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From Matching to Making: A Canvas for Collaborative Circular Value Creation

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Abstract: Co-design, which involves end-users in the design process, has emerged as a promising strategy for developing circular offerings. However, creating such offerings requires collaboration not only with end-users but also between companies forming circular ecosystems centered on shared value propositions. While existing research highlights the importance of inter-company collaboration and co-design with end-users, tools supporting co-creation with both users and multiple stakeholders remain limited. This paper introduces and evaluates a prototype tool called the Collaborative Circular Value Creation Canvas. The tool is designed to facilitate company collaboration in generating concepts for circular offerings, which can serve as structured inputs for co-design with end-users. This paper reports on testing the canvas in a pilot workshop. Initial findings suggest the tool's potential to foster inter-company collaboration and generate valuable inputs for a co-design process with end-users. However, further research is needed to validate its role in a co-design process and its ability to foster business models focused on product longevity. Additionally, the implications of using the tool in a digital format should be further investigated.

Introduction

Increasingly, the idea of co-design, defined as a collaborative approach that involves end-users in the design process (Sanders & Stappers, 2014), has gained attention in circular business model literature (Fernandes et al., 2020; Whalen et al., 2024). Co-design is viewed as a potential strategy to create innovative circular offerings - defined as products or services designed to meet consumer needs in a circular consumption system (Gomes et al., 2022). By collaborating with users, companies can generate insights and create innovative user-centered solutions, as demonstrated by van Dam et al. (2021) who used co-design to enable the development of new circular-oriented service ideas for washing machines. Moreover, Pedersen and Clausen (2018) highlight its potential to integrate various stakeholder's perspectives into the design of circular solutions.

At the same time, recent research underscores the need for inter-company collaboration and partnerships to create circular eco-systems centered on product longevity (Konietzko et al., 2020b). An ecosystem can be described as a structured alignment of multiple partners who must collaborate for a central value proposition to take shape (Adner, 2017). Thus, for a circular eco-system to take place, actors must center their activites, positions, and links to each other around a shared circular value proposition. Trevisan et al. (2022) emphasize the system around firms and how multiple stakeholders interact – rather than focusing on the business model of a single firm.

By merging these two perspectives, an interesting focus emerges: on one hand, companies must collaborate to provide new circular offerings; on the other hand, these offerings must also be co-developed with end-users. This raises a critical question: how can companies align and work together to put forward new concepts to end-users that can then be refined through the co-design process?

Although tools and methods for collaboration exist (e.g., value mapping frameworks and circular innovation toolkits) (Rexfelt & Selvefors, 2024), none are specifically designed for inter-company collaboration with the goal of generating inputs for co-design with

users. Addressing this gap, this paper explores how companies can align and collaborate to generate concepts for circular offerings. These concepts can then be integrated into the co-design process to create offerings that support a circular economy.

This paper focuses on the development and initial testing of such a tool. Designed for the early stages of the design process, the tool intends to generate structured outputs that can serve as inputs for a co-design process with end-users. This work is part of the ongoing research project 'Game-Based Approaches to Create Circular Value Propositions' (henceforth referred to as CBM GAMES). The project explores how game-based methods can facilitate the co-design of user-centered circular offerings. Approaches for fostering inter-company partnerships align with the broader objectives of the project, as will be expanded on further in the next section.

Project context & approach

The CBM GAMES project builds on prior research in circular business models, serious games, and co-design. Findings from the project presented at the PLATE 2023 Conference indicate that games could be used in the co-design of user-centered circular offerings and experimentation of circular business models (Selvefors et al., 2023). However, it was noted that most existing games in the research area primarily focus on educating participants about circular economy concepts rather than providing a platform for direct co-creation with users. The research further highlighted that games could better support the co-design of user-centered circular offerings if they allowed for collaboration both with users and among multiple stakeholders within a business ecosystem.

