

Out of sight, out of mind

What companies still forget when transitioning to a circular economy

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Extended abstract

Introduction and state of the art

Circularity is increasingly utilized as a strategy to enhance ecological sustainability, by “slowing resource loops”, “closing resource loops” and “resource efficiency or narrowing resource flows” (Bocken et al., 2016, p.317). Circularity requires business model-, technical-, and mindset changes (Bocken *et al.*, 2016). But companies willing to transition to a circular economy face many barriers (cultural, market, regulatory, technical, etc.) to go beyond “circular utopia” towards “strong circularity” (Kirchherr et al., 2018; Bocken et al., 2023, p.379; Fraser et al., 2024).

Verleye et al. state that to transition to a circular economy, actors need motivation, ability, and interactional and institutional opportunities to overcome barriers (Verleye *et al.*, 2023). Within the motivation-related practices, Verleye et al. note the importance of signaling, “highlighting potential benefits” and convincing “persuading focal actors to engage with circular business models” (Verleye et al., 2023, p.14). Zooming into the “ability related practices”, actors not only need “supporting” practices (“financial and infrastructural resources”) but also “empowering” practices (“knowledge and capabilities”) (Verleye et al., 2023, p.22). Other scholars agree that awareness on the circular enablers is needed, and that training or upskilling companies might help (Fraser *et al.*, 2024).

It is well known that the use phase and the end-of-life phase have an important impact on the environment (Hischier *et al.*, 2020; Spreafico and Russo, 2020; Sarasini *et al.*, 2024). Nevertheless, 80% of a product's environmental impact is already defined during the design phase (European commission, no date; McAloone *et al.*, 2009; Ellen MacArthur Foundation, 2022). This gives companies the levers to influence the sustainable impact of the use and end-of-life phase ("after gate" phase) throughout the design process.

It is argued that companies might not always follow up what actually happens to their product especially in the phases "after gate". Products and/or business models might be designed for an elongated product life (den Hollander, Bakker and Hultink, 2017). But, how users really engage with the products might not be elaborated further (Polizzi di Sorrentino, Woelbert and Sala, 2016). Are companies aware of all the elements at play, shortening the real use-time of their product (ex. technical, functional, aesthetical, and social obsolescence, user attachment, perceived state of brokenness etc.) (Salvia *et al.*, 2015; Kowalski and Yoon, 2022; Nyström *et al.*, 2023)? The product might be designed to narrow down sources, but do companies have an overview of the indirect consumables needed "after gate" (den Hollander, Bakker and Hultink, 2017)? To close loops, products and materials need to be collected at the end-of-life (den Hollander, Bakker and Hultink, 2017). Do companies know where their products and materials end up in reality (reused, remanufactured, recycled, ...)?

Companies sometimes apply circular strategies envisioning an ideal scenario (Bocken *et al.*, 2023; Dembek *et al.*, 2023). While reality is out of control, context dependent, evolutionary (Ostuzzi, 2017). This creates a gap between what has been designed (ideal) and what really happens (reality).

Given that (I) Verleye *et al.* mention the importance of signaling to highlight potential benefits to actors (Verleye *et al.*, 2023), (II) the real "after gate" phase is important to embrace in circularity, and (III) companies have the levers in the design phase to change the "after gate" phase, companies need a more comprehensive view on the "after gate" phase for opportunities to be signalized. As there is a gap between what companies design and what happens in reality "after gate", this study aims to find blind spots in specific companies' cases concerning the real product "dynamics", "after gate". What information is out of sight, leading to overlooked sustainability impacts?

It is crucial to identify these blind spots, as there are strategies that can be employed to anticipate changes in time and context in design. Open-ended design is such an approach, the product is designed in certain ways "open", leaving opportunities to adapt the product throughout time (Ostuzzi, 2017). Future adaptive design is a way to anticipate this change in product and business model within the circular context (Nyström *et al.*, 2023).

Method

In this study, three companies designing and/or producing physical products in Flanders (more info in Table 1) have been involved in a two-day design workshop.

The first part of the workshop consisted out of a theory lesson to empower the companies (Verleye *et al.*, 2023). The workshop included theories and practices related to design for circularity (the basics of a circular economy, design for R-strategies, circular business models barriers to a circular economy, etc.) (Bocken *et al.*, 2016; Lewandowski, 2016; Potting, Hekkert and Worrell, 2016; Kirchherr *et al.*, 2018; Ceschin and Gaziulusoy, 2020; Geissdoerfer *et al.*, 2020).

The second part of the workshop was designed using signaling techniques and convincing techniques (Verleye *et al.*, 2023). The workshop is based on the methodology described by Pacelli, Ostuzzi and Levi (Pacelli, Ostuzzi and Levi, 2015), composed of two stages: a first **observative stage** of waste stream identification and a second **generative** one where opportunities are signaled. It consisted of visualization exercise of the material flows in the use phase, gathering data on the volume of these flows, guided brainstorming to apply circular strategies and a ranking of the ideas.

