

The Capabilities Sprint Workshop

Developing a tool to help value chain actors identify and improve capabilities that enable a smoother transition towards a more sustainable and circular business model.

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Abstract

The Circular Economy is seen by many governments and businesses as key to promoting sustainability. Value chains are also integral to the success of the Circular Economy transition. While there are tools that businesses can use to strategize their approach towards a circular business model, there is a gap in tools that address transitioning itself for value chain actors. Therefore, this thesis's main research aim was to propose how value chains can improve their ability to collectively transition towards a more sustainable and circular configuration by developing and validating a tool prototype. To achieve this, first, a brief non-systematic literature review of impact assessment, followed by a brief structured literature review on conditions for transitioning, was executed. This was done to identify relevant inputs for the tool. Then, tool development was driven through feedback sessions with TNO employees. Lastly, the final tool prototype was evaluated in a final feedback round with TNO employees. As a result, the thesis identified the concept of dynamic capabilities as useful in categorizing conditions that actors can directly influence and improve, potentially bettering their transition. Furthermore, sustainability could practically be implemented by integrating it into capabilities and the tool structure, rather than having an impact assessment integrated into the tool. The concept of design thinking and a sprint workshop format was effective in orienting tool development towards value chain collaboration. The final tool prototype – the Capabilities Sprint Workshop – was judged by TNO employees to be a potentially useful tool: If the Capabilities Workshop would connect capabilities to business model impacts, definitely position itself as ideational, evaluative or both, and test its assumption in a practical setting, it could be potentially a useful tool. The author judged these caveats, given sufficient time, as resolvable. Overall, the thesis identifies suitable inputs, orientation, structure, and future developments for a tool aimed at helping value chain actors in transitioning towards a more sustainable and circular configuration. Therefore, the tool proposed contributes towards the field of circular business model innovation and circular value chain transitioning.

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1 Introduction

Positioning of the research

The thesis originated as part of internship an the *Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek* (TNO). TNO is an independent Dutch research organization that aims to provide innovative research on system change, provide technological breakthroughs and create innovative ecosystems (TNO, n.d.-b). Research by TNO employee Jelmer Lennartz (2021), the author’s supervisor, found that to reach higher order circular strategies value chain actors typically have to collaborate across business units. To that end, if there is a weak link, either because one value chain actor is not willing or cannot improve their circularity, the entire value chain can be affected. Thus, due to the interdependent nature of the circular ecosystem, circular value chain transitioning is more important and challenging. Thus, value chains play a prominent role for there to be successful circular economy transition. Failure of one value chain actor to transition towards a more circular business model could disproportionately affect all value chain actors (Lennartz, 2021). Based on these insights on the circular ecosystem interdependence and the weakest link caveat, TNO wanted the internship to explore a tool that can guide a value chain redesign process. Specifically, TNO wanted a tool that was able to identify hurdles that could bottleneck the adaptation process (Jelmer Lennartz, personal communication, March 2022). This could then inform the revaluation and reallocation of resources necessary to transition between value chain actors.

Problem definition

Societies, including businesses, are facing several social and ecological crises that require structural change. Rockström et al. (2009) have highlighted the variety of this environmental decline in the form of ‘Planetary Boundaries’, arguing that humanity is operating beyond the means that the planet can safely provide. Kate Raworth (2017) also highlights the need for climate justice and social foundations to accompany the curbing of the planetary overshoots (see Figure 1). We are already facing the consequences for failing to counter the unsustainable practices of society. The nearly 10 million Pakistani displaced from yet another historic flood and the 36.1 million people across the Horn of a Africa affected by yet another historic drought are just some of the impacts that we could connect to unsustainable practices (Kurtzer, 2022; OCHA, 2022). Business’s will not only be affected by the consequences of humanity overshooting the planetary boundaries and not meeting the social foundations, but will have an active part to play in aligning our system to a sustainable one. While businesses have many options to approach these challenges, ranging

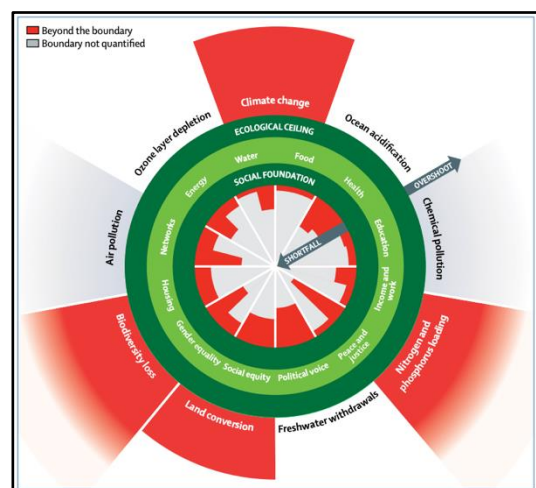


Figure 1: Shortfalls [of the social foundations] and overshoot [of the planetary boundaries] in the Doughnut” (Raworth, 2017).

from Corporate Social Responsibility and Sustainable Management towards Deep Ecology and Degrowth, one of the prominent emerging approaches is the Circular Economy (Pucker, 2021; Zink & Geyer, 2017; Belmonte-Ureña et al., 2021; Schmelzer et al., 2022). This is mainly due to Circular Economy's win-win promises for circular business models by offering both sustainable and economic gains, it offers concrete practices that can give guidance, and the increasing push within the EU and the Dutch government for Circular Economy initiatives (*Circular Economy Action Plan*, n.d.; *A Circular Economy in the Netherlands by 2050*, 2016).

Describing the Circular Economy

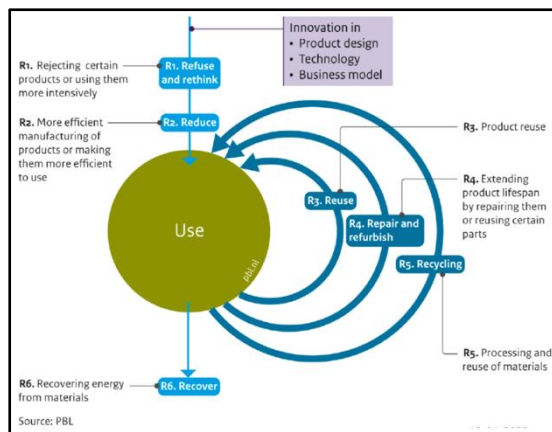


Figure 2: "R-Ladder with circularity strategy" (Hanemaaijer et al., 2021)

The Circular Economy (CE) describes an economic system that minimizes the input, output and leakage of resources by slowing, closing and narrowing material and energy loops (Geissdoerfer et al., 2020; Kirchherr et al., 2018). These can be expressed in circular strategies such as cycling resources, extending a product's lifespan, intensifying the usage of a product or dematerializing physical products (Geissdoerfer et al., 2020). Circular strategies and practices such as the R-hierarchy used by the Dutch Government seen in Figure 2 (Refuse & rethink, Reduce, Reuse, Repair & Refurbish, Recycle, and Recover), could be used as means to solve

sustainability issues (Potting et al., 2017).

There is an ongoing debate as to what extent the Circular Economy is sustainable (Buchmann-Duck & Beazley, 2020; Korhonen et al., 2018). Due to increased economic growth, some CE practices may lead to relative rather than absolute decoupling of environmental gains known as the 'Rebound Effect' (Friant et al., 2020). Circular systems, such as biofuels and biopolymers, are not guaranteed to have reduced environmental impacts compared to their linear counterpart (Friant et al., 2020). Furthermore, social equity aspects are largely ignored in the CE literature, (Kirchherr et al., 2017; Friant et al., 2020). However, while not every circular practice is sustainable, many circular practices can be (Geissdoerfer et al., 2020). Thus, in this research, there is an emphasis on encouraging sustainable circular practices; where circularity is a means to a sustainable end.

As previously mentioned, a circular business model tends to be much more dependent on value chain collaboration than other types of business models (Lennartz, 2021). Transitioning towards a circular business model can therefore be a challenging process that should leverage strategic and deliberate planning. Such a transition, if not properly prepared for, could be exposed to increased risks of running into unforeseen challenges, or even failure. If value chain actors want to collectively transition towards a shared circular business model, they need to understand what models are both feasible, desirable, viable and sustainable (Shapira et al., 2017). This can be a challenging and complex process to undertake and transition towards (Chesbrough, 2010; Koen et al., 2011). Business model innovation, or specifically circular business model innovation (CBMI), aims to research this process of organizational change and its final outcomes (Geissdoerfer et al., 2020; Santa-Maria et al.,

2021). Within CBMI, the concept of dynamic capabilities (DC), has been used to research a business's internal competencies. These can contribute to a business's ability to successfully "integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al., 1997, p. 516). Furthermore, using the concept of design thinking to structure a tool, DC's have been successfully employed in a practical setting (Santa-Maria et al., 2022b). In CE, value chains play a central role compared to more conventional value chains. The value chain is especially vulnerable in CE: If one business actor within the shared value chain underperforms it can affect the entire value chain, potentially even risking the value chain itself (Lennartz, 2021). From the initial resource extraction towards the discarding of the product, many circular strategies and practices go beyond the immediate business unit and can extend along the value chain, often requiring extensive and numerous collaboration (Lennartz, 2021). Furthermore, up to 80% of a business's greenhouse gas emissions and 90% of its air, land and water impacts can happen outside of the immediate business unit (McKinsey Sustainability, 2017). Therefore creating both successful and impactful CBM's can require concerted efforts in expanding the scope and include actors along the value chain.

Research gap and the need for a practical tool

Within CBMI, research can be found surrounding CBM creation, CBM planning and the relating role of the value chain (Jonker et al., 2020; van Bommel et al., 2021; Santa-Maria et al., 2021a; Guldmann & Huulgaard, 2020). However, there is lacking research and frameworks within the CBMI literature on the ability for a relatively linear value chain to transition towards a circular value chain (Lennartz, 2021).¹ The available research often focuses on the immediate business unit or carves out a specific section of the value chain (Hina et al., 2022; Salvador et al., 2021; Werning & Spinler, 2020). There are thus limited insights into how businesses can collectively transition on a value chain level. A further issues is that businesses, and to that extent the value chain, face difficulties managing and implementing knowledge and insights from the field of CE and Sustainability (Durst & Zieba, 2019; Bastein & P. J. Willems, 2019; Bocken et al., 2017). Businesses are struggling to translate insights into CBM's transitions. What elements, characteristics or attributes, or what this thesis collectively calls conditions, within a CBM transition contribute to a better value chain transition is under-researched but needed (Lennartz, 2021). Better meaning transitions that are more reliable and are less at risk for encountering problems or even failure. As a consequence, there is a lack of tools for value chain actors to address these limitations (Jelmer Lennartz, personal communication, March 2022). There are tools that explore what to transition towards and the key milestones to said goal. However, tools are lacking that explore conditions that, when improved, can enhance the ability of transition. Addressing these limitations via a tool could not only contribute to the literature but also potentially achieve a practical impact (Osterwalder et al., 2010, De Reuver et al., 2013). Furthermore, a tool can help advance both a more sustainable and circular value chain by translating said improvements into a usable framework. Overall, the **main research gap** is the deficiency in practical tools that help value

¹ It has to be underlined that this thesis does not focus on the what to transition towards or when to transition but what makes a value chain transition a smooth and successful one.

chain actors collectively transition towards a circular value chain. With this in mind, the thesis's research goal is thus the following:

To contribute insights into how value chains can improve their ability to collectively transition towards a more sustainable and circular configuration by developing and validating a tool prototype.

In this thesis, a tool is defined as an artefact that provides a structured framework for users to achieve a desired end. However, since this is a tool prototype almost from the ground up, significant research has to be conducted exploring what fits and does not fit into a tool aimed at enhancing a value chain's transitioning ability. Not only to enhance circularity for circularity's sake, but with sustainability fundamentally built into it. What also should be noted is that TNO employs many knowledgeable published experts in the field of CBMI that can provide valuable feedback (Geels & Schot, 2007; Jonker et al., 2020; Navarro et al., 2020). Feedback that is both an enabling and limiting factor. With these elements in mind, the main research question of this paper is as follows:

What conceptual inputs and subsequent practical approaches can be used in a tool that aims to help value chain actors transition towards a more sustainable and circular business model?

To further steer the research and ultimately answer the main research question, the following sub-research questions are asked:

- 1. Which impact assessments derived from the circular economy literature could be used to measure the sustainable impact of the value chain?*
- 2. Which conditions to enhance and operationalize the transition towards a circular value chain can be derived from the circular business model literature?*
- 3. Based on feedback from an iterative feedback process, which elements that could constitute a useful tool should be included and excluded?*
- 4. To what extent is the final version of the tool useful based on the final feedback round?*

The first sub-research question aims to identify what possible sustainable impact assessments could be utilized by a tool. This was done with the assumption that an impact assessment would allow the tool to orient the users in a circular yet sustainable direction. Impact assessments were identified through a brief unstructured review centered around the circular economy literature. The utilizable impact assessment would be identified by comparing and evaluating suitable assessments that could assess the value chain's sustainable impacts.

The second sub-research question aims to identify ways to conceptualize and operationalize conditions for transitional ability, particularly for the value chain. This was done with the assumption that it could provide knowledge that could help value chain actors collectively transition. These insights were gained through a brief structured literature review on the relevant circular business model literature. Consequently, what concept(s) to use for said conditions, what conditions may play a role in the ability to for the value chain to

transition, and how to operationalize them for a tool is thus a core aim of this sub-research question.

The third sub-research question aims to translate the findings of the previous questions into a usable tool, through a tool development process. This was done to align content and inputs of the tool with the practical needs of the tool. This would be done through a feedback loop of tool improvement and feedback sessions with TNO experts. Further insights given by TNO experts, especially regarding tool development itself, are addressed here.

The fourth sub-research question aims to give a final round of feedback on the final tool prototype. This was done to give an accessible overview of usability of the tool and its future direction. TNO experts were given a last opportunity to evaluate how usable the tool prototype was, specifically the Capability Sprint Workshop. This would highlight the usability of the tool and possible future avenues of development.

As seen in Figure 3 below, these sub-research questions and their corresponding method should build upon each other to inform the main research question.

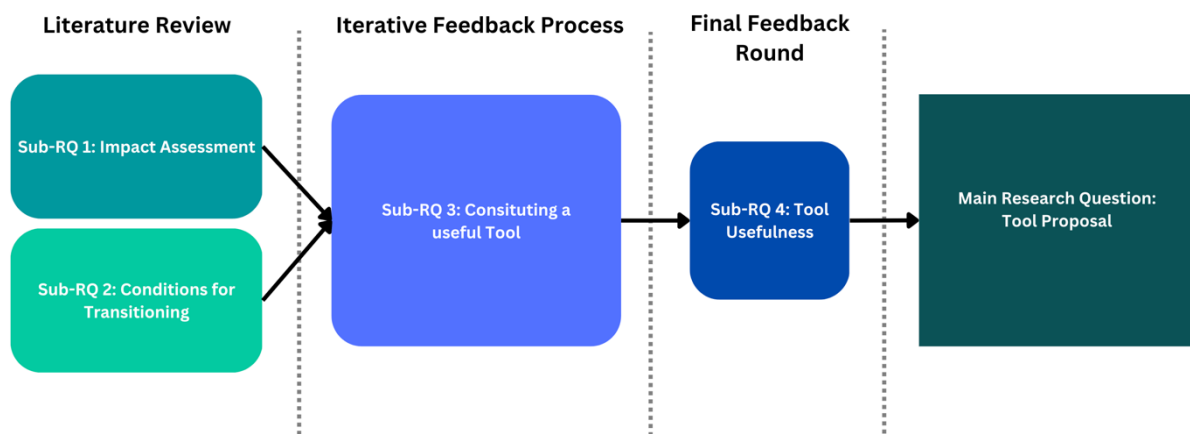


Figure 3: Research Framework

2 Conceptual Background

The conceptual background outlines the key concepts that are a must know for the thesis. In the tool development journey, several concepts emerged but ended up being de-prioritized. Key concepts are concepts that made it into the final tool. De-prioritized concepts are concepts that were not useful or practical to implement into the tool itself but, as will be shown in Key Assumptions Chapter (6.1) of the final tool, were assumed to be covered outside of the final tool. See Table 3 on page 46 to get a full overview. The concepts elaborated here are the most essential concepts for the thesis and are essential for the final tool prototype proposed - the Capabilities Sprint Workshop. The key concepts, the **Circular Economy**, **capabilities** and **design thinking**, are addressed in the given order. Their context and vital elements that are relevant for the thesis are explored in each corresponding sub-chapter. Additionally, there are de-prioritized concepts explored. They were vital to the corresponding key concept within tool development and are thus present alongside the corresponding key concept. The de-prioritized concepts discussed are: Drivers & barriers - which corresponds to capabilities, and design science - which corresponds to design thinking.

2.1 The Circular Economy

The Circular Economy is an underlying concept that was present throughout the entire thesis. It structured the research problem, literature read, and elements within the tool prototypes and the solution structure. The key concept of Circular Economy is explored by first addressing what is understood in this thesis as the Circular Economy, then elaborating on Circular Business Model Innovation, and then finally addressing the Circular Value Chain. Note that the only key concept here is the Circular Economy, with Circular Business Model Innovation and Circular Value Chains not being addressed as such for simplicity.

2.1.1 What is the Circular Economy?

The sub-chapter outlines what is understood here with the 'Circular Economy'. Its reasoning and characteristics should be thus clarified. It particularly outlines the Circular Economy's relation to Sustainability and why it was used over competing concepts that could lead to a sustainable transition of the Economy.

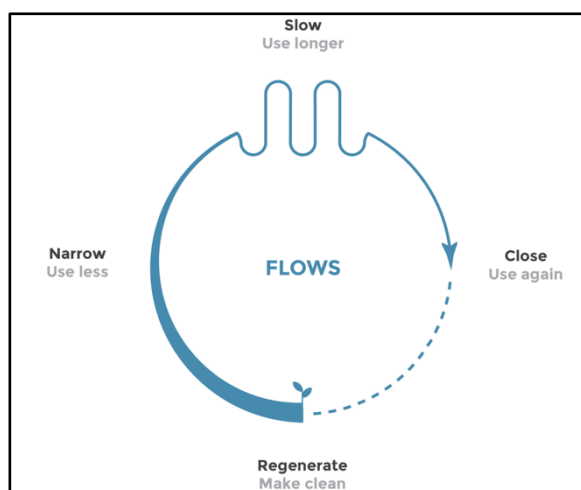


Figure 4: Types of Circular Resource flows (Konietzko et al., 2020)

The Circular Economy (CE) describes an economic system that minimizes the input, output and leakage of resources by slowing, closing, narrowing and regenerating material and energy loops (Geissdoerfer et al., 2020; Kirchherr et al., 2018). It encourages the transition away from a take-make-use-dispose society towards one that minimizes resource input, optimises sustainable values, maximizes waste prevention and helps regenerate the environment (Velenturf & Purnell, 2020).

We are an **entrenched linear society**, even backsliding on circularity. A third of the entire food production is wasted, 90% of electronics end up in landfills and some

arguing that 99% of what people buy is discarded within six months without recovering any of the materials (Gustavsson, 2011; Savage et al., 2007; Velenturf & Purnell, 2020). It was estimated that we only 'cycled' 8.6% of what we used in 2020, which was less than the estimated 9.1% cycled in 2018 (Circle Economy, 2022). Although complete circularity is not possible, there is still a lot of potential left to fill this 90% gap (Skene, 2018).

By transitioning society from a linear towards a circular economy, advocates of CE argue it can **contribute to sustainable development** by maintaining a familiar standard of well-being whilst limiting and regenerating environmental damage (Ellen Macarthur Foundation, n.d.-b, n.d.-a). By providing new and repeating loops of value exchange and increasing economic resilience by reducing resource extraction and waste generation, CE can create new employment opportunities whilst it reduces risks to society. Minimizing the amount of materials needed whilst reducing the size of the physical economy can, in principle, reduce harmful impacts on the environment such as land system change through exploitation or reduction of carbon emissions through decreased energy needs (Stockholm Resilience

Centre, n.d.). **Sustainability** was conceived as both an environmental and social categories using Rockström et al.'s 'planetary boundaries' and Kate Raworth's 'social foundations' (2009; 2017). In other words, operating within the Donut (see Figure 1 on page 9). Planetary boundaries are meant to quantitatively define the safe operating limit for humans within certain biophysical categories. Going beyond said limits risks pushing certain planetary subsystems beyond an irreversible threshold that leads to further ecological and social damage. Social foundations expand on the idea of planetary boundaries, viewing that there are certain social foundations that should be met to achieve a minimum of wellbeing. There is no irreversible threshold that the social minimum cannot recover from, but rather a spiral of deprivation that needs to be minimized.

However, **CE does not automatically equate to sustainability**. CE tends to address sustainable indirectly issues since its primary focus is directed towards resource efficiency, resource longevity and economic growth (Pieroni et al., 2019). And indeed, while many businesses and governments argue to pursue CE in order to improve sustainability, many authors of CE focus primarily on the economic prosperity aspect of it (Hanemaaijer et al., 2021; European Commission, 2020; Kircherr et al., 2017). The CE approach can even be harmful when considering problem shifting, the rebound effect or being used in inherently unsustainable industries. (Kim, 2016; van Meeteren, 2021; Zink & Geyer, 2017). Sustainability can be more directly addressed within CE if it is a concept explicitly addressed and employed within the CE thinking. For instance, when determining goals or choosing which CE practices and strategies to employ, a more holistic thinking can be employed that goes beyond CE to include sustainability. Even adding simple checks of how sustainable a CE weigh-off is can be impactful.

Considering that CE is popular but flawed in addressing sustainability issues, why not use competing concepts that are more sustainable such as **green growth or degrowth**? Green growth is a concept that aims to shift the perspective of sustainability being an opportunity rather than a cost to society; emphasizing the need to promote sunrise industries, phasing out sunset industries and striving to decouple economic consumption from carbon emissions and environmental impacts (Vazquez-Brust et al., 2014; Belmonte-Ureña et al., 2021). Degrowth questions the ability for limitless growth, the ability to decouple economic consumption from environmental impacts, and therefore sets to rethink the current economic system (Schmelzer et al., 2022). This involves reconsidering core values, such as growth and standard of living, and the selective expansion of certain economic sectors whilst disassociating economic growth from environmental and social improvements (Schmelzer et al., 2022). It has one of the closest associations to sustainability when compared to other competing concepts and does not advocate for shrinking the economy (Belmonte-Ureña et al., 2021). Whilst these concepts are closer to sustainability than CE, a defining aspect in how they differ is their scope. CE is practice oriented, especially regarding business models, customers, logistics and the supply chain (Belmonte-Ureña et al., 2021). Green growth has a macro-level and policy level scope, lacking practical application, whilst degrowth has a more academic and philosophical scope, being comparatively limited in practical insights. This has several implications. For one, the thesis has the distinct aim of targeting the value chain. Whilst this does not exclude government actors, academics or communities, it is heavily inclined to approach business actors, who are better addressed through CE compare to the competing concepts.

Furthermore, the thesis is aimed towards a practical implementation of the findings. By employing CE, there is a wider selection of practical knowledge available that can be

selected from and used to improve the practical stage of the thesis. Finally, due to the closer alignment of practice and scope, **CE is a more understandable and receptive concept for business actors**. This allows for easier internalisation and acceptance of sustainability, which can provide more impact for the thesis’s specific goals. Especially degrowth, although possible to implement in a business setting, has considerable misconceptions publicly that would need to be addressed that may detract from the primary goal of this thesis. Overall, while CE may not be fully aligned with the concept of sustainability, its shortcomings can be compensated for whilst being an effective concept to help encourage sustainability in a business context.

2.1.2 What is Circular Business Model Innovation?

This sub-chapter addresses Circular Business Model Innovation (CBMI). It mainly connects to the thesis via the literature reviewed and to the various elements used within the final tool prototype. CBMI will be explored by explaining the various elements it is built upon, why they are used, and their importance for understanding transitioning itself. Business Models are a way to conceptualize and strategies how an organization creates, delivers, and captures value (Osterwalder et al., 2010). One of the most popular ways of visualizing and strategizing business modes is through Osterwalder et al.’s business model canvas (2010). It creates an overall strategy of a business by looking at how feasible (partners, resources, activities), desirable (value proposition, customer relationship, segments and channels) and viable (cost structure and revenue streams) a business model is (Santa-Maria et al., 2022b).

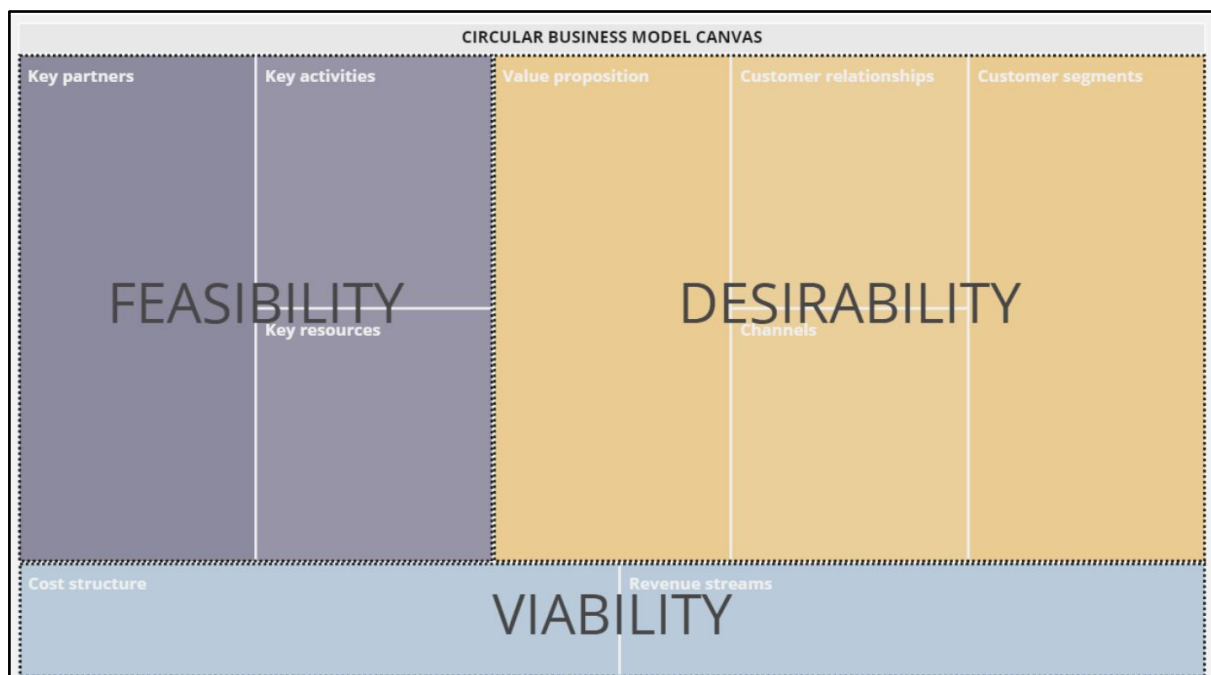


Figure 5: Business Model Canvas adapted illustration found in Santa-Maria et al. (2022b)

Business modelling can be an important tool for systematic analysis, planning and communication of future business models, especially regarding business model innovation (Geissdoerfer et al., 2020). There are many types of business models, ranging from franchising to leasing (Gupta, 2019). However, this paper will stay focused on the circular business model. Circular business models are business models that use circular strategies and practices to

deliver value. There is no broadly agreed upon method on how to order and conceptualize circular practices and strategies. Strategies and practices such as following the R-hierarchy, 'Cycling' resources, 'Extending' product life, 'Intensifying' product usage, 'Dematerializing' a product, 'Product-as-a-Service', sufficiency driven strategies and regenerative practices are some of the few (Potting et al., 2017, Geissdoerfer et al., 2020, Santa-Maria et al., 2022a). By encouraging and employing CE thinking and moving away from a take-make-use-dispose linear society, businesses hope to find win-win situations, where they can reframe sustainability as an opportunity, and become more competitive. However, transitioning from a linear to a more circular business model is a challenge in and of itself; being arduous to plan, prepare, mobilise and execute (Santa-Maria et al., 2021). CBMI, is the "conceptualization and implementation of circular business models" (Geissdoerfer et al., 2020, p. 8). It often aims to find insights into how to improve the transitioning from linear towards circular business models, which is well aligned with the main research question of the thesis (Bocken et al., 2018; Linder & Williander, 2017). As previously outlined, the value chain is especially vulnerable within a CE transition, due to the increased dependency between actors within a shared value chain (Lennartz, 2021). CBMI can help give insights on transitioning that can extend not only from a business unit perspective but also extend towards the entire value chain, since it can also account for an intra-organisational perspective (Geissdoerfer et al., 2020).

2.1.3 What are Circular Value Chains?

The final section clarifies what is understood by value chains, emphasizing their importance to the CE. The section connects to how this thesis mainly differentiates itself from similar academic pursuits

Value chains are a way to conceptualize and strategies value adding activities for a product or service from its sourcing to usage. It is a type of business model perspective that looks at the sequences of value adding activities with a multi-actor perspective rather than the more typical business unit focused models such as the business model canvas (Osterwalder et al., 2010). One of the more popular conceptions of the value chain is done with Porter's Value Chain Analysis (Porter, 1985). It breaks down the value chain into primary activities and supporting activities, with primary activities involving directly adding value to the product, and supporting activities coordinating and facilitating the primary activities (see Figure 6). This overall should help businesses identify their main value adding activities and where they can further increase their competitive advantage (de Bruin, 2018).

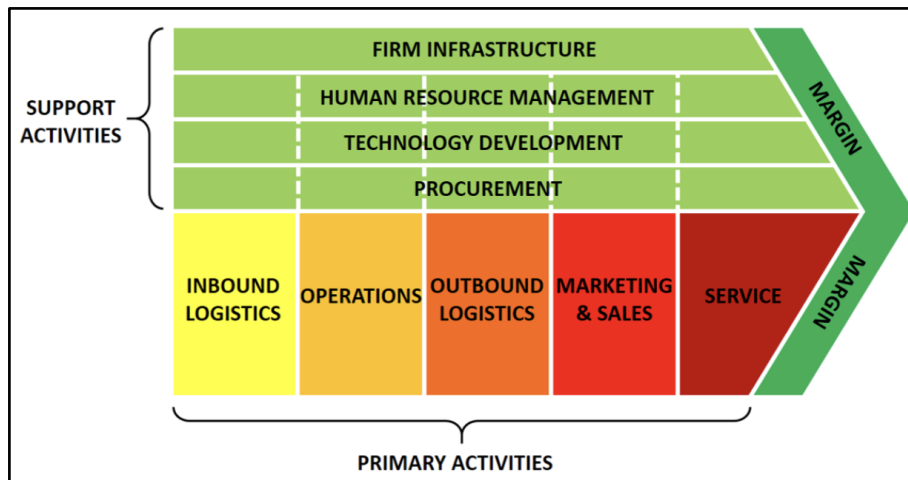


Figure 6: Porter's value chain analysis (de Bruin, 2018)

'Value' within typical value chain analysis is strictly thought of in terms of economic value; how much currency is a person willing to pay for said good (Banton, 2020). However, when looking at circular or sustainable value chains, the idea of value can be expanded beyond the economic to also include material and or environmental and social value adding activities. Furthermore, the entire life cycle, including the value adding activities around end-of-life of a product or service, becomes relevant. Value chain actors typically range from businesses that extract the raw materials needed for manufacturing, towards businesses that extract value from the product at the end of its lifecycle. However, given the expanded definition of value, the value chain could also include the value adding activities of government actors, academics or communities. Due to time constraints, the thesis focuses on business actors but would ideally not excluded non-business actors.

As previously mentioned, a main motivator for the thesis's focus on value chains is due to the increased vulnerability of value chain actors within a circular economy and the need to create more resilient value chains. While this line of argumentation emphasizes the risks, it does not properly underline the benefits that come from taking a value chain perspective. Businesses limit the extent of circular and environmental impacts they can avoid if they only focus on the immediate business unit. Businesses that consider themselves circular and sustainable but only focus on the immediate business unit may be suddenly surprised when they are confronted with a full life cycle analysis (Lonca et al., 2018). They may find their circular business model more linear due to not considering the interplay between multiple businesses within the value chain (Brändström & Eriksson, 2022). By increasing the scope beyond the immediate business unit, businesses unlock more potential to curb their impacts (Santa-Maria et al., 2022a). They also unlock more opportunities, especially in terms of circular strategies and practices, collaboration, and innovation. This, again, can be summed up by the move to widen your scope so that your solutions space becomes wider (Santa-Maria et al., 2021). Businesses may not have to commit to trades-offs since they have more solutions available, they have more opportunities to share knowledge and discover alternative paths for circularity through partners, and can pool resources to innovate and ideate pilot programs (Santa-Maria et al., 2021; Franco, 2017; Hultberg & Pal, 2021). To more efficiently discover, exploit and adapt these opportunities, and mitigate risk, the business within the value chain can acquire a better understanding of what they are capable of.

2.2 Conditions for Transitioning - Capabilities

This sub-chapter will elaborate upon the key concept capabilities, its connection to conditions, and its connection to the de-prioritized concept of drivers and barriers. This is particularly relevant for the second sub-research that questions: Which conditions to enhance and operationalize the transition towards a circular value chain can be derived from the circular business model literature? Capabilities are important since they end up providing the substantial input for the tool. Therefore, capabilities also contribute to the sub-research questions that follow. This chapter will be tackled by first addressing capabilities and then addressing drivers & barriers.

2.2.1 Capabilities

In this thesis, capabilities are the “Organizational capabilities that firms apply to identify, develop, and implement new business models, particularly in uncertain, volatile and complex environments.” (Teece et al., 1997; Santa-Maria et al., 2022a, p. 1309). Note this definition relates to the ‘**Dynamic Capabilities**’ literature but has been simply shortened to capabilities in this thesis. Capabilities can tentatively be compared to supporting activities from Porter’s value chain analysis, but have a more extensive and detailed analysis. Capabilities in this thesis are not a business model, since they do not describe how a business creates, delivers and capture value, but rather emphasize the practices that help enable said value acquisitions. Capabilities are conceptualized here as conditions that are relevant for the transition from a linear value chain towards a circular one. Specifically, capabilities are conditions that value chain actors can directly influence and improve. Thus, this thesis uses a slightly modified version of the original dynamic capabilities found in the literature (Teece et al., 1997). Condition is a term that is used to identify elements that can influence the transition of a given value chain towards a more circular value chain. Conditions are thought of as a more general definition compared to capabilities, meant to be able to cover any type of element that motivates change. Thus, while capabilities are conditions, conditions are not necessarily capabilities. Furthermore, the possibility is not excluded that there may be an overlap between capabilities that are relevant for a linear-to-linear business model transition and a linear-to-circular business model transition. However, this is not further addressed in this thesis.

Capabilities can be broadly broken down into **three categories**: ‘Sensing opportunity’, ‘Shaping opportunity’ and ‘Reconfiguring resources & Structure’ (Santa-Maria et al., 2021). ‘**Sensing** opportunities’ allows for the scanning of the internal and external environment to help identify opportunities and threats (Teece et al., 1997; Santa-Maria et al., 2022a). These are capabilities that help explore and understand the business environment that a value chain operates in. ‘**Shaping** opportunities’ look at the processes and structures that allow capturing value from the sensed opportunities (Teece et al., 1997; Santa-Maria et al., 2022a). Finally, **Reconfiguring** Resources & Structure outline the ability to be flexible and adaptive to market fluxes by (de)aligning (in)tangible resources (Teece et al., 1997; Santa-Maria et al., 2022a). Seeing as circular business models are distinct from linear ones, the capabilities will be oriented towards circular contexts. Capabilities are especially useful for business model innovation since strong capabilities can enable business model creation and implementation (Teece, 2018). Furthermore, the conceptualisation of capabilities helps businesses think

beyond the “traditional resource-based view of the firm into the realm of dynamic environmental contexts, where change and disruption is the norm rather than the exception” (Santa-Maria et al., 2022a, p. 1310).

A final aspect to address are **micro-foundations**, which are categories nested with the overarching categories of sensing, seizing and reconfiguring. They are largely adopted from Santa-Maria et al. (2022a) and are used to further categorize the conditions in more detail. They help provide an understanding of more concrete categories (Teece, 2007). These can then help value chain actors get a more accurate idea of specific themes they need to address. Note that micro-foundations are still capabilities, but further focused. For instance, Santa-Maria et al. (2022a) identify knowledge creation as one of four micro-foundations of sensing. Thus, actors realize immediately that, knowledge creation is essential, and from there start asking questions such as: Do we possess this capability? To what extent is it present? If not, how can we acquire it? How can we increase the capacity of said capability? Furthermore, practices that make up this micro-foundation, give a distinct direction for the actor. Using Santa-Maria et al.’s (2022a) as an example, and as can be seen in Appendix A1, undertaking R&D activities is a concrete practice that actors can focus on in to improve the associated micro-foundation; knowledge creation.

2.2.2 Drivers & Barriers

Whilst capabilities in this thesis are primarily thought of as typically internal conditions that a business can steer and influence, **drivers & barriers** are typically external conditions that are steps removed from the influence of actors. The difference between drivers and barriers, is that drivers positively spur on a circular transition, while barriers are obstacles that obstruct a circular transition. The literature relating to the definitions between capabilities, drivers and barriers are inconsistent, overlapping and even sometimes absent (Franco, 2017; Geissdoerfer et al., 2022; Ranta et al., 2018; Lindgreen et al., 2022; Salvador et al., 2021; Santa-Maria et al., 2022a). That being said, this take on drivers and barriers in contrast to capabilities is a proposition by the author, not being adopted from any particular articles from the literature review. It should further be highlighted that what is considered a capability in one context, could be considered a driver or barrier in another. This is partially the reason why drivers & barrier were ultimately not adopted into the tool, avoiding the problematization. However, they were nonetheless useful in categorizing the non-capability conditions and could be useful in future iterations of this tool.

The usage for micro-foundations was also used for drivers and barriers and essentially has the same role: give value chain actors a better understanding of specific themes they may need to address. A visual example can be given in Figure 7, which can also be viewed in Appendix A3. There one can see the barrier version of the financial category. the micro-foundation’s ‘high investment influences the degree of investment. The degree of investment needed for transitioning is a barrier that affects that ability to transition. All white coloured boxes in Figure 7 are similar to practices but names mechanism instead, since say high upfront costs are not an active practice.

