender to tender and realization as well." (IH_CSLT)

UNDERSTANDING THE CLIENT ORGANIZATION

A stakeholder analysis was conducted to understand the client organization and to form a team that would take part in developing the ambitions for circularity. Through the analysis, the consultants were searching for people with commitment, open-minded people, and people enthusiastic about innovation. In addition to these, they also identified people among the organization responsible for decision making to try and get them as well into the process. The main aim of the analysis was to search for people who would enable the transformation because trying to incorporate circularity into the project is difficult. The team composed of the project did not remain the same throughout and was faced with the challenge of people being replaced through the project. This did pose a challenge for the consultants as getting people enthusiastically involved is a process. When people within the team keep changing it breaks the process leading to a drop in trying to achieve their ambitions. In addition when people switch between roles the perspectives of the newly added members need to be incorporated If not done it could lead to resistance at a later stage. For example, with respect to their role, their focus and priority could be more on time & money and following which sustainability/ circularity may take up a back seat in the project.

"We did a stakeholder analysis through which we were searching for commitment. We were also trying to identify a person who can make decisions because if not involved the process is difficult and gets slow. We were also searching for free-minded people, certain people within the foundation of the company who are enthusiastic about innovation because dealing with circularity is difficult to work with, and has many definitions. So searching for people to make the transformation. We have the commitment, innovate people and people who want to do the process themselves. These three are important to push forward this innovative process." (IH_CSLT)

"There were people switching roles from the client's side. The newly involved stakeholders had a different perspective which slightly changed the weight of sustainability towards time and money due to the deadline that was coming up." (IH_CSLT)

The project did not see much of a detailed investigation into why they decided to incorporate circularity. Neither did the project include processes to understand the kind of people that worked in the organization unlike the other two cases explained previously.

EXPLORING WITH THE TEAM

Before the team could make their choice on the ambitions, understanding of the topic of circularity was provided as not everyone in the team was familiar with its meaning. Out of the whole team, there were approximately 1 or 2 people who were aware of the subject, while for the rest of the team it was the first time that they were trying to incorporate circular ambitions into the project. To create ownership of the process and understanding of circularity the consultants conducted a session at the start. The session began with getting the participants to choose pictures that they most relate with from a bundle of photos. It was planned as a quick warm-up exercise to get the participants out of their daily routine and into an innovation/ abstract mindset. Further, the session consisted of sharing information on what is circularity, what is a circular building, what is the difference between the circular building and circular economy. In addition to the theory, few inspirational examples were also shown to the team. Each example was used to explain the different possibilities such as re-use, disassembly, cradle to cradle, etc. All of these were not a 100 percent circular building but incorporated the principles of circularity in many different ways. The inspirational buildings were used to get the team thinking in different directions. Also, this helped them gain knowledge on the different ways circularity can be added to the tender. The team did not yet choose the type of building they wanted. At this point, they were confused about how to compare the different projects and their corresponding designs. To combat this they were asked to take part in an exercise where they would choose five things that they considered most important from a set of keywords (reuse of materials, demount ability, nature, biobased products). Subsequently, a selection was made based on the majority after which they were asked to put weights on what they considered the most important. In retrospection, the team was allowed to choose what they wanted and then decide what were the topics that were more and less important. It helped give them the ownership of their ambitions so as to make it possible for them to realize it at a later stage. Following this session, a few of the core members drafted the vision document that served as a conclusion for the session described.

"At first, it was to create an understanding of circularity. So I think most people didn't know too much about it. I had some sessions already, so I knew some things already. But first what is circularity and how they defined it in the project."(IH_AR)

"The project leader for the project, that is only the building was not experienced with circular building and he is also working at the water authority for almost 40 years. So for him, it was very hard, new, the new way was difficult. I think for everyone it was difficult.
There is also still not a perfect way of how to approach a project, there is still no tool on how to evaluate circularity. Because we don't know yet how to measure it or to evaluate it." (IH_PM)

Since circularity can be implemented in different ways for a house as compared to an industrial building, the next step was to define the meaning of circularity for this project. The chosen ways of achieving circularity for the project should then be in line with the planning and budget for the project. For this project, the team wanted to translate the mission of the Kaumera process into the ambition of the building. The aim was to have a building that matched the operations of the extraction installation, which was to recover resources from wastewater. From then on the vision of the building was established as 'from waste flow to raw materials'. In terms of circularity, this meant re-using elements and components within the new building. To cater to the vision an additional job of searching for reusable components needed to be added. In terms of circularity, it meant that all elements and components if possible structural elements also should be re-used and not sourced as a new product/ component. If this was difficult to locate the next option was to choose a bio-based/ natural material. Further, if that was also not possible it should be built in such a way that it can be re-used after the life cycle of this building was completed. There were back-up options established so that circularity was incorporated one way or the other. The input from the group sessions was translated into three criteria's namely; re-use, use of bio-based materials, and energy neutrality. At this point the team found it challenging to have two ambitions at equal importance as they could lead to a contradiction. By setting up weights according to the personal preferences of the team members, they were able to prioritize one above the other. The prioritization was done with the consensus of the stakeholders involved.