Subsequent studies have focused on the roles users can take in the co-design of circular offerings (Selvefors et al., 2024) and examined how games might enable such roles in co-design processes (Whalen et al., 2024). Thus, while significant progress has been made in understanding user roles in co-design, how games can support collaboration among multiple stakeholders within a business ecosystem remains an open question. This paper makes an initial contribution to this area of research.

As depicted in Figure 1, the CBM GAMES framework enables companies and customers to collaborate in a digital game environment. Customers engage with challenges designed to gather user insights, which are then shared with companies. Since the companies are involved in shaping these challenges, the collected data aligns with their specific goals and objectives. Part of the game should also enable companies to work together to create challenges they can then pose to the customers. For this to work, we have identified three key steps:

1. **Match** – Companies are matched or paired with another company to explore potential collaboration opportunities.
2. **Create** – Companies collaborate to design a joint challenge aimed at collecting user insights and ideas.
3. **Review** – Companies analyze the user responses to the challenges and integrate the insights into their design processes.

This paper focuses on the second step: company-to-company exchange of ideas and the creation of co-design challenges. To support this process, the *Collaborative Circular Value Creation Canvas* (working title) was developed and tested. Although the final goal is a digital tool, a paper prototype canvas was developed to allow for rapid iteration and testing. This process, and the resulting canvas, is described in the following sections.

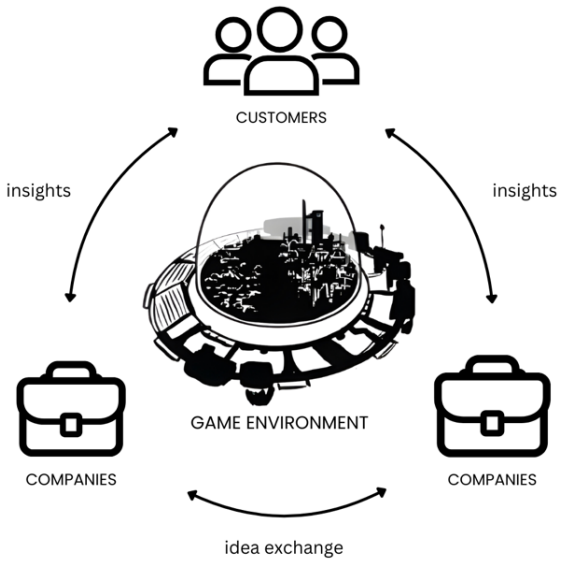

Figure 1. The CBM GAMES framework, depicting the exchange of information between companies and customers.

The collaborative circular value creation canvas

In May 2024, a benchmark analysis scanned relevant tools and methods including 1) approaches to support circular ecosystem design (e.g., Value Mapping Framework (Bocken et al., 2013); Circularity Deck (Konietzko et al., 2020a); 2) (collaborative) circular business model tools and methods (e.g., Circular Strategies Toolkit (Brown, Baldassarre, et al., 2021); BM^{3}C^2 (Boldrini & Antheaume, 2021); Circular Business Model Mapping Tool (Nußholz, 2018); and 3) circular design tools (e.g., Use2Use Toolkit (Rexfelt & Selvefors, 2021)). Review articles including Bocken et al. (2019), Pieroni et al. (2019), and Rexfelt & Sevlefors (2024) were also used to identify relevant tools and methods.

Key insights from the analysis identified existing methods typically involve at least two steps: (1) checking current circularity; and (2) identifying redesign opportunities, often based on a shared common vision.

Building on these methods, we concluded the canvas should enable companies to:

1. Map their current circular actions.
2. Identify overlaps and gaps with their partner company's actions.
3. Explore new opportunities for collaboration.

A finalized version of the canvas prototype is shown in Figure 2. Drawing on criteria from Selvefors et al. (2023), special attention was given to make the canvas simple and appropriate for people not familiar with circular economy terminology. The two main sections of the canvas are described in detail below.