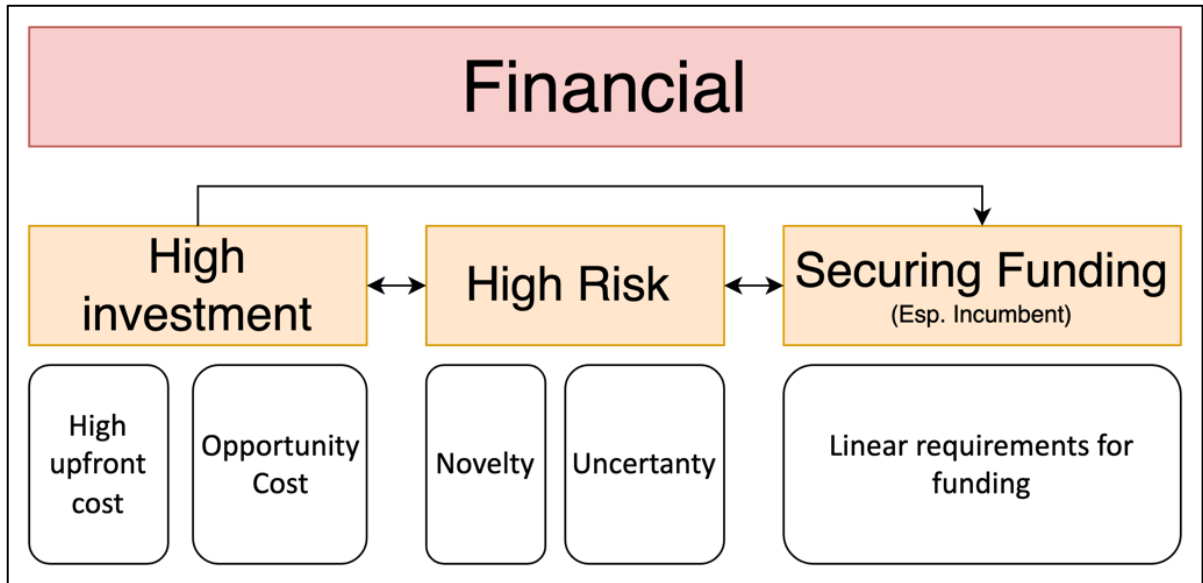


Figure 7: Example for Micro-Foundation shown via a Barrier Category

2.3 Tool Design Process - Design Thinking

This sub-chapter seeks to clarify the key concepts of design thinking and its connection to the de-prioritized concept of design science. Design thinking is most relevant regarding the third sub-research question, which asks: Based on feedback from an iterative feedback process, which elements that could constitute a useful tool should be included and excluded? Design thinking became the core concept used to structure and guide tool development. It emerged from the feedback process as an important element. Design science initially held this position as guidance, but was replaced due to being inadequate for tool development. Design science did help structure the final feedback round, connecting it to the fourth research question, which asks: To what extent is the final version of the tool useful based on the final feedback round? However, this had a rather limited impact, thus not being considered a key concept. This sub-chapter will be tackled in three sections. It first addresses design science, then design thinking and, due to their similarities, ends by comparing both.

2.3.1 Design Science

Design science is essentially a problem solving paradigm, aiming at creating insights on how artefacts can be efficiently and effectively analyzed, designed, implemented, managed and used (Hevner, 2004). Artefacts are ideas, practices, technical capabilities, frameworks, tools or methods; they denote an intellectual product. The artefact of this thesis is the 'tool' it is designing. Design science provides clear and consistent guidance for the research process that takes a positivist stance towards the ideating and evaluating of artefacts (Dolak et al., 2013; Buchanan, 1992). It aims to adhere to the scientific method in order to find answers to design problems. Due to its clear research process, it is especially suited for evaluating tools (Dolak et al., 2013; Peffers et al., 2006).

2.3.2 Design Thinking

Design thinking could also be considered a solution based approach that seeks to identify the problem, ideate strategies and ultimately provide a solution (Dam & Siang, 2021; Geissdoerfer et al. 2016). Design thinking tools are typically built on a non-linear and iterative structure that is built upon 5 phases: Empathise, Design, Ideate, Prototype and Test (Dam & Siang, 2021). A further dimension to these 5 phases is convergent and divergent thinking. Divergent thinking allows space for new ideas while convergent thinking filters out proposed solutions

(Santa-Maria et al., 2022b). See Figure 8 as an overview of the 5 phases with divergent and convergent thinking.

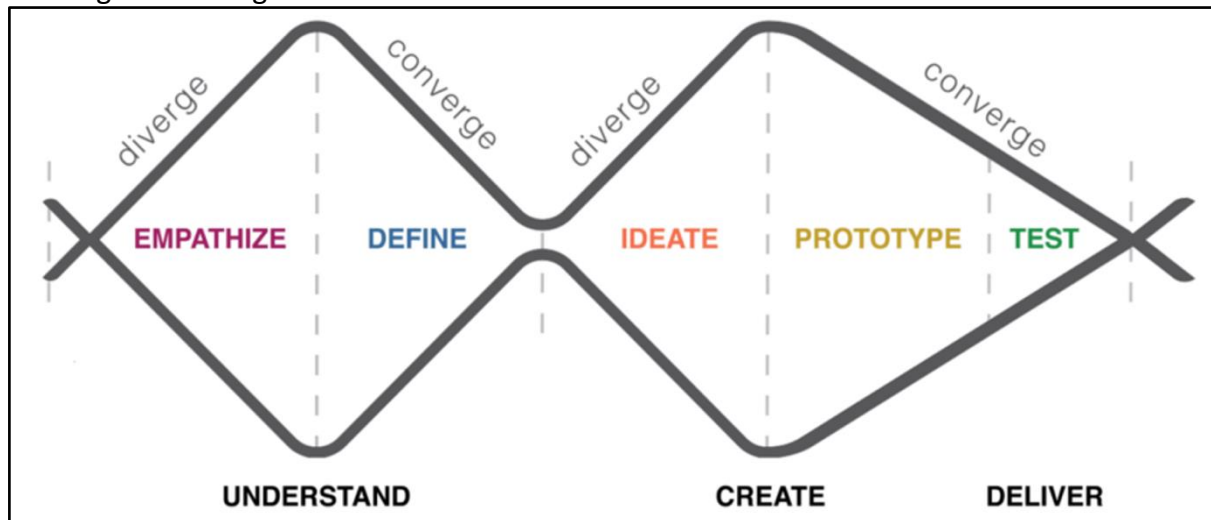


Figure 8: Convergent & Divergent thinking dimension as represented by Grdr Broo & Trngrn (2018)

One way design thinking influences tool creation can be seen through the Workshop method 'Sprint'. Sprint style workshops aim to rapidly go through the design thinking process by solving "big problems and testing new ideas in just five days." (Knapp et al., 2016,). A Sprint workshop is an in-person, tangibly oriented series of exercises that 'map' (empathize & define), 'sketch' (ideate-diverge), 'decide' (ideate-converge), 'prototype' and 'test' a solution for a given problem. A facilitator usually guides the discussion and helps navigate the series of exercises. A Circular Sprint has been successfully used to rapidly innovate and develop new circular business models, somewhat mirroring the goals of this thesis (Santa-Maria et al., 2022b). Figure 9 gives an example of the expected duration and pace of such a sprint.

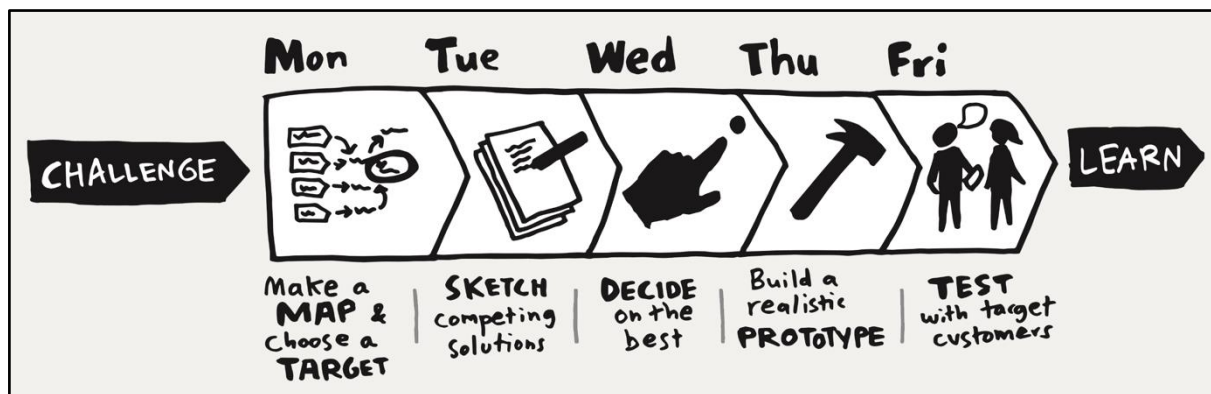


Figure 9: SPRINT Workshop schedule by Jason Knapp (2016)

2.3.3 Comparing Design Science and Design Thinking

Compared to design science, design thinking could be considered a practical offshoot, taking a more constructivist stance towards the designing of artefacts (Devitt & Robbins, 2013). Design science and thinking have a similar goal of providing better processes and tools for practitioners and users, with researchers on both sides arguing that they are especially suited to solving wicked problems (Devitt & Robbins, 2013). However, they differ in approach. Being

a constructivist strand, design thinking implicitly rejects positivist thinking and takes a more holistic, human centred, collaborative and cross-disciplinary perspective (Devitt & Robbins, 2013; Luchs, 2015; Geissdoerfer et al. 2016). In recent years, design thinking advocates have argued that due to design thinking's ability to tackle problems or opportunities that are not well defined but need strategic level solving, it connects especially well to circular business model innovation (Luchs, 2015; Brown & Katz, 2011). Advocates of design science claim that design science is also suited for solving complex and wicked problems such as a circular transition tool (Hevner, 2004). However, due to its positivist angle, it tends to rely more on semi-quantitative data and be less flexible, thus being limited in providing innovative solutions. As will be shown in the methods (3.3), it can nevertheless provide an effective outline of how to evaluate artefacts (Nielson, 1993; Holzinger et al., 2008). As will be explained in Initial Workshop Tool (5.3.1), design thinking ended up being the guiding concept to help further develop the final tool prototype, while design science was primarily used to inform an evaluation of said tool. This is due to design thinking providing a more fitting practical guidance and outline for developing the tool, whilst design science has a more mature conception of criteria that can be used to evaluate an artefact. Design thinking's practical problem solving, collaborative and iterative approach provides is a better fit for the active development phase of the tool (Luchs, 2015).

3 Methods

This chapter will outline the methods for the key research phases of the thesis. This concerns the literature review, the tool design process, and the final feedback session. The literature review chapter (3.1) lays out the investigation of impact assessment and condition for transitioning. The tool design chapter (3.2) addresses the tool design process, followed then by how the relevant concept structured tool design. Finally, the final feedback round chapter (3.3) outlines how feedback was collected for the final tool design.

3.1 Literature Review & Evaluation

As outlined in the introduction (1.0) the first phase in the research, as part of the first and second sub-research question, was to conduct a literature review to identify relevant impact assessments and conditions that promote a more successful value chain transition as inputs for a tool. This was deemed important in order to assure the sustainability of a circular transition and provide guidance on how value chain actors could improve their value chains transition. The impact assessment sub-chapter (3.1.1) lays out the process for structuring the investigation for identifying and evaluating the sustainable assessments. The conditions for the transitioning sub-chapter (3.1.2) outlines the structure of the literature review and disseminate the results relating to conditions for transitioning.

3.1.1 Literature Review - Impact Assessment

The aim for the sustainable impact assessment was to conduct a brief unstructured literature review of available impact assessments that could be potentially integrated into a tool. A brief comparative evaluation was then conducted afterwards. This sub-chapter specifically relates to the first sub-research question asking: *Which impact assessments derived from the circular economy literature could be used to measure the sustainable impact of the value chain?* As mentioned in the introduction (1.0), this was done to based on the assumption that an impact assessment would allow the tool to orient the users in a circular and sustainable direction. A brief literature review of available impact assessments that could be potentially integrated into a tool and serve as a reference point was thus conducted. This sub-chapter will first address the method of the literature review and then the method of evaluating the identified impact assessments.

Method of Literature Review – Impact Assessment

In terms of the method for collecting impact assessments, a brief unstructured literature review of available impact assessments was conducted. The aim was to find a significant amount of impact assessments until saturation was reached. Saturation would be reached if the author was of the impression that no additional impact assessment could significantly contribute to the pool of relevant impact assessments. The impact assessments were collected via suggestion by the supervisor, based on the background knowledge of the author and through the snowball of articles. Originally, it was thought that saturation would be reached by the 20th impact assessment. This was not the case. Despite then doubling the aimed amount of assessments methods to 40, the author could not confidently admit saturation was reached (Roos Lindgreen et al., 2022; Navarro et al., 2020; Franco, 2017; Greenhouse Gas Protocol, n.d.; Integrated Reporting, n.d.). To follow the word 'brief' in the brief systematic literature review, the author decided to halt the search at 43 impact assessments. When identified, each impact assessment was briefly contextualized in a word document using the primary source and supporting grey literature. Via the 'topics' section on Science Direct's website, the majority of impact assessments could be contextualized (Science Direct, n.d.).

Impact Assessment Categorization Table		
	Description	Scoring
Environmental:	Denotes what environmental impacts the impact assessment addresses. Categorisation inspired by Rockström et al.'s (2009) 'Planetary Boundaries' & the focus of the CE on the resource perspective	
Resource	Addresses material flows	+1
Climate	Addresses impact from carbon dioxide equivalent (CO ₂ e)	+1
One Additional (Planetary Boundary) Theme	Based on Planetary Boundaries (Novel Entities, Stratospheric Ozone, Atmospheric Aerosol Loading, Ocean Acidification, Biogeochemical Flows, Freshwater use, Landsystem Change, Biosphere Integrity)	+1
High flexibility option	The categories assessed are highly dependent on the choice of the user	1.5
Social Foundation:	Denotes the social foundations that the impact assessment addresses. Categorisation inspired by Raworth's 'Social Foundations' (2017)	
Wellbeing	Impacts on wellbeing (food security, adequate income, water and sanitation, health care, housing)	+1
Productive	Impacts on productivity (education, decent work, modern energy services)	+1
Empowerment	Impact on empowerment (gender equality, social equity, having political voice)	+1
High flexibility option	The categories assessed are highly dependent on the choice of the user	1.5
Tool Type		
Tool Type	Denotes the core characteristic of the impact assessment. Categorisations below are based on Lindgreen et al. (2021). The Exploration category was additionally added by author.	
Life Cycle Analysis	Impact assessments that assess the impacts of a products across its the entire life cycle	
Reporting Framework	Impact assessments that provided a structure for businesses to report their impact based on a standardized systems	
Exploration	Impact assessments that were more generalist and philosophically oriented rather than providing a quantative evaluation	
Single Indicators	Impact assessments where multiple impacts were condensed into a single indicator	
Tailor-made	Highlights that they are usually developed in house. Is an add on category to the previous four.	

Table 1: Impact Assessment Categorization Table

In terms of the **method for cataloguing**, the literature was catalogued via an excel sheet.² The excel sheet catalogued in the rows the impact assessment and various categories in the columns. While a plethora of data was recorded (focus level, decision level, type of data) the categories ‘Environmental’, ‘Social Foundation’ & ‘Type of Tool’, were the most relevant for the assessment. See Table 1 to get a complete overview of how the categories were broken down. Note that the scoring in the table will become relevant in the following section.

To cover the breadth of sustainability as outlined in the conceptual background chapter (2.1.1), the **environmental category** was primarily structured through the categories from planetary boundaries (Rockström et al., 2009). Of the planetary boundaries, ‘Climate Change’ was placed in its own sub-category. Due to the strong presence of climate only impacts assessments, the author wanted to see at a glance impact assessments that also consider more planetary boundaries. The ‘one additional’ sub-category thus covers impact assessments that assess one or more planetary boundaries, which are: biodiversity loss, nitrogen use, phosphorus, freshwater use, land use change, ocean acidification, atmospheric aerosol pollution and chemical pollution. Additionally, it was catalogued if the impact assessment addressed any material flows, in order to track its addressing of circularity.

Social foundations only used categories suggested in doughnut economics (Raworth, 2017). However, the categories were aggregated into ‘wellbeing’ (food security, adequate income, water and sanitation, health care, housing), ‘productive’ (education, decent work, modern energy services, network) & ‘empowerment’ (gender equality, social equity, having political voice). This was done to simplify the comparison in the later evaluation and to numerically match the environment categories. The numerical matching is due to the environmental and social perspective being equally weighed. Note for both social foundations and environmental, if the breadth of the impact assessment is highly dependent on the choice of the user, they are placed in their own ‘flexible’ sub-category. This will become important for the evaluation.

Finally, the tool type was catalogued. The tool type logs the general structure of the tool and is primarily based on Lindgreen et al. (2021). They identified ‘Life Cycle Analysis’, ‘Reporting Framework’, ‘Single Indicators’ and ‘Tailor-made’ as the main separating characteristic of the various impact assessments. Additionally, ‘Explorative’ was added by the author to better characterize a set of identified impact assessments. Note that even though there was considerable overlap, the assessment impacts were put into set categories in order to get a workable overview.

Method of Evaluating – Impact Assessment

The method for evaluating the impact assessment was qualitative, with the usage of scoring to create a more logical argument. It was qualitative in that the scoring was more of a structuring tool to orient the results, rather than a narrow and reproducible comparison. The exact scoring can be viewed in Table 1 above. There were two stage of analysis done: One that compares the tools just on their sustainable breath and another takes in addition their tool type in account.

² The raw data is available on request via justin.seydoux@gmail.com

Regarding the scoring for the environmental category and social foundation category, impact assessments can score +1 point for each individual sub-category they address (see Table 1). With there being three sub-categories, an assessment could receive a max of 3 points per category. The max total an impact assessment can thus score if they take the broadest approach to sustainability is thus a 6. Some impact assessments were highly user dependent on what sub-categories they addressed. They were thus given a scoring of 1.5 in the relevant environmental and or social foundation category, which is the mean number for both categories. The sustainable input aimed at being a clarifying element rather than a 'choose your own adventure' story.

3.1.2 Literature Review - Conditions for Transitioning

The aim regarding condition for transition was to conduct a brief systematic literature review to identify relevant conditions for a value chain transition. Furthermore, the literature review was also used as an opportunity to identify useful concepts. This sub-chapter specifically relates to the first sub-research question asking: *Which conditions to enhance and operationalize the transition towards a circular value chain can be derived from the circular business model literature?* As outlined in the introduction (1.0), conditions were used as a catch all term to identify what elements, characteristics or attributes in a CBM transition could contribute towards a better value chain transition and can thus be used as input for the tool. In this context, better means that transitions are more reliable and are less at risk of encountering problems or even failure. To explain how the methodology was structured, this sub-chapter is broken into three parts: The method of the literature review, the method of identifying conditions and the method for categorizing the data.

Method of Literature Review – Conditions for Transitioning

Articles for the literature for the review were mainly selected through the search engine Web of Science using the search term: "value chain" AND "circular*" AND "business model*" (Web of Science, n.d.). 94 articles were initially found but were reduced to 61 after excluding non-cited articles. It was discovered after the literature review and evaluation that adding "transition" to the search term list could have brought the count down to a sufficient 34 articles. Additionally, articles reviewed that were recommended by the author's supervisor, which amount to 2 articles. To keep the literature brief, the number of articles was set to 30. The recommended articles were given priority, allowing only 28 from the previously 61 articles that were identified through Web of Science to be used. These articles were selected by ranking them via most to least cited articles, with a hard stop at the 28th article. Figure 10 gives an overview on how the articles were narrowed.

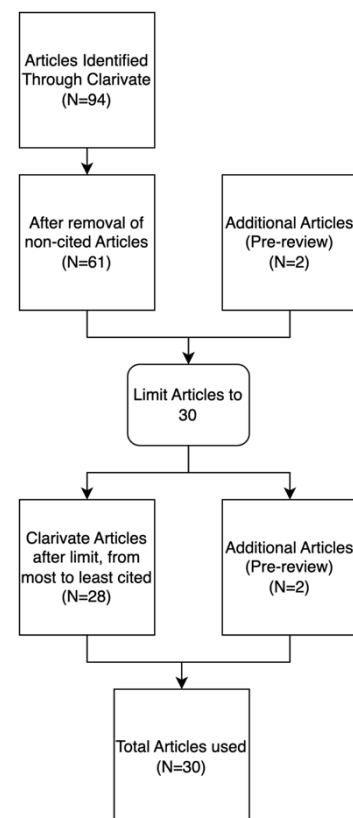


Figure 10: Conditions for transitioning literature review flow diagram

Method for identifying conditions – Conditions for Transitioning

Again, as outlined in the conceptual background (2.2), conditions are relevant for the transitioning from a linear value chain towards a circular one. Conditions are elements, characteristics or attributes that can influence the transition of a given value chain towards a more circular value chain. They are meant to be able to cover any types of situation that motivates change. Conditions were catalogued in an excel sheet, where the rows logged the individual conditions whilst the columns logged various

information relating to the condition.³ Whilst a number of attributes were logged in the columns (Quadruple Helix, Short/Medium or Long Loops, Incumbent or Start-up, Industry Sector), the 'Paper', 'Unit of Analysis' and 'Empiricalness', were the most relevant for later evaluation.

The term paper referred to the academic article the condition was sourced from. Unit of analysis outlined if the article the condition was sourced from took a business unit perspective or a value chain perspective. Empiricalness determined how reliable an article was by breaking it down into '+ Empirical ($\geq 80\%$)', '- Empirical ($>30\%$)' or 'Theoretical Evidence ($<30\%$)'. An article was considered empirical if it validated their given conditions with a case study or interview involving relevant business actors. If more than 80% of their participants considered it a relevant condition, it was considered strongly empirical. If more than 30% of participants agreed, it was considered only weakly empirical. If less than 30% of participants agreed with the conditions or if the condition was based on logical reasoning, it was categorized as theoretical evidence. These categorizations later helped inform the author in the bundling of conditions, which will be elaborated in the next section.

The subjectivity of identifying conditions could considerably vary from article to article. The majority of articles would give a list of conditions that could influence the ability to transition (Santa-Maria et al., 2022a; Tura et al., 2019; Guldmann & Huulgaard, 2020). There, the author of this thesis would simply directly log the condition. A minority of articles would address a question that did not directly serve to identify conditions for transitioning (Perey et al., 2018; Islam & Iyer-Raniga, 2022; Awan et al., 2022). There, the author would have to dissect the condition of the text. These were much more subjective and theoretical, with the author only logging conditions if more convinced than not in its appropriateness.

Method for categorizing the Conditions – Conditions for Transitioning

While the categorization was constantly worked on throughout the review, a clear categorization structure emerged by the end of the review. This section will address the two overarching categorizations used to order the conditions. Namely, dynamic capabilities and drivers & barriers. As outlined in the conceptual background (2.2), the primary way they differ is that while dynamic capabilities here are conditions that value chain actors can directly influence, drivers & barriers are conditions that are indirectly influenced by actors. As will be further elaborated upon in the coming substantive inputs chapter (5.0), these concepts were not identified from the beginning but emerged from the articles during the literature review. This section aims to address how the categorization was structured, first tackling dynamic capabilities, followed by drivers & barriers.

As elaborated in the conceptual background (2.2.1), the literature dynamic capabilities, known from here as **capabilities**, use an overarching three pronged categorisation. These are 'sensing opportunity', 'shaping opportunity' and 'reconfiguring resources & structure' (Teece et al., 1997). Again, sensing concerns the identification of opportunities, shaping the capturing of value, and reconfiguring the flexibility and adaptiveness of the business units themselves (Teece et al., 1997; Santa-Maria et al., 2022a). There were **three layers** in the excel, of which **sensing, seizing and reconfiguring** was **first**

³ The raw data is available on request via justin.seydoux@gmail.com

layer. This first layer served to broadly and easily categorize a given condition, especially against drivers & barriers. All conditions, according to the article they were sourced from, that were directly influenceable were linked to either sensing, seizing or reconfiguring. Some conditions, depending on the context, could be in one of the three capability categories. There were also occasions where similar conditions were found for both capabilities and drivers & barriers. However, it was mostly a straightforward process. **Micro-foundations**, as inspired by Santa-Maria et al., (2022a) were the **second layer.** This layer served as a bridging categorization and to quickly communicate a theme. Some of the micro-foundation categories were adopted or inspired from Santa-Maria et al. (2022a). Furthermore, it helps value chain actors get a more familiar idea of what areas are important and may need to address. Again, see the conceptual background (2.2.1) for elaboration. Initially, the previous two layers were the only layers used. However, this was seen by TNO employees as too broad. **Bundled conditions**, also inspired by Santa-Maria et al. (2022a), were thus used as the **third layer.** Once enough conditions are found that relate to a given micro-transaction, similar conditions are bundled together into a practice. This was done to allow the capabilities to be operationalized, connecting certain practices to a micro-foundation. In other words, these were the most concrete actions which value chain actors could orient themselves around. It should finally be noted that discovering what descriptive categories for the various micro-foundation and bundle conditions were appropriate was an iterative endeavour. The categorizing, fitting and comparing were done until the large majority of capabilities could be accounted for.

Taking all this into consideration, how would a condition be categorized? Let us take an example. Say we find in Perey et al. (2018) that making nature a key stakeholder was a key motivator for innovation. We log it in the excel file as 'nature as stakeholder'. We notice that this aligns with Santa-Maria et al.'s (2022a) 'adopting holistic perspective' and log it as the associated category. Said micro-foundation connects to the overarching category of sensing and log it as such. Now we have three layers; the overarching capability, the micro-foundation and the condition itself. Once all the articles have been read, we compare the 'nature of stakeholder' condition to conditions connected to the same micro-foundation. We find that there are half a dozen similar conditions that have a sufficient empirical basis. Thus not only are the conditions bundled together under the practice 'adopting a holistic perspective and framework' but it is judged to be reliable enough to include in the final capabilities map, as seen in Appendix A1.

As explained in the drivers and barriers chapter (2.2.2), the difference between **drivers and barriers**, is that drivers positively spur on a circular transition, while barriers are obstacles that obstruct a circular transition. Driver & barriers used a similar categorisation to capabilities. They had three layers: the first layer determined if the condition was sorted conditions into either financial, market, value chain, organizational, technological or legal, which are categories shared by both drivers and barriers. The second layer could also be considered micro-foundations. It also helps value chain actors get a more familiar idea of what areas are important to take into consideration. It served a similar function to the micro-foundation used for capabilities, just now directed at the drivers & barriers categories. The third layer, mirrored the capabilities layers, where specific mechanism were made up of bundled conditions. They are not practices since it may be confusing to, for instance, call market forces a practice. Mechanism are thus a better description of these bundled conditions. These mechanisms were intended for users to better depict more concrete

mechanism that could pose as a driver or barrier and are there to operationalize the drivers & barriers.

In the definitions used for the first category are as followed: The **financial** category denotes monetary pressures on the business itself, especially regarding cost structure and revenue streams. For example, can relate to investments, returns, access to funds, profitability, sustaining the business, and shareholders. Can be thought of as mirroring market, since its internally and more micro economically oriented. The **market** category denotes the pressures on the external economic space, especially relating to customers. For example, can relate to market trends, changing customer needs and demands, and competition. Can be thought of as mirroring financial, since it is externally and more macroeconomically oriented. The **value chain** category denotes pressures on the internal operations of a business, especially relating to key activities and resources. For example, relate to culture, structure, thinking and knowledge. Can be thought of as mirroring 'Value Chain', since its operations are internally oriented. The **organizational** category denotes pressures on the external operations of a business, especially relating to the business's partners. For example, relates to sharing, trust, cooperation and system complexity. Can be thought of as mirroring 'Organizational', since its operations are externally oriented. The **technological** category denotes the pressures from Socio-Technological conditions. From the literature review, it seems that technology itself is not often the deciding factor, but rather the conditions relating to it. For example, distribution and access of technology and its viability. The **legal** category denotes the pressures relating to regulatory, legislative and judicial. For example, decisions by government, mandates by institutions and enforcement by law. These categorizations emerged towards the end of the literature review and could account for the vast majority of driver & barrier conditions.

3.2 Tool Design

This sub-chapter will address how the tool design process was tackled. First, this sub-chapter outlines the overarching approach of the tools development cycle. Then, it covers the initial structure used to design the tool, which was informed through design science. Finally, it explores how the structure of design thinking helped guide the tool design process that was eventually settled for.

3.2.1 Tool design process – Iterative feedback process

A cornerstone of tool development, irrespective of how the tool would be structured, were the iterative feedback sessions. These **feedback sessions** occurred primarily in two forms: as a one-on-one feedback session with the primary supervisor of the author, a TNO employee, and through group feedback sessions with several TNO employees. The **one-on-one** feedback session were held on a weekly basis with the author's primary supervisor at TNO. These were rather flexible sessions and could, for instance, be used to answer questions by the author, help explore development avenues and highlight potential points for improving the tool. Rough notes were taken alongside these typically hour long discussions. The **group** feedback sessions would typically involve the author giving a PowerPoint of the direction of tool development, or a tool pitch to multiple TNO employees. This would then be followed by said employees giving feedback. This feedback was unstructured, with rough notes being taken.

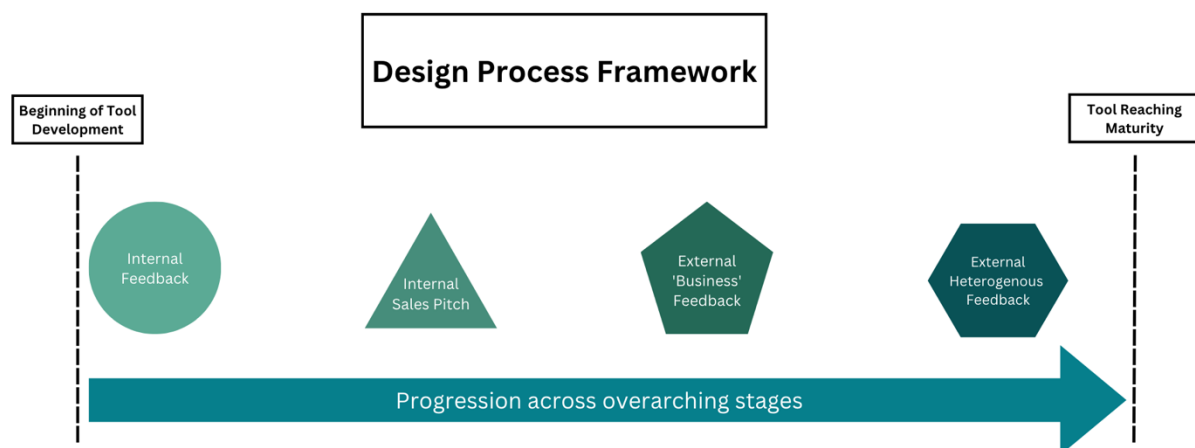


Figure 11: Design Process Framework

The overall design process was framed within 'overarching stages'. The reasoning was that by orienting the progress of the tool in contrast to specific design stages, a rough idea can be formed of how mature the tool is. Figure 11 gives a visualization of the stages and the progression across them. These stages were the 'internal feedback' stage, the 'internal sales pitch' stage, the 'external business feedback' stage and the 'external heterogenous feedback' stage. The **internal feedback** stage was centred around an open and relatively unstructured approach to developing a tool. Here, feedback sessions with TNO employees varied greatly in topics addressed. Many potential development avenues and ideas were explored, filtering out the most promising ideas. Once a tool was sufficiently structured, an

internal sales pitch was given on the tool to TNO employees. Here, the tool was ‘sold’ to TNO employees to test the overall structure of the tool via a PowerPoint presentation. The presentations generally followed the same outline: Addressing the problem context, what the tool was, why use the tool, how participants would use the tool and the final deliverable. If there was an unsatisfying point along this outline, the pitch would be revised, or even sent back to the internal feedback stage. If TNO employees would have deemed the tool developed enough, the tool development could have moved on to the following stages. However, tool development never went passed the internal sales pitch stage. If the tool would have passed the internal sales pitch stage, the **external ‘business’ feedback** stage would have been tackled. This would have involved giving a full test case of the tool to participants. These participants would have ideally been actors from a shared value chain and possessing a business background. They are ‘external’ in the sense that they are non-TNO employees but would have likely been approached through the TNO network. Here, testing the usability and practicality of the tool would have been most productive. It is presumed that, due to logistical reasons and participation fatigue, this would have been a one-shot presentation; no matter the feedback, the next stage would have commenced. The final stage, **external heterogeneous feedback**, would have had a similar structure to the previous stage. The only difference is that participants involved would be non-business actors that have a stake in a given value chain. This is not to the exclusion of business actors, but to the inclusion of a wide range of stakeholders. This would have been done to attain and test a wider range of feedback. Circular value chains are embedded in societal systems with multiple actors, thus said actor’s input is a significant source of knowledge. The participant’s backgrounds could have potentially ranged from government, NGO, academics, community leaders, media or simply have some form of justifiable stake.

3.2.2 Tool Evaluation – Design Science

Design science, as explored in the conceptual background (2.3.1), aims to outline how tools can be efficiently and effectively analyzed, designed, implemented, managed and used (Hevner, 2004). It was suggested by a TNO employee during an early feedback session to use design science as a means to guide the design and evaluation of the tool. Thus, a brief exploration of the concept yielded the following insights that were used to help guide the initial tool development:

- Need for a delineable tool
- Operationalization
- Simple Dialogue
- Speaking the user’s language
- Minimize memory load
- Consistency
- Feedback
- Help and Documentation

The ‘need for a tool’ is the idea that one needs to have a delineable tool that has functionality and can be evaluated (Peffer et al., 2006). ‘Operationalization’ is the related idea that there needs to be some form of measurability to a tool (Peffer et al., 2006). ‘Simple dialogue’

underlines how any unnecessary information should be avoided (Nielsen, 1993, p.20). 'Speaking the user's language' outlines that words, phrases and concepts should be familiar to the participants using a tool (Nielsen, 1993, p.20). 'Minimize memory load' highlights the need to make learning and understanding easy for a participant using a tool (Nielsen, 1993, p.20). 'Consistency', refers to avoiding the usage of different or conflicting terms for the same object; avoiding semantics (Nielsen, 1993, p.20). 'Feedback' stands for the idea that a tool should keep the participant informed on what is happening (Nielsen, 1993, p.20). 'Help and documentation' highlights that any help or need for reviewing certain info should be easily accessible (Nielsen, 1993, p.20). Design science was guiding tool development for around half of the tool design process. However, as is explored fully in the Initial Workshop Tool chapter (5.3.1), design science is better used for evaluating tools, offering rather general advice for designing a tool. Due to the lack of guidance for designing the tool itself, design science was largely replaced by design thinking as the primary concept to guide tool development.

3.2.3 Tool Design Structure – Design Thinking

Design thinking was used to guide the tool design process in the latter half of tool development. This sub-chapter will outline how design thinking's insights and non-linear process helped shaped the Capabilities Workshop tool. This will be done by exploring the main principles of design thinking and then further elaborate on the design thinking process from the conceptual background (2.3). Design science, is a solution based approach that seeks to identify the problem, ideate strategies and ultimately provide a solution (Dam & Siang, 2021; Geissdoerfer et al. 2016). As is more deeply explored in the Initial Workshop Tool chapter (5.3.1), design thinking provides a more focused and appropriate guidance for a Capabilities Workshop tool. For one, this is found in its main **principles**. Luchs (2015) provides a general overview what are the main principles of design thinking. Luchs proposes that the main principles of design thinking involve being people-centric, collaborative, holistic, flexible, communicative and having a 'growth mindset'. As the image shows, people-centric focuses on human interaction, with the source of innovation emerging from participant's ideas. Collaborative emphasizes the need to include participants with different backgrounds to access differing, potentially significant, perspectives. Holistic underlines the ability to connect seemingly disparate ideas. Flexibility highlights the ability to have a versatile content and approach. Communication means presenting multiple dimensions of communication (verbal, visual, tangible). Finally, a 'growth mindset' purposes that participants should not embrace risk and not fear failure. How did this translate into tool design? Adopting a people centric principle meant that closer, in-person interaction would have to be prioritized and that technologies or mediums that could inhibit collaboration were avoided. Actors involved in a tool should not be only business model specific but also the reach from the value-chain and society it is embedded in to increase collaboration. The tool would be built upon the ability to be flexible in its execution, modular, integrated and lean on separate but supporting tools. And finally, a growth mindset, although a bit of a slogan, could help emphasize to a participant to not play it safe and reach beyond their comfort zone so as to learn as much as possible.

The design thinking process, as previously addressed in the conceptual background (2.3.2), is typically a structure that enables identifying problems and deciding on a solution. A specific structure that serves as inspiration was found in SPRINT style workshop that relies on

activities that 'map' (empathize & define), 'sketch' (ideate-diverge), 'decide' (ideate-converge), 'prototype' and 'test' a solution for a given problem. This would help highlight essential elements within the tool and give an example for a beginning and end process for the tool to be designed. Namely, there should be elements of identifying the problem, identifying solutions, have a prototype to work with and test. There would also need to be a balance between opening the space for ideas and options, but also closing the spaces to prioritize the best avenues.

3.3 Final Feedback Round

A semi-structured feedback session was specifically designed when receiving the final feedback, concerning the usability, strengths and weaknesses, of the tool. This was done to understand how useful the tool in its final state is and how to further develop it beyond the thesis. This section will outline how the feedback session was structured and what is defined here as usability, as well as how the questions were structured.

Three TNO employees were confronted in a total of two **feedback sessions**⁴ with the final version of the Capabilities Workshop Tool. The ‘feedback session’ denotes a semi-structured recording of the feedback given by TNO employees after receiving a presentation on the final version of the Capabilities Workshop Tool. Appendix C presents the main steps of the final tool that were presented to the employees. Chapter 6.3 gives a more detailed outline of the Capabilities Workshop than what was presented. Employees received a condensed version of said outline in a presentation between 30-40 minutes long. The employees giving feedback are experienced in tool design and are regularly involved in innovating (circular) business modelling with clients. Before initiating the recording, employees were verbally asked for consent to record their feedback with the feedback being then later transcribed. To avoid ethical considerations, direct quotations or personal names were avoided and the recordings and transcripts were kept with the author for informing the relevant chapters. Once completed, the recordings and transcript were sent to the relevant TNO recipient for documentation, with the authors then deleting both the recordings and transcript. It should be noted that the participants were already confronted at least once with the project and thus already possessed some fundamental knowledge and assumptions on the workshop.

- What is your first impression of the workshop? (Warm-up)
- Do you think you have a clear understanding of what the workshop aims to achieve? (Learnability)
- Do you think the various steps in the workshop can be reliably done? (Reliability)
- Do you feel like the insights from the workshop would be meaningful? (Satisfaction)
- What are the strengths or weaknesses of the workshop? (Pro-con)
- How would you improve the workshop? (Improvement)

Figure 12: (Semi) Structured Feedback Questions asked

Insights from design science were used to inform the author how to evaluate a tool. As will be explored in chapter 5.2.2, while design science may be limited in on inform how to design a tool, its main strength lies in tool evaluation. Many criteria could have been used for a tool evaluation (effective, efficiency, utility, efficacy, etc.) (Peffer et al., 2006; Venable et al.,

⁴ One interview was conducted with one employee and another with two employees together.