Setting the ambition was the most important turning point for the project. If the ambition was not included it would have been a regular project following the process that has been previously taken up by the organization. The ambition led to a lot of material is reduced as compared to the initial design that had an excess of material which was incorporated to showcase the use of the extracted materials. With the addition of circularity, the main aim was to reduce all unnecessary material in the design and then search for re-use options. For example, in the initial design, there was a perforated wall that ran across the plot. After the inclusion of the ambitions, it was decided not to build this wall. The only function of the wall was to show the use of the materials being extracted. Hence, including the ambition resulted in a far better sustainable end-product than it would have without the ambitions.

"The ambition was very important. If we did not include ambition, we would have had a traditional building based on a traditional approach. So a lot of concrete would have been used for more than we did include at this moment. Because there was also a wall around the building, an architectural wall, which was made of concrete. In the end, we didn't include it, for circular reasons. If we did not have the ambition, we might have built it this way. So I think by including the ambition, the result is far better than we would have had without the ambition." (IH_PM)

The main goal for the project was to realize the Kaumera extraction installation for which it had to be done within a specific timeframe. Over the course of the project, the time and budget took precedence over the circular ambitions set for the project, which led to the ambitions getting diluted and difficult to achieve. Though the circular ambitions were set for the project not everyone had the same priority and end goal. Some of the project team members had more practical goals which were to finish the project within time and budget while others wanted to integrate circularity more. Integrating circularity on the other hand would require more time and commitment. Everyone agreed to the ambitions but not all were comfortable/ confident with it as this was the first time most of the members were working on a project with circular ambitions. Further, there was no proven process yet on how to carry on the project. The team also faced the challenge of how to comply with the expectations of all the different stakeholders.

"The challenge was to see the same goal. Some had more practical goals like we have to finish this project before this time and within this budget and yes that's another goal as others they would integrate more of circularity." (IH_AR)

IDENTIFYING OPPORTUNITIES

The incorporation of circular principles did not take place when the project was in a greenfield situation. Ideally to get the best it would have better to begin collecting ideas with no existing initial design. However, the initial design had already got its approval from the stakeholders and was difficult to get them to think away from it. The project had to proceed to incorporate circularity forcefully into the initial design. The team had to work with ways of reducing materials and finding possible reusable components to incorporate into the initial design. The opportunity to explore and identify various possible smart goals had gone past. In addition, the team was faced with the pressure of time and budget. At this phase, the project began with a budget and reference design to try and incorporate as many circular ambitions as possible within the budget and replacing the materials that were incorporated in the initial design. First, calculations were made to see how the current quantities and use of materials can be reduced. An iteration of the initial design was made in consultation with the architect. Secondly, a list of all the elements and components were made and there were groups of people searching how these can be replaced by a reused component. The challenge here was to get the team away from the reference design and for them to think freely about all the options possible.

"It was so difficult to get away with the fence. And that is what we did in the beginning, trying to make them think away from it because this is not going to happen if we want circularity. We want fewer materials. There was a square box that had reused walls, furniture, reused doors, and at that phase we were talking to them so much just to get away from all the materials. We did a calculation and realized that half of the material was used for the fence. So we talked with the architect to change the reference.
We were incorporated to have an exploratory phase of possible options. We were not there when they created this, reference building. And in the end, we cut a lot out of it. So we did do optimization for the first couple of months, but it was quite difficult. But it was a really good architect and he was thinking with us the whole time." (IH_CSLT)

CASE REFLECTION

The ambitions were set and clear. However, when the search began to find the right contractors, the ambitions set were not matched with those of the contactors nor was the sustainability part of their core motivation. A re-iteration of the exploration phase with the contractors could have been a possible solution to develop re-framed ambitions that would be in line with all the involved stakeholders. During the project, the chosen contractors were forced to work towards incorporating circularity when they personally did not see value in it. Besides, the pressure of timelines and budget overweighed the desire to incorporate circularity and at this point, the vision was almost lost. Through the process, they organized sessions to increase the knowledge levels of the newly added stakeholders and also arranged for a trip to a completed project that had successfully incorporated circular principles. The trip and the sessions did help to trigger and create a mind shift to believe that it is possible to complete projects within time and budget even after incorporating such ambitions. The added stakeholders were not previously involved in executing circular projects and hence it took time for them to believe in the possibilities. Following this, to ensure circularity was not dropped completely the team together put out a list of all the materials included in the building from doors to the floors. A date and budget were set that served as a guideline for which all the stakeholders involved could search for materials.

In retrospection, as gathered from the interviewees there were some phases in the processes that went well and there were also lessons learned by the team. According to the interviewees, the initial phase went well. There was collaboration and communication between the client, architect, and consultant who were all enthusiastic and were open to making changes to the initial reference design. The ambitions set for the project was in line with the possibilities that could be done, considering a design was already made. Consequently, the building managed to incorporate most of the ambitions set. Through the project, there were three main lessons learned that the interviewees reflected on. First, the recognition that the initiation phase is the most important because it is where the team sets the ambition for the rest of the project and that it will take up more time and expenses. The interviewees recommended that it is more advantageous to start the project as a greenfield situation, unlike this project, which had an initial design ready prior to the incorporation of circular ambitions. Further, they suggested the use of the beginning to explore all possibilities with no pre-conceived notions. Reflecting on their experience, the team had a hard time trying to make people think away from the visualization of the initial design which also blocked the free-thinking among the stakeholders.