Company Circularity Check

Companies start by completing the "Circularity Check," represented by the blue boxes on either side of the canvas. This check focuses on two aspects of existing company practices: circular flows (Rexfelt & Selvefors, 2021) and circular behaviors (Poppelaars et al., 2020; Selvefors et al., 2019). There is space for each company to individually fill in Step 1 and reflect

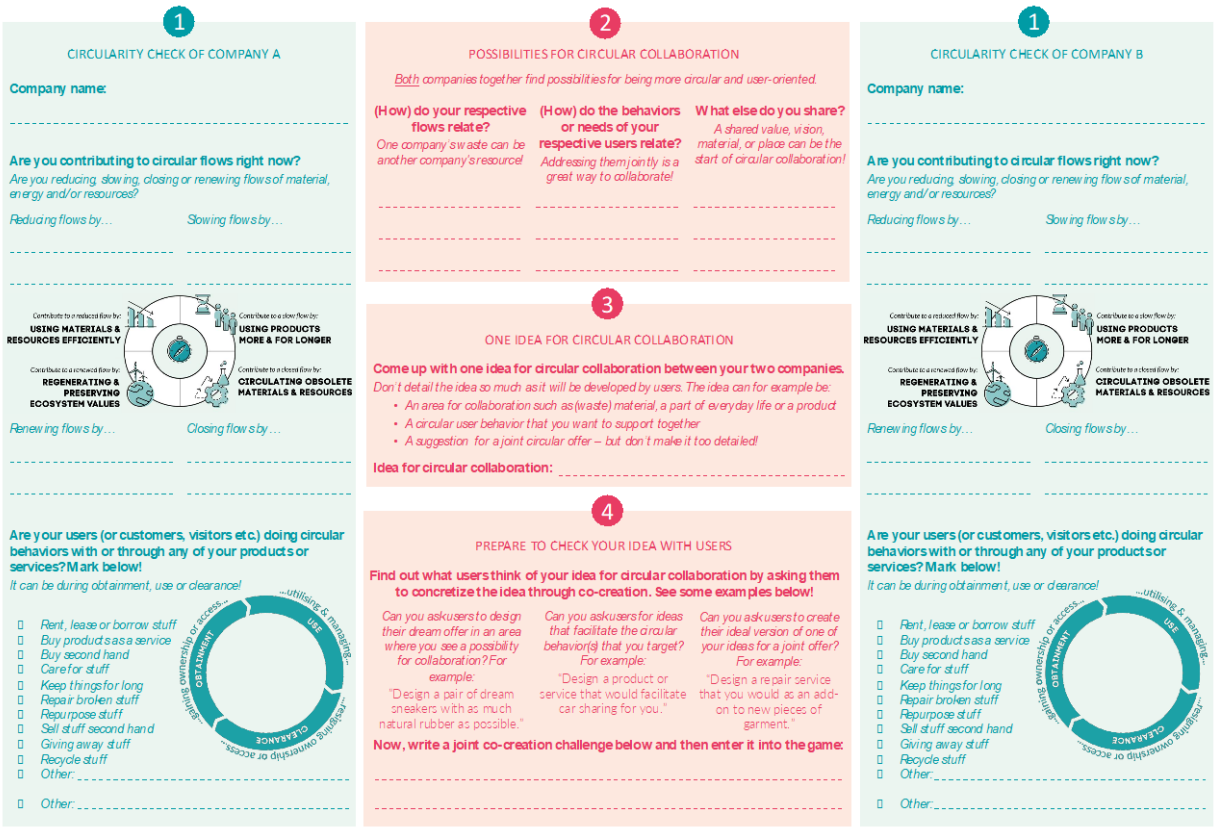

Figure 2. Collaborative Circular Value Creation Canvas.

on how their current business offerings contribute to circular strategies such as reducing, slowing, renewing, and closing material resource flows (Konietzko et al., 2020a). Next, they consider how their current business offerings support circular behaviors during the phases of circular consumption: obtainment, use, and clearance (Rexfelt & Selvefors, 2021; *The Circular Behavior Toolkit*, 2024).