2017.; Gregor & Hevner, 2013). However, usability was chosen since it best represented the thesis's aim to provide a practical tool. Furthermore, using a measurement that is centred around the experiences of the user rather than the tools 'actual' impacts seemed more attainable. **Usability**, as inspired by Nielsen (1993) and Holzinger et al. (2008), is made up of the attributes 'Learnability', 'Reliability' and 'Satisfaction' (p. 26; p. 101). Learnability denotes how efficient it is for the user to know how to use the tool. Is there are steep or even learning curve? When a user starts using the tool for the first time, are they frustrated and confused or can they quickly and easily start with their tasks? Reliability denotes not only the frequency of mistakes made by the user but also how easily they can rectify and recover from said mistake. Does the user insert data and get a misleading or confusing result or is it clear what data is needed and that the results make sense? Satisfaction denotes how pleasant the tool is both in terms of use and deliverable. Does the user feel like the tool is tedious and a waste of time or do they keep getting an 'Aha!' moment throughout the tool? Do they feel like when they walk away from the tool that they have learnt little or nothing productive or a lot of practical information and insights? Efficiency and memorability is a core attribute for Nielsen and Holzinger et al. that could have been included. Efficiency denotes how productive the user is in following the steps of the tool. Does the user spend unnecessary time navigating, re-reading, understanding and executing the tasks or do they quickly identify what they need to do and how they need to do it? Memorability denotes the ability of the user to remember how to use the system when returning to it after a period of time. They were excluded because it would have made more sense to evaluate the tool by these metrics in a fully executed test case of the tool with participants. Instead, the tool evaluation was based on an outlining of the tool via a PowerPoint presentation to TNO employees.

These different attributes of usability were explored by asking questions that addressed a given attribute. Thus, all questions relating to an attribute should contribute to answering usability as a whole. Approaching the feedback in a more structured form, there was first a leading question warm up the feedback session; a precursor question used to ease them into more challenging questions. The first leading question addressed how the participants feel. Afterwards, questions relating to learnability, reliability and satisfaction were asked. Direct questions about the workshop's strengths and weaknesses, as well as points for improvement are asked towards the end. This was done to allow interviewees the to declare where they think what development on the tool should be prioritized. The Questions asked are listed in Figure 12.

4 Substantive Input for the Tool

This chapter will examine the findings from the literature review. Specifically, what findings can be taken and potentially implemented into the tool design. This connects to the first two sub-research questions. The first asks: *Which impact assessments derived from the circular economy literature could be used to measure the sustainable impact of the value chain?* With the second asking: *Which conditions to enhance and operationalize the transition towards a circular value chain can be derived from the circular business model literature?* This chapter will first tackle the insights from the impact assessment literature review, then address the insights from the conditions literature review.

4.1 Substantive Input for the tool – Impact Assessment

The substantive input for the tool regarding the impact assessment is addressed here. Clarifying this was assumed to make a CE oriented tool more sustainable. Whilst impact assessment, as will be elaborated upon in the Second Excel Tool chapter (5.2.1), was relatively quickly de-prioritized from tool development. That being said, while impact assessments were not integrated into the tool, it was nonetheless significant for the final tool prototype. To this end, first, the impact assessments are briefly analysed as a whole, particularly what findings can be taken from there. Then, the most promising impact assessments, Cradle-to-Cradle and Hotspot Scan, are briefly contextualized.

4.1.1 Impact Assessment – General Findings

The impact assessments, as outlined in the methods (3.1.1), investigated the breadth of the impact assessments. In short, it was determined that LCA based approaches the most environmental and social categories. A condensed ranking is given of the assessments that scored at least 4 points out of 6. As we can see in Table 2, only 5 of the 43 impact assessments could achieve a wide sustainable coverage. As outlined in the methods (3.1.1), it should be

Points	Impact Assessments
5	Cradle-to-Cradle (LCA) Hotspot Scan (LCA)
4	Product Environmental Footprint (LCA) GRI standards (Reporting Framework) IMPACT (LCA)

Table 2: Condensed Impact Assessment Ranking

noted that the author was not confident about having reached saturation. Thus, an already relatively subjective method for analysing the available assessment impacts should be carefully accepted. That being said, the findings could provide several insights about the current impact assessments available: The impact assessments often overlook the social angle and they tend to be very narrow in their focus. The impact assessments often **overlooked social considerations** in their assessment structure, and if they did it was only one category of the social foundations. In contrast, there were a dozen assessments that scored full points on the outlined environmental requirements. Thus, while many assessments are willing to cover a wide range of environmental impacts, this is less the case for social impacts. This is somewhat regrettable for the tool, since to fully account for risks related to sustainability and achieving the most impact, one would also want to be aware of the social impacts. When just focusing on the coverage of environmental impacts, there is a **tendency to go narrow** rather than broad. The majority of assessments seem to be specialized in one to two particular categories. Predictably, climate change is rather a standard inclusion, unless the impact assessment was particularly specialized. This is somewhat unsurprising, since climate change is hegemonic within the environmental movement (Whatmore, 2008). But, again, sustainability is not only climate change. The tool would ideally want to account for a variety of environmental impacts.

As we can see from the Impact assessments found in Table 2, LCAs tended to possess the most environmental and social coverage. This is partially due to the range LCA offers and

the lack of social focus for competing frameworks. Many of the top scoring LCAs offered a holistic approach with a systems thinking process; they considered both environmental and social issues important. This would allow businesses to identify and focus on multiple environmental and social impacts. If one would also allow Cradle-to-Cradle to be a reporting framework, since it is basically an LCA oriented reporting framework, Reporting Frameworks closely followed.

4.1.2 Impact Assessment - Cradle-to-Cradle and Hotspot Scan

Cradle-to-Cradle is a philosophy and certification method that adopts circular and life-cycle thinking to assess social and environmental impacts in accordance with cradle-to-cradle principles (“What Is Cradle to Cradle?,” n.d.). The main cradle-to-cradle principle that sets it apart from higher level circular economy view is its emphasis on technological (synthetics) vs biological (biodegradable) nutrients. According to this, product design should favour biodegradable materials and avoid mixing of biodegradable and synthetic materials. Furthermore, there is a stronger emphasise that at the end of a product’s life cycle, technical materials are upcycled into further products and biological products are upcycled into the natural environment (Kowasch, 2022). As can be seen in Figure 13, Cradle-to-Cradle takes a holistic view where social impacts are an integrated part of their certification assessment. The certification investigates a product’s chemistry or material health, water quality, energy, material use or reutilization, and social fairness (Van Houtum Company Narrative, 2014). Generally, getting a Cradle-to-Cradle certification can take up to 7-14+ months (Lesley, 2019).

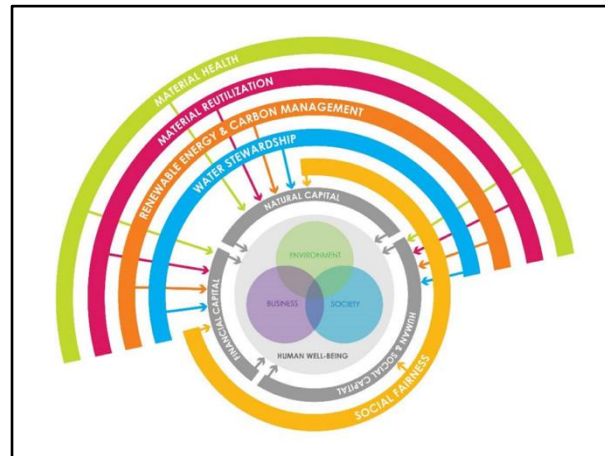


Figure 13: Cradle-to-Cradle Conceptual Framework (Van Houtum Company Narrative, 2014)

As can be seen in Figure 13, Cradle-to-Cradle takes a holistic view where social impacts are an integrated part of their certification assessment. The certification investigates a product’s chemistry or material health, water quality, energy, material use or reutilization, and social fairness (Van Houtum Company Narrative, 2014). Generally, getting a Cradle-to-Cradle certification can take up to 7-14+ months (Lesley, 2019).

Hotspot Scan is a self-assessment excel tool developed within TNO following LCA criteria (Navarro et al., 2020). It is meant for users with little knowledge, time and data at hand and to get a quick overview of the main hot-spots of a chemical product’s environmental and social impacts. The primary goal is for the Scan to provide a basis for discussion (Navarro et al., 2020). Social impacts analysed in the Hotspot Scan “basic rights and needs, labour rights, health & safety, skills & knowledge and well-being” while the environmental impacts analyzed are “resource depletion, climate change, environmental quality and toxicity” (Navarro et al., 2020, p.18). As can be seen in Figure 14, Navarro et al. (2020) provide a simplified flowchart of the process of the Hotspot Scan. While this version of the Hotspot Scan is primarily targeted at chemical businesses, there is a new version that is being developed that can tackle a broader range of industries (TNO, n.d.-a). Generally, the Hotspot Scan takes about half a day once familiar with the tool (Navarro et al., 2020).

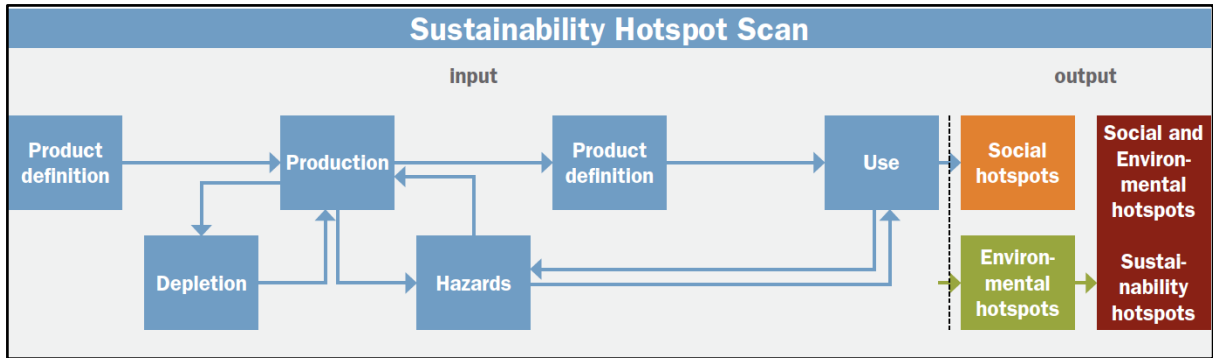


Figure 14: "Flowchart of the Sustainability Hotspot Scan" (Navarro et al., 2020, p. 18)

4.2 Substantive Input for the tool – Conditions for transitioning

The substantive input for the tool regarding the conditions for transitioning is addressed here. This was done to give users a research basis on potential conditions for transitioning. Through the research, capabilities emerged as and remained a key concept throughout the entire tool development and were used to categorize directly influenceable conditions. Drivers & barriers also emerged as a useful concept to categorize conditions that are steps removed from the influence of actors. They eventually became de-prioritized, which will be further elaborated upon in the Initial Workshop Tool chapter (5.3.1). This chapter rather focuses on the findings regarding the literature review itself, then why capabilities and drivers & barriers were mapped in Appendix A the way they were.

4.2.1 General Findings – Capabilities and Drivers & Barriers

Capabilities

Already in the first handful of articles from the literature review, dynamic capabilities were gradually crystallizing into a core conceptualization of conditions that are influenceable. The conceptual background (2.2.1) elaborates deeper on capabilities. In terms of how capabilities emerged: Santa-Maria et al.'s (2022a) article on identifying micro-foundations of **dynamic capabilities** was one of the initial papers to emerge and grew to become a cornerstone of this thesis. Said article aims to discover which practices for circular business model innovation focused on the *process* are relevant. In other words, if a business wants to transform into a more circular business model, what has been shown to help businesses transition and implement said circular business model? Seeing as it has very similar goals as the 2nd sub-research question that aims to discover conditions for transitional ability, Santa-Maria et al.'s (2022a) findings could have potentially been adopted, ending the literature review right there. However, since Santa-Maria et al. (2022a) was not value chain focused and with the prospect of potentially identifying more capabilities, the literature review was continued. Note that, again, capabilities are conditions that are influenceable and help value chain actors transition towards a circular business model.

Of the following articles in the literature review, only a minority of papers explicitly tackled capabilities for transitioning towards a circular business model in a value chain context. There were quite a few articles that were **business unit focused**. By the end of the literature review, roughly a third (90/301) were business unit focused. Four articles provide around 40% of the capabilities (Santa-Maria 2022a; Salvador et al., 2021; Franco, 2017; Goni et al., 2021). However, two of these influential articles (Santa-Maria 2022a; Salvador et al., 2021) were business unit focused. Employing capabilities informed from a singular business unit perspective in a value chain context is not ideal, since business units and value chains have differing dynamics and challenges to tackle. Compared to the business unit perspective, value chains in a transition context have a stronger need for interest alignment negotiating roles and resource distribution between actors (Konietzko et al., 2020). Given these limitations, there is still likely an overlap in capabilities relevant to business units and capabilities relevant to value chains. Seeing as value chains, at their core, are essentially made up of multiple business units, one could argue that there is at least some overlap in the issues

faced by a business unit and several value chain actors. Thus, even if the literature is not fully aligned with the research focus, conceptual and practical insights to help value chain actors transition towards a more sustainable business model can be gained.

Drivers & Barriers

Despite capabilities providing a useful categorization, by the end of the literature review, **165 conditions** would not have been able to confidently be categorized into capabilities. Whilst capabilities emerged rather early and could be used to create many conditions, there were still conditions that were relevant to the transition ability of a business but only awkwardly fit within the capabilities concept. These were conditions that affected the transitional ability of a business but in which the business could not directly intervene. For instance, larger market trends, larger consumer trends, regulations, etc., were forces that were steps removed from a business's ability to influence. One could even argue how some business's internal forces, given the right context, could be in the short term more of a barrier than a capability. **Barriers** thus emerged to fill this gap to categorize conditions that were obstructing or even preventing a circular transition of a business but were challenging to positively steer. This could account for the majority of non-capability conditions (124/165). Conditions that positively pushed the transition with little steering ability by the business, i.e. **drivers**, logically followed after. They followed only after the introduction of barriers due to the literature seeming skewed towards identifying barriers. Only 5 conditions would be left unaccounted for after having devised the concepts of drivers and barriers after capabilities.

Drivers & barriers, like capabilities, faces the issue of a business unit focus by the literature, but also the issue of there being few reliable articles for drivers. When it comes to the **business unit focus**, drivers & barriers face an even stronger slanting by the literature, which focuses on a business unit perspective rather than a value chain perspective. Roughly 80% of the literature (129/160) takes a business unit focus. As argued in the previous capabilities section, business unit findings could still reveal insights about the value chain. However, even with the argument still standing, this is a heavy bias on the business unit. Furthermore, while it seemed logical to present drivers after using barriers as a category, 36 drivers were identified across 4 articles. This is a rather **low number of articles for drivers**, especially when taking into account that the majority are considered 'theoretical' (26/36). This points towards two insights; drives are underrepresented in the literature and the finding of drivers is to be accepted with caution.

4.2.1 Mapping Capabilities

The mapping of capabilities was used as a basis to inform users of their capabilities to transition. As elaborated in the methods (3.1.2) and conceptual background (2.2.1), capabilities had three layers in the excel, with sensing, seizing and reconfiguring being the first layer. Again, sensing concerns the identification of opportunities, shaping the capturing of value, and reconfiguring the flexibility and adaptiveness of the business units themselves (Teece et al., 1997; Santa-Maria et al., 2022a). All conditions that are directly influenceable by the value chain actor could fit into one of these three categories. As can be seen in Appendix A, 10 micro-foundations with 22 practices were mapped across the three

categories. Due to the thesis being primarily focused on developing a tool rather than categorizing capabilities, only the most prominent insights will be briefly examined. Most prominent in that they present micro-foundations and their associated practices that tended to have the highest amount cited articles and or highest empirical findings within their given capabilities category.

Regarding the **sensing** category, all three given micro-foundations, namely, external sensitivity, adopting a holistic perspective and sustainably oriented tools are well supported by the literature. They had a relatively low number of conditions (38/160) and were split in empirical foundation vs theoretical foundation (Empirical - & + = 22/38). However, they were also very consistent and uniform in their advice compared to other capabilities categories, making them more reliable. **External sensitivity** relates to the ability to perceive and leverage changes from the external environment (Santa-Maria et al., 2022a). This was mainly centred in the literature around understanding the needs and roles of stakeholders (Franco & Groesser, 2021; Salvador et al., 2021, Santa-Maria et al., 2022a; Kawashima et al., 2019; Manninen et al., 2018). Understanding customers' needs and desires was seen as especially prominent, thus customers are an especially important stakeholder to consider (Franco & Groesser, 2021; Salvador et al., 2021, Santa-Maria et al., 2022a; Manninen et al., 2018). Adopting a **holistic perspective** denotes a value chain actor having the perspective that their BM is embedded within and connected to a wider socio-environmental system. This can lead to actors expanding their range of opportunities and identifying new stakeholders (Santa-Maria et al., 2022a; Santa-Maria et al., 2021a; Perey et al., 2018; Kawashima et al., 2019). Perey et al. (2018, p. 639) even argue that it "is a precondition to transition away" from linear to circular value. Finally, **sustainably oriented tools** allow value chain actors to help measure their circularity and environmental impacts and thus tackle areas of high importance (Bastein & P. J. Willems, 2019; Islam & Iyer-Raniga, 2022; Kawashima et al., 2019; Manninen et al., 2018; Munaro et al., 2020; Salvador et al., 2021; Santa-Maria et al., 2021a; Santa-Maria et al., 2022a).

In terms of **shaping**, finding solutions via BM and collaboration were one of the most prominent micro-foundations identified from the literature. Shaping conditions were by far the most numerous (88/160), with half of the sources being empirically supported (Empirical - & + = 48/88). However, they were quite diverse, and one of the hardest and thus most subjective to categorize. Many authors emphasized the need for rethinking, designing and implementing sustainable/**circular business models**, enjoying rather strong empirical backing (Santa-Maria et al., 2022a; Santa-Maria et al., 2021a; Goni et al., 2021; Moran et al., 2021; Salvador et al., 2021; Bocken & Short, 2021; Manninen et al., 2018). These authors tend to emphasize the need "to think in 'BM'"; to rethink and transform existing BM's, or create entirely new BM's (Santa-Maria et al., 2022a, p. 1317). Strategizing BMs can lead to improvements in the value chain and value proposition (Manninen et al., 2018). **Collaboration**/cooperation is also widely regarded in the literature with strong empirical backing (Ávila-Gutiérrez et al., 2020; Charnley et al., 2022; Franco, 2017; Franco & Groesser, 2021; Guldmann & Huulgaard, 2020; Hultberg & Pal, 2021; Jonker et al., 2020; Kühnen & Hahn, 2018; Salvador et al., 2021; Santa-Maria et al., 2022a). Focusing on complimentary partners, building close and strong relations throughout the entire value chain and aligning towards a shared vision, can lead to new and innovative partnerships (Franco, 2017; Salvador et al., 2021; Santa-Maria et al., 2022a).

Finally, **reconfiguring** conditions were the least numerous (34/160), and weakest in empirically supported (Empirical - & + = 15/34) of the capabilities categories. However, due

to transitions having an element of unpredictability, being flexible and adaptable is theoretically critical for the value chain. That being said, organisational flexibility and leadership & change management, were the most prolific micro-foundations within reconfiguring. Various authors broadly agree that businesses should strive to poses **organizational flexibility** to face unforeseen changes in their business model (Awan et al., 2022; Bastein & van Olffen, 2022; Franco & Groesser, 2021; Hultberg & Pal, 2021; Jonker et al., 2020; Kawashima et al., 2019; Perey et al., 2018; Santa-Maria et al., 2022a; Santa-Maria et al., 2021a). An especially consistent recommended strategy is establishing experiments and pilots (Bastein & van Olffen, 2022; Hultberg & Pal, 2021; Jonker et al., 2020; Santa-Maria et al., 2021a; Santa-Maria et al., 2021a). Having experiments and pilots to test and gauge the viability of certain value propositions allows businesses to detect problems, opportunities and scalability early on in the process. It allows businesses to make risks cheap. In other words, “Start small, pilot, and fail quick,” (Santa-Maria et al., 2021a, p. 1317). **Leadership and change management** is essentially the ability of top management to lead a transition and to accurately manage the transition by planning and using reliable measurements (Goni et al., 2021; Moran et al., 2021; Santa-Maria et al., 2021a; Santa-Maria et al., 2022a).

4.2.2 Mapping Drivers & Barriers

The mapping of drivers & barriers was, up until the final version of the tool, used to inform users of the capabilities they may not be able to directly influence in the short term. During the processing of the evaluation, six main categories organically emerged that were both present in drivers and barriers. These were financial, market, organizational, value chain, technological and legal. Following this first layer of categories, a second layer of micro-foundations, and a third layer of mechanism was used, to further understand and clarify various individual drivers and barriers. The categories are more deeply elaborated in the methods (3.1.2), but here is a short recap: **Financial** relates to the way capital is used and managed, such as concerning investments, profitability, sustaining the business, etc. **Market** relates to the space where the product is sold, especially in regards to the customer. **Organizational** relates to the internal operations and factors of a business that are relatively challenging to influence. **Value chain** relates to external operations and factors of a business unit, especially concerning businesses or stakeholders that are along the value chain. **Technological** is the technological and performance categories available to the business. Finally, **legal** relates to the regulatory, legislative or legal influence on the business or value chain. Using these categories, virtually all drivers and barriers could be satisfyingly placed in a sub-category. These sub-categories were the creation of the author based on the evaluation of the drivers & barriers and were not particularly inspired by any one categorization found in the articles.

In Appendix A2 & A3, the full mapping of the drivers (A2) and barriers (A3) are given in a visual overview. For barriers, a diverse 22 micro-foundations and 43 mechanisms were mapped, whilst, for drivers, 15 micro-foundations and 19 mechanisms were mapped. Due to the thesis being primarily focused on developing a tool rather than categorizing drivers and barriers, only the most prominent insights will be briefly examined.

In regards to the **financial** category, high upfront costs and difficulty to secure funding were an especially prominent barrier (Tura et al., 2019; Charnley et al., 2022; Guldmann & Huulgaard, 2020; Werning & Spinler, 2020). Costs could incur from transitioning itself, such

as through the product's redesign, procuring new knowledge or building a new manufacturing line (Guldmann & Huulgaard, 2020). Especially start-ups faced difficulty to secure the necessary funding; lenders may be averse to the long-time frame and perceived risk of a CBM (Guldmann & Huulgaard, 2020; Jonker et al., 2020). The prospect of cost reduction and business growth are potential drivers that could counteract lender's concerns and push business actors towards pursuing more CBMs (Geissdoerfer et al., 2022, Hina et al., 2022)

In terms of **market** category, lacking consumer demand and uncertainty are the most salient market barriers. Many cite a lacking demand pull by consumers due to unwillingness to pay higher prices or lack of consumer awareness, even misconceptions (Geissdoerfer et al., 2022; Salvador et al., 2022; Franco, 2017; Hina et al., 2022; Tura et al., 2019). There was also uncertainty by producers regarding the reliability of the feedstock return and quality of the circular products (Santa-Maria et al., 2021a; Guldmann & Huulgaard; 2020; Werning & Spinler 2020; Salvador et al., 2022). Market relevant drivers were sparse in the literature, mainly highlighting the increased demand by consumers for sustainable products (Geissdoerfer et al., 2022).

In terms of the **organisation** or business itself, company culture and lacking knowledge are the most prominent barriers. Due to dominant linear thinking and a general reluctance by employees for CE directed transition, the businesses culture may be difficult to change (Salvador et al., 2022; Tura et al., 2019; Hina et al., 2022; Geissdoerfer et al., 2022; Guldmann & Huulgaard, 2020). Furthermore, a lacking knowledge base within the business, specifically surrounding the concept of CE and the technical knowledge to implement it, is another common barrier. (Hina et al., 2022; Salvador et al., 2022; Guldmann & Huulgaard, 2022; Geissdoerfer et al., 2022). Good leadership emerged as the most important driver for organizational change (Hina et al., 2022; Geissdoerfer et al., 2022). Again, as explained in the conceptual background (2.2), given the right context, these drivers & barriers could be capabilities. However, they could be seen by actors as too hard to actively change in the short term, thus being a barrier.

In regards to the **value chain**, the most important barrier was trust. There were fears in the literature by businesses that they risked revealing their internal processes to the competition (Hina et al., 2022, Charnley et al., 2022). Trust is also a large time and resource investment that may not necessarily come to fruition (Guldmann & Huulgaard, 2020). Although not supported by the literature review, logically, trust could also be a driver for greater cooperation. And as shown in the capabilities section, that is a prominent capability.

Concerning the **legal**, the most salient barrier was institutional uncertainty. Businesses, especially start-ups, may be unaware of the regulations surrounding their new CBM (Guldmann & Huulgaard, 2020; van Bommel et al., 2021). There may also be long-term concerns due to shifting political, legislative and regulatory landscapes (Tura et al., 2019). However, these regulatory shifts can also promote circularity, such as supermarkets required to provide deposit return schemes for plastic bottles (Hina et al., 2022; Geissdoerfer et al., 2022).

Concerning **technology**, it should be emphasized that it was considered a relatively minor driver or barriers within the literature review. Drivers and barrier regarding technology itself were the rarest and rather situational. There may be issues around acquiring and learning, but rarely around the technology itself. Unless the CBM is a niche innovation, users would very likely not run into issues regarding a technology itself.

5 Tool Development

This chapter will outline the journey of the tool development. This primarily connects to third sub-research question, that asks: *Based on feedback from an iterative feedback process, which elements that could constitute a useful tool should be included and excluded?* It breaks down the tool development into key stages of its evolution; the first excel tool, the second excel tool and the initial workshop tool. The final workshop tool is addressed in chapter 6. Each sub-subchapter will describe the tool designed, especially in terms of concepts, as well as the most prominent insights along the tool’s development. Again TNO employees provided the necessary feedback to drive too development. Table 3 gives a visualization of the main stages of tool development, as well as the concepts and their status within each stage.

In short, the main lesson was that feedback was a must for development and to not be afraid to kill your (conceptual) darlings. Group and one-on-one feedback considerably helped refine the concepts and make the tool more practical. Even though the only survivors of the initial concepts would be internal capabilities and circular economy, this downsizing contributed to making the tool less complex, understandable and thus more practical.

This chapter will first address the first excel tool, then address the second excel tool, and finally, address the initial workshop tool.

Evolution of Concept usage across Tool Development			
First Excel Tool	Second Excel Tool	Initial Workshop tool	Final Workshop tool
Capabilities	Capabilities	Capabilities	Capabilities
Circular Economy (sustainability, circular business model innovation, circular value chains)	Circular Economy (sustainability, circular business model innovation, circular value chains)	Circular Economy (sustainability, circular business model innovation, circular value chains)	Circular Economy (sustainability, circular business model innovation, circular value chains)
-	-	Design Thinking	Design Thinking
Design Science	Design Science	De-prioritized*	De-prioritized*
Drivers & Barriers	Drivers & Barriers	Drivers & Barriers	De-prioritized*
Impact Assessment**	De-prioritized*	De-prioritized*	De-prioritized*

Table 3: Evolution of Concept usage across Tool Development - *Still is significant, but is not a core mechanism in the specific tool - ** Could potentially be considered more of a mechanism than a concept, but added here for clarity.

5.1 First Excel Tool

This sub-chapter will describe the First Excel Tool, which was the initial tool conceived at the beginning of tool development. For a quick descriptive overview of the First Excel Tool Table 4 is given. Furthermore, the First and Second Excel Tools are compared to highlight the shift. This is not only useful for the coming description but for the coming insights. This sub-chapter will first outline the initial considerations of integrating the results from the literature review; the impact assessments and the conditions for transitioning (capabilities and drivers & barriers). Then it will explore how the first excel tool was designed. The insights from the feedback sessions which lead to the shift towards the Second Excel Tool will be discussed and used in following sub-chapter (5.2.1).

Characteristics of the Excel Tool		
	First Excel Tool	Second Excel Tool
Purpose	The tool suggests the level <u>risk faced from the coming circular transition of the economy</u> , determined by the sustainable impact and the capabilities gap.	The tool suggests to help participants understand which <u>capacities they meet or need to improve</u> , to transition from a linear toward a circular business model.
Outcome	Identifying the 'level of concern' a business should have in transitioning via the ' <u>transformative capacity matrix</u> '.	Demonstrating and prioritizing which capacities to improve by identifying the ' <u>capacity gap</u> '
Layering of Concepts	Sustainable Impact Governance Capacity Transformative Capacity	Current Capacity Future Capacity Capacity Gap
Meaning of 'Capacity'	<ul style="list-style-type: none"> - Governance Capacity: <i>Internal capabilities & external drivers and barriers</i> - Transformative Capacity: <i>Governance Capacity x Sustainable Impact</i> 	Capacity: <i>Internal capabilities & external drivers and barriers</i>
Target User	Actors linked to a singular Business Unit	Actors linked to a singular Business Unit
Medium	Microsoft Excel	Microsoft Excel
User's Learning Experience	Self fill out Step-by-Step; handful of participants working together	Self fill out Step-by-Step; handful of participants working together
Relative Time/Resource Investment	<ul style="list-style-type: none"> - High (with full LCA); Significant preparations - Low (with abbreviated LCA); Little preparations needed 	<ul style="list-style-type: none"> • Low (No LCA within tool); Little preparation needed

Table 4: Comparing the Excel Tool's Characteristics

5.1.1 First Excel Tool - Integration of Literature Review Results

Impact Assessment

Sustainable impact, as elaborated upon in the conceptual background (2.1), is the negative social and environmental impact of a given activity. It is meant to give a practical grounding

in the environmental and social consequences of a value chain's activity. As was assessed in the impact assessment chapter (4.1), Life Cycle Models, specifically, Cradle-to-Cradle and Hotspot Scan were viewed as the most promising impact assessments that could be used in a tool and assess the broad environmental and social categories. The main benefit of these impact assessments for a tool would have been the data they could provide. Data that could be used to somewhat determine the impact of a given activity. Thus the tool would need a section where said data could be inputted into the tool. However, a relevant issue became apparent for any given tool: The **time-resource** investment and the resulting weigh off of accuracy vs practicality that comes with the LCA's. It can take several months to conduct an extensive LCA analysis and potentially more than a year if a business wants to receive certification (Lesley, 2019). The resulting data is typically very informative, but there is a high cost barrier associated with it. In comparison, Hotspot Scan takes a more practical stance. It takes about half a day to complete (Berkers, 2020). It does assume that participants have product data available, such as energy and water consumption, which may not be the case for every business. Otherwise, it allows estimation, which significantly shortens the necessary time compared to an LCA. This would be crucial since the time investment would presumably also have an influence on a tool's characteristics.

The initial idea to solve this was to attempt to create the best of both worlds, whilst also accepting the worst of a compromise. The author wanted to leave the choice to the participant who could make a contextually appropriate decision. Thus, it was aimed for the tool to account for **both impact assessments**: the longer form LCA's such as Cradle-to-Cradle, and shorter form LCA's such as Hotspot Scan. The assumption was that to do this, the data input for a tool would have to be general enough to allow either version of a tool. Presumably, the main issue with this is the accuracy of insight. Input data into a tool from a Hotspot Scan like assessment would allow less accuracy and, due to the generality of the input categories, would also be rather unfocused. Cradle-to-Cradle would presumably give more accurate input data, but also in general unfocused categories. However, as will be elaborated in the following chapter (5.2), the integration of the impacts assessments was dropped before and thus integration was never fully explored.

Capabilities and Drivers & Barriers

In an effort to identify conditions for transitional change towards a circular economy, the literature review found that **capabilities** and **drivers & barriers** would be very useful concepts and categorizations. As is elaborated upon in conceptual background (2.2) and substantive input (4.2), capabilities are essentially internal conditions of a business that can be influenced by said business, whilst drivers & barriers are external conditions that are steps removed from a business's ability to influence. Both internal and external conditions can exert on the ability of a business and value chain to transition towards a circular business model. As a result of this close association, the means for implementing them into a tool were the same. It was thought that the findings should be operationalized into the tool; participants should be allowed to measure their capabilities, drivers & barriers. This came in the form of micro-foundations, a term loaned from Santa-Maria et al. (2022b), which are essentially operationalized units of a capability, driver or barrier. It was thus initially intended that a tool should have a section where the internal and external conditions would be evaluated through their micro-foundations. Furthermore, they would be considered equally as a combined

section. However, the concepts of sustainable impact, capabilities and drivers and barriers were disconnected. In an aim to further connect the concepts, a unifying concept of **transformative capacity** was conceived. Keep in mind this is neither a key concept, nor a de-prioritized concept, but an eventually defunct concept. However, it was important for understanding the first excel tool and is thus discussed here.

The fundamental reasoning was that by integrating the insights from a sustainable impact section and a capabilities, drivers & barriers section, one could give better insights into the need and ability to transition towards a circular business model. By considering and contrasting both the impact and the internal & external capabilities against one another, the idea was to get a relatively more holistic impression of the risk the business model faced. To do this, data from both the sustainable impact section and the section addressing capabilities and drivers & barriers would be integrated into transformative capacity. By contrasting the values from either section, say through a matrix, transformative capacity would give a single descriptive value of how concerned a business model might be. This level of concern was subjective and not founded on empirical insights, which is a problem that will be further explored in Second Excel Tool chapter (5.2.1). The hope was that by simplifying all the calculations, that culminated in transformative capacity, participants would have a straightforward if simplistic idea of how concerned they should be. It was reasoned that participants would thus have a better basis on the subjective risk they face and, hopefully, feel more motivated to commit to improving the circular of the business model. How they could do this, would not have been addressed. Only if. As will be elaborated in the later sections of chapter 5, the concept of transformative capacity and the direction it brought the tool was limited, a bit too unsubstantiated and too complex.

5.1.2 First Excel Tool - Description

Initial Justification for First Excel Tool

Once, the initial concepts of sustainable impact, capacities and their combination into transformative capacity emerged from the literature review, how these concepts would be translated into a tool had to be explored. Initially, it seemed straightforward to implement the concepts into an excel tool. TNO had made a similar tool that allowed an abbreviated LCA self-assessment, which quickly caught the attention of the author (TNO et al., n.d.). It could provide rough guidance on how a tool could be designed, seemed to make a rather complicated process much simpler, and could potentially reach a wide audience with few resources. The internal discussion quickly shifted to what type of digital self-fill in tool it should be: Would the tool be step-by-step or more fluid, Would it be alone or with a facilitator, would it just be a tick the box or would there be exercises involved? Design Science was the primary theory used to guide how to create a usable tool. Due to Design Sciences' semi-quantitative preference, this further solidified an excel tools place.

First Excel Tool

The First Excel Tool tried to fully include the initial concepts of Sustainable Impact, Governance Capacity and Transformative Capacity. Note that **Governance Capacity** is basically the precursor to capabilities. It was also centred around the key concept capabilities and the later de-prioritized concept of drivers & barriers. It is used here, since all the figures in the First Excel Tool referencing these conditions under the umbrella of Governance Capacity. See Table 4 and Table 5 for a quick overview of this shift. The First Excel Tool accumulated into a four step process, which can be viewed in full in Figure 15. These were the intro step, the Sustainable Impact step, the Governance Capacity step, and, finally, the Transformative Capacity step. While it gave a rough idea of where the tool was initially heading, it was ultimately not deeply developed. This section will clarify the initial rationalization behind the tool and then go through each step; explaining why and how the steps were implemented.

First iteration of Excel Tool - Rationalization

In the initial rationalization, the excel tool's purpose, outcome and audience differed significantly, compared to later tool iterations. The then conceived **purpose** of the initial tool was to demonstrate the risk potentially faced by the business unit assuming that the economy would transition from a linear towards a circular one. It was primarily meant to be a tool that was exploratory with recommendations being more implicit. Since a scoring would keep track of the Sustainable Impact and the Governance Capacity, the final Transformative Capacity would give an automatic scoring ranging from critical to little concern. The tool would thus have been meant to not only explore but motivate. A fundamental and somewhat problematic assumed **outcome** was that if a business has more of the identified capabilities present and rather low sustainable impacts, they are less likely to face future perturbations such as legislative and societal backlash whilst also being more competitive. This is a rather liberal assumption to make based on the literature reviewed, since it is one thing to say that certain capabilities helped businesses transition but another to imply that having a set amount of capabilities would make you to this degree more secure in transitioning. This is further complicated by combining sustainable impact and capabilities and making the same claim, whilst not relying on any empirical sources to substantiate that. Finally, the main **target audience** would be actors primarily from a business background that are focused on a singular business unit and are interested in transitioning their business model towards a circular one. It was still focused on the value chain but was somewhat removed from it. It was assumed that since businesses make up the value chain, using this excel for every business within the value chain can later result in an overall view of the value chain. However, there was little further elaboration on this until the development of the workshop format.

First iteration of Excel Tool: Main Steps

In the first iteration of the Excel Tool, four main steps were interconnected, which is fully visible in Figure 15. Individually, the Info and Sustainable Impact step are shown in Figure 16, the Governance Capacity step in Figure 17 and the Transformative Capacity step in Figure 18. The four main steps will now be reviewed.

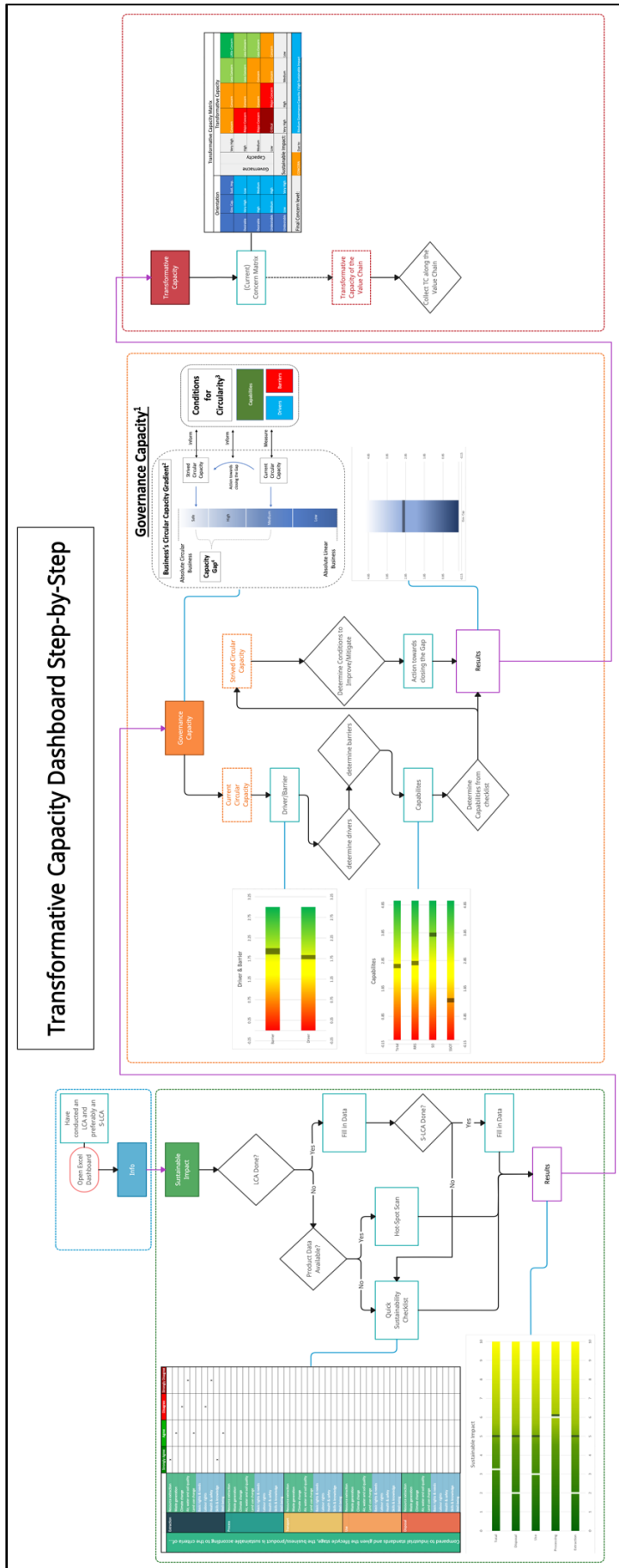


Figure 15: Decision path of first iteration of Excel Tool

The beginning of the First Excel Tool starts with the **Info** step, as seen in Figure 16 on page 53. It is meant to be the first sheet participants face when opening the tool, clarifying the aim of the tool, structure and additional info for the tool. The only prerequisite of the tool was to have a sufficient foundation of the participant's current and desired future business model. Then participants would move on to the **Sustainable Impact** step of the tool. It would ask participants to fill in any LCA data they have available on their business model related product. Ideally, they would have both an LCA and S-LCA to cover the whole spectrum of sustainable impact. However, if that was not the case, the Sustainable Impact had contingencies available. The contingency was to directly use the hotspot scan or, if unsuited or unavailable, a crude checklist that asks participants their estimates on how impactful is their product along its life-cycle, according to environmental and social criteria. The aim was to have some data on a product's sustainable impacts, even if it was imperfect. We can see in the bottom left of Figure 16 how the data would be simplified into a sliding scale, not only meant to be informative at the moment but also be used as input for the Transformative Capacity step.