In this paper we only focus on the **observative stage** of the workshop and only one case is reported in detail.

During the workshop, a whiteboard diagram was created by the company mapping out the use phase of the value chain and visualizing the waste streams. The researchers guided this mapping process by asking questions such as: “What resources does the product consume during use?”, “What are typical use scenarios?”, “What are typical maintenance, repair, adaption activities?”, “What are typical end-of-life reasons?”, etc.

The whiteboard (later digitized) is utilized as basis for our study (Figure 1).

	Sector	Description of the company	Description of product	Number of employees	Circular strategy claimed by the firm
A	Beverage sector	Products and services to provide beverages for home settings, governments, companies, healthcare, ...	home appliance	30-100 FTE	service agreements, installation, and maintenance.
B	Toy industry	Design and development of games	Boardgame	10-30 FTE	One ecofriendly collection
C	Construction industry	Produce and distribute flooring	Floor	30-100 FTE	non claimed

TABLE 1: DESCRIPTION OF THE COMPANY

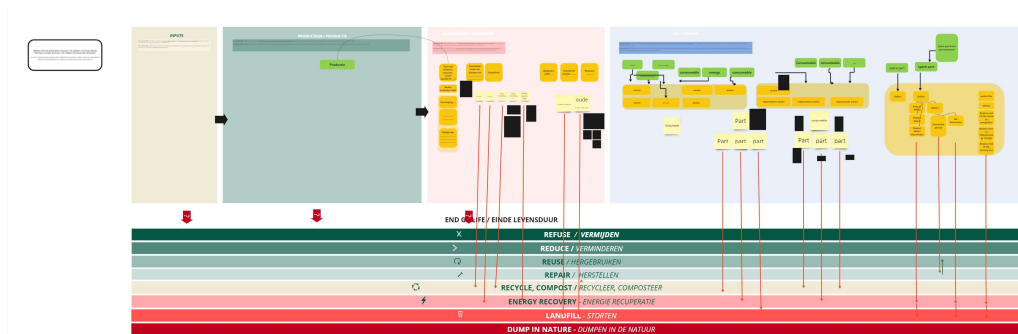


FIGURE 1: EXAMPLE OF THE OUTCOME OF THE MAPPING ACTIVITY

Two researchers observed and analyzed the resulting map to uncover the missing information. This missing information is seen through different lenses such as, but not limited to: product longevity (Salvia *et al.*, 2015; Jensen, Laursen and Haase, 2021), the creation and capturing of value (van de Poel, 2021; Boruchowitch and Fritz, 2022; Brysch, Garcia i Mateu and Czischke, 2023) and product attachment (Kowalski and Yoon, 2022). The researchers annotated the observed disregarded aspects, with a method inspired by the annotated portfolio technique (Sauerwein, Bakker and Balkenende, 2018).

In a second stage the annotated portfolio was anonymized, pictures were deleted, words being replaced by the category they belong to (ex. action, consumable, energy, part, spare part, behavior, ...).

Result

The resulting annotated portfolio is shown in Figure 2 and can be found, in more detail, on https://miro.com/app/board/uXjVNW9jH2c=?share_link_id=253124772229.

General findings

In general, the mapping scheme looked quite linear (rather than a complex map), using a limited number of stakeholders (In the observed example; the person buying and using the product, and the service technicians from the company). The (changing) behavior of stakeholders was not documented (Polizzi di Sorrentino, Woelbert and Sala, 2016). While in reality, the involvement of a myriad of actors interfering with the products and the values they bring, happen simultaneously (Verleye *et al.*, 2023).

In this study, we observed a blind spot that product “dynamics” (products gradual change, contextual changes, and changes in user behavior) are not mapped out, while it is in the nature of products to be changing (Ostuzzi, 2017). Not observing the change consequently means overlooking the sustainability impact of these “dynamics” .

Discussion and conclusion

The findings show that these firms lack awareness of the product interaction of multiple stakeholders. The number of companies observed (3) is very limited. Future studies with higher number of case studies should aim at further discovering the blind spots companies might have on the “after gate” and real lives of their products, and therefore of the impacts created. Are there certain insights that are recurring across multiple companies or business categories?

The way the workshop and mapping exercise is designed and the guiding questions during the workshop define the way the use phase is mapped out. Future studies can redesign the mapping exercise of the “after gate” phase, which might lead to uncovering other insights. For example, the template does not give insight into how the company considered circularity in the design phase and thus what the intended (ideal) scenario is.

We hypothesize that companies able to map out the reality of their products “after gate”, will be capable of seeing circular opportunities. These opportunities can then be signaled internally and to other stakeholders. This in turn might lead to a higher likelihood of accepting circular business models (Verleye *et al.*, 2023). This hypothesis still needs to be tested.

Further research could investigate how designers can anticipate the change in product, context, and stakeholder within the circular economy, by for example designing open-ended (Ostuzzi, 2017).

Keywords

Circular Economy, Life Cycle Design, Open-ended Design, Actors Engagement, Design Thinking.

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