Possibilities for Circular Collaboration

The center section of the canvas (in pink, Steps 2-4) is filled in jointly by both company representatives after they finish their individual circularity checks. Step 2 asks the representatives to reflect together and relate their existing flows, behaviors, goals, and company visions (Brown, Von Daniels, et al., 2021; Pedersen & Clausen, 2018, 2019; Selvefors et al., 2024). Afterwards, in Step 3, they brainstorm potential collaboration ideas. In the fourth and final step, they select one idea and reframe it in a way that can be communicated to end-users. The result is a joint challenge that can be shared with users in the next step of the co-design process.

Pilot test of canvas

The canvas was tested during a gamified workshop at the Design Research Society (DRS) Conference 2024. The workshop lasted 1.5 hours and involved 12 total participants. Six participants were asked to take on the role of companies. These participants selected fictional company profiles and role-played as designers/managers from these companies. The remaining six attendees participated as users, responding to the challenges generated by the companies. Participants were asked to respond to a short survey covering demographics, gaming experience, and experience in relation to circular economy.

During the workshop, the participants role-playing as companies used the canvas to map their circular actions, identify collaboration opportunities, and create a joint challenge. These challenges were then entered into a digital platform developed as part of the CBM GAMES project. The participants role-playing as users were then asked to respond to the challenges through the platform. The workshop concluded with a plenary reflection. Figure 3 shows participants using the canvas in the workshop setting. Drawing from Keebler et al. (2020), three main aspects were emphasized when reflecting specifically on the canvas, and these serve as the foundation for the reflections presented in the remainder of this paper:

1) Usability: Ease of use and intuitiveness of the canvas.
2) Engagement: Level of participant focus and enjoyment.
3) Collaboration: Effectiveness in fostering inter-company collaboration and generating user insights.

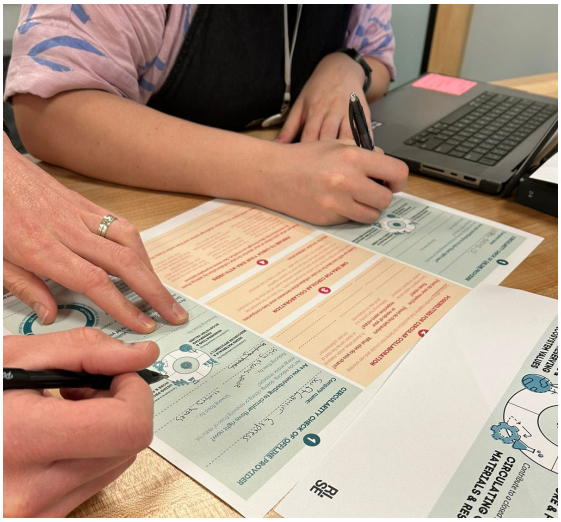

Figure 3. Workshop participants filling out the canvas.

Canvas' usability

The pilot revealed some confusion regarding Step 1, as participants struggled to connect the initial questions to the accompanying circular flows graphic. Adjusting the layout so it makes it clearer that the graphic is related to the first question was identified as an improvement for future revisions. Other than this, however, the participants were able to use the canvas without help from the facilitator. This is particularly noteworthy as most participants did not have research backgrounds in circular economy.

Engagement

Participants using the canvas appeared highly engaged, talking and laughing in their groups. When a latecomer joined an ongoing group filling out the canvas, she initially assumed the participants were actual employees of the companies rather than role-playing. This was due to how animated and immersed the group was, as they spoke convincingly from the

perspectives of the companies they were representing.

Collaboration ability
The tool facilitated inter-company collaboration in the current setting, but participants expressed a desire for more interaction with users. The limited functionality of this feature in the digital game platform may partly explain this observation. Nevertheless, it highlights the importance of fostering reciprocal collaboration not only between companies but also between companies and end-users. End-users should not only provide input to companies, as this could feel exploitative. Companies must also offer feedback and reflections to end-users, creating a more balanced and collaborative exchange.