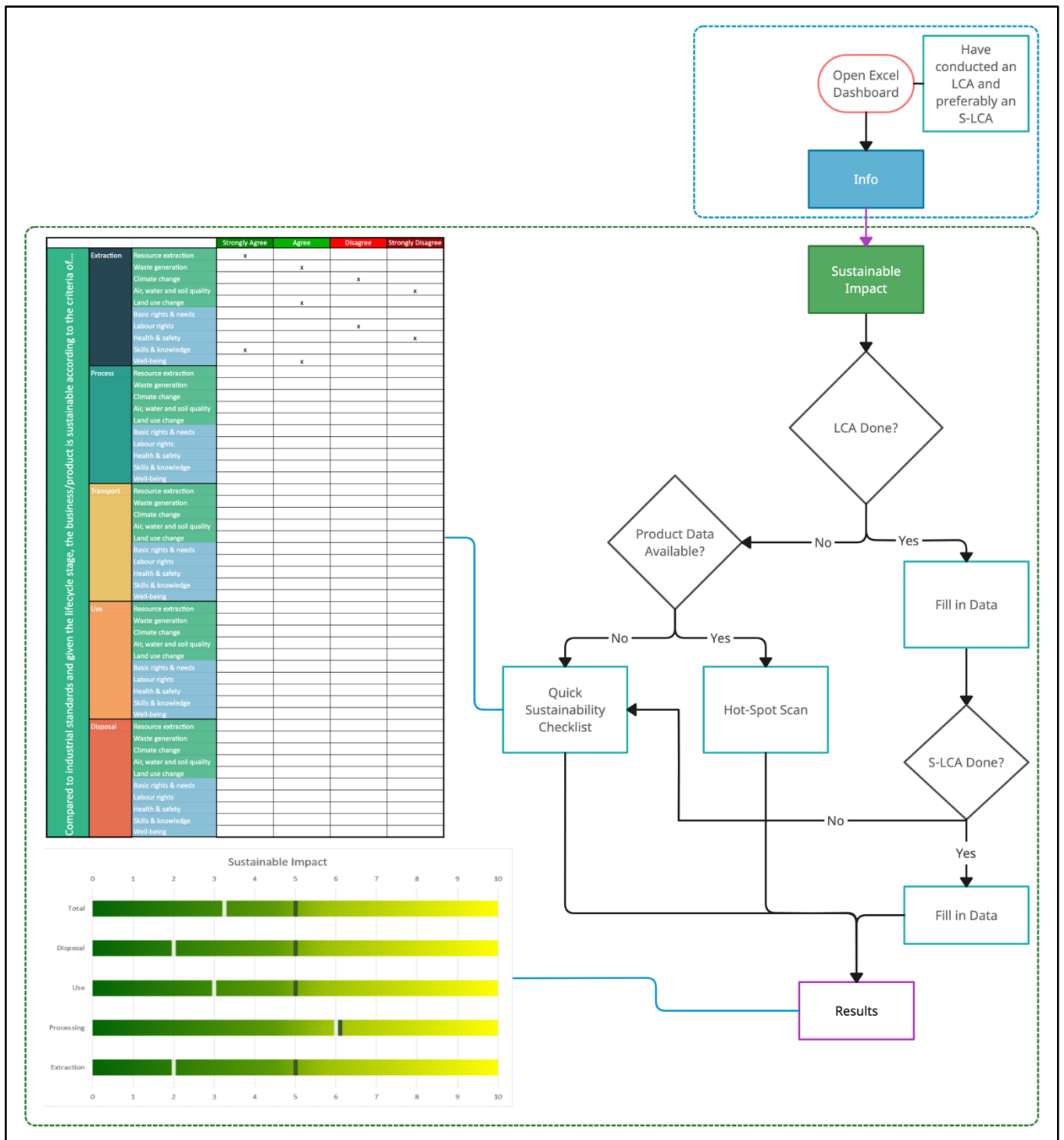


Figure 16: Final Excel - Sustainable Impact

Once the data had been filled in, participants would move on to the **Governance Capacity** step as seen in Figure 17. In the top right of the figure, one can see the initial rather convoluted conceptual framework of the Governance Capacity step. Here, one can see the hints of how capabilities alone could fulfil the aims of the tool without necessarily needing the rather stitched on concepts of Transformative Capacity as was conceived. One can also see that the data that was collected would be placed on a sliding scale and ultimately cumulate into one final value, that would give the degree of capacity gap. However, as

mentioned in the rationalizations section, the data did not have a strong empirical connection to what was being communicated. The scoring was thus merely an argumentation and not a substantiated quantitative assessment, which could have been misleading.

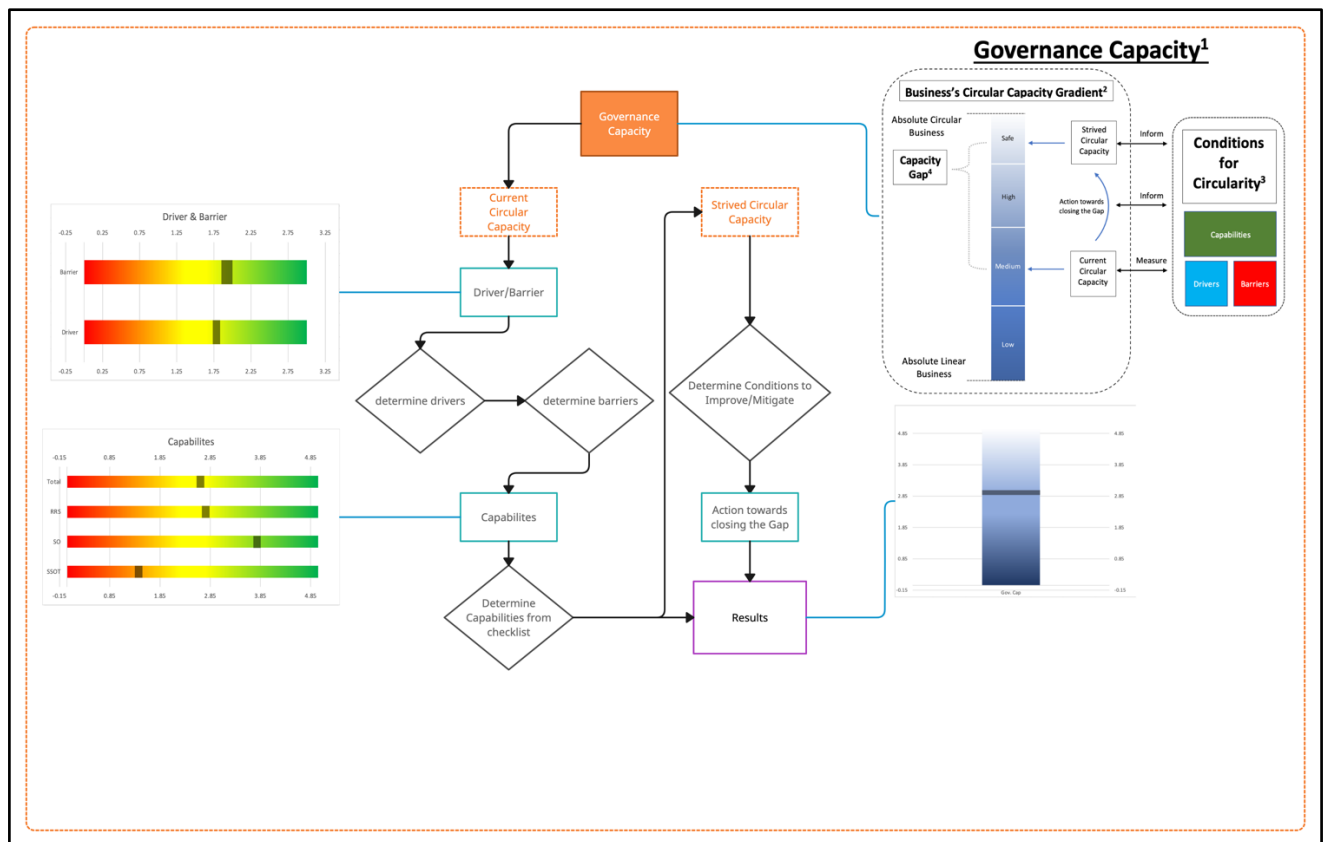


Figure 17: Final Excel - Governance Capacity (Capabilities)

Finally, the **Transformative Capacity** step, as can be seen in Figure 18 on page 55, would combine to give an idea of how concerned participants should be about transitioning their current business model. The worst values, meaning a very high (damaging) Sustainable Impact value and a low Governance Capacity value, would lead to a low Transformative Capacity value. Thus, the participants should be rather concerned about the challenges of the transition. On the other hand, possessing a low (damaging) Sustainable Impact value and a very high Governance Capacity value, would lead to a high Transformative Capacity value. Thus, participants should feel little concern for the coming transition, since they are rather well prepared.

Transformative Capacity Matrix									
Orientation			Transformative Capacity						
	Gov. Cap.	Sust. Imp.	Governance	Capacity	Very High	Concern	Concern	Less Concern	Little Concern
Desirable	Very High	Low			High	Major Concern	Concern	Less Concern	Less Concern
Desirable	High	Medium			Medium	Major Concern	Concern	Concern	Less Concern
Undesirable	Medium	High			Low	Critical	Major Concern	Concern	Concern
Undesirable	Low	Very High			Sustainable Impact:		Very High	High	Medium
Final Concern level:			CONCERN		Due to: Medium Governance Capacity / High Sustainable Impact				

Figure 18: Final Excel - Transformative Capacity

5.2 Second Excel Tool

The Second Excel Tool suspended the concept of transformative capacity, de-prioritized the initial concepts of sustainable impact and prioritizing capacity. Table 5 gives a quick overview of the characteristics of the Second Excel Tool and how they compare to the Initial Workshop Tool that follows after. This sub-chapter will overview how this Second Excel Tool in two sections. First, the main insights from the First Excel Tool and how they were planned to be improved upon going into the Second Excel Tool, will be reviewed. Secondly, a description of the Second Excel Tool is given. Any insights reached through the Second Excel Tool will be discussed in the following chapter (5.3.1)

Comparing Excel to Workshop Tool		
	Second Excel Tool	Initial Workshop Tool
Purpose	The tool suggests to help participants understand which <u>capacities they meet or need to improve</u> , to transition from a linear toward a circular business model.	The tool suggests to help participants understand which <u>capabilities they meet or need to improve</u> , to transition from a linear toward a circular business model.
Outcome	Demonstrating and prioritizing which capacities to improve by identifying the <u>'capacity gap'</u>	Using the insights from the capabilities gap to prioritize and initially negotiate <u>which capabilities to improve</u> .
Layering of Concepts	Current Capacity Future Capacity Capacity Gap	Current Capabilities Future Capabilities Capabilities Gap
Meaning of 'Capacity'	Capacity: <i>Internal capabilities & external drivers and barriers</i>	Capabilities: <i>Internal capabilities</i>
Target User	Actors linked to a singular Business Unit;	Differing actors linked to a shared value chain via a business model
Medium	Microsoft Excel	'SPRINT' Workshop (in-person)
User's Learning Experience	Self-fill out Step-by-Step; handful of participants working together	Facilitator enabled exercises; max 6 participants in one group
Relative Time/Resource Investment	Low (No LCA); Little preparation	Medium; Preparations via Circular Business Model Workshop

Table 5: Comparing Excel to Workshop Tool

5.2.1 Second Excel Tool - Feedback & New Characteristics

During the feedback session and one-on-one conversations, there were large concerns about the initial tool concept. It was felt that the conceived tool was overly convoluted, and not meaningfully connected and it was believed there could be a stronger purpose. Based on the personal notes by the author on the feedback sessions and one-on-one conversations, it seemed to be the case that the purpose and outcome of the First Excel Tool was never easily understood by TNO employees. Not to the fault of TNO employees but rather demonstrating the over-complexity of the tool. It seemed that there the Frist Excel Tool was trying to do juggle too many different elements, leading to a forceful combination rather than a subtle

integration of the elements into the tool. The author also noticed that while there was an attempt to compare the tools insights against a standard, that standard needed to be fully defined. Therefore, it was decided that having a future CBM that a user already had strategized and was striving for could fill this role. However, it was not until the initial workshop (5.3) that it would be fully elaborated upon how the user would already have a CBM in mind.

The new purpose came indirectly from feedback asking to simplify the tool into focusing on Capacity which resulted in a **new layering** of the concepts. Transformative Capacity was suspended and the sustainable impacts de-prioritized to further focus on Capacity and make the tool less complex. Sustainable impacts would from now on have an indirect effect, emphasizing the need to have a sustainable and circular business model to strive for but not having any substantial mechanisms in the tool itself. Transformative Capacity was entirely relegated, due to the lack of clear insight and ultimate meaning of the concept. Capacity in the form of internal capabilities and external drivers & barriers would become the main concept the Second Excel Tool would come to utilize. It was viewed by TNO employees that Capacity was the most developed and had the clearest contribution, although it was underlined it needed further development. The conceptual framework seen in **Error! Reference source not found.** outlines this new conceptual layering. From this new conceptual layering, the tool's **purpose** was further focused on the business model and not the circular economy transition as a whole. It continued to the purpose of being a tool for exploration but is now focused on helping participants understand the business models capacities that have been met, are missing and need to be improved upon. The **outcome** of the tool would then be a scored hierarchy of the capabilities gap; the largest distance between actual current and desired capabilities for a future circular business model. This new purpose and outcome considerably helped TNO employees conceive how this tool could be used and be useful, as well as reducing the complexity.

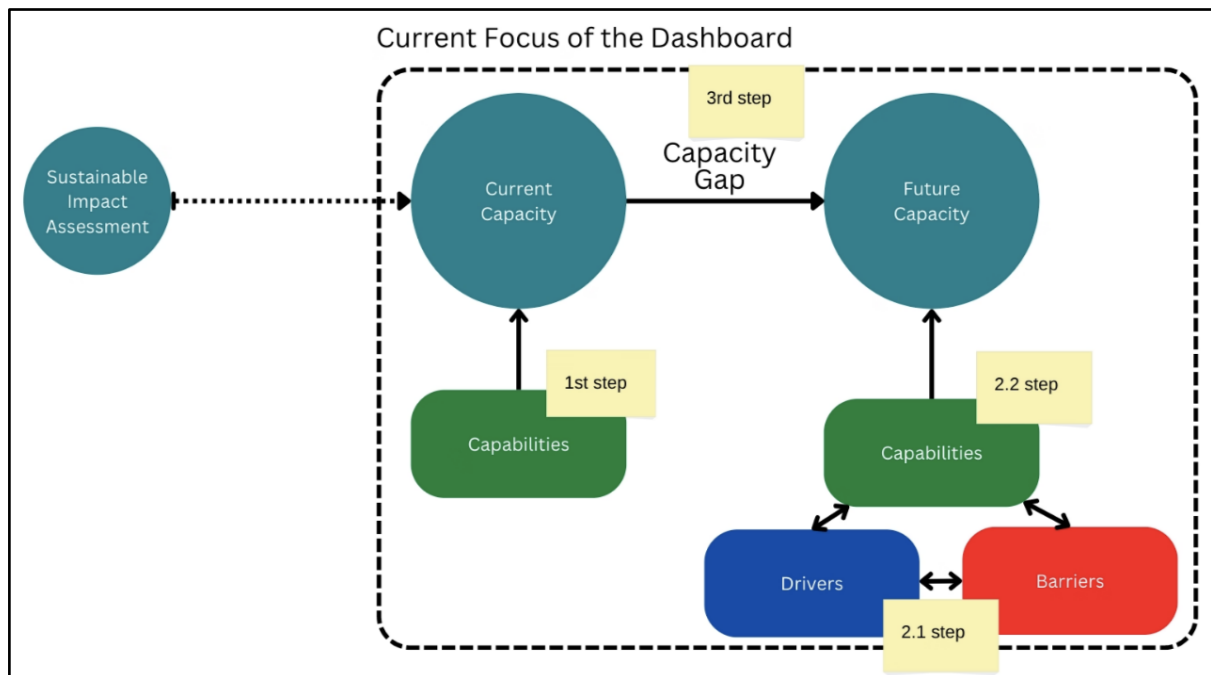


Figure 19: Conceptual Framework of the Second Excel Tool

5.2.2 Second Excel Tool - Description of Main Steps

In the Second Excel Tool, next to an introduction, three new steps were used to construct the tool: Current Capacity, Future Capacity and the Capacity Gap. This section will briefly outline and reason each step. A near complete mock-up of the Second Excel Tool was established. Figures from the Mock-up appearing in this section can be viewed in a more complete context in Appendix B.

A 'pre-' step to this tool was the **introduction**, specifically, the 'homepage'. As seen in Figure 20, participants would understand the aim, outcome and steps of the tool, and could navigate to any of the individual steps or additional information pages. This would be done using macro-coded buttons. As can be seen in Figure 20, info could be accessed on the aim of the tool, and elaborations on the concepts of capabilities, circular economy and circular business models. Although not included in every figure in Appendix B, the navigation bar on the left side of the 'Homepage Sheet' would be a frozen column where every step of the tool could access, and would follow the user across every excel sheet. Due to feedback by from TNO employees with concerns about participants wanting to start immediately, every excel sheet had 'Quickstart notes' so that the user could quickly understand how to continue.

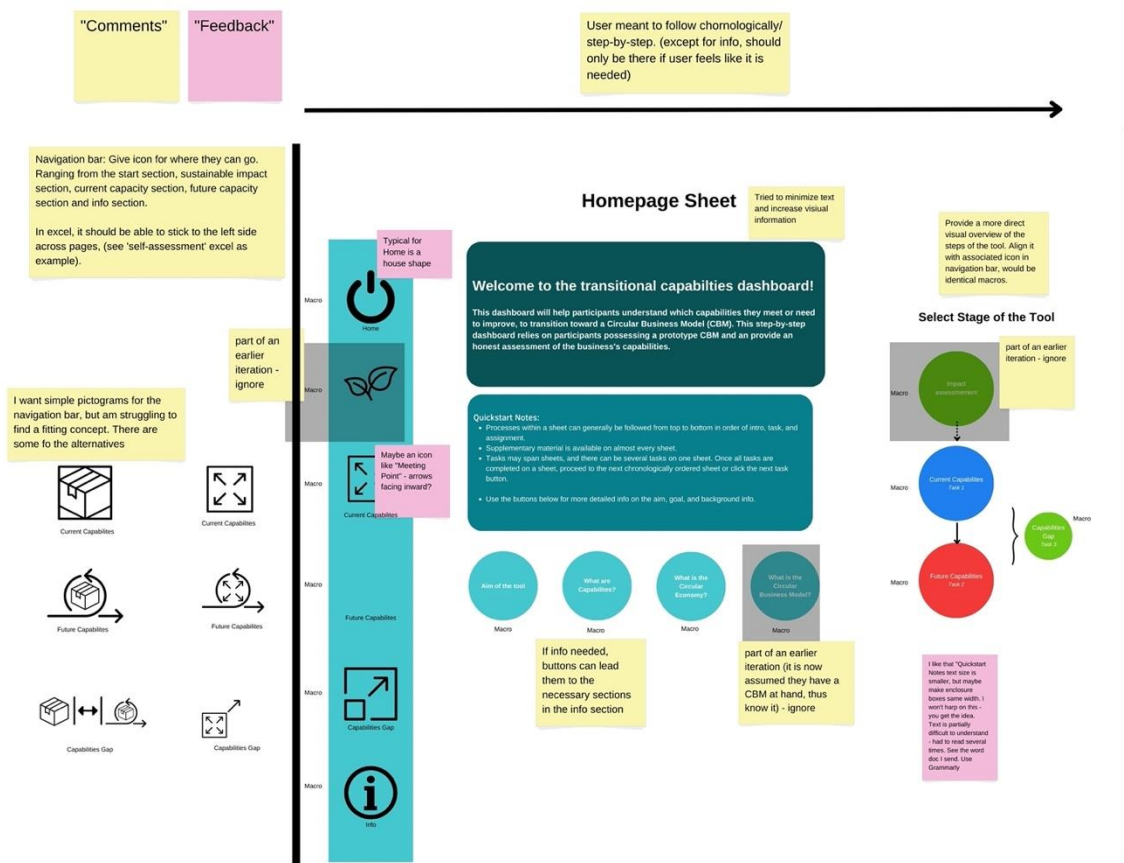


Figure 20: 'Homepage' of the Second Excel Tool Mockup

Once the introduction is complete, the user would move on to determine the **Current Capacity**⁵ within their business model. Participants would go down a checklist of all 22 practices, which gave an explanation of the internal capabilities, why it is important and to what degree it is present in a structural or ad-hoc form. An example of this checklist can be found in Figure 21. TNO employees suggested that a maturity scale would help structure the degree an internal capability is present. Inspired by S. C. Arends (2018), a maturity model, ranging from *Ad-Hoc*, *Low*, *Intermediate*, *High* to *Excellent*, would be used by participants to determine the maturity of a current capability. Maturity was defined as ‘looking at the current degree to which a capability is developed within the business’. Therefore, for instance, *Ad-hoc* would have been the situational, sporadic or unstructured development of the capability, whilst *Excellent* would consider the capability to have been developed towards saturation; much of if not all avenues had been exploited. Once the checklist had been completed, participant would move on to the following step.

System for Understanding Customers				
Having a system that can lead to a deep understanding of target customers, their needs and demands. For instance, a product-as-a-service model that has been guided by early and ongoing discussions with customers.				
Why is this Important? Knowing who your target customers are and what are their needs and demands can help product development and viability. Customers in a new CBM may be very different from the current business model. In a CBM transition context, knowing your target audience is repeatedly mentioned as important, since they provide some realism to the CBM and having lacking knowledge of target customers has been named as a key failing for some businesses.				
Ad-Hoc	Low	Intermediate	High	Excellent
System for understanding target customers is incomplete; mostly assumed, diffuse and improvised	System for understanding customers is limited; deduced to some extent with lacking knowledge of their needs and demands	System for understanding target customers is respectable; deduced to a wide extent with a respectable knowledge of their needs and demands	System for understanding target customers is considerable; deduced with little knowledge of their needs and demands	System for understanding target customers is extensive; complete if not pushing the envelope of customer research, with a full understanding of their demands and needs.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 21: Current Capabilities check list example within the Excel Tool second iteration

In the second step, the **Future Capacity** step, participants would work together to determine relevant drivers & barriers facing the transition towards a future strategized CBM and, given the key drivers and barriers, determine what are the relevant capabilities for the transition towards the CBM. Participants would have first filled in as many conditions for drivers and barriers under 6 categories (Financial, Market, Organizational, Technological, Value chain, Legal & Political or Other) that could be relevant for the new CBM. This would be done through a brainstorm, where participants would suggest different drivers and barriers, and ultimately narrow down towards a handful of what they agree to be the most relevant drivers & barriers. Participants would be given a list of suggestions for drivers & barriers which can be viewed in Appendix A2 & A3. However, participants are encouraged to consider the drivers and barriers with their unique business context.

Once the relevant drivers & barriers had been identified, participants would, similar to the Current Capacity step, fill in a checklist on the need for the capabilities. This would be based on the future capabilities needed for maturity, relevance and influence, and using the familiar ‘Ad-hoc’ to ‘Excellent’ range. Figure 22 below gives an example of how this could have

⁵ Note that it would have been more internally consistent to have named it ‘Current Capabilities’, since this section does not address drivers nor barriers.

been presented. Maturity, for this checklist, would have looked at the degree a capability should be developed for the CBM. Relevance would have asked participants to determine the extent that a given capability impacts the journey to transition towards the CBM. Finally, influence would have asked participants to determine the extent a particular business could steer a given capability in a beneficial direction. The relevant drivers & barriers would be visible on the sheet and help participants better imagine what capabilities might be needed to meet external challenges. Once the checklist had been fully filled out, participants would have moved on to the final step.

System for Understanding Customers					
Maturity	Having a system that can lead to a deep understanding of target customers, their needs and demands. For instance, a product-as-a-service model that has been guided by early and ongoing discussions with customers.				
	Why is this Important? Knowing who your target customers are and what are their needs and demands can help product development and viability. Customers in a new CBM may be very different from the current business model. In a CBM transition context, knowing your target audience is repeatedly mentioned as important, since they provide some realism to the CBM and having lacking knowledge of target customers has been named as a key failing for some businesses.				
	Ad-Hoc	Low	Intermediate	High	Excellent
	System for understanding target customers is incomplete; mostly assumed, diffuse and improvised	System for understanding customers is limited; deduced to some extent with lacking knowledge of their needs and demands	System for understanding target customers is respectable; deduced to a wide extent with a respectable knowledge of their needs and demands	System for understanding target customers is considerable; deduced with little knowledge of their needs and demands	System for understanding target customers is extensive; complete if not pushing the envelope of customer research, with a full understanding of their demands and needs.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relevance	Ad-Hoc	Low	Intermediate	High	Excellent
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Influence	Ad-Hoc	Low	Intermediate	High	Excellent
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 22: Future Capabilities Check List example within the Second Excel Tool

The Capabilities Gap, the final step, Participants will compare their current and future capabilities, determining what capabilities participants already had met and what capabilities they would presumably need to improve. There would theoretically have been no input from the participants, since scoring from the checklist would have been fed into this final sheet. Essentially, the values of the future capabilities would have been subtracted from the current capabilities to determine the Capabilities Gap. A positive value means that the business model already poses the necessary capabilities, while a negative value highlights that there is a gap between the current and desired capabilities. 'Influence X Relevance' column seen in Figure 23 would be there to hierarchize the capabilities in order of importance. The reasoning here was that when developing capabilities, one might want to tackle the low hanging fruit before developing capabilities that are less relevant or influenceable. It was hoped that with this information, participants could begin to address their business's capabilities that are most important for transitioning, with different businesses individually developing their capabilities and thus improving the value chain as a whole, and ultimately smoothing a transition towards a CBM.

Capabilities Gap Current Capabilities - Future Capabilities = Negative Maturity Gap			Maturity Gradient									Met Capabilities Gap Current Capabilities - Future Capabilities = Equal/Positive Maturity Value		
			-4	-3	-2	-1	0	1	2	3	4			
Influence X Relevance	Capability	Maturity Gap										Influence X Relevance	Capability	Maturity Gap
10	System for Understanding Customers	-1										17	Integrated System Thinking	1
6	Engaging Partners and Aligning Vision	-3										12	Digitalization	0
4	Experimenting, Organizational Learning & Piloting etc..	-2										5	Management ability to prepare, manage and reinforce organizational change etc	2

Figure 23: Capacity Gap's deliverable within the Second Excel Tool

5.3 Initial Workshop Tool

The Initial Workshop Tool pivoted away from the Second Excel Tool towards implementing elements and concepts within a workshop format. This transition resolved some of the main weak points of the excel tool, further develop and prioritized the concepts, and helped clarify the targeting and role of the tool. This sub-chapter will first elaborate on the main insights from the feedback session that lead to said pivoting. This boiled down to the Excel tool being too complex, too text heavy and due to the limits of the medium. Then it will outline the main inter-workshop changes driven by the feedback sessions that lead up to the final tool prototype – the Circular Sprint Workshop. The main changes revolved around fleshing out the CBM standard, the tools positioning, the further simplification of the tool via the de-prioritization of drivers & barriers and the need for a negotiation section in the tool.

5.3.1 Initial Workshop Tool – Pivoting away from an Excel Format

Spanning two feedback sessions on the development of the Excel Mock-up, involving both the TNO thesis supervisor and a senior TNO member of the Business Model Department, it emerged that the Excel tool had many flaws that could potentially nullify its impact and which would be alleviated in a workshop format. There were mainly three problems identified: The excel tool was still too overly complex, there was too much text and there was a disjointedness in individual and group work for a medium best serving individual work. This section will further elaborate upon these problems and how the workshop would elevate them.

The Excel tool, even though it already deprioritized sustainable impact and decommissioned ‘transformative capacity’, was still suffering from being **too complex**. The scoring system with the Excel tool was opaque and it was not fully clear what was being exactly scored and evaluated. It was simply too puzzling for TNO employees. Thus, participants using the tool with no knowledge on the concepts whatsoever, a demographic that this tool is meant to be especially useful for, would likely be too confused and frustrated to find any use for the tool. Therefore, it was thought that having a stronger visual dimension to the tool and bringing in the assistance of a facilitator to guide participants could help meaningfully simplify the tool. This could also include more flexibility into the tool, allowing for usage of some info on an at need basis, rather than said info having taken up valuable space on an excel. As is explained in the following section, the workshop tool would be further slimmed down by removing drivers and barriers. However, complexity would still be an ongoing problem even leading into the final tool (see final feedback round 6.4).

A closely connected problem to the overly complex nature of the Excel Tools were their extensive usage of text; it was simply **too much text**. A chief concern was that participants would not read any of the text until they are lost or frustrated. They would just want to get started with the tool. If the tool is too complex, they cannot intuitively go through the steps, get lost and read the text, which may cause impatience. This is made worse by the amount of text given. There were questions in the feedback sessions if so much text was ultimately needed, if the tool itself could be further slimmed down and if a more visual approach could reduce the cognitive load. Here a workshop would significantly reduce the

need for text, by relying on a more engaging structure; using a facilitator and physical collaborative exercises to ‘show and not tell’.

Finally, there was an **inherent tension in the medium** perpendicular to its goal. An excel tool heavily favours individual work over group work. Simply put, there are better mediums to facilitate group work than an excel format. The goal of the tool in helping value-chain actors collectively transition needed some form of group work. Group work is valuable since it allows to pool together different views that can build to provide a better solution to a given problem compared to a single individual (Knapp et al., 2016). This is especially the case with the value chain, where value chain actors have to come to a common agreement and solution. One could argue that if the tool would be fully committed to individual work, the tool could provide exploratory information that could help with a future value-chain transition. But this would significantly weaken the Excel Tool, especially compared to competing tools. Therefore, a workshop format would be a straightforward medium to use, capitalizing on the participants knowledge. Since design science did not adequately fulfil the need to guide a workshop setting, there was need for a new concept that focused more on collaborative group work. This led to the discovering and adopting of the related concept of design thinking. As elaborated in the conceptual background, Design science is more useful to evaluate rather than help design a tool, and thus had limitations in the extent it could guide the development of the tool. Design thinking could be considered the opposite. It offered useful structures as guidance in designing a tool built on group learning. Design science was eventually a useful resource in structuring the interview questions surrounding the final tool prototype. That being said, the adoption of design thinking would be the proverbial nail in the coffin for the Excel Tool. Through the lens of design thinking, the Excel Tool’s weakness in group work was sub-optimal for its evolved goal.

5.3.2 Initial Workshop Tool – Main Inter-Workshop Changes

Substantiating the future CBM that tool contrasts against

It was already assumed in the Excel Tool that there needed to be a CBM as a goal to orient towards. However, this was not fully elaborated upon. Given the need to reduce complexity, adding additional exercises to a workshop to develop a CBM would further stretch the tool and invite mission creep. The solution was to recommend that the Initial Workshop Tool, would accompany a **Circular Business Model Workshop** (CBM Workshop). A CBM Workshop aims to build a CBM prototype from scratch by building upon several group activities. The CBM Workshop by Santa Maria et al., (2022b) would then be used as a framework for how such a workshop would be constructed. It would serve as a pre-step to the Initial Workshop Tool. It is not outlined as a necessity but as an acknowledgement that certain elements, which the Workshop Tool does not integrate, are worked on external to the Initial Workshop Tool. The CBM Workshop thus highlights what is best to have done beforehand to fully execute the Workshop Tool. It does not prescribe that one has to have done a CBM Workshop, but recommends what activities can support the Initial Workshop Tool. This reduces the Workshop Tool from an independent to an auxiliary tool, exporting certain key activities. However, the trade-off allows for the tool to be more fleshed out, and require less complexity. Thus, the role of the de-prioritized concepts, such as impact assessments (sustainability) and

later drivers & barriers (mapping opportunities and threats), could be exported onto the CBM Workshop. There was a debate then if the Initial Workshop Tool should be integrated into the CBM Workshop or stay as a modular and separate workshop. Figure 24 and Figure 25 below show how Initial Workshop Tool would be either integrated or be modular.

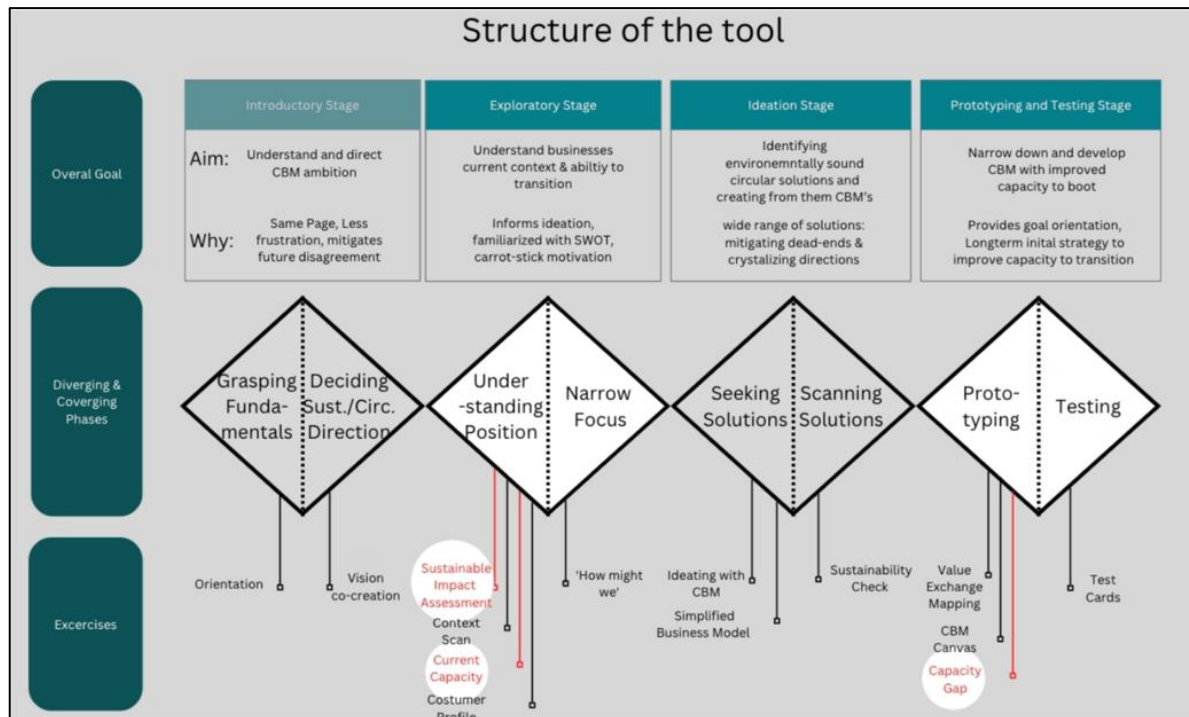


Figure 24: Structure of the CBM Workshop with Initial Workshop Tool integrate into said workshop. NOTE – re-inclusion of Sustainable Impact was explored but eventually relegated and figure was designed before the Capacity to Capabilities shift.

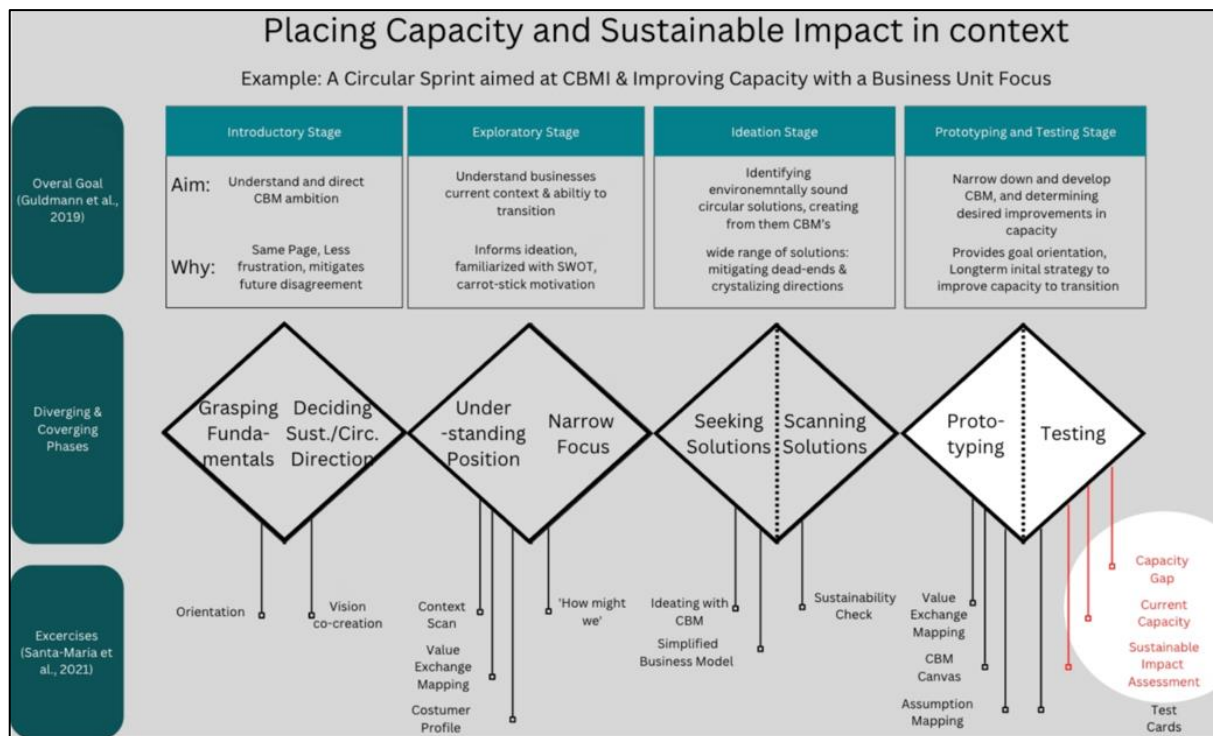


Figure 25: Structure of the CBM Workshop with the Initial Workshop Tool acting as a follow up to said workshop. NOTE – re-inclusion of Sustainable Impact was explored but eventually relegated and figure was designed before the Capacity to Capabilities shift

While there were some weigh-offs made, see Figure 26, it was ultimately decided to be built separately due to the prime need to reduce complexity and increase flexibility by allowing easier inclusion of exercises that do not exactly follow the structure of the example CBM Workshop. It could also be applied to a wider range of contexts where participants already have a developed CBM prototype. To see a full elaboration of the CBM Workshop example used and how the Initial Workshop Tool leverages upon and compliments it, see Figure 28 in the key assumptions sub-chapter (6.1).