"I think the initiation phase is the most important phase because in that phase you set the ambition and you prepare the document for the tender phase, you make a strategy. So in this phase, the level of ambition is sort of determined. So the initiation phase already sets the goals you can reach at the end. I think it is the most important phase for a circular building." (IH_PM)

"In the initial phase, we have to talk about circularity already and also think like a designer already about circularity apart from what the clients think. So, make it a way of design for ourselves, then it's easier. It could already be in small things to integrate that way of thinking." (IH_AR)

The second was to involve more people from the water authority during the initiation phase. At the moment the experience is only available within a selected group of people within the water authority. An extended group of people would have provided more people with the experience of taking up circular ambitions to continue to incorporate them in future projects.

"Normally we are used to saying, 'we want to have a building made of concrete, for example, or a stone or whatever'. And then we ask the market to build that. So we are used to making a very detailed design as a governmental organization. But in this case, you have to be confident in the market parties, that it will come up with very good solutions matching your ambition. But then you also have to be confident that you don't have to detail design that much as we are used to. And to get confident with that, you need some good experiences to do so. So I think that's sort of a, a thing that has to grow, a culture that has to grow within an organization and cannot be reached with just one project." (IH_PM)

Lastly, the ambitions should have been used in the tendering stage to find partners who resonate with the established ambitions. If that did not work, other possible recommendations were either to find another contractor that is more experienced and share the same goals as that set by the client team. Or repeat the process from vision formation with the newly involved stakeholders or at least take them through the process of how and why they were established.

In the end, the building did achieve most of the ambitions and is able to tell the story of the Kaumera extraction.

"I think I still feel very confident with the ambitions we set in the project. And I also, at the end, when we have the building, I think it's a good building and we have a very good story to deal with the different options we included." (IH_PM)

Table viii: Complilation of the analysis for the Inspiration House, WRIJ

THEME	DESCRIPTION	CHALLENGES	SOLUTIONS (EXERCISE/ TOOLS USED)	LESSONS LEARNED
UNDERSTANDING THE CLIENT ORGANIZATION	A stakeholder analysis was conducted to understand the client organization and to form a team that would take part in developing the ambitions for circularity	• The team composed of the project did not remain the same throughout and was faced with the challenge of people being replaced through the project. This did pose a challenge for the consultants as getting people enthusiastically involved is a process • In addition when people switch between roles the perspectives of the newly added members need to be incorporated If		

EXPLORING WITH THE TEAM	Before the team could make their choice on the ambitions, understanding of the topic of circularity was provided as not everyone in the team was familiar with its meaning. To create ownership of the process and understanding of circularity the consultants conducted a session at the start.	• Out of the whole team, there were approximately 1 or 2 people who were aware of the subject, while for the rest of the team it was the first time that they were trying to incorporate circular ambitions into the project	• The session began with getting the participants to choose pictures that they most relate with from a bundle of photos. It was planned as a quick warm-up exercise to get the participants out of their daily routine and into an innovation/ abstract mindset. Further, the session consisted of sharing information on what is circularity, what is a circular building, what is the difference between a circular building and a circular economy. In addition to the theory, few inspirational examples were also shown to the team.	• To involve more people from the water authority during the initiation phase. • The ambitions should have been used in the tendering stage to find partners who resonate with the established ambitions.
	The inspirational buildings were used to get the team thinking in different directions. Also, this helped them gain knowledge on the different ways circularity can be added to the tender.	• At this point, they were confused about how to compare the different projects and their corresponding designs	• To combat this they were asked to take part in an exercise where they would choose five things that they considered most important from a set of keywords	
		• At this point the team found it challenging to have two ambitions at equal importance as they could lead to a contradiction	• By setting up weights according to the personal preferences of the team members, they were able to prioritize one above the other.	
IDENTIFYING OPPORTUNITIES	The project had to proceed to incorporate circularity forcefully into the initial design.	• The initial design had already got its approval from the stakeholders and was difficult to get them to think away from. • In addition, the team was faced with the pressure of time and budget. • The challenge here was to get the team away from the reference design and for them to think freely about all the options possible.	• Calculations were made to see how the current quantities and use of materials can be reduced. An iteration of the initial design was made in consultation with the architect. Subsequently, a list of all the elements and components were made and there were groups of people searching how these can be replaced by a reused component.	• Recommended by the interviewees that it is more advantageous to start the project as a greenfield situation, unlike this project, which had an initial design ready prior to the incorporation of circular ambitions. Further, they suggested the use of the beginning to explore all possibilities with no pre-conceived notions.

APPENDIX E: Validation Session

Table viii: Complilation of the analysis for the Inspiration House, WRIJ

'+' : Advantage
'-' : Challenge

Figure iii: Exercise sheet used for the validation of the outer shell of the strategy

Figure iv: Images from the validation session

Table ix: Written feedback received from the experts during the validation session