Concluding Remarks

This paper has proposed and piloted a tool to support company collaboration and co-design of circular offerings with multiple stakeholders. Initial results suggest the tool's potential to foster company collaboration and generate valuable inputs for a co-design process with end-users. However, the research is still early stages, and much more in-depth research must be conducted to validate its role in a co-design process and ability to foster business models focused on product longevity. Further development and testing of a digital – instead of paper – prototype is also necessary to align with the growing need for digital collaboration tools in a post-COVID-19 world. To this end, several directions for future research have been identified:

How does the lack of physical presence affect engagement and perceived enjoyment? Participants playing as companies reported enjoying the workshop, with some noting that the role-playing aspect added an engaging dynamic. However, it remains unclear how much of this engagement was due to physical presence, the group dynamic, or the act of role-playing. Future research should test the tool with actual representatives from companies (rather than role-playing participants) and assess its performance in remote and asynchronous settings. Understanding how digital environments affect collaboration and enjoyment is important for adapting the tool for broader use.

How should matching between companies be executed?
In the pilot workshop, companies were randomly matched. While this was done for practical reasons, questions remain about how to do this in the real world. What should be criteria for matching companies? Matching could be based on shared values, complementary resource flows, circular strategies, or other factors (Boldrini & Antheaume, 2021; Konietzko et al., 2020b). Moreover, how should this occur? Companies could create profiles and 'swipe right' ala the popular dating app Tinder – or external facilitators could play matchmaker, setting companies up based on their characteristics. Other questions arise including: how much information are companies willing to share to facilitate meaningful matches, and how can potential concerns about confidentiality be addressed? Exploring these issues will help refine the matching process.

How do companies want to complete the canvas? In the pilot, participants worked together in physical groups where they were able to communicate directly in real time. Future research could investigate preferences for different formats, such as in-person workshops, synchronous online meetings, or asynchronous collaborations where notes and ideas are exchanged digitally over time (i.e. such as through an online whiteboard). Each format offers advantages and challenges, and determining the most effective method will enhance the tool's adaptability to various organizational contexts.

What features do and do not translate when digitalizing the canvas? Some of the tactile and collaborative aspects of the physical canvas may be lost when translated into a digital version. However, a digital version creates possibilities for new features such as automated data analysis, visualizations, or integration with other collaborative platforms. Identifying which features enhance and/or hinder the collaborative process will help guide the tool's future digital development.

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References

Adner, R. (2017). Ecosystem as Structure: An Actionable Construct for Strategy. *Journal of Management*, *43*(1), 39–58. https://doi.org/10.1177/0149206316678451

Bocken, N. M. P., Pauw, I., Bakker, C. A., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *J. Ind. Prod. Eng.*, *1015*.

Bocken, N., Short, S., Rana, P., & Evans, S. (2013). A value mapping tool for sustainable business modelling. *Corporate Governance*, *13*(5), 482–497. https://doi.org/10.1108/CG-06-2013-0078

Brown, P., Baldassarre, B., Konietzko, J., Bocken, N. M. P., & Balkenende, R. (2021). A tool for collaborative circular proposition design. *Journal of Cleaner Production*, *297*, 126354. https://doi.org/10.1016/j.jclepro.2021.126354

Fernandes, S. da C., Pigosso, D. C. A., McAloone, T. C., & Rozenfeld, H. (2020). Towards product-service system oriented to circular economy: A systematic review of value proposition design approaches. *Journal of Cleaner Production*, *257*, 120507. https://doi.org/10.1016/j.jclepro.2020.120507

Gomes, G. M., Moreira, N., & Ometto, A. R. (2022). Role of consumer mindsets, behaviour, and influencing factors in circular consumption systems: A systematic review. *Sustainable Production and Consumption*, *32*, 1–14. https://doi.org/10.1016/j.spc.2022.04.005

Keebler, J. R., Shelstad, W. J., Smith, D. C., Chaparro, B. S., & Phan, M. H. (2020). Validation of the GUESS-18: A short version of the game user experience satisfaction scale (GUESS). *J. Usability Studies*, *16*(1), 49–62.