<h2>Pros & Cons of configuration</h2>		
	<h3>Integrated</h3>	<h3>Modular</h3>
<h2>Pros</h2>	<ul style="list-style-type: none"> • More fluid connection between CBMD & Capacity • More logical usage of capacity elements within the whole 	<ul style="list-style-type: none"> • If CBM already present – saves time • Allows more flexibility – client wishes • More generous towards CBM tools that do not fit the assumed format
<h2>Cons</h2>	<ul style="list-style-type: none"> • Capacity tool losses clean structure – Dashboard/Workshop integration • Is comparatively a larger time investment – riskier if tool is not useful enough 	<ul style="list-style-type: none"> • Dependant on quality of CBM already developed – trash in trash out • Currently just modular with CBMD – not designed for other innovation frames • Risks overlap/repetition of excercises

Figure 26: PowerPoint slide of Pro's & Con's weigh off to integration or modularity of the Initial Workshop Tool with the CBM Workshop

Tools positioning

A request from feedback sessions during workshop development was the need to further clarify the tools position in contrast to relating tools. It was the view by TNO employees that the Initial Workshop Tool's position needed to be clarified versus other competing tools, justifying what it contributes in comparison. Initially, this was seen as a formality. However, it greatly helped further crystalize the tool's role and also led to the push to further develop the value-chain aspect of the tool.

	Initial Workshop Tool	Business Model Canvas	Road Mapping Tool
Primary aim	Provides an opportunity to identify and explore	Provides a structure for developing a	Provides a descriptive

	capabilities that contribute to a smooth transition towards a circular business model	business model by identifying core competencies needed to deliver on a value proposition	plan of the intermediate steps towards a business model
Highest Categories of Analysis	Sensing and shaping opportunities and threats, Seizing opportunities, Reconfiguring resource and structures	Feasibility, Viability, Desirability	Business Model Milestones, Activities

Table 6: Comparing the Initial Workshop Tool to competing tools (BMC & RMT)

Initial Workshop Tool was compared to Reuver et al.'s 'Business model roadmapping: A practical approach to come from an existing to a desired business model' (2013) and the Business Model Canvas (BMC) by Osterwalder et al., (2010). These tools would contribute the most insights when compared to the Initial Workshop Tool, due to all three tools sharing the overall goal of providing more effective implementation of a desired (circular) business model. Specifically, all three tools focus on and improve the transition from one business model to another, use a future business model for a goal oriented approach, break the transition into manageable elements for analysis and the fundamentally underline the need for a strategic rather than ad-hoc approaches to transitioning.

The **Road Mapping Tool** creates a plan of the intermediate steps when transitioning or implementing a business model (De Reuver et al., 2013). De Reuver et al.'s roadmap involves two layers when planning the sequential steps: The necessary business model changes; the necessary changes in service, technology, organization and finance, and the required activities to realize these changes. When comparing the Road Mapping Tool to the Initial Workshop Tool, there are two main differences. The main difference between the Initial Workshop Tool is that while the Road Mapping Tool sets a plan for the BM transition; what actions you take and when you take them, the Initial Workshop Tool assesses whether the business and or value chain possess the mindset, structures and configurations to set out for a smooth transition. The Initial Workshop Tool is primarily risk preventative than planning oriented. While planning may reduce foreseeable risk, the Initial Workshop Tool aims to mitigate the impacts of unforeseen risk. For instance, a hiker may plan to hit certain milestones at certain times but if they do not have the right expectations, equipment and flexibility, they may struggle to complete the journey, if not fail entirely.

The **Business Model Canvas** finds the strategic and core competencies that are necessary to deliver a value proposition (Osterwalder et al., 2010). As seen in chapter 2.1.2, a BMC highlights the core competencies in terms of feasibility, desirability and viability of a business model. It can also be easily converted into a sustainable BMC, additionally including the 'sustainability' into considering core competencies in terms of costs and benefits (Santa-Maria et al., 2022b). The main defining difference, and simultaneous overlap, is found between the BMC and the Initial Workshop Tool in the identification of capabilities. With the BMC using key competencies and, as previously outlined, the thesis adopting dynamic capabilities as a framework to find competencies for transitioning, there is potential for considerable overlap. The capabilities and BMC competencies are distinct in terms of direction; capabilities target competencies that address the transition towards rather than

the realization itself of a CBM. This means that they give information for different uses and can draw different lessons. Still, even if different lessons are drawn, there can be an overlap between the two competencies. There are two main arguments as to why the Initial Workshop Tool is not simply a derivative of the BMC.

The main argument is that the BMC focuses primarily on the product of a business. In contrast, the Initial Workshop Tool equally considers wider supportive activities that may not be directly linked to a product. While there is almost a guarantee of some overlap when it comes to identifying key abilities, the Initial Workshop Tool further investigates and structures these abilities. For example, while a BMC may find that what is important for developing a given value proposition is having a partnership with businesses A, B and C, the Initial Workshop Tool highlights that close communication and sharing knowledge between partners was a common theme in transitioning towards a CBM. The Initial Workshop Tool is still product focused, since it sets a given CBM as a goal, but also includes conditions that are not immediately apparent to the development of the value proposition. To use the framing of the Porter Value Chain, which can be reviewed in chapter 2.1.3, the Initial Workshop Tool focuses on both the primary and supporting activities, rather than just the primary activities. Even if there is overlap, the Initial Workshop Tool, as will be apparent in the final tool prototype steps (6.3.2), provides a more guided and focused perspective, potentially highlighting capabilities that may have been missed.

Further focusing of the tool

While Feedback favoured the **removal of drivers and barriers** since this would help with further reducing complexity, this was not immediately adopted. The message from the feedback was that internal capabilities were the most useful concept and the removal of drivers and barriers cut down on complexity and elevate internal capabilities at a minor cost of losing the contribution of drivers and barriers. Drivers and barriers contribution was in helping participants navigate internal capabilities by contrasting them to external influences. This can help put internal capabilities further in context but does not add significantly much beyond that. When it was considered that the CBM Workshop with the 'future context' exercise could somewhat fill the role of drivers and barriers, they were ultimately removed. Due to the difficulty of understanding internal capabilities in the final tool, considerations were made from later individual meetings to reintroduce drivers & barriers in a somewhat altered form. These lines of thinking could not be fully resolved, thus the final tool is still primarily focused on internal capabilities.

The **value chain** was an aspect of the Initial Workshop Tool that needed further development. As outlined in the previous sub-chapter (5.3.1), it assumed that by addressing the future circular business model from different actor's perspectives, one could represent this as being a value chain perspective when congregated. However, this was underdeveloped and could be made more impactful. Especially the differing power relations and interests between the actors, as given per group feedback from TNO members, were left unaddressed. As previously mentioned in this sub-chapter, a distinct contribution of the Initial Workshop Tool would be its addressee of the value chain. Therefore, the value chain became a closer focus of the workshop. This was done by assuming that all exercises were done by participants who came from differing businesses but from a shared value chain, and by including a final exercise that aimed at mediating commitments between value chain

actors on improving the capabilities. The concepts of Principled Negotiation began to be used to frame said mediations and were thus a very late addition to the Capabilities Tool. The fourth key exercise of the final tool prototypes main steps (6.3.2) has a an extended elaboration on the concept of Principled Negotiation.

6 Final Tool Prototype - The Capabilities Sprint Workshop

The final tool prototype is the last version of the tool presented to TNO employees. This chapter is most closely connected to the fourth sub-research question: *To what extent is the final version of the tool useful based on the final feedback round?* What will be outlined in this chapter is an outline of the tool that was given in the presentation, albeit much more detailed than the presentation itself. The structure of the Capabilities Sprint Workshop, also known as Capabilities Workshop, is given in Figure 27 below. This chapter will clarify the final tool by detailing its key assumptions, key concepts and key steps.

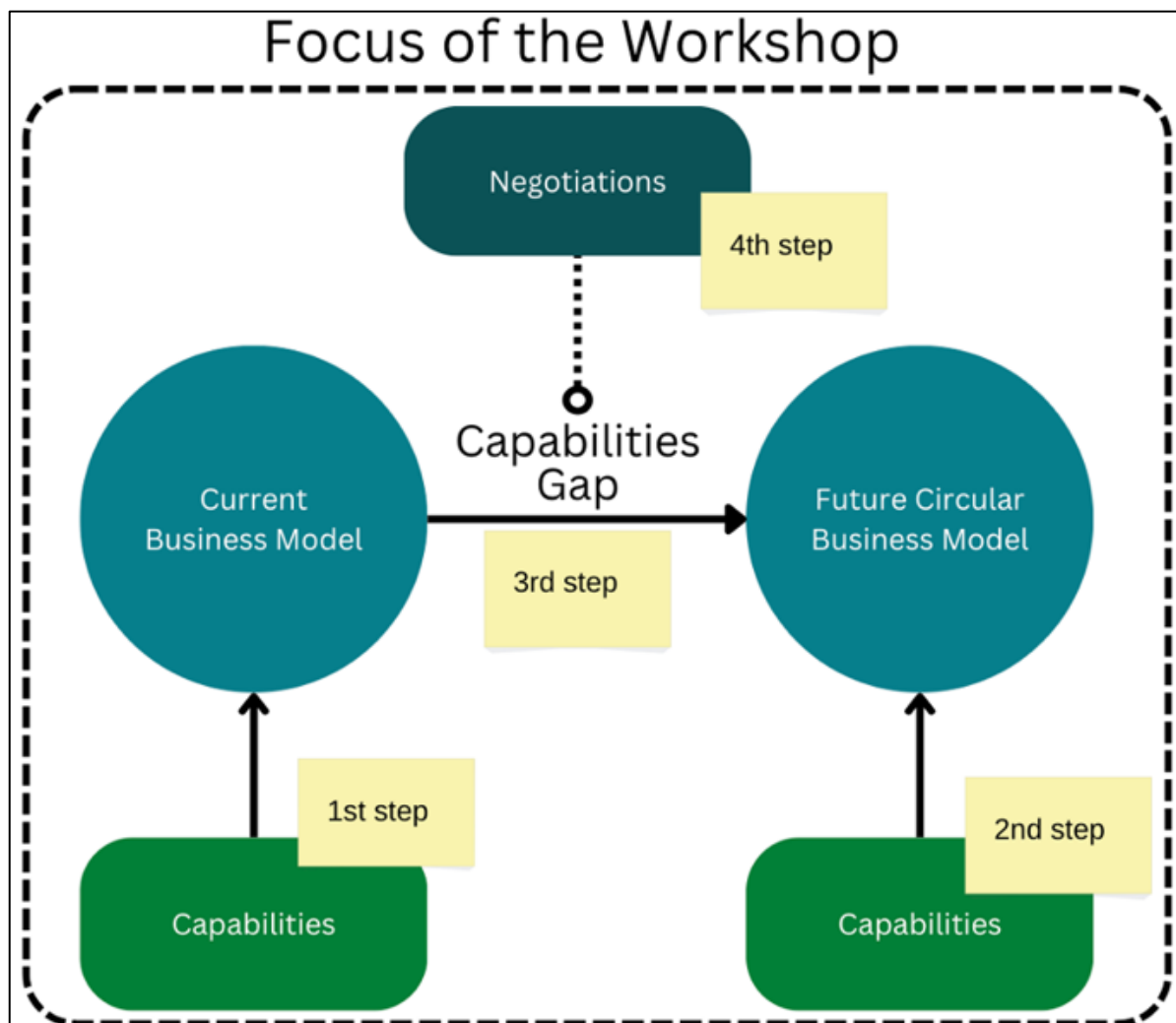


Figure 27: Key steps of the Capabilities Workshop

6.1 Key Assumptions

To better understand the reasoning for the key steps of the workshop tool, the key assumptions going into it need to be addressed. Table 7 gives an overview of the key assumptions. This is not something that would be present in a fully completed tool but it helped TNO employees to identify correct given assumptions. This context clarification will be done by addressing the audience the workshop tool is directed at and its role in comparison to competing tools.

Overview of key assumptions	
Audience	2-6 participants for 1 facilitator
	Can make strategic decision for a business
	Are from a shared value chain
	Need/interest to transition value chain
	Lack oversight and or knowledge gap
CBM Workshop activities	Future Context Mapping
	Value Exchange Mapping
	Circular Business Model Canvas
	Sustainability Scan

Table 7: Overview of Key Assumptions

6.1.1 Key Assumptions - Audience

The audience of the workshop is considered as participants from a shared value chain who ideally can do the strategic decision-making for their respective business. These participants are focused on a singular business model that is shared in various degrees by multiple participants of a corresponding value chain, as opposed to multiple overlapping business models that are tied by a specifically chosen value chain. These are relatively linear businesses and thus relatively linear value chains. For simplification, it is assumed there are 2-6 participants, which is considered a good range of participants for a workshop (Knapp et al., 2016). This allows a facilitator to efficiently managed a workshop, with more participants increasing the danger of significantly slowing or gridlocking the workshop. The facilitator is mainly the director of the workshop, meant to guide participants through the workshop, help them find the right questions & insights and make sure the workshops activities are accomplished in a timely manner. Participants are assumed to be motivated, willing to invest their time and effort and, at least not publicly, express greenwashing ambitions. They express interest or a need in transitioning their value chain towards a circular one. Having a business background, these are participants that have a basic understanding of circular business models, sustainability and circularity. However, they may lack the necessary oversight and may have knowledge gaps. Therefore, this is an audience that hopes that this tool can help them with their interests or needs to transition towards a circular business model.

6.1.2 Key Assumptions - CBM Workshop

A further core assumption is that there are specific exercises that were performed beforehand in the form of a Circular Business Model Workshop (CBM Workshop). The Capabilities Workshop is specifically uses a CBM Workshop format as inspired by Santa-Maria et al. (2022b), Knapp et al., (2016) and Konietzko et al. (2020) when structuring it's development and where the assumptions on activities are taken from. It is assumed to be a SPRINT style workshop, which, as explained in the conceptual background (2.3.2) means it is rapid, collaborative and has a clear agenda with clear activities Knapp et al., (2016). A full outline of the in person activities assumed in CBM Workshop and where there Capabilities Workshop comes in, is given in Figure 28 below.

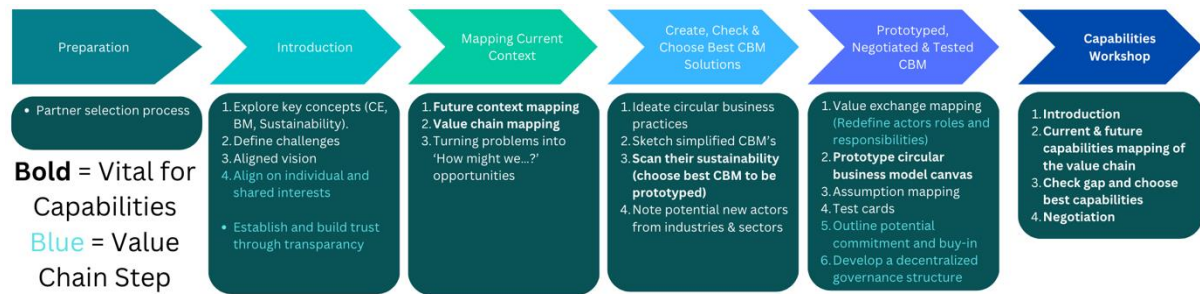


Figure 28: The assumed Circular Business Model Workshop and the Capabilities Workshop

The Capabilities Workshop particularly assumes that there are four activities addressed by said workshop: Future context mapping, the value exchange mapping, the creation of a Circular Business Model prototype and that this prototype was scanned for their sustainability. A CBM Workshop may cover other activities that can be helpful for the Capabilities Workshop, but these four activities are considered essential for the Capabilities Workshop. Future context mapping is where you take categories such as financial, legal, technological context the business or value chain is embedded in and analyse how they might impact the business. In previous iteration of the workshop, this role was mostly fulfilled by drivers & barriers capabilities, with their removal being elaborated upon in the Initial Workshop Tool (5.3.2). This helps participants contextualize and categorize the capabilities for the participants given situation. How this exactly helps will be clarified in exercise 1 & 2 of the key exercises (6.3). The value exchange mapping simplifies what value is exchanged between which partners of a business model. This mapping will be used as a basis for negotiation between the different participants, which is exercise 4 of the Capabilities Workshop (6.3). The scanning of the circular business model for its sustainability means that some review has been made of the future CBM's environmental and social impacts. Most importantly and above all else, a future CBM should be available to work with, as it provides the main goal that the capabilities workshop orients towards.

If one of these activities is lacking, they weaken the Capabilities Workshop or even hinder the proceeding. The Capabilities Workshop is significantly weakened if some form of future context mapping and or sustainable scanning are not present. The Workshop cannot proceed outright if a prototype circular business model and a value exchange map are not available. They would have to be first executed to proceed due to how the Capabilities Workshop is structured. There are also activities that are not 'essential' but would wisely be included in the Capabilities Workshop if they have not been done: A partner selection process, the introduction of concepts, the defining the challenges and the alignment of interests. Looking at Figure 28 above, these are the preparations and introductions of the CBM

Workshop and could easily be attached to the equivalent preparations and introduction of the Capabilities Workshop. Partner selection helps select the relevant participants of a shared value chain. Obstructive participants, such as partners that would be transitioned out of a CBM or partners that have insignificant involvement or stake in the value chain are excluded. Concepts, namely Circularity, Sustainability, Business Models and Value Chains would presumably be covered by the CBM Workshop. Defining challenges and aligning on a vision allows differing participants to work collaboratively and prevent participants talking past one another. The reasoning is similar for aligning on individual and shared interests and can otherwise lead to conflict or, even worse, disengagement (Konietzko et al., 2020). Further elaboration on interest alignment can be found in principled negotiations sub-chapter (6.2). Other activities, such as “how might we...?”, ‘ideate circular business practices’ or ‘note potential new actors’ are not necessary for the Capabilities Workshop but helped build the story of the CBM Workshop. This story can be found in Santa-Maria et al. (2022b), whilst the value chain dimension of this story can be found in Konietzko et al. (2020)

The precondition of the Circular Business Model Workshop and Capabilities was done for two main reasons. Firstly, it allowed to completely focus and elaborate upon the capabilities for the value chain. As demonstrated in the key concepts (6.2.2), capabilities became the central contributor of the tool and thus being the main focus of said tool. These activities could be attached at the facilitator discretion if they are missing, but the this thesis wants to primarily argue the reasoning and use for capabilities. Secondly, addressed in the key concepts (6.2.2) as well, it gives the Capabilities Workshop the necessary goal orientation, thereby increasing its usefulness. Without the having a prototype CBM which the Capabilities Workshop can use to orient itself towards a specific goal, it becomes a rather one-dimensional activity. It would otherwise be just focused on realizing “these are important capabilities” rather than “these are important capabilities and you are specifically lacking these number of capabilities that could help your transition”. The capabilities workshop also is a post hoc impact on the CBM Workshop due to contributing to its presumed goal of successfully enacting a CBM.

6.2 Key Concepts

The core concepts have evolved since the initial tool development, even to the reader throughout this thesis. Thus, it may be confusing as to how the concepts are ultimately understood and therefore relevant as a deliverable through the tool. In this section, the key concepts as used specifically in the final tool prototype are therefore explained. These are the Circular Business Model, Capabilities and Principled Negotiation. Design thinking is not a concept participants have to be familiar with in-depth, and is thus not included. Principled Negotiations is a key concept that was a rather late addition, and was thus not present in the conceptual background or tool process.

6.2.1 Key Concepts - Circular Business Models

Circular Business Models is assumed to be a concept that is already covered from the preceding CBM Workshop. Thus, it would ideally not need to be a concept that would need to be explained due to repetition. If, for whatever reason, it would need to be explained, the conceptual view has remained consistent throughout the thesis, with the workshop using the same explanation found in the conceptual background. An explanation would specifically follow the structure found in the conceptual background (2.2). First, the facilitator would highlight that the circular economy slows, narrows, closes and regenerates resources which can provide positive sustainable impacts. However, circular does not automatically equate to sustainable, thus provisions need to be in place to check for that. They would not mention the philosophical debate on green growth and degrowth juxtaposed to the circular economy since it is not relevant to the workshop. The facilitator would continue to explain that business models are a way to conceptualize and strategies how an organization creates, delivers, and captures value (Osterwalder et al., 2010). That circular business model innovation specifically aims to find insights into how to improve the transition from linear towards circular business models, which this workshop aims to achieve in the broadest sense (Bocken et al., 2018; Linder & Williander, 2017). Finally, the facilitatory would outline how in CE making a business highly circular without some form of additional collaboration or partnership is the exception rather than the norm. Value chains are a way to conceptualize and strategies value adding activities for a product or service from its sourcing to usage. Thus, adopting a value chain perspective can further curb sustainable impacts and unlock more opportunities for circular strategies & practices.

6.2.2 Key Concepts - Capabilities

Capabilities within the Capabilities Workshop are competencies that can be sensed, shaped and reconfigured, and which contribute to a more successful transition towards a circular business model. **Sensing** is the ability to scan the internal and external environment to help identify opportunities and threats for a business model (Santa-Maria et al., 2022a). For instance, a business model that adopts a more holistic framing will be able to have a broader understanding of the context and thus a broader solution space. Examples for a holistic framing are, for instance, having sustainability policies in place that provided conceptual principles for design and implementation of the business models or including nature as a stakeholder (Perey et al., 2018). **Shaping** is the degree of having processes and structures that

allow capturing value from opportunities (Santa-Maria et al., 2022a). For instance, establishing or solidifying collaboration can provide further opportunities. Examples are Eco-Industrial parks where one business's waste is used as input in another business's production or establishing and facilitating trust between partners to promote information exchanges and lowered the costs of engaging in arm's-length contracts with suppliers (Maria Franco, 2017). **Reconfiguring** is the ability to be flexible and adaptive to market fluxes by (de)aligning (in)tangible resources (Santa-Maria et al., 2022a). For instance, have an established regime orchestration; where partners of a shared value chain are encouraged, assisted and steered in promoting the long-term interest of the group rather than short term interest of the individual business (Abbott, 2018). An example would be having developed skills to integrate stakeholders and coordinate partners in the business ecosystem whilst dealing with conflicting interests and unequal power relations (Santa-Maria et al., 2021a). To have a completer overview of the Capabilities and their subcategories, view Appendix A.

These capabilities are based on a literature review that adopted a broad approach; not specific to a value chain or business unit, to incumbents or start-ups, to SME's or MNC's, or the final degree of circularity. It is rather what academics, accounting for the degree of empirical evidence, publish to be relevant factors that lead to a more successful transition. Previous iterations of the tool had an even broader definition of Capabilities. These included forces, i.e 'Drivers and Barriers', that were steps removed from the control of a business or value chain actors yet affected its transitional success, but have been resigned from this workshop. Capabilities are now closer in-line with the Dynamic Capabilities (DCs), which are defined as a firm's ability to successfully "integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al., 1997, p. 516). The main difference between the two being the broader focus that includes the value chain, and the specific focus on transitioning towards CBM's rather than transforming the existing BM's.

However, the problem context remains relatively similar. Like Capabilities, DCs posture that competitiveness stems from leveraging resources such as knowledge, skills, technology, and organizational culture (Barney, 1991). In regimes of rapid change, such as a circular economy transition, they both try to answer how competitive advantage can be achieved (Teece et al., 1997, p. 509; Peteraf et al., 2013). The literature over the years has also suggested that if a firm has strong DCs, this can lead to effective BM transformation (Teece, 2018). To highlight the debate again between the Capabilities Workshop and the Business Model Canvas in chapter 6.1, there is a difference between (Dynamic) Capabilities and Organizational Capabilities. The first seeks to successfully transition (C)BM's while the latter asks what is necessary to establish a BM. Capabilities focus on the space between state A & B, while Organizational Capabilities focus on state B. There is partial overlap in relevant competencies, but also benefits in considering either separately.

6.2.3 Key Concepts - Principled Negotiation

Principled Negotiation, also known as integrative negotiations, is an approach to negotiation that focuses on problem solving, creating value, communicating and finding win-win solutions (Fisher et al., 2007; Alfredson & Cungu', 2008). Instead of taking a zero-sum approach to negotiations, such as the strategic or behavioural approach inherently has, principled negotiation rejects the premise of fixed value, and looks for ways to create more value for

the parties through the negotiation (Alfredson & Cungu', 2008). Alfredson & Cungu' have an apt analogy for this (2008, p. 19):

“Two siblings enter into a quarrel over who can have a single orange. Though each sibling may maintain the position that he should get the orange (a zero-sum situation), when stated in terms of the sibling’s interests the problem may appear to be much less irreconcilable. For example, the siblings in the story turn to their underlying reasons for wanting the orange. One sibling desires the flesh of orange because he wants to make juice. The other has need of the rind to flavor a cake. When framed this way, in terms of interests instead of stated positions, the problem appears to become a positive-sum or win-win solution. The siblings discover that each may in fact have what he or she needs from the orange without depriving the other of his or her interests.”

There are 7 main elements suggested by Fisher et al. (2007): Identifying interests, separating people from the problem, using the best alternative to an agreement (BATNA), identifying options, using objective or legitimate criteria, creating commitment and good communication.

Identifying interests emphasizes the need to identify and align interests rather than focus on the positions of parties (Alfredson & Cungu', 2008). By focusing on interests, there is more flexibility and possibility in finding mutual solutions that serve the interests of all parties (Isabella van Rossum, 2022).

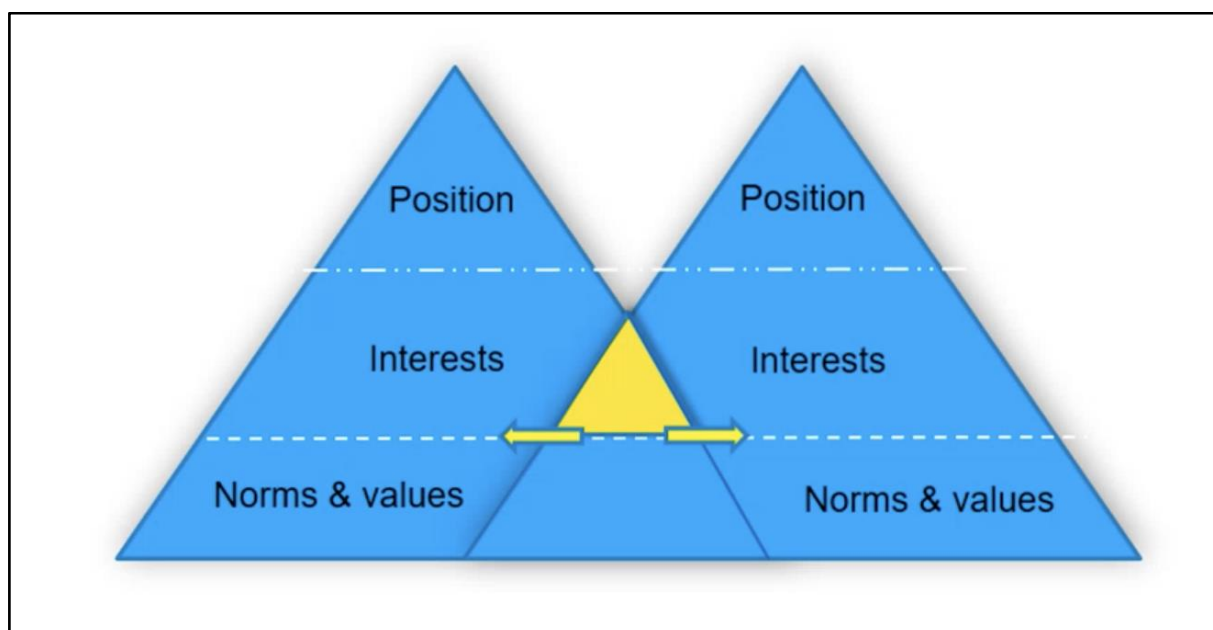


Figure 29: 'The Golden Triangle: Lecture 'Workshop stakeholder engagement' 14/02/2022 Isabella van Rossum, Utrecht University

The element '**separating people from the problem**', highlights the need to remember that the participants are humans with their faults and the importance of preserving the relationship between partners (Alfredson & Cungu', 2008). The idea being that the better the relationship is between the parties, the more cooperative they are and thus successful in negotiating a mutually satisfying solution (Alfredson & Cungu', 2008). This can be done by

establishing rapport, allowing parties to save face and, albeit more difficult, building trust and honesty (Fisher et al., 2007; Alfredson & Cungu', 2008).

Having a **BATNA** is a further element that can help prevent settling for an inflexible bottom line. Instead, having a 'best alternative to a negotiated agreement' allows parties to negotiate with an alternative in mind that can adapt to evolving negotiations (Fisher et al., 2007). This allows parties to explore solutions, reevaluate their position, recognize opportunities and not feel pressured into accepting offers that should be rejected (Alfredson & Cungu', 2008).

Identifying options is a straightforward element that emphasizes the need to generate options. By generating several options, there can be more solutions to a problem and allows for more creative thinking (Alfredson & Cungu', 2008).

Using objective or legitimate criteria is a further element that reminds us that parties can possess different standards or criteria that influence how 'fair' they view the process and solutions of the negotiation. For instance, two parties may be negotiating on GHG emissions, where business A argues that business B needs to invest more in abating GHG emissions due to the size of business B. However, business A argues that business B needs to invest more in abating GHG emissions due to the industry of business B being inherently more unsustainable. To overcome this, both parties need to use a criterion that are independent of the biases of either party (Fisher et al., 2007). For instance, both parties could use scop 2 emissions, GHG emissions generated by the business unit and by the production of energy it buys, to settle the share in investing abatement. By having objective and or legitimate criteria, negotiations can end with more value-adding solutions that are more likely to be implemented after the negotiations (Alfredson & Cungu', 2008).

Creating commitment, is an element that can also often be found in workshops that are based on design thinking principles in the form of 'testing' (Santa-Maria et al., 2022b; Knapp et al., 2016). After all, negotiations or workshops are less valuable if you are not going to commit to them afterwards. By emphasizing between the parties that these are negotiations they should aim to commit to, this allows for more serious and, assuming these commitments are then actually committed to, can build trust (Alfredson & Cungu', 2008).

Lastly, **good communication** skills are an essential element that can change attitudes and overcome deadlock (Alfredson & Cungu', 2008). Using active listening by asking questions, paraphrasing, 'listening' and through acknowledgement, both parties can feel heard, leading to more productive negotiations (Fisher et al., 2007; Alfredson & Cungu', 2008). Good communication also means learning how to deal with difficult emotions. Fisher et al., recommend that in such cases it is best to confront these emotions by allowing the other party to release their feelings, advising them to listen and be patient (2007). They also further recommend that one should also be in touch with their own emotions within a negotiation.

Principled Negotiation is a concept that is, when considering the entire thesis, unique for the final Capabilities Workshop. As found during the inter-workshop changes (5.3.2), there was a need, in some form, to lock in commitment and account for power relations between participants. Due to this late arrival, it is not as an extensively developed concept as it should be. However, it sufficed to set a direction where future iterations would have headed. It is seen as a solid approach to start from given the alignment of principled negotiation values with the thinking of the CE and Design Thinking.

6.3 Capabilities Sprint Workshop

The key exercises to the final tool prototypes are finally explained. This section outlines the final tool prototype in the form of a workshop. It will first list the preconditions for beginning the workshop, then the introduction participants would be faced with, then outline what exercises from the Capabilities Workshop participants would be conducting. The four key exercises of the workshop: An examination of the current business model capabilities, an examination of the future circular business model capabilities, an identification of the capabilities gap and a negotiation process. This section is structured identically, presenting first the preconditions, then the introduction, and, finally, the four key exercises.

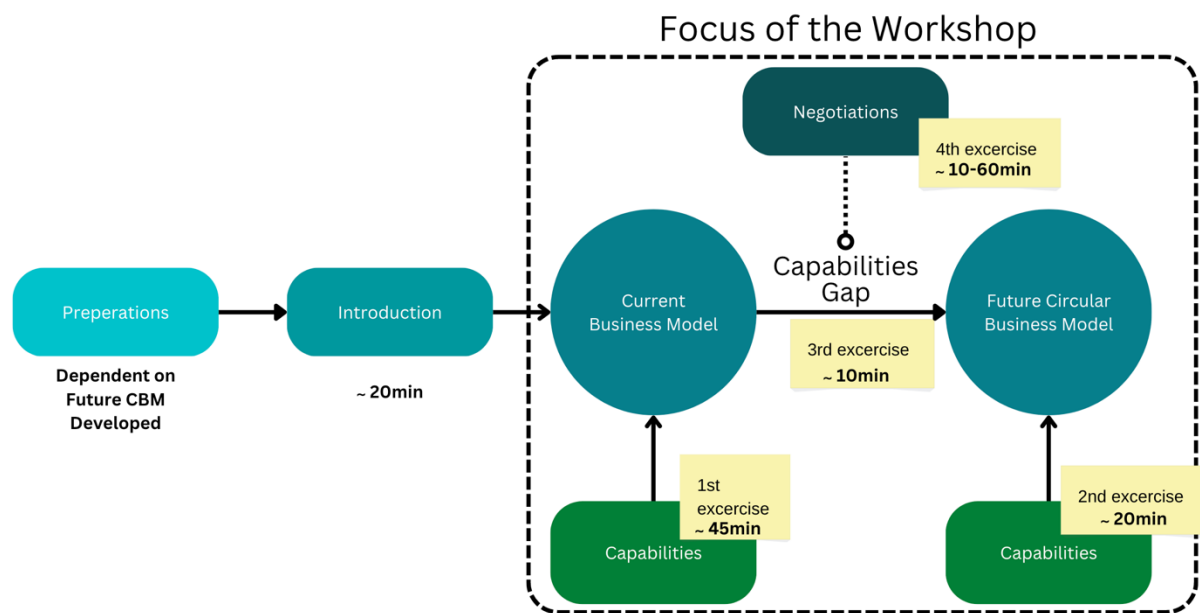


Figure 30: Image of the 4 key exercises of the workshop that are preceded by preparations and introduction.

6.3.1 Capabilities Workshop: Preparation & Introduction

Capabilities Workshop - Preparations

Preparations are necessary for three main reasons: Firstly, as partially outlined in 6.1, there are activities or deliverables this workshop requires or would benefit from in order to function and, furthermore there are time and resource considerations that have to be made. The time needed for this step is thus dependant on how developed the future CBM is, and, if there are missing requirements, if participants want to flesh out their CBM with one of the exercises in Figure 28.

The simplest path to possessing the necessary **deliverables** for this version of the Capabilities Workshop is to couple it as a follow up to a CBM Workshop. While following up from a CBM Workshop is recommended and assumed to have been done in this thesis, what matters are the deliverables that you would likely find in such a workshop. As detailed in 6.1, the main deliverables are a future context map, a value exchange map, the creation of a CBM prototype and that this prototype was scanned for their sustainability. Concurrently, activities that are not essential but highly advisable are partner selection, the introduction of concepts,

the defining challenges and the alignment of interests. If any of these activities or deliverables are not present, their inclusion into the Capabilities Workshop as part of the preparations or introduction should be considered. **Time** is equally and important preparations to be considered. Participants would presumably need ~13h for the CBM Workshop and ~2h – 3h for the Capabilities Workshop all assumptions holding. This would be conducted consecutively within a week. This guesstimation is based on Santa-Maria et al.'s. (2021b) CBM Workshop and a personal educated guess for the Capabilities Workshop. This is rather quick due to the workshop type, namely, it being a SPRINT workshop. As mentioned previously in the conceptual background (2.3.2), SPRINT workshops main selling point it to be rapid, thus low risk (Knapp et al., 2016). They aim to be as productive as in little time as possible, relying on their purposeful structure to achieve this. Because SRPINTs are rapid, relatively little time is invested in them. Thus even if it is only a partial success, the impact on the time invested by the participants is relatively minor. **Resource** needs would come in two forms. Firstly, the materials from the previous CBM Workshop, specifically the deliverables from the key activities, would need to be available for use. While SPRINT workshop activities and deliverables come in a physical form, they have also proven themselves in a purely digital form (Jonathan Courtney, 2020; Knapp et al., 2016; Santa-Maria et al., 2021b). If the CBM workshop deliverables are digital, for consistency, the Capabilities workshop should be adapted to be digital⁶. The final Capabilities Workshop is assumed to be in person. Secondly, for an in person workshop, one would ideally have a facilitator, whiteboards and basic office supplies such as pens, paper, sticky notes, markers and a timer (Knapp et al., 2016). The Capabilities Workshop also uses Mentimeter, thus also needs to be set up beforehand. Not to mention, a reserved space and time to conduct the workshop that all the participants can access should be planned.

Introduction

Once preparations have been undertaken, the introduction to the Capabilities Workshop can be held to the participants. In the Introduction, participants will be first explained what are capabilities, why capabilities are used and how this would be achieved through the four exercises of the tool. This step should take around 20 min.

To answer **the what**, capabilities would be used as a basis. What would mainly be touched upon is how capabilities are competencies that contribute to a successful transition towards a CBM, how they focus on the competencies that participants can directly influence and that these capabilities can be categorized into sensing, shaping and reconfiguring. As will be underlined in the final feedback round (6.4), Capabilities could very easily be a confusing concept for the participants. Therefore, extra care would need to go into clearly explaining Capabilities and clarifying questions within the workshop. Thus, not all the details listed in key concepts (6.2) would be used unless prompted in some form by a question. Only the most essential parts of Capabilities should be explained so that participants can more easily grasp the new concept. See Appendix C to have an idea of the direction this would head in, but note that it was built for a TNO audience and for a different purpose, thus it would need to be slimmed down considerably. Addressing **the why** and comparing the Capabilities Workshop to similar tools, could also help with clarifying Capabilities. The Workshop's benefits would

⁶ See Santa-Maria et al., 2021b who use Miro to conduct a Digital SPRINT Workshop

be summarised along the writings of the key assumptions (6.1), namely, that the Workshop is primarily a risk preventative exercise in regards to transitioning towards CBM, that competencies that were potentially overlooked in a CBM canvas could be identified due to the inclusion of supporting activities, and that it is designed to promote collaboration of a value chain rather than distinct business units. Contrasting the Workshop with the Business Model Canvas and Roadmapping, would further highlight these points. Finally, the introduction will briefly outline what are **the four exercises** and how they contribute individual and as a whole towards the structure and outcome of the tool, see Appendix C as an example. With the what, why and how of the Capabilities Workshop being addressed, the main focus of the workshop can commence.