Sub-phase	Activity		Expert 1	Expert 2	Expert 3	Expert 4
EXPLORATION	Client focus	Advantage			Stakeholder mapping is essential to connect interests instead of letting them clash later on in the process.	Search for the intrinsic motivation
		Challenge				
		Comments	Would like to see the end-user perspective in the exploration phase			Do you know all the stakeholders here already?
	Circularity concept understanding	Advantage		Yes, necessary but don't make it a scientific definition process. You need it to align the project group and stakeholders.	Every stakeholder on the same level	Creating an understanding of a topic is always helpful
						Creates a common language
		Challenge			Confirmation bias: only showing others what you would like to see influences the outcomes.	
		Comments				
	Problem re-framing	Advantage			Shoot for the moon, try to achieve the highest outcome possible	Finding needs early on in the process helps later on
		Challenge	Re-framing and iteration are hard to plan as a phase. This happens when things 'just click' this can happen at any time.	Depends on who is on-board in the project and where the interests are. Problem re-framing can have a lot of impacts. You might need some extra work on getting everyone on board (which is in the model but not until alignment).	Sometimes, there isn't necessarily a 'need', it is an ideological way of changing the current approach	
		Comments	To be able to re-frame end-user perspective should be in the exploration phase as well.			
	Aspiration Formation	Advantage		Yes, love this step.	Everybody is on the same level	Raising aspiration could create 'power' to push a project through the end.
		Challenge	One of the biggest implicit challenges of design thinking is opening up minds to believe in alternative options. For that reason, we prefer to call this 'imagine' and use	Challenge however is that a lot of people still 'dream' in technical ideas 'what' and that it might be sparking some more functional dreams to add user's wishes and experience (step ideation) to fuel the aspiration from a functional value perspective.	Risk of dreaming for too long	

			visual language and experience.			
					Depends on the person, whether he/ she can dream without thinking of conditions.	
		Comments				
ALIGNMENT	Alignment	Advantage			Existing strategies bring organizations comfort.	Checking alignment with the organization creates organizational commitment.
		Challenge				
		Comments	Alignment to use is the result of thorough stakeholder understanding in combination with a collaborative approach.	Continuous process	Innovation always clashes with existing strategies and policies	Are Organizational strategies so clear? Challenge will be to clarify the organizational strategy.
					Existing strategies should never determine which innovation should be introduced.	
					Financially driven companies always steer based on financial results. Ideological change never fits financial results.	
IDEATION	Project user focus	Advantage		Definitely a positive addition	User focus ideology connects functionality with ideology	Letting the client see value helps to create power and commitment
		Challenge			For example, tenants of social housing don't choose housing based on circular ideology.	
		Comments		We could start implementing these views in the aspiration formation step		
	Functional focus	Advantage		Yes, functional focus from the beginning on functionality. It is so difficult to keep people away from technical, end-result thinking.	Functionality is a key factor for a product to be used in the long term	Tangibility makes people understand
		Challenge				Losing a focus on real needs
		Comments	Bring the understanding of functional, emotional, political, technical motivations and 'functions' to the beginning.			

PRIORITIZATION	Prototyping and testing	Advantage		Most important step almost. I see a lot of projects where we pile-up ambitions without thinking of the consequences and pushing those difficult decisions in the operational phase. And then the policymakers and/or planners question with hindsight why the project ambitions changed in the end. They 'blame' the operation but fail to make the different choices themselves.		Reducing goals creates focus
		Challenge				
		Comments	The concept of prototyping can be applied to all activities. Even research of prototype focusing.			Many more prototyping tools to mention
REFLECTION		Advantage				
		Challenge				
		Comments	A core attribute of design is called "reflection in action". A reflection mindset is what you need during the full process.	We usually forget this step, how can we make this more on top?	Decision-maker? Based on what are decisions made? And who makes them? And when?	
General comments			Experiential/ human focused/ re-framing/ contextual/ co-creative			Is design thinking a regulated process
			All layers of 'functions' social, emotional, technical to the beginning			How are the feedback loops incorporated?
			End-user understanding of the beginning			Focus on exploration is good and through the model, it is depicted as a large part of the process which is also good
			Prototyping and reflection as a constant stream			
			Design thinking maturity, adaptive. Design thinking is essential to succeed.			

APPENDIX F: Explanation of the Design Thinking Tools

Tools were chosen and compiled from the following books: (1)The Design Thinking Toolbox by Michael Lewrick, Patrick Link and Larry Leifer, (2) Design Thinking by Thomas Lockwood, (3) Delft Design Guide, (4) The Circular Design Guide by Ellen MacArthur Foundation and IDEO

EXPLORATION: CLIENT FOCUS

TOOL 1A: EXPLORATIVE INTERVIEW

WHAT IS IT?

Obtain a deep understanding of the client and their unspoken needs.

Get a view of the basic values, beliefs, motivations, and aspirations that influence behavior.

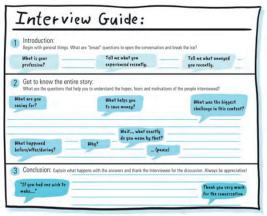
Identify opportunities, and test initial concept ideas at an early stage.

HOW THE TOOL IS APPLIED?

Step 1: Create an interview guide with the topics and questions to be dealt with.

Step 2: Ask open questions, such as "what," "why," and "how". Dig deeper, for example, "What does this mean to you..." or "Why did you...."

Step 3: Complete the interview with questions such as: "What would happen if you had one wish to make?"



USE IT FOR

As an internal or external consultant supporting the team with the process, this can be used to really understanding the internal stakeholders and identify their perspectives. Understand what they feel and not what they are saying.

TOOL 1B: EMPATHY MAP

WHAT IS IT?

The empathy map is a canvas split into four quadrants (says, thinks, does, and feels), all positioned around the stakeholder being interviewed. Can act as a continuation to the explorative interview.

HOW THE TOOL IS APPLIED?