Konietzko, J., Bocken, N., & Hultink, E. J. (2020a). A Tool to Analyze, Ideate and Develop Circular Innovation Ecosystems. *Sustainability*, *12*(1). https://doi.org/10.3390/su12010417

Konietzko, J., Bocken, N., & Hultink, E. J. (2020b). Circular ecosystem innovation: An initial set of principles. *Journal of Cleaner Production*, *253*, 119942. https://doi.org/10.1016/j.jclepro.2019.119942

Pedersen, S., & Clausen, C. (2018). *Co-designing For A Circular Economy*.

Pedersen, S., & Clausen, C. (2019). Staging Co-Design for a Circular Economy. *Proceedings of the Design Society: International Conference on Engineering Design*, *1*(1), 3371–3380. Cambridge Core. https://doi.org/10.1017/dsi.2019.344

Poppelaars, F., Bakker, C., & van Engelen, J. (2020). Design for Divestment in a Circular Economy: Stimulating Voluntary Return of Smartphones through Design. *Sustainability*, *12*(4). https://doi.org/10.3390/su12041488

Rexfelt, O., & Selvefors, A. (2021). The Use2Use Design Toolkit—Tools for User-Centred Circular Design. *Sustainability*, *13*(10), Article 10. https://doi.org/10.3390/su13105397

Rexfelt, O., & Selvefors, A. (2024). Mapping the landscape of circular design tools. *Resources, Conservation and Recycling*, *209*, 107783. https://doi.org/10.1016/j.resconrec.2024.107783

Sanders, E., & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. *CoDesign*, *10*(1), 5–14. https://doi.org/10.1080/15710882.2014.888183

Selvefors, A., Renström, S., Nordenö, H., Einebrant, E., Fallahi, S., Whalen, K. A., & Leivas, M. (2023, June 31). *How can games aid co-design of user-centered circular offerings?* Product lifetimes and the environment (PLATE), Espoo, Finland.

Selvefors, A., Renström, S., Whalen, K. A., Fallahi, S., Leivas, M., Nordenö, H., & Fransson, A. (2024). User-centered circular value propositions – approaches in practice and research. *Resources, Conservation and Recycling*, *207*, 107628. https://doi.org/10.1016/j.resconrec.2024.107628

Selvefors, A., Rexfelt, O., Renström, S., & Strömberg, H. (2019). Use to use – A user perspective on product circularity. *Journal of Cleaner Production*, *223*, 1014–1028. https://doi.org/10.1016/j.jclepro.2019.03.117

The Circular Behavior Toolkit. (2024, April 8). DDC – Danish Design Center. https://ddc.dk/tools/the-circular-behavior-toolkit/

Trevisan, A. H., Castro, C. G., Gomes, L. A. V., & Mascarenhas, J. (2022). Unlocking the circular ecosystem concept: Evolution, current research, and future directions. *Sustainable Production and Consumption*, *29*, 286–298. https://doi.org/10.1016/j.spc.2021.10.020

van Dam, S., Sleeswijk Visser, F., & Bakker, C. (2021). The Impact of Co-Creation on the Design of Circular Product-Service Systems: Learnings from a Case Study with

Washing Machines. *The Design Journal*, *24*(1), Article 1. https://doi.org/10.1080/14606925.2020.1851427

Whalen, K. A., Selvefors, A., Fransson, A., Fallahi, S., Renström, S., Nordenö, H., & Leivas, M. (2024). Opportunities for engaging users in co-design of circular offers through games. *Proceedings of the 9th International Conference on New Business Models NBM2024*. 9th International Conference on New Business Models NBM2024 Sustainable business models for the digital, green and inclusive transition.