6.3.2 Capabilities Workshop: The four key exercises

As seen in Figure 27 on page 69, the Capabilities Workshop has four key exercises for participants to follow. These start with finding the Current Capabilities, then the Future Capabilities, then the Capabilities Gap, and, finally, Negotiations. Note that this section gives a more detailed explanation of the individual exercises than what was outlined in the PowerPoint presentation to TNO employees.

First Exercise: Current Capabilities

After the introduction, the first exercise of the Workshop, the Current Capabilities, seeks to visualize what are the comparative capabilities that are current in the present Business Model. To achieve this, this exercise asks participants to accomplish three tasks with the facilitator: Use a Business Model Canvas (BM Canvas) and Capabilities Map, determine to what extent the practices from the Map fit within their current BM Canvas, and, finally, if said practices are present in an ad-hoc fashion or are structurally developed.

The BM Canvas is a simplified visualization of the necessary elements to market a value proposition. It is used to help participants get a better grasp of what Capabilities. Note that Porter's version of the Business Model Canvas is used because that is the BM Canvas that would most likely be used in a previous workshop (Porter, 1985). However, any BM Canvas can be used, with the Service Dominant Business Mode Radar, due to its more focused value chain actors orientation, potential being a better suited BM Canvas (Turetken et al., 2019). If participants have not already sketched and filled a BM Canvas from the previous CBM Workshop, they will simply use a blank BM Canvas. Next to this, they will use the Capabilities Map, see Appendix A1. The Map is a wider overview of the three overarching categories, sensing, seizing and reconfiguring, which lead down into the practices, the smallest units on the map. See chapter 6.2 for an extensive elaboration. These micro foundations are then interpreted by the participants within the context of their business model; what is the closest activity in their business model that resembles said practice? In this interpretation, participants are asked to also evaluate if said activity is done on an ad-hoc basis; improvised, often assumed and undertaken on a 'need' basis, or is it done on a strategic basis; planned, assumptions scrutinized and structurally integrated. The interpreted practice is attached to a stick note and placed within a relevant field of the BM Canvas. This is done for all 23 practices. Once participants have a solid understanding of what the capabilities are after going through

the 23 proposed practices, they are encouraged to propose a further limited amount of capabilities they view as highly relevant. If participants cannot identify a relevant practices, or it is an ad-hoc activity, they would be persuaded to reference this on a sticky note and add it to the Canvas. This investigating and categorizing of micro foundations is done so that there is a underlying basis to contrast the necessary capabilities needed for the future Circular Business Model (CBM) and identify the largest gaps in capabilities.

Let us go over an example of how the first exercise might be executed. Under ‘sensing’ on the Capabilities Map, the first practice is ‘Be aware of exogenous technology’. The facilitator would explain that many successful Circular Business Models (CBMs) have an up-to-date understanding of the current relevant technologies for their given industry (Santa-Maria et al., 2022b; Inigo et al., 2017; Mezger, 2014; Goni et al., 2021). As seen in Figure 31 below, let us assume the participants view their employees as the most prominent source for being aware of exogenous technologies for their current business model. The participants then note it on a sticky note, applying it to ‘key activities’ section. In this case, participants believe their overall BM possesses a culture of employees exchanging their insights, and thus view it as a structured undertaking. Once all 23+ practices have been noted, participants will move on to the second exercise.

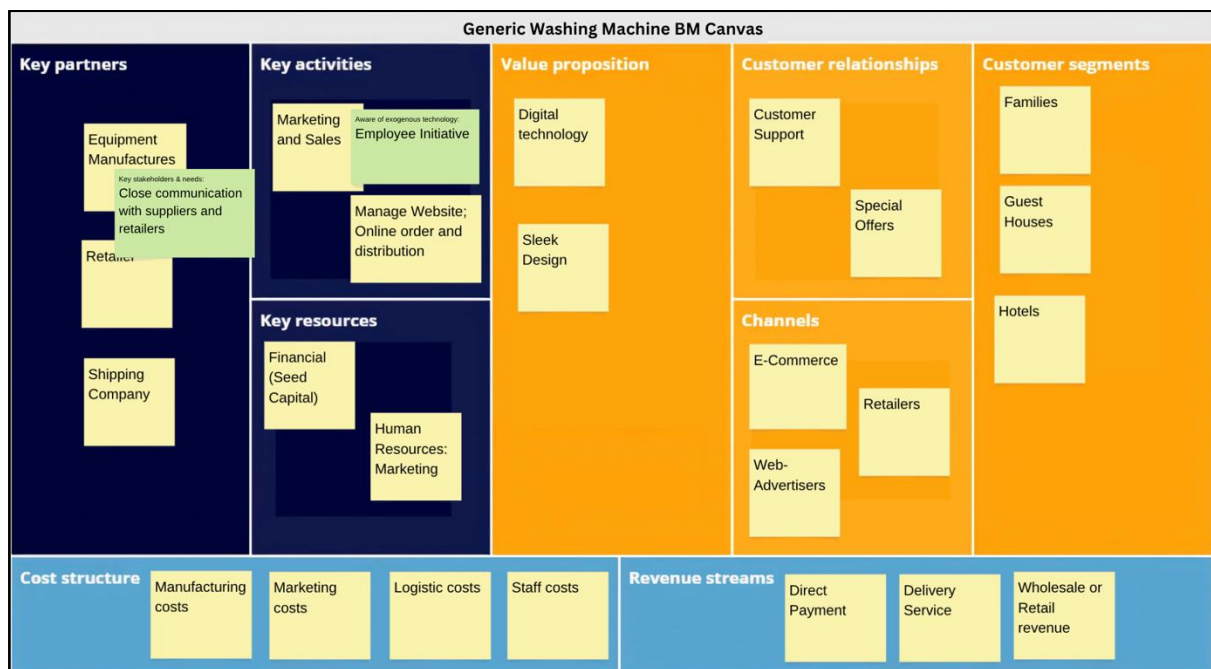


Figure 31: Generic Washing Machine BM Canvas, From Workshop Power Points, Inspired by Santa-Maria et al. (2021b)

Second Exercise: Future Capabilities

The second Future Capabilities exercise outlines the necessary capabilities to transition towards a future CBM by asking participants to accomplish 3 tasks: Use a CBM Canvas and the Capabilities Map, place the interpreted practices into said CBM Canvas and then use unlimited dot voting to prioritize the capabilities.

The initial task is similar to the first tasks found in the first exercise. Participants will use a CBM Canvas as a background for placing practices found through the Capabilities Map. Here, participants use a CBM they aim to strive towards and, as mentioned earlier in chapter

6.3, is an essential pre-condition that needs to be present. With a CBM in mind, participants would likely have a CBM Canvas available from the earlier CBM Workshop. If none is available, they would use a blank BM Canvas. Participants would also use the same Capabilities Map from the last exercises, which can be found in Appendix A1. Participants would again be asked to interpret the practices but, instead for the current BM, interpret them for the future CBM. Participants would not be asked to difference them ad-hoc or structured, since it is assumed that the Capabilities are implemented in a deliberate manner and will be hierarchized through dot voting. All 23 practices from the Capabilities Map will be interpreted by the participants for their specific CBM context and added to the CBM Canvas in the form of sticky notes. If there any Capabilities that participants find very relevant, they may add them in addition. Unless participant unanimously declare it to be irrelevant, even capabilities that are seen as minorly relevant are added to the Canvas. The role of creating an hierarchy of importance is done through unlimited dot voting. In unlimited dot voting, participants each receive an unlimited amount of stick dots which they can place on the sticky notes. It is unlimited in order to account for the stronger or weaker preferences between participants. Say there is one capability participant from business A finds a specific capability very important for a successful transition, but participants from business B & C are indifferent towards. In an equal dot voting, A's capability is overlooked in favour of more 'dotted' capabilities. Unlimited dot voting helps track the weighted preference each participant gives towards the capabilities, avoiding potential resentment in the future. Once the capabilities have been weighted, facilitators are encourages to remove sticky notes with one or less dotes, or simply sticky notes with relatively few dots.

These tasks can be illustrate through an example. Let us use the same example from the last exercise, namely the practice 'Be aware of exogenous technology' found under the 'sensing' Capability. The facilitator would ask participants how must the future CBM conduct awareness for exogenous technologies to in order to improve the hypothesized success rate of the transition. Say participants would agree that 'sharing between partners' would lead to a better transition, they would note this on a sticky note and place it on the CBM canvas as seen in Figure 32 on page 82. Once they have done this with all the practice, the participants conduct an unlimited dot voting, the abbreviated results are seen in Figure 33 on page 82. Notice that there are many dots on the 'sharing between partners', possibly more than active participants, highlighting that it is seen as an especially relevant capability. Notes with one or less dots are have been removed. Once the dots have been placed, the capabilities are hierarchized and the participants can proceed to exercise 3.

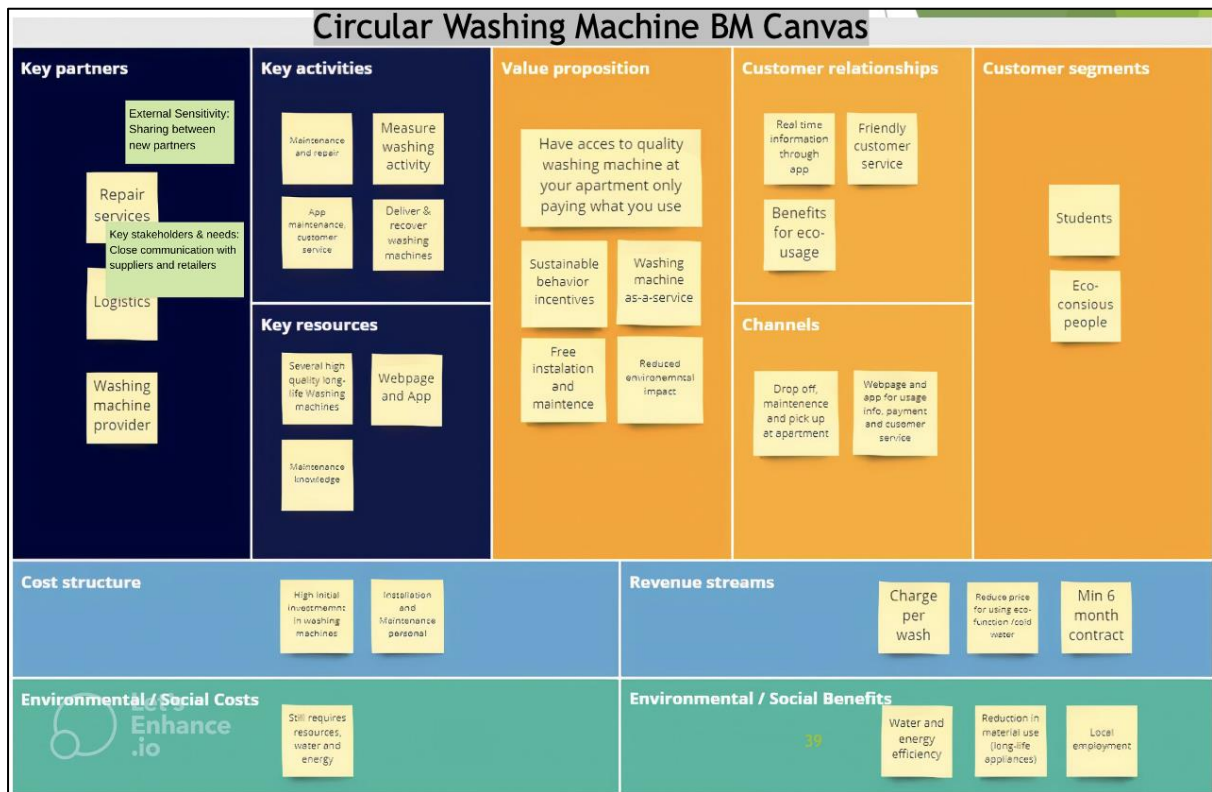


Figure 32: Circular Washing Machine BM Canvas, From Workshop Power Points, Inspired by Santa-Maria et al. (2021b)

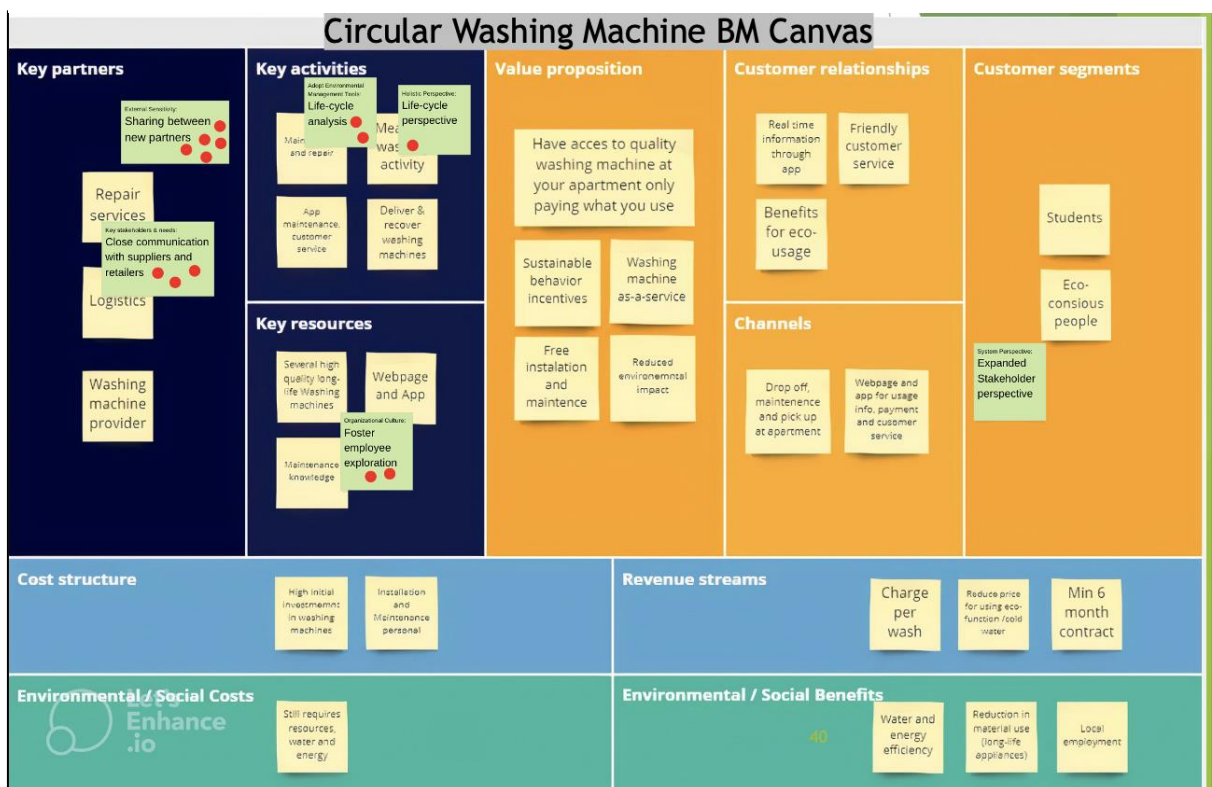


Figure 33: Circular Washing Machine BM Canvas with dot voting, From Workshop Power Points, Inspired by Santa-Maria et al. (2021b)

Third Exercise: Capabilities Gap

The third exercise, the Capabilities Gap, tries to compare the future capabilities to their counterparts of the current business model to outline the gap, then determine the capabilities impact and influence. This will be by participants via two activities: By comparing the current BM Canvas with the future CBM Canvas and then, by selecting capabilities that exhibit a gap, subsequently placing capabilities on an impact x influence matrix.

The initial exercise will determine the **gap** in capabilities by comparing them their current business model equivalent. As can be seen in Figure 34, this is done by taking the deliverables from exercise two, the future CBM Canvas, and then comparing them to the deliverable from exercise one, the BM Canvas. Capabilities from the future CBM Canvas will be compared to the capabilities of the BM Canvas, from most to lesser dotted capabilities/sticky notes. Future capabilities that are met by current capabilities can be ignored and set aside by the facilitator, unless requested otherwise by participants. If they are roughly met, they can be ignored. Future capabilities that are not met by the cure capabilities, due to being too different, being ad-hoc or missing entirely, would demonstrate a gap. These capabilities should be transferred to the impact x influence graph. This is done until a sufficient amount of stickies have been transferred, sufficient being determined mainly by the participants. However, it would be advise to not do more than a handful, since every additional 'gap' capability could lengthen the fourth exercises negotiation process.

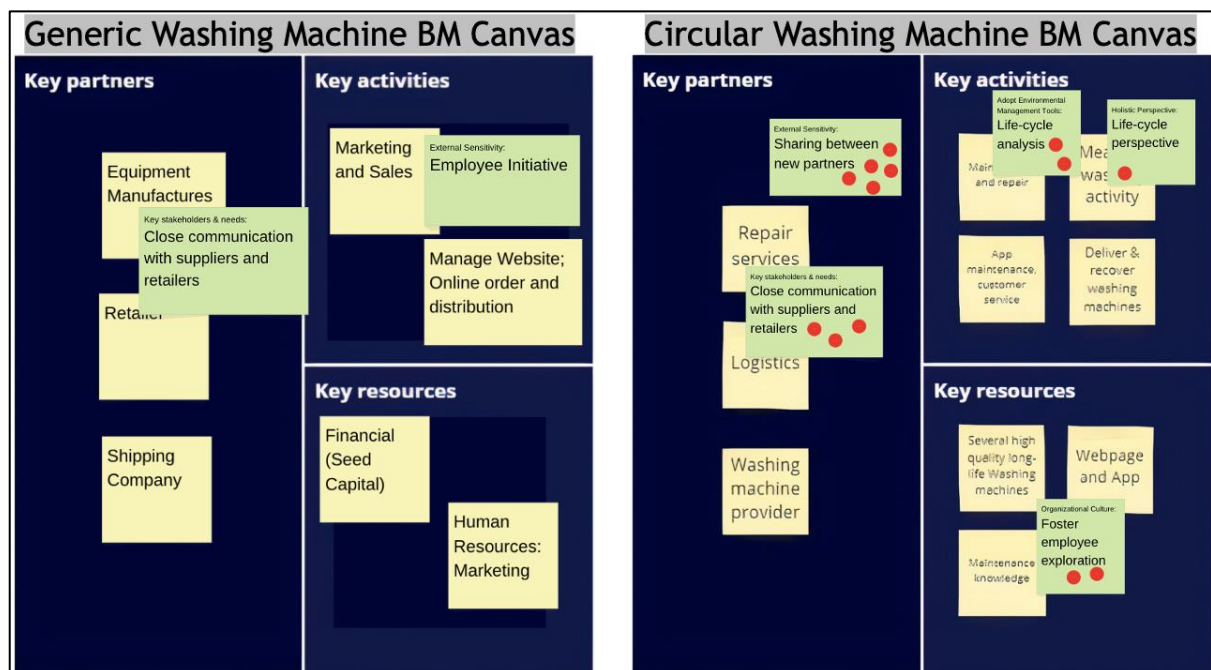


Figure 34: Comparing the current BM Canvas to the future CBM Canvas, Inspired by Santa-Maria et al. (2021b)

On the **impact x influence** graph, as seen on Figure 35, participants determine if there is a relatively high/low impact of the capability vs a high/low influence capability. The impact category expresses if participants view this capability as being more or less impactful for the business model transition; will this capability significantly help in smoothing the transition? The influence category expresses if participants view the capability as being easy to steer; how easily do participants think this capability could be currently implemented and developed? This is done to help further prioritize the capabilities, singling out the most

pertinent of the capabilities. Thus, capabilities that are highly impactful and highly influenceable, i.e the top right of the matrix, should ultimately be prioritized.

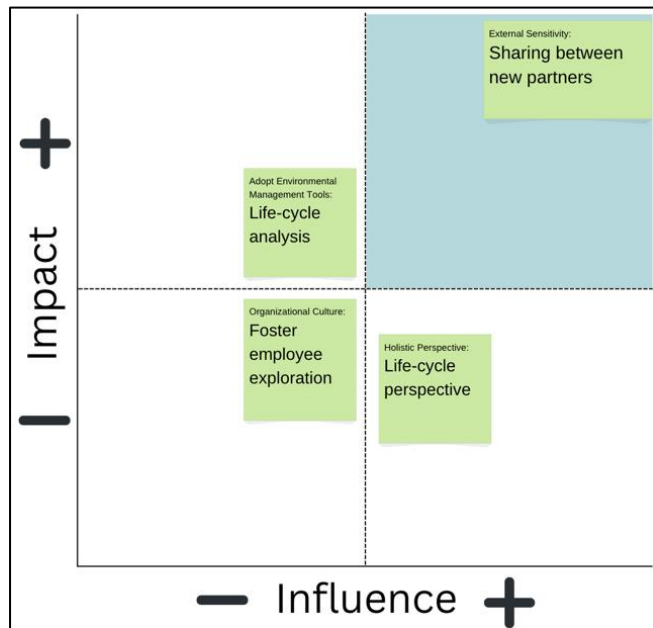


Figure 35: Impact x Influence matrix

This exercise can be demonstrate through an example. Let us again return to the capability ‘sharing between new partners’, which example participants have dotted as highly relevant and which would be also thus the first capability/sticky note to address. They find that there is a gap with this highly relevant capability, since the current BM equivalent capability, ‘employee Initiative’, is seen as misaligned and added to the impact x influence matrix. The capability is judged by participants as being impactful for helping smoothen the transition and is believed to be rather straightforward to implement. Therefore, they decide to place the capability in the top right half of the

matrix, making it a rather pertinent capability. Once the capabilities from the future CBM Canvas and the impact x influence matrix have been addressed, participant can move on to the final exercise.

Fourth Exercise: Negotiation

The fourth and final exercise heads into a negotiations process. Participants will negotiate the financial, logistical or other aspects of implementing the capabilities by using the framework of principled negotiation. Ideally, by the end of the negotiations, participants have a first rough draft of how the capabilities are implemented and everyone’s associated roles. Most likely, it would hopefully spur and set the scene for future negotiations. There are three activities to help structure these negotiations: A short Mentimeter overview, placing the pertinent capabilities on a value exchange map, then negotiation what, when and how the capabilities would be developed within the value chain.

The first activity is to conduct a pulse check on the group of participants with the use of a **Mentimeter**. Due to the personalities of participants and or unequal power relations, some voices may be louder than others. This could lead to the overemphasis of certain capabilities or the smouldering of unaddressed conflict. This could potential disrupt negotiations, the long term implementation of capabilities and, ultimately, hamper a transition by misidentification or inter-partner conflict. Mentimeter allows participants to anonymously answer questions via an electronic device and display the response in an understandable manner. If there are hidden grievances or inaccuracies, this process can open the discussion towards addressing them, underlining to participants, without being patronizing, their long term interest in expressing and listening to said grievances and inaccuracies. Figure 36 is an example how a Mentimeter response could appear.

on the placement of capabilities chain, rate the following 1-5

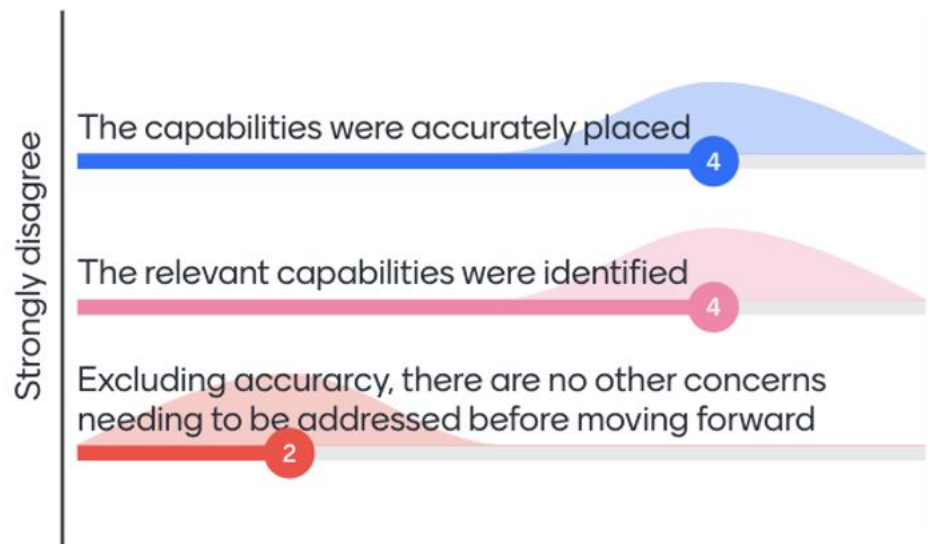


Figure 36: Example response from Mentimeter (Mentimeter.com, n.d.)

After the Mentimeter pulse check, a **value exchange map** is used to place the most pertinent capabilities. A value exchange map is a visualization of the actors from a shared value chain and how value is exchanged between the actors. Figure 37 on page 86 is an example figure how the value exchange map could be constructed. A value network map could fulfil the same role in a more detailed fashion but this thesis will use the less complex value exchange map. The value exchange map would be a deliverable carried over from the CBM Workshop. However, if this is not available, it can be easily sketched by first noting the main actors within the business models value chain, then, secondly, connecting the actors by the value that is being exchanged whilst making sure that all actors have input and output value. With the value exchange map in place, participants will now place the most pertinent capabilities on the map. The placement of the capabilities should be a short hand for responsibilities; where on this map do the capabilities need to be developed to achieve the most impact and benefits the value chain?

For instance, to use a familiar example, participants are now deliberating where to place the capability 'sharing knowledge between partners'. As demonstrated in Figure 37, the participants decide that this is a capability that needs to be developed equally among all participants. The eventual debate on the what, when and how could then move on to, for instance, setting up an institution or monthly session to share and disseminate promising knowledge and technologies. As another example, 'implement product passport' is a capability that participants decide would mainly be implemented by the manufacturers of the value chain. The debate could then move on to how the participant representing the manufacturer expresses concern of bearing all the costs while all participants benefit from the implementations and what solutions could be implemented to redistribute the costs or create further benefits for the manufacturer. With the placing of the capabilities, negotiations

may start emerging, since the placement of the capabilities on the map is not a politically neutral decision; it anchors the debate. Thus, before participants begin placing the capabilities, the facilitator should briefly give a bullet point advice on negotiating, based on principled negotiation. They would underline that participants should take a positional stance but rather focus on interests, agree on objective and or collectively legitimate criteria and remind them they should have a BATNA in mind. See principled negotiation sub-chapter (6.2.3) for a more detailed explanation on the subject. From then on out, the facilitator will take a less active role. They should help with potential bottlenecks, as will be explained in the following paragraph, but also be at ease with taking a less hands on role during this final phase of the workshop.

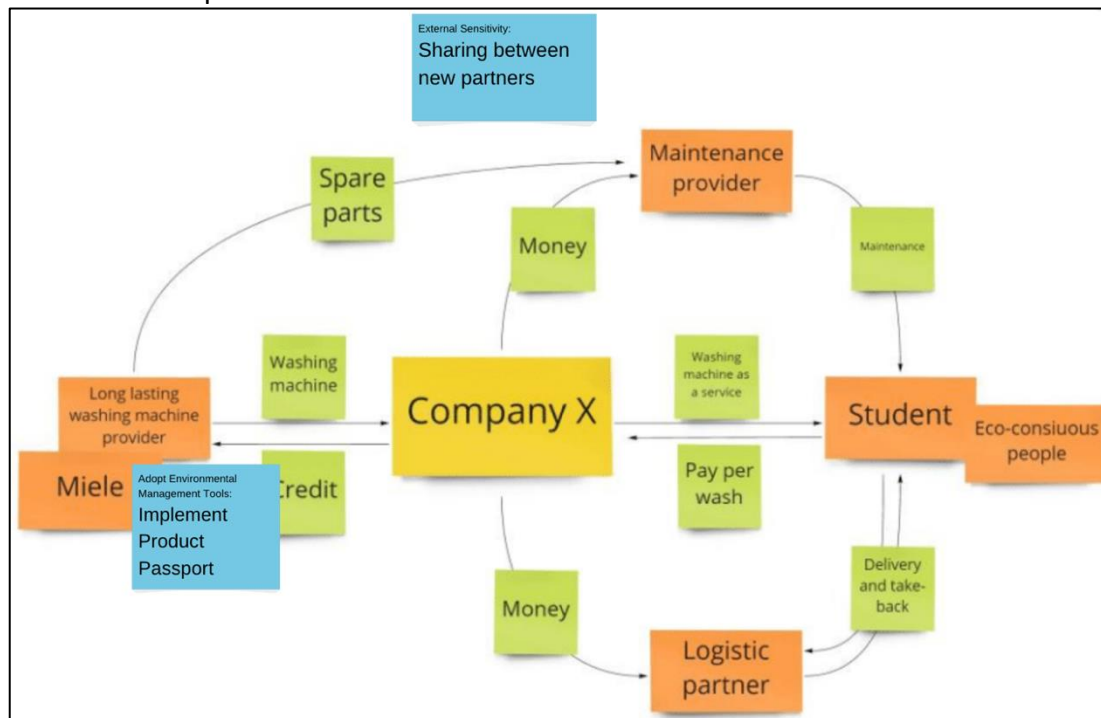


Figure 37: Value Exchange Map, adapted from Santa-Maria et al. (2021b)

After the placement of the capabilities on the map, value chain actors would need to negotiate **what, when and how** they develop the capabilities. What are the key milestones for developing said capability? By when should these milestones be achieved? How should these costs be shared in order to achieved a fair benefit that the collective value chain can benefit from? With these questions clarified, participants should also agree verbally or formally to a form of commitment. This is to build long term trust, nudge participants to approach the negotiations seriously and encourage lock-in. To increase the success of these negotiations, the facilitator could help guide the participant through bottlenecks by using elements of principled negotiation to identify the problem(s) and try and use said elements as inspiration to find practical solutions. Bottlenecks are thought of here as impasses between participants that slow or stall the negotiations process. The seven elements of principled negotiations to keep in mind when approaching the bottlenecks are identifying interests, separating people from the problem, using the best alternative to an agreement (BATNA), identifying options, using objective or legitimate criteria, creating commitment and good communication. The elements are elaborated in the principled negotiation sub-chapter (6.2.3) and thus will not be rehashed. In terms of practical approaches, for instance, if the facilitator think that participants are being too inflexible with their negotiations stance, the

facilitator could remind and guide the participants in identifying common interests and outlining their BATNA. If a bottleneck revolves around issues of trust and communication, the facilitator could guide participants to be more active listeners and set up some preliminary commitments and agreements. If participants are limited by the solutions, the facilitator could suggest quickly ideating solutions by doing a quick exercise; participants individually take 5 minutes to rapidly write down possible solutions on a paper, then they select the 5 best solutions to place on sticky notes, and finally collectively use dot voting to highlight the most promising solutions. If a bottleneck is consuming too much time and resources, the facilitator should encourage participants to move on to capabilities on the map that have not been addressed yet. These are just some suggested approaches. Other approaches could be just as or even more viable. The facilitator is encourage to approach these bottlenecks innovatively and flexibly, deviating from the given elements or suggestions if they do not neatly fit in or help solving the problem. To round off the Workshop, some final minutes should be dedicated towards reviewing the key findings of this workshop and ask participants to keep notes and pictures of the results. It is crucial that all the relevant info is documented and does not go to waste.

6.4 Final Feedback Round

This is as brief chapter that lays out the main arguments and points that emerged from the structured feedback on the final Capabilities Workshop prototype. To that end, a semi-structured Interview was conducted with TNO employees. This chapter explores the feedback given by TNO employees after they were presented with the final version of the Capabilities Workshop; clarifying the tools strengths, weaknesses and perceived usability. This section lays out the most salient feedback: first explaining how the feedback session went generally, then exploring the main points of feedback in detail, followed by briefly relating the feedback to the usability of the tool.

Overview of the main points of feedback on the final Capabilities Workshop prototype condensed into bullet points:

- Capabilities and their specific impact on a business model needs to be further developed. The language used in the tool should be made more legible.
- The Purpose of the tool needs to be clarified: If it is more ideational, evaluative or both, and what is its position in relation to similar tools.
- A test case would help clarify if the results generated by participants matched assumptions and would substantiate assumed variables.
- Structure in terms of buildup and pre-requisites are good, but may be compromised if capabilities are not further developed.
- Given further development, the tool would be seen to provide significant value.

General Impression of the Final Feedback Round

While these final feedback session on the Capabilities Workshop were semi-structured, the structured questions did not significantly contribute to the discussion. It was rather clear to the participants what were the key points needed to be addressed. For instance, the warm-up question revealed in both structured feedback sessions already half of the main arguments listed above. Thus, the author considers the main points of feedback that were given by the participants as significant. The effort to use usability to guide the feedback was, in the end, a rather mote endeavor. Due to the clarity by the TNO employees in the feedback needed, the main points of feedback would have likely been discovered in an unstructured approach.

Main Points of Feedback Round

All three TNO employees agreed on the need to further develop **capabilities** to improve the workshop's usability. As the Workshop currently stands, participants would likely find the capabilities too difficult to relate to, too difficult to understand and thus be limited in their findings. If the tool would make its capabilities more explicit, it would be much more practical and meaningful for participants. To this end, capabilities would need to be made more tangible and relatable. A deeper explanation would need to be made as to the reasons that a capability is impactful for a given business model. The TNO employees agree that with these improvements, participants would likely come to better results. Furthermore, there was concern that due to the novelty and academic language of capabilities, there was concern

that participants could face difficulties and disengage. These are language barriers that would need to be further reduced. The author suggests one possible solution is to take real world circular value chain transition that is being realized and hypothesize how various capabilities could help and impact their transition. This way, a story needs to form around the capabilities on its effects and impacts, further fleshing them out. This way, they are made more relatable and tangible. Another suggestion by the author is to take the previous suggestion and flip it on its head; take an ex-ante case of a failed/succeeded value chain transition and test the capabilities. This could help build the narrative around capabilities and directly link them to historical examples.

The **purpose** of the tool could be further clarified to make it insightful. There was still confusion as to the exact purpose of the tool; specifically, if it is ideational, evaluative or both. An ideational workshop would help participants generate ideas relating to a circular business model. An evaluative tool would determine how well a circular business model is 'developed' by evaluating it against a comparative. They were confident that a comparative could be somehow established given time and effort. Choosing either an ideational or evaluative purpose would significantly influence the placement of the tool. An ideation tool would be placed in the beginning process of business model development when the business model is still malleable. An evaluative tool would be placed at the end of the business model development process due to needing a concrete business model to evaluate. The purpose could also depend on if participants already had a clear end goal in mind or whether they are open to exploring different end goals. The author suggests that as the Capabilities Workshop tool stands, the tool somewhat does both, but lacks being explicit. It is positioned towards the end of the business model development process but has ideation elements. Thus, in order to clarify this, it is important to realize the purpose Capabilities Workshop in the context of a CBM strategizing process vis-à-vis other tools and value chain needs. Currently, the Workshop tries to evaluate the potential circular business model's capabilities, and also ideate potential solutions for improving the transition process. However, any comparatives are left implicitly for the participants to make. The current Workshop also depends on participants being willing to improve the business model and value chain structure. TNO employees emphasized that no matter if the tool was ideational, evaluative or both, it would provide value. Furthermore, while an employee in a separate interview also underlined the need to clarify the purpose, they focused more on the need to further clarify the positioning of the tool in relation to similar tools. This would help clarify why the Capabilities Workshop should be done and clarify its unique selling points. Note that while a weigh-off was done by the author in the background, see the inter-workshop changes chapter (5.3.2), it was not explicitly integrated into the presentation.

Two TNO employees explicitly expressed that a **test case** should be made to confirm if the results generated by participants matched the assumptions made by the author. Currently, the tool is limited by the author producing their own results. The employees expressed understanding that this is necessary for the earlier stages of tool development. However, as the Workshop currently stand, there is doubt that the results given by the author would match with the results participants would generate. If the capabilities and purpose of the tool would be further developed, the employees would feel more confident that participants would meet expectations. Furthermore, a test case could help further clarify important assumptions in given variables. Variables such as the application context within business model development, what type of value chain actors to include, if actors involved could be from different departments, etc.

A final main point was that all three TNO employees **saw potential** in the tool and were satisfied with the overall structure. They thought that with improvements, the Capabilities Workshop could provide significant value for circular business model development. The structure in terms of buildup and prerequisites are overall good. However, one TNO employee emphasized that the difficulty for participants to understand capabilities could undermine the reliability of the tool.

Based on the summary of the above given feedback, one could argue that there is potential for the Workshop tool to be usable and practical. However, this would require further development of the Capabilities Workshop. TNO employees indicate that **the tool needs further development to become significantly usable**. As the tool currently stand, its usability and practicality of the tool are limited. All the usability categories; those being learnability, reliability and satisfaction, would improve with further development of dynamic capabilities and purpose.

7 Conclusion & Discussion

The discussion chapter gives an overall picture of the research findings, wrapping up the thesis. The discussion is tackled first by addressing the overall conclusion (7.1); reiterating what the thesis set out to do and relaying the main findings. Then the reflection section further substantiates said findings and their contribution (7.2). Following the reflection, the dominant limitations of the thesis are outlined (7.3), elaborated upon and suggested how they could have been overcome. Finally, based on the findings, further research avenues are suggested (7.4).

7.1 Conclusion

The underlying issue the thesis is predicated on is the current lack of research for value chain transitioning in the Circular Economy (CE). This thesis aimed to contribute to the field of Circular Business Model Innovation, on how value chain actors could collectively approach transitioning from a linear to a more circular value chain. TNO, the company where the internship thesis was placed, identified value chain transitioning as an integral part of the CE transition, because businesses are still lacking the knowledge to implement the value chain transition. Therefore, as part of the author's thesis internship, TNO wanted a tool prototype to be designed that could help fill the gap in knowledge and practical implementation needed to transition towards a circular value chain. With this in mind, this thesis set out to answer its main research question: *What conceptual inputs and subsequent practical approaches can be used in a tool that aims to help value chain actors transition towards a more sustainable and circular shared business model?*

To answer this question, four sub-research questions were posed. The first asked which impact assessment could be used as an input for a tool. This was done in the hopes of ensuring the social and environmental sustainability of the value chain transition. Impact assessments based on life cycle analyses were identified by the author as most suitable. However, impact assessments could eventually not be practically integrated into the tool that was designed. To still ensure that the circular transition would also be a sustainable one, sustainability was integrated into the tools' design.