During the explorative interview pay attention to the gestures and body language of the interviewee and, if required, note down and clarify if these signals are contradictory to the answer.

Post the interview, fill the map.

USE IT FOR

Filling the map allows to produce an overview of who the involved stakeholders are and to identify inconsistencies in the perception.

EXPLORATION: CLIENT FOCUS

TOOL 1C: ASK 5 X WHY

WHAT IS IT?

Discover the true intention of seeking circularity. Digs deeper and get to know more than just exploring and deeper to gain new and surprising insights.

HOW THE TOOL IS APPLIED?

Start with a "root cause" analysis and ask "Why?" as often as possible. Try to counter each answer with a follow-up why question untill it no more makes sense.

USE IT FOR

To understand the intrinsic motivation of the inovolved stakeholders. This is a constant for a person and from here the 'what' and 'how' can be identified.

TOOL 1D: CONTEXT MAPPING

WHAT IS IT?

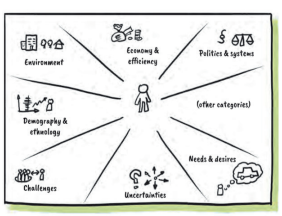
Learn from an "expert": namely the internal stakeholder who imparts unexpected insights into what he goes through in their routine job.

To have true knowledge, the context must be known, and this tool helps to create this kind of awareness.

HOW THE TOOL IS APPLIED?

There is no substitute for seeing reality from the point of view of the stakeholder. It is important to understand for who will join the process.

Observe the user and his environment. Typical questions: What does he do? Where does he do it? With whom does he do it? What is the impact of his activities on the environment? Which individuals lend support?



USE IT FOR

The wider picture of that particular stakeholder and past work, probabky also on the topic of circularity/ sustainability.

EXPLORATION: CLIENT FOCUS

TOOL 1E: STAKEHOLDER MAP

WHAT IS IT?

Make assumptions about the influence of certain actors in the project.

Draw first conclusions with respect to alliances or power structures and identify potential conflicts between different stakeholders.

USE IT FOR

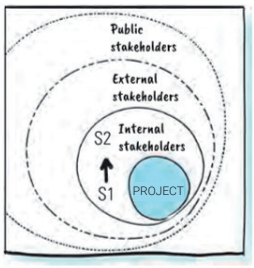
To identify the different types of stakeholders such as enthusiasts, innovaters, adaptors, resistors, etc along with their ability to influence and make decisions.

HOW THE TOOL IS APPLIED?

List all stakeholders involved. In addition, deepen the understanding of the various stakeholders by asking questions.
– Who will benefit from the success? Who has an interest in it being a success?
– Who do we collaborate with? Who provides us with valuable ideas?
– Who is blocking the idea, and for what reasons? Who benefits from a failure?

First create a stakeholder map and enter the various stakeholders on the map.
Then enter the connections of the stakeholders to one another.

Reflect on the stakeholder map and determine the next steps.



TOOL 1F: ECOSYSTEM MAP

WHAT IS IT?

The ecosystem map is a synthetic representation capturing all the key roles that would have an influence on the project.

USE IT FOR

To see an overview of the stakeholders and extended stakeholders involved with the project. This helps to make sure stakeholders from different departments and layers of the organization are identified to be kept in contact/ involve in the future.

HOW THE TOOL IS APPLIED?

Identify all players and entities involved.

Search in depth also for stakeholders operating behind the scenes, as well as the ones not directly involved with the project but have an impact.

Place the project at the center of the worksheet, then position the other players in the space around and make connections.

Notice anything missing?

Highlight pain points or gaps in the map.

EXPLORATION: CIRCULARITY CONCEPT UNDERSTANDING

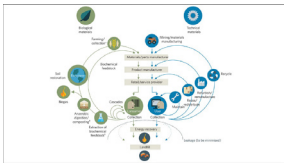
TOOL 2A: CIRCULAR FLOWS THEORY

WHAT IS IT?

To understand the different ways to shift the project to be more circular.

USE IT FOR

To get acquainted with the different ways of being circular.
At a glance, which of these loops feels most relevant or achievable for what the team is designing.



TOOL 2B: INSIDE OUT APPLICATION

WHAT IS IT?

Take apart an everyday product to build empathy and understanding around the implications of disassembly and recovery of materials and parts.

USE IT FOR

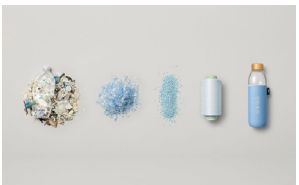
To create belief in the concept of circularity and make the extended stakeholders understand its need.

HOW THE TOOL IS APPLIED?

After disassembly,
Which materials and components could be recovered from this device and reused?

Does the manufacturer produce individual parts if you needed to replace only a battery, for example? Is it economically viable to disassemble them in the way you have done?

If not, what needs to change to make it so? Consider a range of interventions such as product design, business models, reverse cycle or policy enablers.



EXPLORATION: PROBLEM RE-FRAMING

TOOL 3A: PROBLEM STATEMENT

WHAT IS IT?

Develops common understanding of the problem with the clients and the team along the initial solution for it.

USE IT FOR

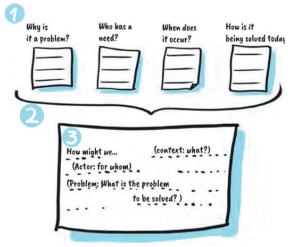
As an internal or external consultant supporting the team with the process, this can be used to really understanding the internal stakeholders and identify their perspectives. Understand what they feel and not what they are saying.

HOW THE TOOL IS APPLIED?

The following questions (problem/actor/context) help with the formulation of the problem statement:
- What is the problem?
Why is it a problem?
- Who has a need?
- How is it solved today?

Produce at least 10 of such problem definitions.

Start transferring the individual problem definitions systematically into an overarching problem, for example, in the form: "How might we redesign... [what?] ...[for whom?] ...so that...[his need]...is satisfied?"



TOOL 3B: HOW MIGHT WE

WHAT IS IT?

See for every problem description and level of circularity what are the possible solutions.

USE IT FOR

To map our all the possible solutions for the problems along with taking into consideration the different levels of circularity. This allows for exploration and finding the right solution in relation to the heart of the problem.

HOW THE TOOL IS APPLIED?

Reflect upon the findings from the previous phases of "understand" and "observe."

Determine what needs the team should address and what qualifying additional information is relevant in this context.

Motivate the design thinking team to come up with several "How might we..." questions that address the identified needs or opportunity field.

Each question should adhere to the logic of "How might we..."

EXPLORATION: PROBLEM RE-FRAMING

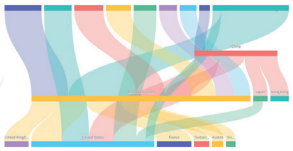
TOOL 3C: VISUALIZATION OF CURRENT PROCESS

WHAT IS IT?

To visualize the curruent waste flow of material used for the solution stated at the start.

USE IT FOR

Create an impactful visualization to steer the team to opt for a change in the process. In addition helps to highlight major chunk of waste, where more ideas can be targeted towards to avoid it.



TOOL 3D: MIND MAP

WHAT IS IT?

Map all the thoughts around the specific topics, building a mental model of it

USE IT FOR

Foster unconstrained thinking and uncover interesting connections

HOW THE TOOL IS APPLIED?

Start by putting a topic, idea or problem at the center of a blank surface, and then write down other words, signs, drawings around it. Write them as they come to your mind, always showing the connection with the initial point, or how they are linked one to each other. Let your mind free to explore, diverge and connect points, growing the map bigger and bigger - there will be time later on to review and rationalise it.

ASPIRATION FORMATION

TOOL 4A: STORY TELLING

WHAT IS IT?

Highlight unexpected results and generate new perspectives.

HOW THE TOOL IS APPLIED?

Provide the team with a situation and allow them to describe their expression of it.

USE IT FOR

The team to express wishes, dream and escape reality.

TOOL 4B: DESIGN PRINCIPLE

WHAT IS IT?

Focus on a specific requirements for the project.

Provide the team with a uniform understanding of the task so that everybody is on the same level.

Define general characteristics that should be treated with a higher priority.

Develop a guideline that ensures that future design challenges are created on the same overarching principles.

HOW THE TOOL IS APPLIED?

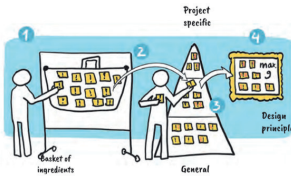
Sketch a "basket" and a pyramid on the whiteboard. Then invite all participants to write design principles on Post-its and place them on the "basket."

Sort the principles based on priority. The higher up on the pyramid, the more project-specific the principle is. General design principles are located at the bottom of the pyramid.

Carry out a vote to a maximum of three per pyramid.

USE IT FOR

To select themes that captures the aspiration and serves as boundaries for the project.



ASPIRATION FORMATION

TOOL 4C: VISION CONE

WHAT IS IT?

Get a feeling for changes over time. • Think in periods and time segments (e.g. from the past into the future).

Outline projected, plausible, possible, preferred, or absurd futures.

Point out the potential of all possibilities, for example, in terms of technological and sociological developments.

HOW THE TOOL IS APPLIED?

Use the template or draw two connected cones and label them with PAST, NOW, and FUTURE.

Start with the NOW and describe the status quo of the project, the state of the art, and the current perception in society.

Focus on the PAST. Add the findings of research done to date as well as important technological and sociological changes.

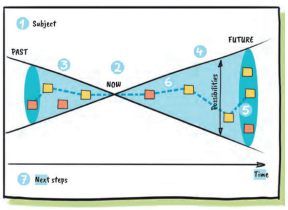
Focus on the FUTURE. Write down all of the findings relating to a fictitious future.

Identify possible scenarios for the future from the findings and give them memorable names for better storytelling.

Select a future that is "desirable" in the context of the project.

USE IT FOR

Allows the team to think in terms of the future. Especially with the case of circularity by the time the building is realised a lot of new concepts would have arrived in the market. v



TOOL 4D: SYNTHESIS WALL

WHAT IS IT?

Use a physical wall and post-it notes to debrief the sessions and cluster important insights.

HOW THE TOOL IS APPLIED?

The synthesis wall is a key support in the moment of debriefing and analysis of outcomes.

The team writes down all the relevant notes from the research on single post-it notes, and organize them on the wall in order to start identifying clusters, relevant themes, important insights that can inform and inspire the design process.

USE IT FOR

Collaboratively discuss insights and analyse aspirations.