The second sub-question asked what conditions could be used to enhance and operationalize the circular transition as input for a tool. These conditions should help clarify what elements may play a positive role in the ability for the value chain to transition. Logically, this should provide knowledge for value chain actors on what to focus on when they want to transition. From this review of conditions, capabilities emerged as a useful concept. Capabilities helped categorize what conditions could a value chain directly influence to potentially improve their transition towards a more circular state. Capabilities would later be practically implemented into the tool, providing the tools substantive basis.

The third sub-question asked what elements that constitute a useful tool should be included or excluded via iterative feedback. This was done to translate conceptual inputs into practical insights and drive tool development. TNO employees delivered the iterative feedback, adding their practical knowledge. Next to highlighting the impact assessment practical difficulties and underlining the practical strengths of capabilities, the feedback sessions helped inform tool development itself. Specifically, the sessions found design thinking as the most useful concept to guide tool development. A sprint style workshop was quickly seen as the best format to be used for the tool. It incorporated design thinking principles and provided examples, as well as patterns to follow. The sprint format would come to structure the final tool prototype.

The fourth and final sub-question asked how useful the tool is via a final feedback round. The final feedback round was done to determine if the final tool prototype, the Capabilities Sprint Workshop, could contribute towards value chain transitioning. TNO employees saw potential in the Capabilities Workshop to help value chains transition and mitigate transition risks. However, two main caveats needed to be resolved: The tool would need to more deeply substantiate capabilities and their impact on the business model, as well as delineate if the tool's role is ideational, evaluative or both.

Overall, a tool founded on capabilities, structured through design thinking and translated into the Capabilities Sprint Workshop, could be a tool candidate to help value chain transitioning. With the caveats addressed, the tool may provide an approach for value chain actors to transition towards a more sustainable and circular value chain.

7.2 Reflection on results

This chapter will elaborate upon the main findings of each sub-research question. While the conclusion (7.1) already gives a brief overview of these main findings, this chapter aims to give a more detailed elaboration. Note that these elaborated main findings build upon the work of previous chapters. The elaboration of the main findings will be done by approaching each of the four sub-research questions in sequential order. As a short-hand, each of the sub-research sections has a main theme: The first regards impacts assessments, the second regards capabilities, the third regards design thinking, and the fourth regards final feedback round.

First Sub-Research Question - The Impact Assessments

The first sub-research question asked: *Which impact assessments derived from the circular economy literature could be used to measure the sustainable impact of the value chain?* This was done in the hopes of ensuring the social and environmental sustainability of the value chain transition. As explained in the introduction (1.0), the Circular Economy (CE) is not necessarily a sustainable one. Thus it was thought that inputting an impact assessment into the tool could mitigate this.

In short, the sustainable impact assessment review, as well as its integration into a tool, was less productive in its findings. When comparing the different types of impact assessment, namely, framework assessments, single indicator assessments, in-house assessments and exploratory assessments, **Life Cycle Analysis (LCA)** assessments stood out in addressing both the planetary boundaries and social foundations. LCA is an impact assessment that keeps track of environmental and or social impacts born across the entire lifecycle of, typically, a product. Planetary boundaries quantitatively define the safe operating limit for humans within certain biophysical categories, whilst social foundations take the view that certain social foundations should be met to achieve a minimum of wellbeing (Rockström et al., 2009; Raworth, 2017). While all previewed assessments struggled to create a completely holistic assessment framework, especially regarding the social foundations, assessments that had LCA as a guiding structure fared best. Of the LCA's, **Cradle-to-Cradle** fared best in incorporating this holistic perspective, whilst **Hotspot Scan** compromised best regarding practical considerations. Cradle-to-Cradle is a philosophy and certification system that adopts circular and life-cycle thinking to assess social and environmental impacts. Hotspot Scan is a self-assessment tool developed by TNO which allows users with little knowledge, time and data at hand to get a quick overview of the main 'hot spots' of a product's environmental and social impacts. Practical considerations were tool relevant factors such as time, resources, and output.

Insights from the assessment struggled to be implemented in a practical fashion. Any sustainable assessment that went beyond a very simple overview made the tool overly complex and thus impractical to the user. The tool could not tackle impact assessment along with capabilities without compromising practicality. As can be seen in the pivot chapter (5.3.1), this was the case for an excel based tool and presumably would have been the case for a workshop based tool. Therefore, any LCA that could be done with any significance would have been best done outside of the tool itself. Whilst the impact assessments could not be successfully implemented, the goal of providing a circular and sustainable tool was not

divorced from tool development. To nevertheless ensure a both circular and sustainable tool, two actions were taken: Integration of sustainability into tool design and into capabilities. Sustainable considerations were kept in mind during **tool design**. The Capabilities Workshop, which is the final tool prototype proposed, relies upon there being a future circular business model (CBM) that it can work with and set as a goal. The Workshop emphasizes to participants the need for the CBM to have undergone a sustainable impact review. If that is based on an LCA, even better. Furthermore, the facilitator of the Capabilities Workshop is encouraged to underline the need for sustainable circularity. They are further encouraged to include exercises that check the sustainable impact of a business model if such is lacking. Furthermore, the given **capabilities** frequently have sustainability as an underlying influence. It is assumed that this should result in users implicitly being more considerate towards sustainable circularity. For instance, the capabilities, ‘emphasizing the need for holistic thinking’, ‘using sustainably oriented instruments’, ‘delineating sustainable solutions’ and ‘cultivating a sustainable innovation culture’ would be the underlying capabilities that would encourage actors towards more sustainable circularity.

Overall, while this research does not exclude impact assessments being a valuable way to determine environmental and sustainable impact, the assessments could not be practically implemented within the thesis’s developed tool. Sustainability is assumed to be ensured by underlining its importance through the tool’s design and through the capabilities it uses.

The Second Sub-Research Question - Capabilities

The second sub-research question asked: *Which conditions to enhance and operationalize the transition towards a circular value chain can be derived from the circular business model literature?* As elaborated upon in the conceptual background (2.2), conditions are meant to cover elements that may be a force that exerts change towards a circular business model. Logically, by identifying what elements may play a role for a value chain to transition, this should provide knowledge what to focus on when value chain actors want to transition.

During the identification of conditions through a brief structured review of the circular business model innovation (CBMI) literature, capabilities emerged as a cornerstone concept. Capabilities from said literature specifically look at the “organizational capabilities that firms apply to identify, develop, and implement new business models, particularly in uncertain, volatile and complex environments” (Teece et al., 2007; Santa-Maria et al., 2022a, p. 1309). Thus, capabilities underline the ability of the business itself to enact change. With that in mind, capabilities here are conditions which are directly influenceable by value chain actors and which can improve the transition towards a circular business model. Note that while capabilities are conditions, not all conditions are capabilities. Capabilities were a productive concept for **three key reasons**. Firstly, the concept of capabilities were used to successfully categorize and operationalize conditions identified in the literature. Secondly, capabilities allowed actors to focus on conditions they could influence and thus improve upon. Finally, capabilities could be used to identify capability gaps within the current value chain, which could inform negotiations between value chain actors.

The **categorization** prescribed by the capabilities literature was useful in identifying and operationalising conditions for transitioning. Capabilities followed a categorization of ‘sensing’ opportunities, ‘seizing’ upon said opportunities, and ‘reconfiguring’ their resources to align with opportunity seizure (Teece, 2007). As seen in the substantive input chapter (4.0),

conditions that related to a more successful transition and which could be internally influenced were covered by these capability categories. Within these categories, the capabilities could be operationalized via the practices found in micro-foundations. Micro-foundations are, in short, overarching themes of bundled practices, and act as a bridge to connect bundled practices with the main capability categories. Practices were the collection of different specific capability practices found in the literature review. These bundled practices are the main way of operationalizing capabilities. These three layers of main capability categories, their associated micro-foundations and their specific practices, are all technically 'capabilities' but serve the purpose of giving different layers of detail. See Appendix A for a complete overview of this three layered structure.

Capabilities also allowed the possibility for business actors to focus on **influenceable conditions**, which was seen by the author as one of the tool's main relevancies. As elaborated in the inter-workshop transition chapter (5.3), this helped differentiate the Capabilities Sprint Workshop from other tools. Within this research, there was a differentiation made between internal and external influence. The literature had a wide practice of thinking in terms of 'drivers' and 'barriers' when it came to transitioning. However, there was often a lack of differentiation between drivers & barriers that businesses could directly influence and drivers & barriers which businesses were several steps removed from influencing (Geissdoerfer et al., 2022; Werning & Spinler, 2020; Hina et al., 2022). It was also challenging to differentiate articles using drivers & barriers from articles using capabilities. Thus, next to internal capabilities that are more easily influenceable, external drivers and barriers that are less influenceable were also catalogued. Through this thesis specific framework of capabilities and drivers & barriers, many elements of the organizational change process could be accounted for. The emphasis on differentiating internal and external conditions would help shape and inform the tool, providing actors options in what they can influence and thus improve upon.

Finally, **capability gaps** could be identified and thus provide a gravity for discussion in eventual value chain negotiations. Capability gaps are essentially the difference between the capabilities needed for the future CBM and the capabilities present in the current linear BM. TNO, as mentioned in the Introduction (1.0), wanted a tool that was able to identify hurdles that could bottleneck the adaptation process. The capabilities gap contributes to this by helping prioritise these 'capability bottlenecks'. By highlighting the most pertinent gaps for the shared selected business model, value chain actors could address the most pressing capabilities in their negotiations.

Third Sub-research Question – Design Thinking

The third sub-research question asked: *Based on feedback from an iterative feedback process, which elements that could constitute a useful tool should be included and excluded?* This was done to orient the inputs and processes of the tool in a practical direction. Without aligning the practical needs of the user with the tool's content, the tool will only have a limited impact. The practicality of the tool was determined through feedback sessions with TNO employees who were experienced in what constitutes a practical tool. As outlined in methods chapter (3.3), feedback sessions were one-on-one and group discussions with TNO employees centred around the tool's development. Having a back and forth between the author designing an iteration of the tool, and then receiving feedback on said iteration, drove tool progression. While previous sections already covered the practical aspects of the main inputs of the tool,

this section will focus more on design thinking, which was the final fundamental concept that informed and steered the tool's design in a useful and practical direction.

With that being said, this section will first address design science and why it was replaced by design thinking. Before the usage of design thinking, **design science** was an initial concept used for tool development that emerged from the feedback sessions. Design science aims at creating insights into how tools can be efficiently and effectively analyzed, designed, implemented, managed and used (Hevner, 2004). However, it also became apparent in following feedback sessions, that design science is more suitable for tool evaluation and nudged the tool development into a more quantitative direction. As elaborated in the pivot chapter (5.3.1), the excel version of the tool that partially resulted from this orientation at the beginning of tool development was too complex and unproductive. The main issue was that it could not adequately incorporate collaborative development that would be necessary for a value chain transition. Design science, in some ways, hindered tool development when taking the role of the main source to structure the tool.

What emerged from following the feedback sessions was a new shift towards **design thinking** as the core concept for tool development. Design thinking is a solution based approach that seeks to identify the problem, ideate strategies and ultimately provide a solution (Dam & Siang, 2021; Geissdoerfer et al. 2016). Design thinking, compared to design science, provided a much more focused approach to tool development. As elaborated in the conceptual background (2.2), design thinking offered more concrete principles to follow and gave a simple five step process (empathise, define, ideate, prototype, test) on how a tool should be designed. With design thinking, the tool's practical goals could be aligned with their contents. This became even more focused when the tool adopted the **Sprint Workshop** format. Sprint Workshops are workshops that aim to bring as many insights as in little time as possible, relying on their purposeful structure to achieve this. The feedback session suggested, rather straightforwardly, that sprint style workshop was a natural succession to the previous excel styled tool approach. This is due to sprints being built upon design thinking practices and principles. Furthermore, there were examples to be found of sprint style workshops, which greatly helped inspire the tool's design (Knapp et al., 2016; Santa-Maria et al., 2022b; Jonathan Courtney, 2020). Design thinking, and specifically the Sprint Workshop format, enabled the tool to follow a more collective approach to exploring, identifying and negotiating capability gaps between value chain actors not possible in the excel format. This approach should thus help the tool in enabling better insights by value chain actors into their collective transitioning.

Fourth Sub-research Question – Final Feedback Round

The fourth sub-research question asked: *To what extent is the final version of the tool useful based on the final feedback round?* This was done to evaluate the final tool prototype/iteration on its practicality and usefulness, allowing a concise overview of the final state of the tool and its future direction. Usefulness, as explored in methods chapter (3.3), was a category inspired by the design science based scholar Nielson (1993) and Holzinger et al. (2008) to evaluate the tool's usability or how practical it was. The final feedback round was similar to a feedback session. The main difference was that it was recorded and oriented towards tool evaluation rather than tool improvement.

Determining the tool's usefulness could only be done to a limited extent since the tool is not fully matured. Any insights on usefulness are thus limited and based on predictions by the author and TNO employees. One of the main points from the feedback round that tied into this is that the tool needs to be **tested** in a practical setting. Testing a tool with target users and varied stakeholders could give insights and test assumptions. According to the TNO employees, to reach a testable state, there were mainly two obstacles. The first obstacle was that the tool did not seem to take a stance yet if it was **ideational, evaluative or both**. Ideational in that the tool aims to bring forth capabilities that could be used as building blocks for further developing a CBM. Evaluative in that such a tool aims to judge what capabilities it meets compared to a given standard. The tool currently is to some extent both ideational and evaluative, but the tool needs to be more explicit in the direction it takes. The second obstacle was that the tool needs to connect capabilities to the **business model impact**. It would further clarify capabilities and a concept, and deepen how useful the tool is for the users. Currently, the practices suggested to help identify capabilities are too descriptive. If the practices would be further elaborated upon and connected to business model potential outcomes, this could further solidify the tool. This would also reduce abstraction and ease the somewhat present academic language barrier, likely increasing the usability of the tool. The author suggests a way to clarify this is to either take an ex-ante or ex-post case study analysis on failed/succeeded circular value chain transitions and test the capabilities against it. This should help form more concrete stories around the capabilities potential effect and impacts. The author judges that all these points given in the feedback round, given time, could be resolved. TNO employees thought that if all these points were resolved, they could envision the tool having a useful and practical benefit.

7.3 Reflection on research approach

This sub-chapter will explore the most important points regarding the research approach. Three points - namely, the higher than expected workload, the tool's lack of maturity, and the limits of the literature - are discussed. Each point is addressed by first describing the point itself and outlining its importance. The nature of said points is then explored and contextualized. Finally, suggestions on lessons for the future are explored.

One of the main points regarding the reflection on the research approach was the **unexpected workload**. Specifically, the time investment needed into tool development itself was misjudged. This misjudgement in time investment resulted in not developing the tool into full maturity. This misjudgement happened despite receiving an approval for the research proposal. If supervisors did not see an issue, why was it then misjudged? This has mainly to do with the feedback session with TNO employees. TNO employees had de facto power to dictate the pace of tool development. Without the feedback sessions, a subjectively mature tool would have probably been developed. However, a tool developed without TNO feedback would have likely been a suboptimal tool. Valuable insights were gathered through the feedback process; guard railing the tool to continuously re-aligning with its aim of having a practical application. Thus, despite the final tool prototype not being fully mature, it provides more value and insights than what would have been produced without TNO input. A main lesson the author took away from the feedback sessions was the necessity to allocate enough time to fully understand and align with the expectation of TNO on the problem the researcher should tackle. Research should have begun with completely clarifying the problem, and paying more attention if everyone was aligned with the direction of the thesis. This could have made tool development more efficient.

A related but further point is the **lack of a mature prototype**. A fully mature tool would have had a sufficiently in-depth capabilities structure and would have been tested in a practical setting. Currently, the final Capabilities Workshop prototype, as outlined in the final feedback round (6.4), could have more in-depth capabilities and be explicitly connected to business model impacts. It also remains untested in a practical setting. This is important since it limits the insights on how useful the tool is and to what extent it can contribute to the field of circular business mode innovation on a practical level. While insights could be formed from the tool as proposed, nonetheless, not enough time had been allocated to the stage of tool development, thus the Capabilities Workshop ended up being more superficial than what would have been optimal. As outlined in final feedback round (6.4), many assumptions had to be made by the author on how participants would act and the type of insights they would make. This was a necessary step in order to design the tool in the first place. However, what ideally should follow up from this would be testing how these assumptions aligned or conflicted with reality. That being said, given the circumstances, the Capabilities Workshop provides insights into what concepts could be used and how to use them to create a tool focused on aiding value chain actors to transition towards a more circular value chain. As outlined in the last chapter, a slow but critical approach provided more value than a completed but hasted approach.

Another point was how the **capabilities literature** had a limiting effect on the insights the Capabilities Workshop tool could provide. Ideally, the capabilities literature would have summarized a collection of literature that investigated the transitioning of value chain actors towards a collaborative circular business model and or shared value chain. Currently, most of

the literature that was analysed takes a rather business unit view, with the value chain only partially addressed, if at all. CBMI literature that focused on the value chain was simply too sparse. This limitation weakens the accuracy that can be given through the capabilities, since they may not be appropriate for a value chain context. This was accepted since the available capabilities would have otherwise been sparse, limited to only a handful. Capabilities related to 'sensing and shaping new opportunity' would have been overlooked altogether if only using value chain focused literature! The author judges that this is not due to sensing capabilities not being relevant to the value chain, but that the research in this direction is lacking. Thus, even if the capabilities may not be context accurate by having a business unit bias, that does not necessarily make them wrong. A possible solution would be to simply bite the bullet and only use value chain specific literature. The findings may be more sparse, but there would be more assurance in the capabilities presented. The usage of capabilities may not be as well rounded, but such limitations do not necessarily prevent useful insights and advice. However, the author opted for a more well-rounded approach. Because a value chain is in its parts a collection of business units, the author assumed that many business unit specific insights are to some degree also relevant for a value chain perspective.

7.4 Contribution & Further Research

This section will outline how precisely the insights in this thesis contributed to the academic field, and what further research avenues could be explored. This section will first outline its contribution to the research gap by reiterating the research gap tackled and how said contribution helped address said research gap. Afterwards, three further topics to research are addressed: Collective value chain transition, capabilities and drivers & barriers interaction, and tool development. Each topic is tackled by describing it, emphasizing its importance and elaborating on how it could initially be tackled.

As outlined in the Introduction (1.0), the main research gap this thesis wanted to address and contribute towards, is the deficiency in practical tools that help value chain actors collectively transition towards a circular value chain. This is built upon several insights: Value chains, whilst being important, are under addressed for the CE transition and to that extent the CBMI literature. There is a need to identify conditions that promote a smoother transition of the value chain. Businesses struggle to translate CE insights into practice. Finally, there is a lack of practical tools that address these previous insights.

The Circular Sprint Workshop contributes to the research gap and in various degrees to the beforementioned insights. Namely, the Capabilities Workshop puts **value chains** at the centre of its design, allowing for collaboration and eventual negotiation. By using design thinking principles and sprint workshop techniques, the collaboration of value chain actors is placed in the centre. This allows insights into business actors of a shared value chain to inform the value chain transition. Room is made for an actor to negotiate with one another on how these insights can be improved and implemented. Furthermore, the research has made inroads into what **capabilities** could help value chain actors improve their circular transitional ability by outlining what conditions they can directly influence and improve upon to increase their transitional ability. First attempts have been made in using the CBMI literature to orient around what gives value chain actors the ability to more smoothly transition towards a circular value chain. Further operationalization of these insights has been done for users to better grasp what may be important for transitioning. Finally, the most significant contribution of this thesis is the Capabilities Workshop. The Workshop was proposed to fill the gap in **lacking tools**, with an aim to help translate CE insights into the practice of their value chain transition. Compared to the Business Model Canvas, which focuses on what makes a good CBM, or the Business Model Roadmap, which focuses on when to enact what CBM aspect, the Capabilities Workshop focuses on what conditions help make the value chain transition a less risky endeavour. By aiming to identify, improve upon and implement capabilities that could be considered good practice for transitioning, the transition should ideally be made more smoothly and successfully. By addressing in varying degrees the previously listed insights, the Capabilities Workshop contributed to filling the research gap in the lack of practical tools that help value chain actors collectively transition towards a circular value chain.

Given the contributions of the Capabilities Workshop, some further limits and insights that could be tackled as a separate or connected research avenue. Firstly, of course, the **tool proposed** in this thesis could be further developed. From the final feedback session, we can see that there may be potential in the tool. A mature tool could lead to more impactful contributions to the field of CBMI. Tool development itself could also lead to further insights,

especially in terms of what does and does not work in a practical test. In the best case scenario, the tool could be a further resource next to value chain maps and business model tools in helping progress the CE transition. As outlined in the previous final feedback round (6.4), the Capabilities Workshop has some main rather straightforward improvements: the purpose of the tool needs to be settled, capabilities connected to business model impacts and practically tested against the assumptions made. Reduction in overcomplexity and reduction in technocratic language would then likely follow.

There seemed to be some implicit **interaction** and connections within and between internal capabilities and external drivers and barriers. Maria A. Franco (2017) explicitly outlined how different internal capabilities⁷ affect one another or how some barriers affect only specific value chain actors. In their paper, the capability ‘collaboration’ would have an effect on the capability ‘business model development’ or how the barrier ‘consumer demand’ would disproportionately affect the retailer. Kirchherr et al. (2018) outlined several internal and external barriers to CE implementation in the EU, with their effects being linked into a chain reaction. There was not enough literature that took these interactions into account to make this a meaningful aspect of the Capabilities Workshop. Exploring and understanding these interactions could however add another dimension towards the circular business model transition. It could help further pinpoint which capabilities value chain actors should address to achieve maximum impact in the form of interaction and chain reaction. The capabilities interaction could also be extended further by then connecting the capabilities to the impact on the business model and value chain.

As was apparent in the previous sub-chapter (7.3), the CBMI literature focusing on **collective value chain transition** is lacking. Much of the literature focuses on the business unit or addresses the supply chain, with less attention on a value chain wide scope. As addressed by Lennartz, the Circular Economy often requires more collaboration between value chain actors (2021). Therefore, investigating what conditions improve a value chain transition towards a more circular value chain would be a salient topic. Many researchers found success in outlining conditions for transitioning by accompanying and interviewing a business on their transition journey (Jonker et al., 2020; Klitsie, 2021; Bojesson & Fundin, 2020; Santa-Maria et al., 2022a) through group discussion (Bastein & P. J. Willems, 2019) or through surveys (Roos Lindgreen et al., 2022; Salvador et al., 2021) rather than a literature review. That being said, the closest article found that comes to addressing value chain transitioning is by Konietzko et al., who outlines a set of principles for three circular value chain relations (2020). It was discovered very late in the thesis and thus could not be fully integrated. However, it would have likely been a key foundation of the literature review due to its relevant insights and could be a good starting point for further collective value chain transition research. This could also be done with several actors from a shared value chain and or shared business model which is transitioning or has transitioned. Focusing on specific contextual factors, such as the type of CBM used, the type of businesses present, the type of industry they are nested in and the geopolitical context, could further enhance the applicability of the insights.

⁷ He focused on ‘barriers’ but according to the thesis definition on capabilities, could have been considered as unmet internal capabilities.

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Appendix

Appendix A

Results from the conditions for transitioning literature review. Final categorisation visually mapped.

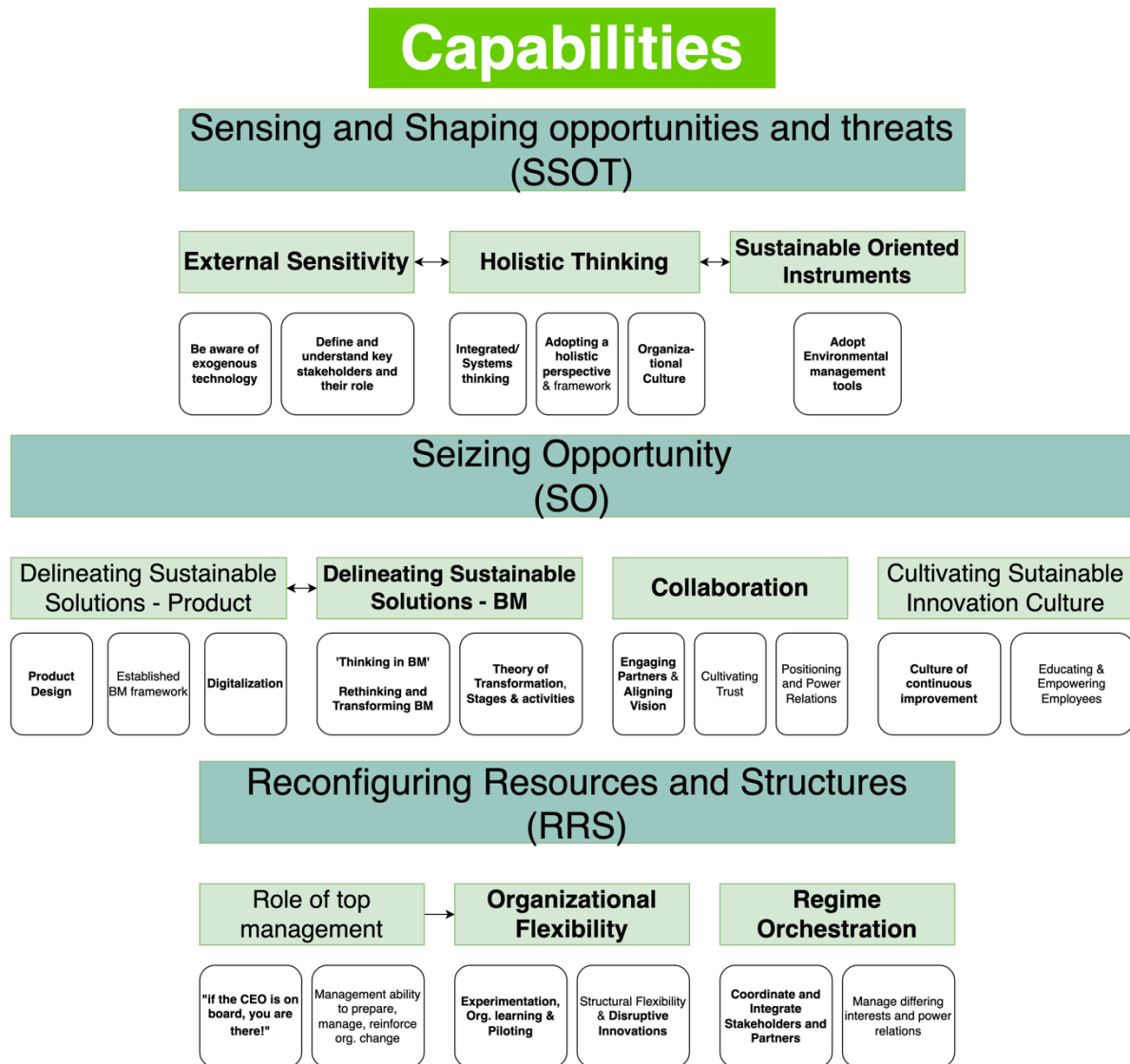


Figure A1. The Capabilities Map.

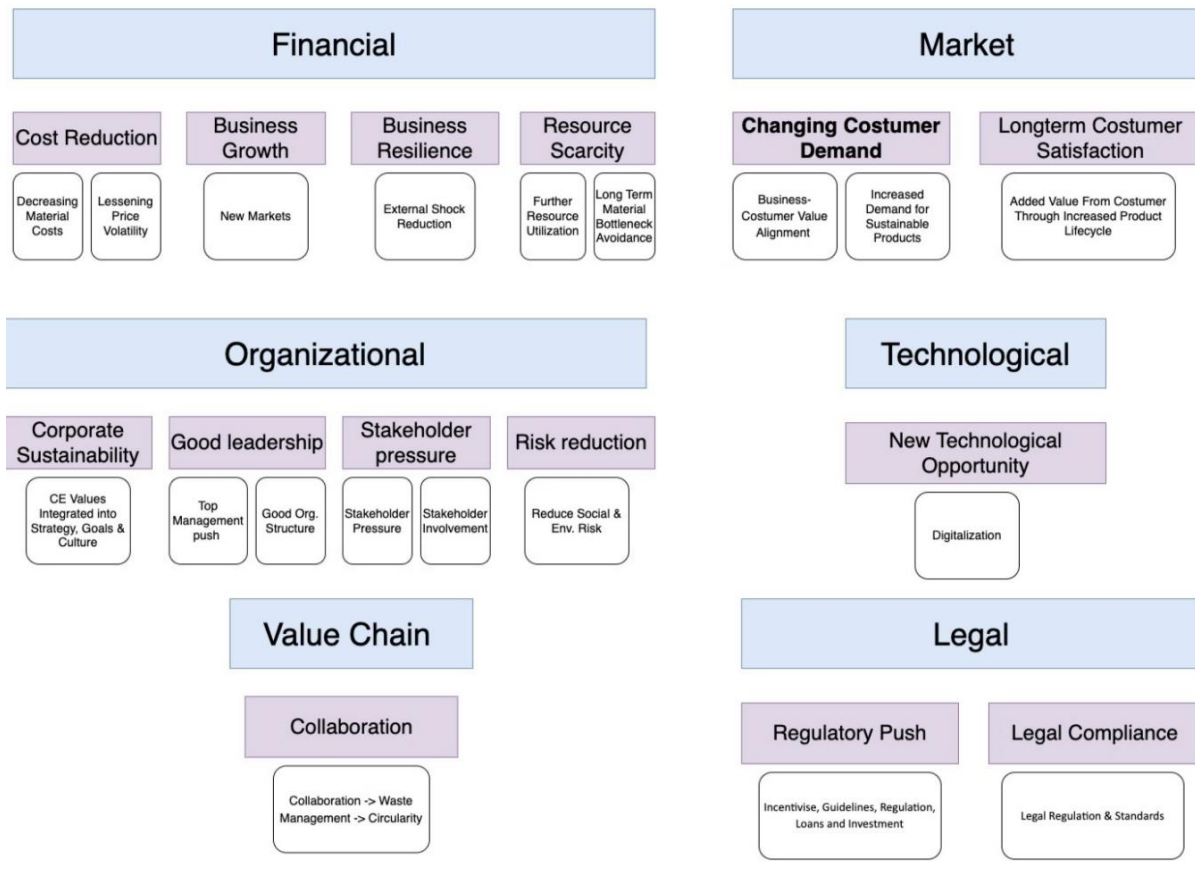


Figure A2. The Drivers Map.

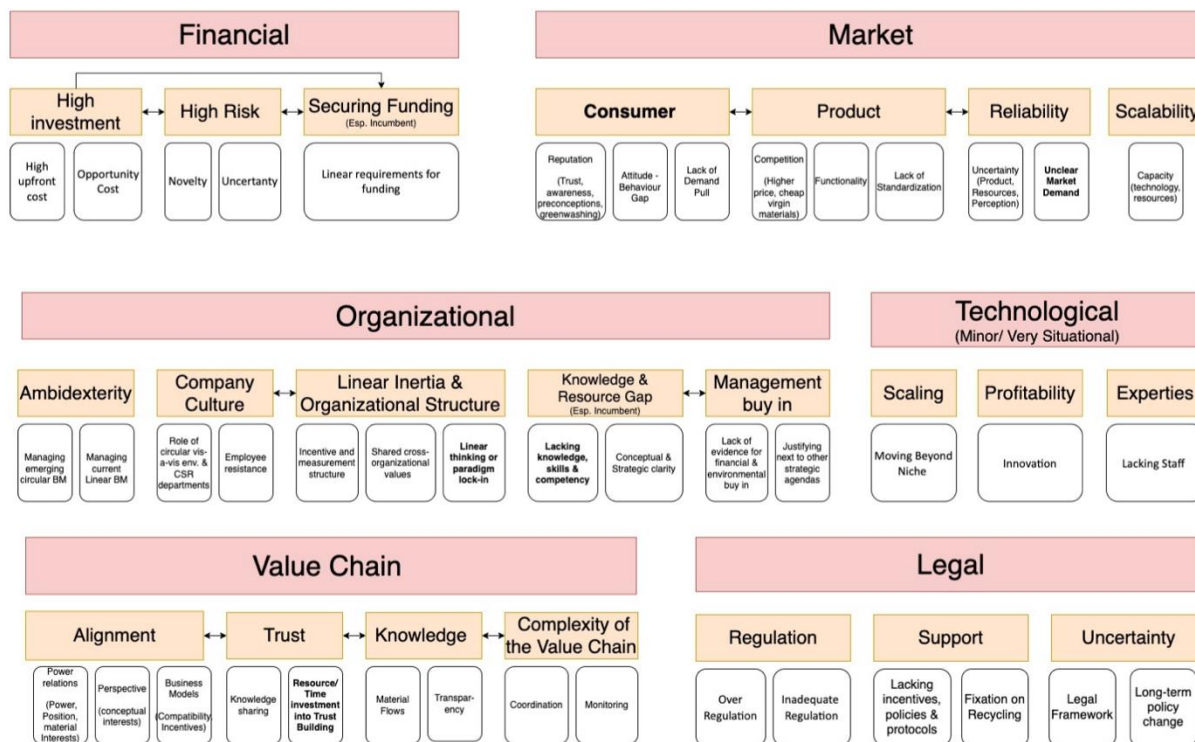


Figure A3. The Drivers Map.

Appendix B

Mock-up of the second version of the excel tool. Note that 'Comments' were made by the author while the 'Feedback' is not from TNO employees but from a close friend to the author. The images are in chronological order, with the thick black lines outlining the edges of the excel sheet. The dotted line was supposed to highlight that the section to the right of was collapsible. This was typically additional info.

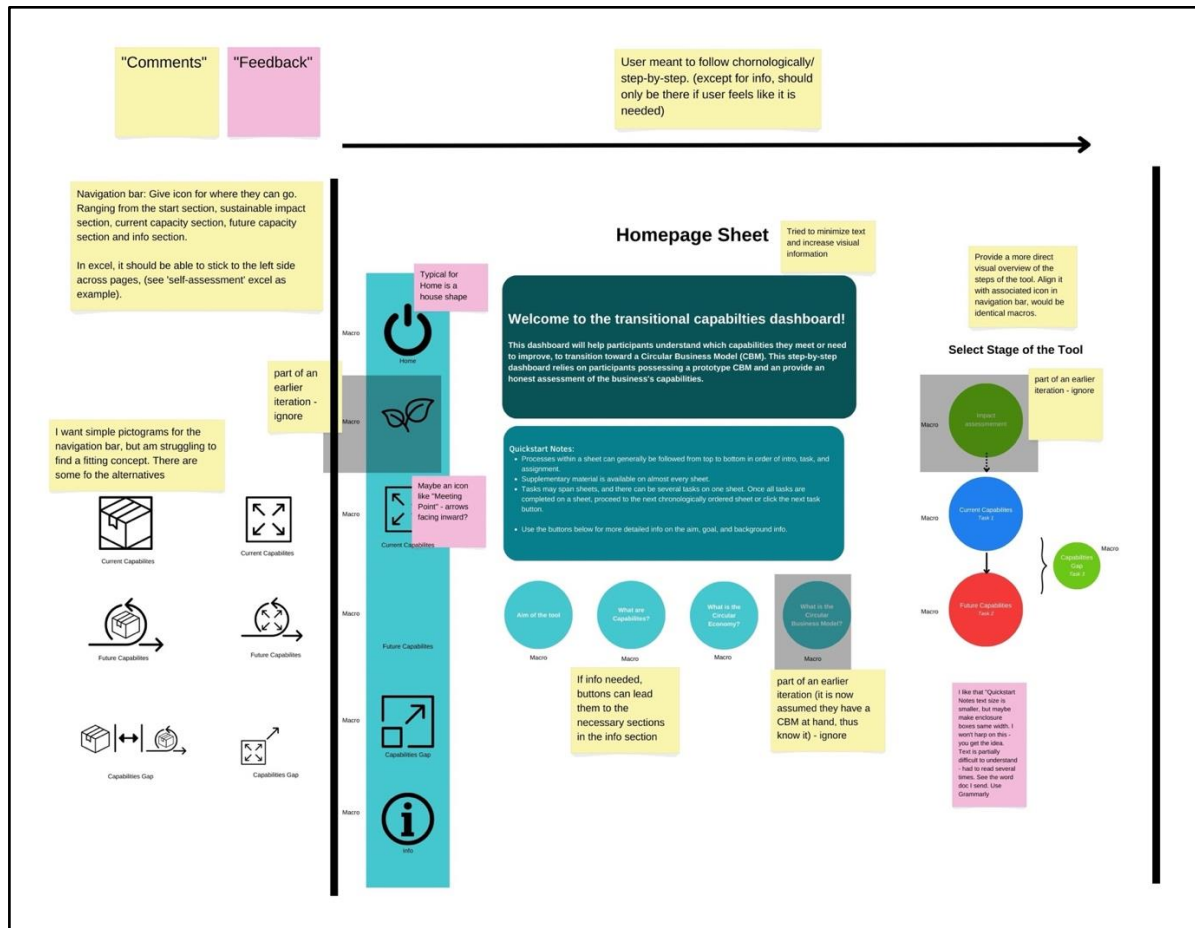


Figure B1: Homepage

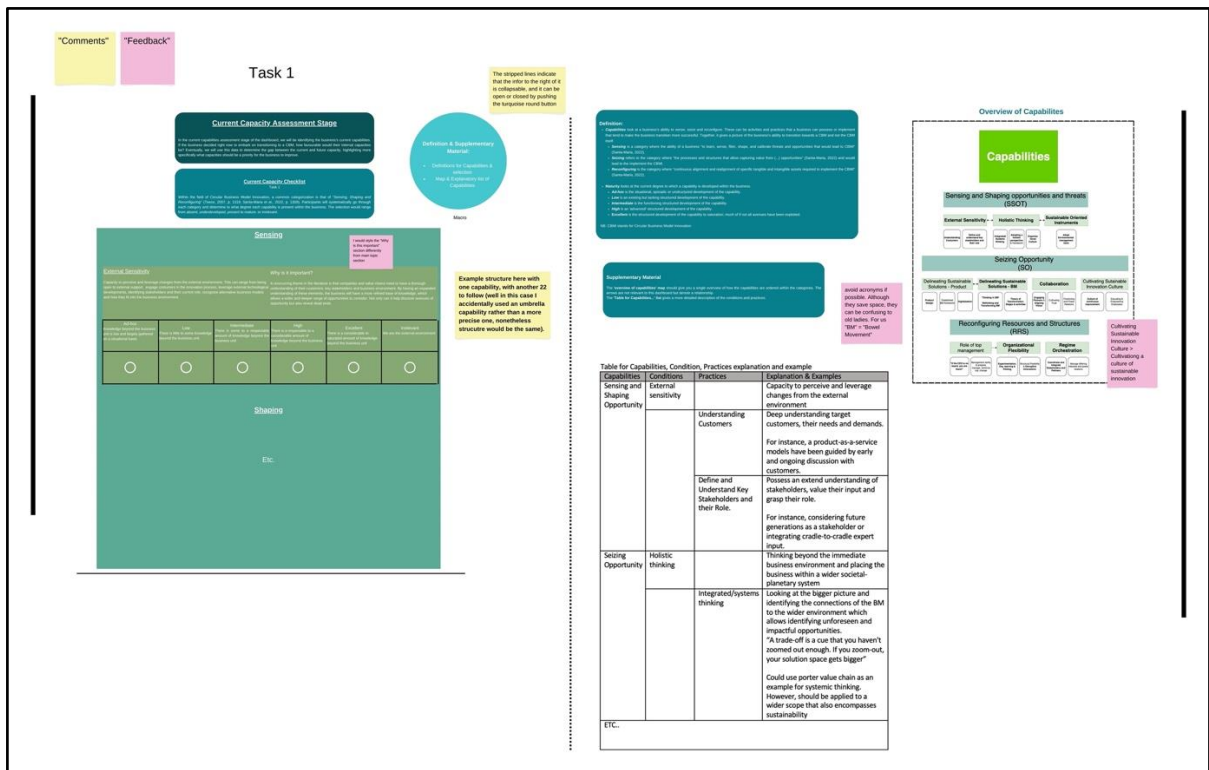


Figure B2. Task 1 – Current Capacity.