ALIGNMENT

TOOL 5A: EMOTIONAL RESPONSE CARD

WHAT IS IT?

Testing the feelings of the team post establishing the aspirations and themes.

USE IT FOR

To get an understanding of the feelings of various members if they are comfortable with the set ambitions, do they find in difficult, are they wary, etc.

HOW THE TOOL IS APPLIED?

Stakeholders select 3 cards from the set that best describe their experience and current feeling.

As soon as the user has selected the 3 cards, explore (through questions) the deeper insight by asking "why" questions.

TOOL 5B: DEFINE SUCCESS

WHAT IS IT?

Vote and come to a consensus on the team as to what success is to be achieved.

Ensure that requirements of the organization/management/ users and other stakeholders are understood; that makes it easier later to get a buy-in from the decision makers.

USE IT FOR

To take into account the varrying perspectives and align the team on the aspiration set.

HOW THE TOOL IS APPLIED?

t is best to have everybody share their thoughts first; subsequently, discuss and narrow down the elements of success. Then the core elements of success are selected (e.g. by forming clusters). Based on this, conduct a vote.

• Ideally, involve important decision makers (e.g. management, founders, and partners), so you ensure already in the run-up that no time and no money will be wasted. Even more important is that no frustration accumulates.

ALIGNMENT

TOOL 5C: ORGANIZATIONAL DESIGN

WHAT IS IT?

To ensure your organisation can - support the change to circularity.

USE IT FOR

To highlight on changes in the organization working for the project where required to realize the circular ambitions.

HOW THE TOOL IS APPLIED?

Create a value proposition by conducting research with employees and internal stakeholders to spot opportunities to change ways of working.

Create some organisational hypotheses to test out your ideas.

ps activity can help you make sense of your learnings as you go.

TALENT	INFRA-STRUCTU-REENT	PRCOESS

TOOL 5D: ISSUE CARDS

WHAT IS IT?

Support the conversation around complex matters by breaking down the subject into physical cards.

USE IT FOR

Guide a creative conversation, making it open and fun, avoiding the creative block.

HOW THE TOOL IS APPLIED?

Issue cards are used to promote discussion, to suggest new avenues of exploration, to structure thinking, and to spark ideas. They can be especially useful when the group feels stuck, or is unable to move away from familiar thinking.

The basic concept behind issue cards is to isolate a specific element into each card, and then use the cards as starting point for a 1:1 or group conversation. An issue card can contain an insight, a picture, a drawing, a feature, a keyworkd, a description, etc. based on the specific need.

ALIGNMENT

TOOL 5E: OFFERING MAP

WHAT IS IT?

Describe what benefits the project can have.

HOW THE TOOL IS APPLIED?

The offering could be described with words, images or through a simple graph. As the project develops in complexity, the offering map can also become more articulated, showing distinct macro-areas of offer, and then narrowing them down into more specific areas and functions.

USE IT FOR

Shape and explain the aspiration and themes expert audience.

IDEATION: PROJECT USER FOCUS

TOOL 6A: EXPLORATIVE INTERVIEW

WHAT IS IT?

Obtain a deep understanding of the end-user and their unspoken needs.

Also, use context mapping as a support.

HOW THE TOOL IS APPLIED?

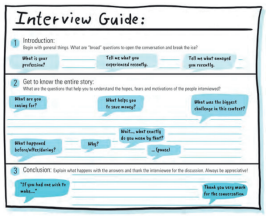
Step 1: Create an interview guide with the topics and questions to be dealt with.

Step 2: Ask open questions, such as "what," "why," and "how". Dig deeper, for example, "What does this mean to you..." or "Why did you...."

Step 3: Complete the interview with questions such as: "What would happen if you had one wish to make?"

USE IT FOR

Understand their current context, problems and future desires.



TOOL 6B: EMPATHY MAP

WHAT IS IT?

The empathy map is a canvas split into four quadrants (says, thinks, does, and feels), all positioned around the stakeholder being interviewed. Can act as a continuation to the explorative interview.

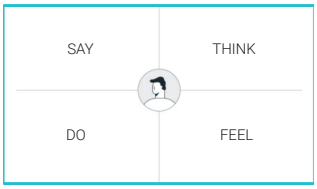
HOW THE TOOL IS APPLIED?

During the explorative interview pay attention to the gestures and body language of the interviewee and, if required, note down and clarify if these signals are contradictory to the answer.

Post the interview, fill the map.

USE IT FOR

Filling the map allows to produce an overview of who the involved stakeholders are and to identify inconsistencies in the perception.



IDEATION: FUNCTIONAL FOCUS

TOOL 7A: BRAINSTORM

WHAT IS IT?

Generate many ideas that the team spontaneously comes up with.

Obtain an interdisciplinary perspective on a problem that represents different skills and knowledge.

Inspire enthusiasm and generate momentum.

HOW THE TOOL IS APPLIED?

Prepare a clear HMW question "What possibilities are there..."

Try to motivate the group to give more ideas during the session and build upon the ideas of others.

Make sure that all are heard and all ideas are written down.

All participants write their ideas on a Post-it.

The result is a clustered collection of ideas, which can be later evaluated.

USE IT FOR

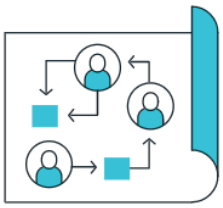
To collect and innovate on as many tangible goals/ ideas as possible.

TOOL 7B: SYSTEM MAP TO HIGHLIGHT OPPORTUNITIES

WHAT IS IT?

Visualise all the components involved in the building.

A system map is a synthetic representation that shows in one single frame (e.g. materials, energy, information, money, documents, etc.). The system map clarifies how the different components and roles are connected one to the other, highlighting through a visual where opportunities can be realised.



USE IT FOR

Understand the current possibilities and opportunities where the goals can be incorporated into the physical structure..

IDEATION: FUNCTIONAL FOCUS

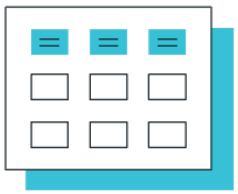
TOOL 7C: CARD SORTING

WHAT IS IT?

Organize tangible goals.

HOW THE TOOL IS APPLIED?

Users are asked to organize the collection of cards with ideas into predetermined categories (themes selected during aspiration formation).



USE IT FOR

Learn what items go together based on stakeholder perspectives. Categorizing which of the ideas can be used to realise which themes.

TOOL 7D: ROLE PLAY

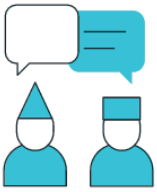
WHAT IS IT?

Perform a hypothetical stakeholder to understand the perspective of another stakeholder and their priorities based on the role they play.

HOW THE TOOL IS APPLIED?

The role play typically requires to define some roles (e.g. the user, the service employee, etc.) and prepare rough prototypes or other materials that can facilitate the performance.

While a team is acting out their story, the rest of the audience learn about the idea, understand the high-level sequence of actions required.



USE IT FOR

Allows the stakeholders to understand each others perspectives to later on help align the team towards common priorities.

PRIORITIZATION

TOOL 8A: SOLUTION INTERVIEW

WHAT IS IT?

Understand whether the intended solution is valued by users and internal stakeholders.

Question the underlying task of the project, that is, examine whether you are focusing on the crucial issues in the project.

USE IT FOR

To identify those ideas that really provide for value to the organization and project, thereby narrowing them down.

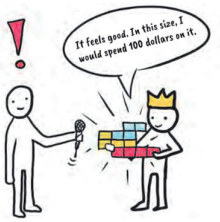
HOW THE TOOL IS APPLIED?

First define the interview goal.

Depending on the current phase in the macro-cycle, the goal is to check the impact of the solution or measure the value of the solution.

Determine the interview team, in relation to their role.

Let the interviewee work out the solution by themself; ask him to "think aloud."



TOOL 8B: EVALUATION MATRIX

WHAT IS IT?

Prioritize ideas based on the most relevant success criteria for the project.

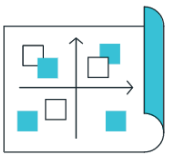
USE IT FOR

Prioritize ideas based on complexity and value.

HOW THE TOOL IS APPLIED?

The evaluation matrix allows to weight different ideas, rating them based on a set of defined criteria, in order to identify the most promising ones.

A common set of criteria includes the level of complexity related to idea implementation, and level of value they will bring to the project and to the organization.



PRIORITIZATION

TOOL 8C: ISSUE CARDS

WHAT IS IT?

Support the conversation around complex matters by breaking down the subject into physical cards.

USE IT FOR

Guide a creative conversation, making it open and fun, avoiding the creative block.

HOW THE TOOL IS APPLIED?

Issue cards are used to promote discussion, to suggest new avenues of exploration, to structure thinking, and to spark ideas. They can be especially useful when the group feels stuck, or is unable to move away from familiar thinking.

The basic concept behind issue cards is to isolate a specific element into each card, and then use the cards as starting point for a 1:1 or group conversation. An issue card can contain an insight, a picture, a drawing, a feature, a keyworkd, a description, etc. based on the specific need.

TOOL 8D: FIELD EXPERIMENTS

WHAT IS IT?

Invite small groups of external market parties to give their opinion on the choosen aspirations and ideas.

USE IT FOR

Allows to understand if the external stakeholders (eg. contractors) that would be part of the team later on, if they are open and enthusiastic to work with these aspirations or do they find it difficult.

PRIORITIZATION

TOOL 8E: TESTING WITH INTERNAL AND EXTERNAL STAKEHOLDERS

WHAT IS IT?

Discuss the final goals and visions with both internal and external stakeholders through interviews. Provides an understanding if they are capabale of going ahead with the ideas.

USE IT FOR

Provides an understanding if the extended and internal stakeholders are capabale and enthusiastic of going ahead with the ideas.

TOOL 8F: EXPLORATION MAP

WHAT IS IT?

Make visible the types of experiments that were carried out

Record the delta between the expected and actual outcome of an experiment.

Obtain a shared understanding of the experiments carried out so far.

USE IT FOR

The exploration map helps to stimulate the discussion among team members, provides the basis for planning new experiments, and helps with the reflection after tests. Also to analyse, which of the ideas will pose a challenge to the team.

HOW THE TOOL IS APPLIED?

The exploration map gives the team an overview of the experiments (eg. field experiments with market parties) carried out and shows the areas in which experiments can still be made.

Enter the experiments already carried out.

Discuss the positioning of the experiment on the team. Have we really left our comfort zone?

The reaction of the stakeholders and the findings of the tests can also be captured.