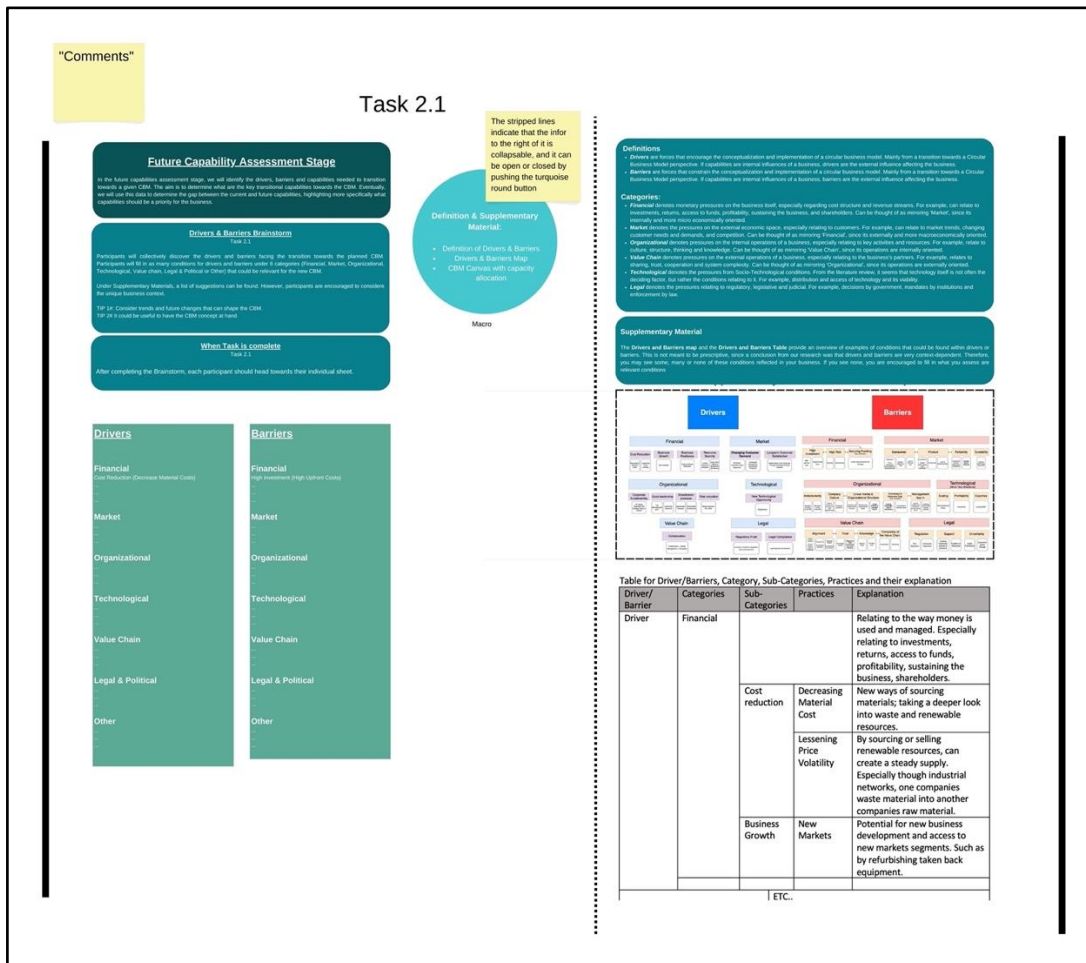


Figure B3. Task 2.1 – Drivers & Barriers Brainstorm

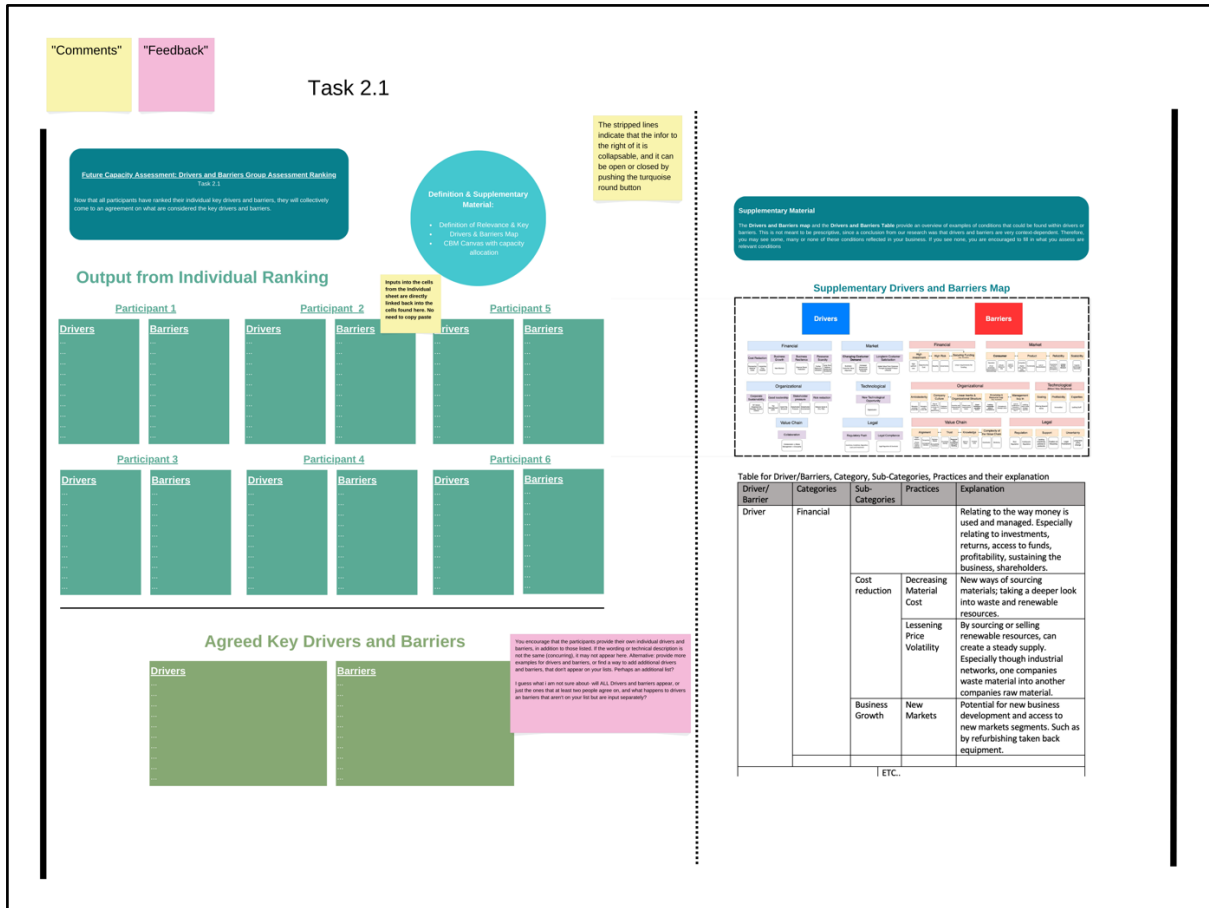


Figure B4. Task 2.1 – Drivers & Barriers Ranking

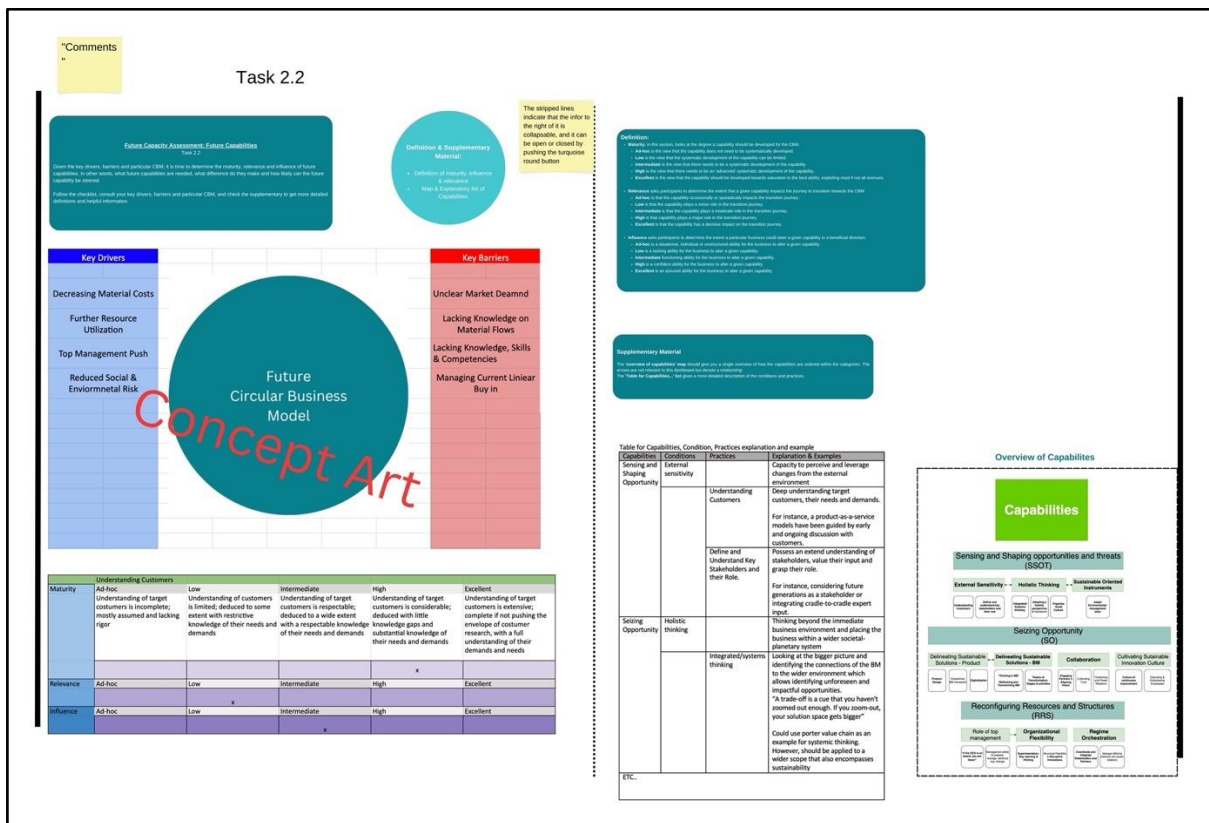


Figure B5. Task 2.2 - Future Capabilities.

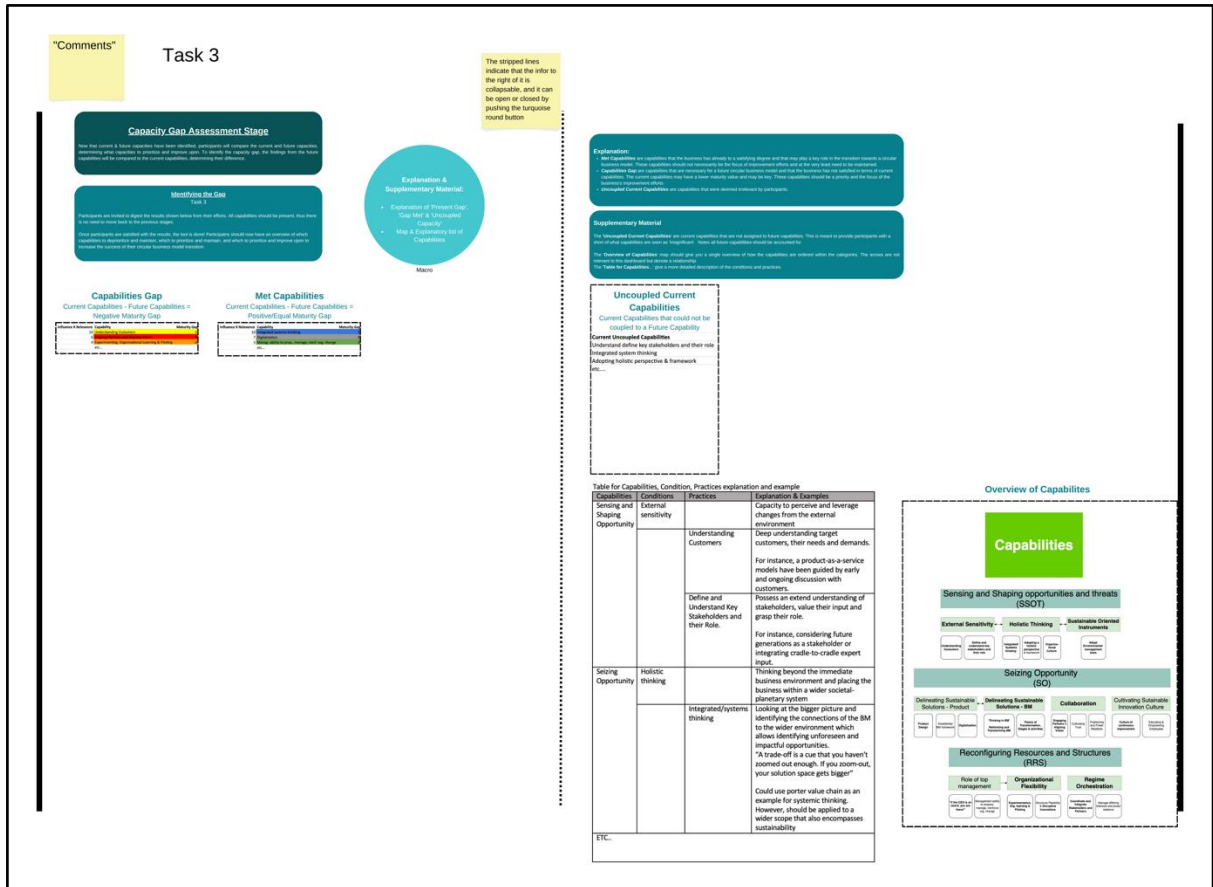


Figure B6. Task 3 - Capabilities Gap.

Slides from the final presentation to TNO employees. Specifically, the slides that explained the what and why of capabilities (C1-C4) and the main steps of the workshop (C5-C18).⁸

What are (Dynamic) Capabilities?

- ▶ Dynamic Capabilities stems from the ‘resource’ perspective in business management.
 - ▶ Competitiveness stems from leveraging resources such as **knowledge, skills, technology, and organizational culture** (Barney, 1991).
- ▶ Dynamic Capabilities were design to answer how to “achieve competitive advantage ‘...’ in **regimes of rapid change**”, such as the CE regime (Teece et al., 1997, p. 509; Peteraf et al., 2013).
 - ▶ Literature suggests **strong capabilities lead to effective BM transformation** (Teece, 2018).
 - ▶ Organizational Capabilities are more of product central in comparison and are not the focus of the workshop.

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Figure C1. What Capabilities (1/2).

What are (Dynamic) Capabilities?

- ▶ Dynamic capabilities (henceforth capabilities) are a firm’s ability to successfully “**integrate, build, and reconfigure** internal and external competencies to address rapidly changing environments” (Teece et al., 1997; Santa-Maria et al., 2022).
 - ▶ **Sensing opportunities** - Allows *scanning* of the *internal and external environment* to help identify opportunities and threats. (Santa-Maria et al., 2021)
 - ▶ **Shaping opportunities** - The processes and structures that allow *capturing value* from these opportunities. (Santa-Maria et al., 2021)
 - ▶ **Reconfiguring Resources & Structure** - The ability to be *flexible* and adaptive to market fluxes by (de)aligning (in) tangible resources. (Santa-Maria et al., 2021)
 - ▶ ‘Micro-foundations’ are more detailed criteria for the capabilities.

Identified in the Literature review:

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Figure C2. What are Capabilities (2/2).

⁸ For the full PowerPoint, email justin.seydoux@gmail.com.

What are (Dynamic) Capabilities?

(Brief) Examples for Circular Capabilities:

Sensing:

- ▶ Exploring new technologies: Manager proactively exploring new digital technologies.
- ▶ Identifying and understanding key stakeholder needs: Including actors and customers in the innovation process.

Seizing:

- ▶ Establishing or Solidifying collaboration: Eco-industrial park; one mans waste is another mans treasure

Reconfiguring:

- ▶ Business ecosystem Orchestration: Having an institution that coordinates collaboration and manages different interests

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Figure C3. Example of Capabilities.

Why a Capabilities Workshop?

- ▶ Is a source of competitive advantage in rapidly changing and complex regimes (such as the CE regime).
- ▶ Highlights 'good practice' competencies that can potentially go even beyond CBM perspective (Eisenhardt & Martin, 2000; Santa-Maria et al., 2021).
- ▶ Provides an effective mitigation strategy by bolstering resilience along the journey towards a CBM (Teece, 2018).
 - ▶ While other workshop focus on the goal, or the milestones towards that goal, the capabilities highlights the ability to weather the journey to said goal.
 - ▶ Can help mitigate risk by highlighting key competencies.
 - ▶ Can help manage uncertainty (unknown, unknowns) by encouraging more flexible and responsive competencies.

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Figure C4. Why use Capabilities.

Steps for Capabilities Workshop

- ▶ There are 4 main steps that will be undertaken:
 - ▶ 1st: Assessing the capabilities of the current business model
 - ▶ 2nd: Assessing the capabilities of the future circular business model
 - ▶ 3rd: Identify and prioritizing the capability gaps.
 - ▶ 4th: Negotiate on capability development between value chain actors

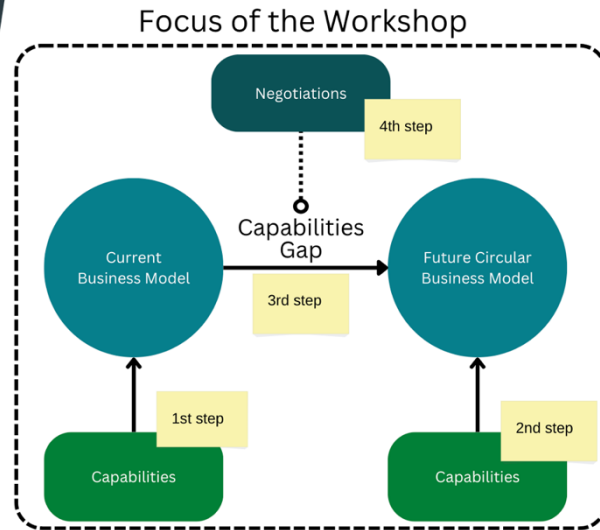


Figure C5. Overview of the Workshop's Mains Steps.

Steps for Capabilities Workshop (Step 1)

Assessing the capabilities of the current business model:

- ▶ Establish capabilities using business model canvas.
 - ▶ What:
 - ▶ Collectively determine if specific 'micro-foundations' relating to 'Sensing', 'Shaping' and 'Reconfiguring' as identified from the circular capabilities literature review are present.
 - ▶ How:
 - ▶ Presence of a micro-foundation will be asked in question format, asking if it is present in an ad-hoc form or more structurally developed if no other criteria is given.
 - ▶ Ad-hoc capability are dissuaded from being placed on the business model canvas.

Helps participants understand capabilities, ideally where they can even themselves suggest more context specific capabilities.

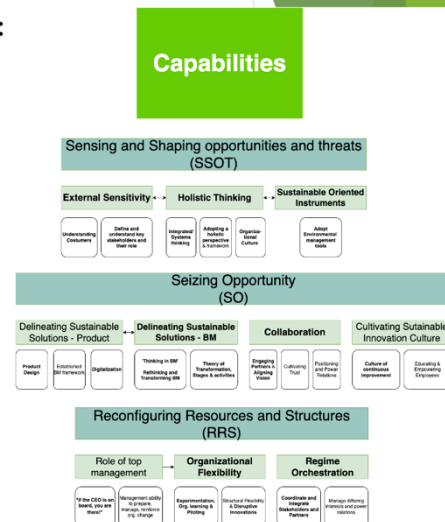


Figure C6. Step 1 of the Capabilities Workshop (1/2).

Steps for Capabilities Workshop (Step 1)

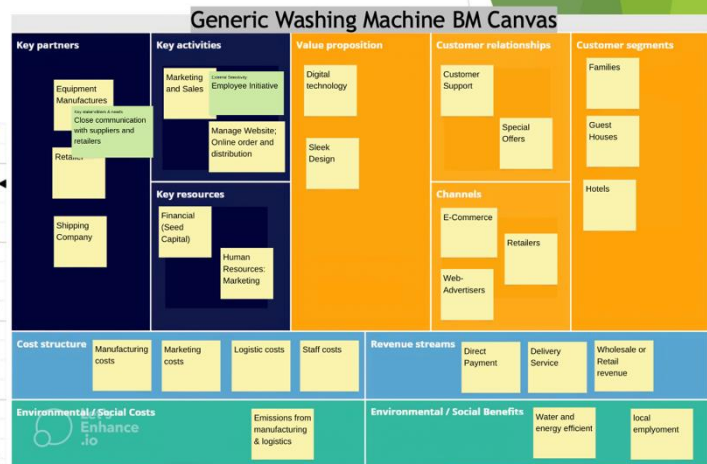
Example:

What capabilities are there that help with learning and monitoring the environment?

External Sensitivity

Becoming aware of exogenous technology

Define and understand key stakeholders and their role



Inspired from Santa-Maria et al. (2022)

Figure C7. Step 1 of the Capabilities Workshop (2/2).

Steps for Capabilities Workshop (Step 2)

Assessing the capabilities of the future circular business model:

- ▶ Follow a similar process as the previous but now with the a future circular business model.
 - ▶ Collectively go through Micro-foundations and then place on BM canvas.
 - ▶ But no weigh off in needed development (no ad-hoc vs structured).
- ▶ Once all capabilities placed, heat mapping via unlimited dot voting is done on the future capabilities.
 - ▶ Narrows down capabilities
 - ▶ Unlimited dot voting to not account for weighted preference between value chain actors.

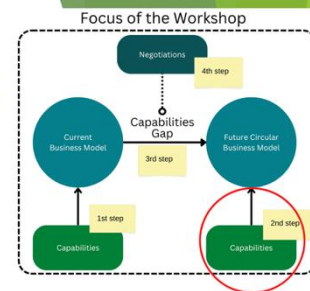


Figure C8. Step 2 of the Capabilities Workshop (1/3).

Steps for Capabilities Workshop (Step 2)

How it could look like?

- ▶ Micro-foundations questions (same example as in step 1)
 - ▶ What capabilities are necessary to identify exogenous science and technologies?
 - ▶ What capabilities are necessary to identify key stakeholders?

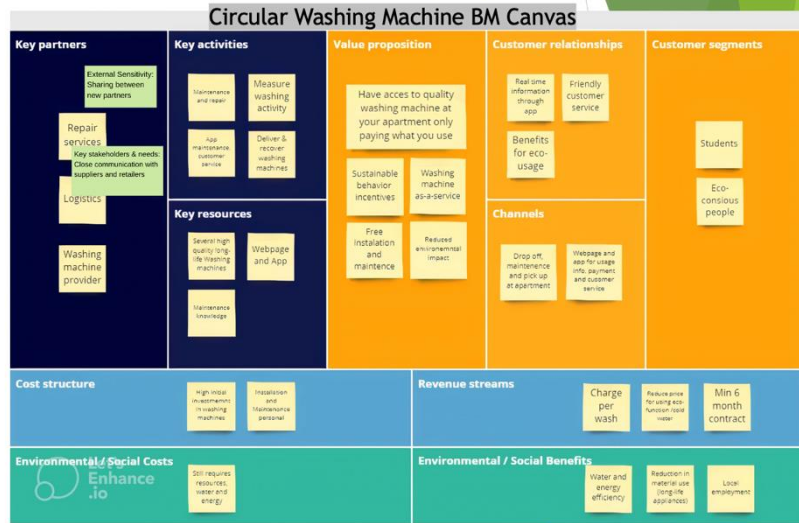


Illustration by Santa-Maria et al. (2022)

Figure C9. Step 2 of the Capabilities Workshop (2/3).

Steps for Capabilities Workshop (Step 2)

How it could look like?

- ▶ Heat mapping

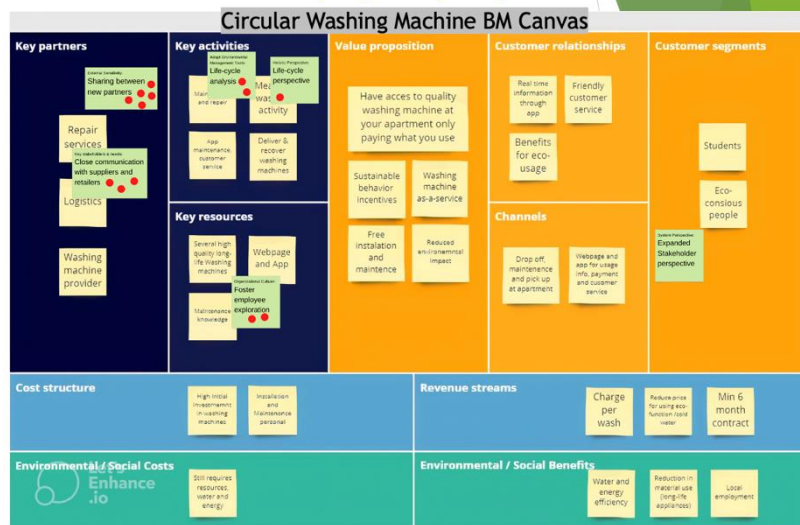


Illustration by Santa-Maria et al. (2022)

Figure C10. Step 2 of the Capabilities Workshop (3/3).

Steps for Capabilities Workshop (Step 3)

Identify and prioritizing the capability gaps:

- ▶ Will compare the most 'relevant' capabilities from the future CBM, to that of the current BM
 - ▶ If capabilities are met, can be largely ignored
 - ▶ If there is a gap (equivalent capabilities present in the future CBM but not the current BM), then the capability sticker will be placed on the 'impact x influence' graph
 - ▶ Impact x Influence estimates how timely and effective the development of a capability for the the value chain can be

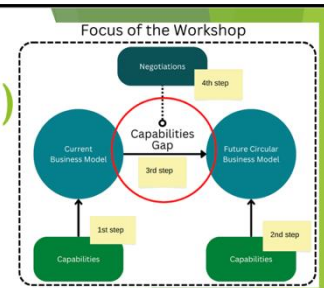


Figure C11. Step 3 of the Capabilities Workshop (1/3).

Steps for Capabilities Workshop (Step 3)

Comparing BM's capabilities

Generic Washing Machine BM Canvas



Circular Washing Machine BM Canvas

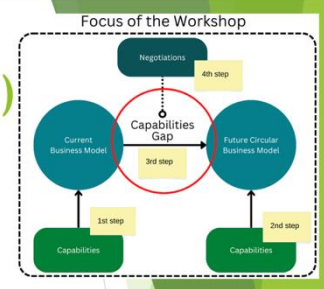
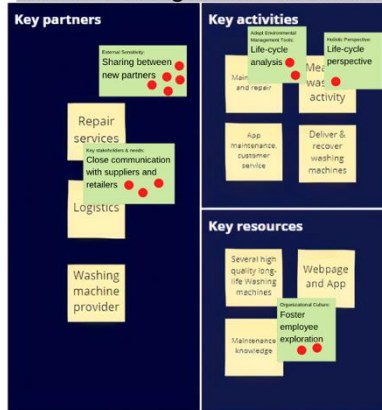


Figure C12. Step 3 of the Capabilities Workshop (2/3).

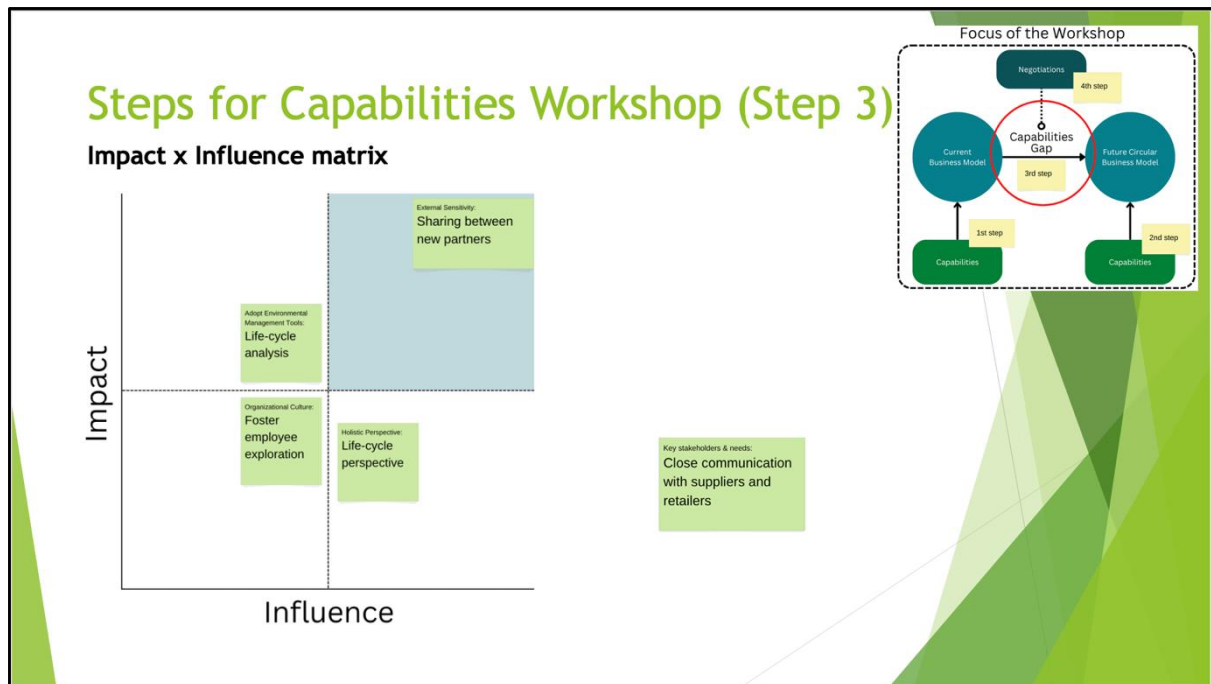


Figure C13. Step 3 of the Capabilities Workshop (3/3).

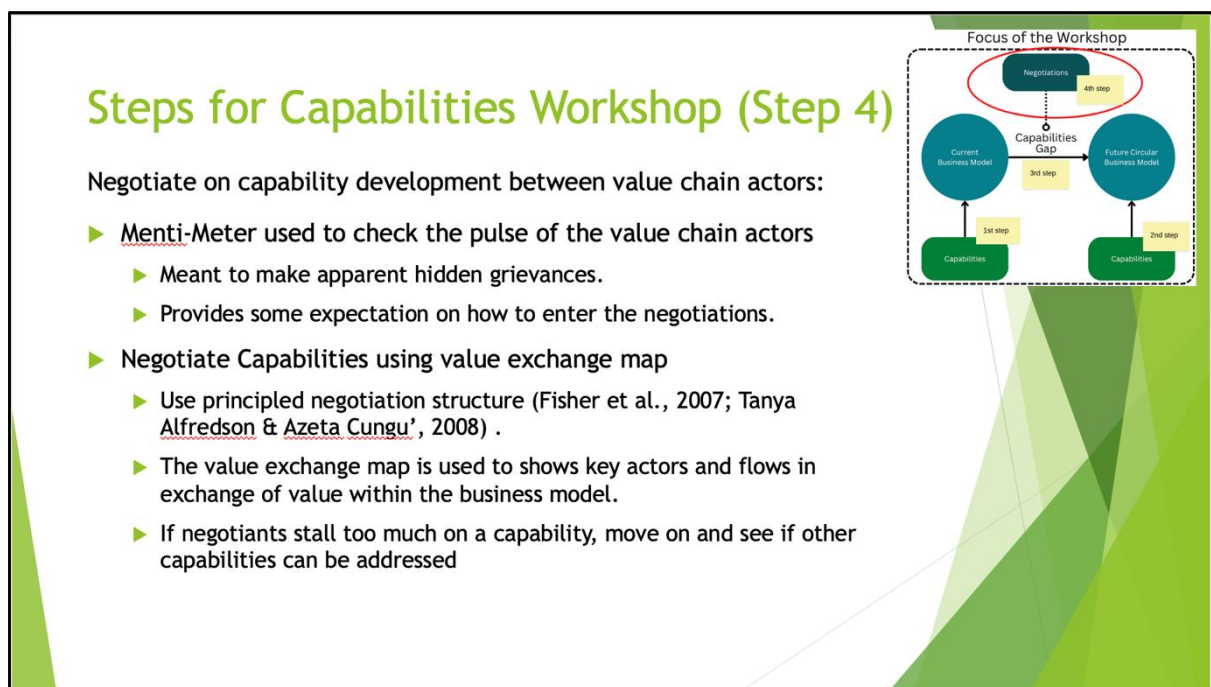


Figure C14. Step 4 of the Capabilities Workshop (1/5).

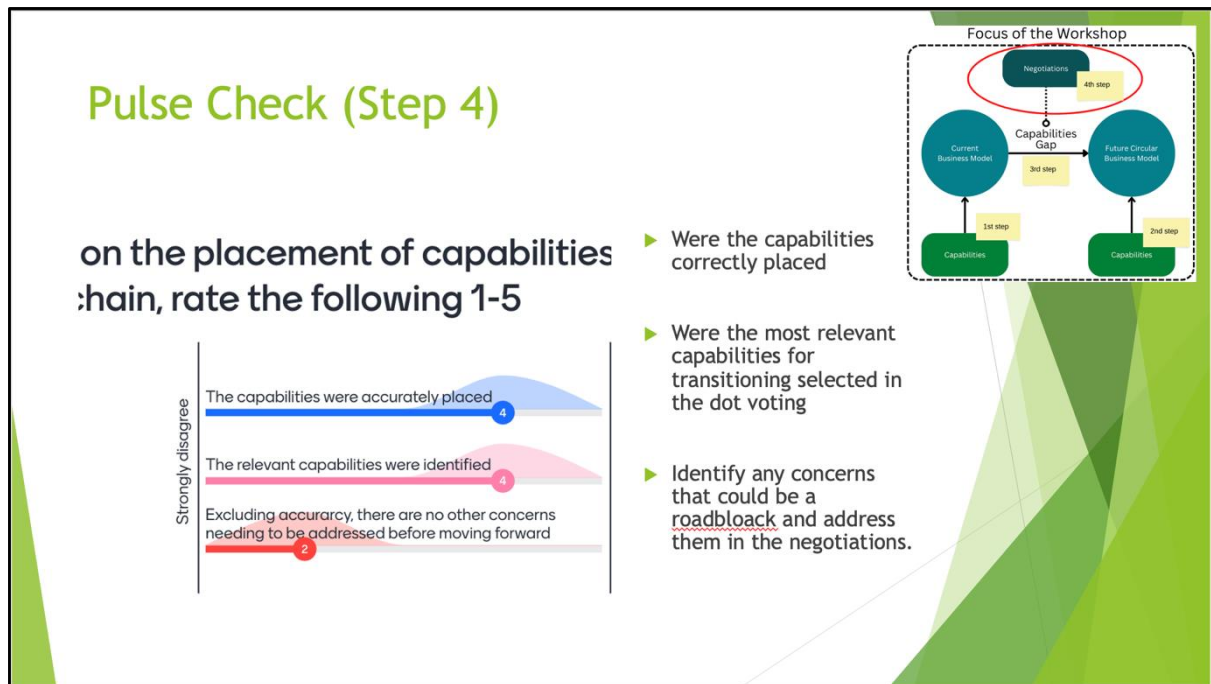


Figure C15. Step 4 of the Capabilities Workshop (2/5).



Figure C16. Step 4 of the Capabilities Workshop (3/5).

Steps for Capabilities Workshop (Step 4)

Value Exchange Map & Goals

Create the Value Exchange map:

- ▶ Identify all key stakeholders of the future CBM
- ▶ Map the value exchange relations.
- ▶ Confirm that every value chain actor gives and receives something.
- ▶ If necessary, discuss alternatives.

Decide where capabilities fit best on the map

Set out the goals for negotiating on the capability:

- What would be considered a developed capability?
- How would this affect the value chain?
- How can that capability be developed?

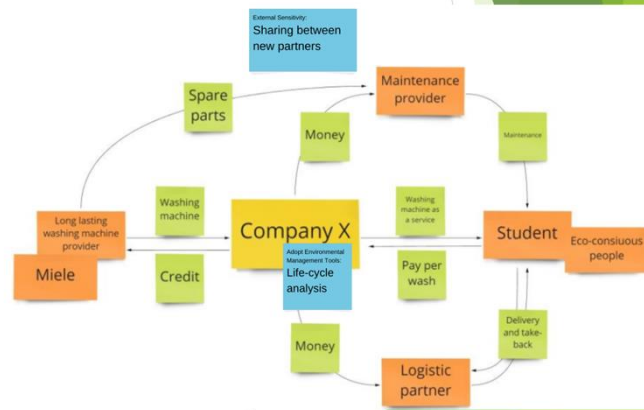


Figure C17. Step 4 of the Capabilities Workshop (4/5).

Steps for Capabilities Workshop (Step 4)

▶ During Negotiations

Identifying interests	Instead of stance and negotiation, address underlying reasoning Reframing the positions into interests can potentially overcome stalemates
Separate people from the problem	Aim for honesty, trust and preserving credibility Can be done through trust building such as informal meetings, conversation and accepting commitment. Probably limited influence within this workshop to actually positively influence this.
Generate options for problems	Could do a 5x5 in (10 min) 5min to write down possible solutions. Then select the 5 best and dot vote which ones are the most promising. Now have potential solutions which to continue negotiations.
Use objective criteria or faire process to settle differences	Use a faire agreed upon standard since there may be multiple potentially acceptable ones. Having a faire process that is perceived as legitimate by all involved actors. Either way, need a non-arbitrary decision making process that adds value and is seen a legitimate.
Create Commitment	Why conduct negotiation if actors do not intend to commit to them? Can build trust be holding to commitments and makes actors approach the negotiations more seriously.

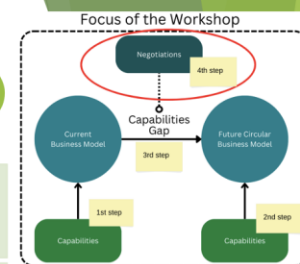


Figure C18. Step 4 of the Capabilities Workshop (5/5).