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Who gets a turn? Exploring multi-stakeholder collaboration in circular innovation and the role of gamification

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ABSTRACT

Open innovation, especially through processes that support remote collaboration such as gamification, has the potential to support multi-stakeholder collaboration for circular innovation. This study explores how companies want to collaborate for circular innovation, specifically with end-users. We identify how gamification can support companies and end-users in open circular innovation processes. We use a research-through-design approach and offer a game concept for remote digital co-design in the context of circular innovation to elicit company responses to such a game. We collect data from interviews with 15 company representatives. The results reveal a tension: Although previous research stresses the importance of involving end-users in circular innovation, some companies are skeptical. Companies prefer to extract insights from end-users and collect feedback on ideas generated by the companies themselves. However, the companies appear eager to engage with other companies in open circular innovation. The study contributes to circular economy literature by mapping co-design and circular co-design processes to theoretically ground the latter within co-design literature. It also identifies challenges related to open circular innovation, especially in the integration of end-users. From a practical standpoint, we offer insights on how to approach and structure collaborative efforts for designers and innovation managers aiming to transition toward circular business models in their organizations.

Introduction

Moving to a circular economy, where resource consumption is decoupled from economic growth, has been viewed as a promising approach to support green transition (Ghisellini et al., 2016). Businesses undertake circular business model innovation by reconfiguring how they create, capture, and deliver value in ways that contribute to the reuse of products and materials (Bocken et al., 2016). Yet, widespread adoption of circular business models has yet to be adopted (OECD, 2019), prompting research into drivers and barriers to their implementation (Guldmann & Huulgaard, 2020; Vermunt et al., 2019; Werning & Spinler, 2020; Whalen, Milios et al., 2018). Recent academic research emphasizes the necessity of collaboration between stakeholders in circular innovation processes, including businesses, customers, research institutes, and suppliers (Dorrego-Viera et al., 2025; Perotti et al., 2024; Rexfelt & Selvefors, 2024). For a circular value proposition to materialize, a multilateral set of partners must interact. For example, inspired by nature, Tate et al. (2019) argued that a circular business ecosystem needs a producer, consumer, scavenger and decomposer, while other scholars included policy and research organizations (Cantele et al., 2020; Konietzko, Bocken et al., 2020) and a coordinator of the ecosystem (Konietzko, Bocken et al., 2020). Lacking a key actor, such as a waste processor, can make circular innovation difficult or even unfeasible to implement.

Previous research highlighted the importance of including end-users in circular innovation as circular business models considerably affect the consumption process and can alter the relationship between users and providers of products and services (e.g., from buyer to subscriber) (Lofthouse & Prendeville, 2018; Santa-Maria et al., 2022a; Selvefors et al., 2019). In this study, we use the term end-user to refer to the intended user of a circular product or service. Based on a systematic literature review on innovation and the circular economy, Suchek et al. (2021) concluded that circular transitions require new business models and that the role and involvement of consumers in these circular

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innovations require further exploration. Prieto-Sandoval et al. (2018) highlighted customers as a key circular economy determinant, underscoring the need to engage customers to ensure their needs or desires are met. Ways to involve end-users in circular innovation processes include activities to better understand these changed user needs (Camacho-Otero et al., 2018), mapping users' contexts (Gomes et al., 2022), and co-creating solutions (Dorrego-Viera et al., 2025; van Dam et al., 2021). An investigation into 10 firms that successfully implemented a circular business model showed that in 80 % of the cases, firms had engaged in efforts to understand the needs of customers and key stakeholders, and most of the firms had engaged potential users to co-develop solutions (Santa-Maria et al., 2022a). However, an interview study with 13 firms of various circular maturity showed that only one of them engaged in co-ideation with end-users, but not in a structured manner (Selvefors et al., 2024). Thus, while the need to involve end-users is recommended and may contribute to successful circular business model innovation, it does not appear universal for all firms. Furthermore, while collaboration between different types of stakeholders—including end-users—is a necessity for circular innovation, previous research emphasized a lack of knowledge in how companies should approach collaboration for circular innovation (Brown, Von Daniels et al., 2021).

Open innovation presents a possibility for companies to engage and collaborate with multiple stakeholders for circular innovation (Bocken & Ritala, 2022; Ranta et al., 2018). Open innovation accelerates the flow of ideas and knowledge beyond organizational boundaries, both among companies and between companies and end-users (Chesbrough, 2003). Open innovation and knowledge sharing mechanisms inherent in them can reduce uncertainties related to market acceptance and enhance capabilities needed for circular solutions (De Angelis et al., 2023; Dorrego-Viera et al., 2025; Ghisellini et al., 2016). It can also allow experimentation and rapid prototyping of circular ideas to quickly gather feedback from external stakeholders (Konietzko, Baldassarre et al., 2020). To this end, game-based approaches present a potential approach from open innovation for engaging with end-users in open circular innovation. Gamification has previously been applied in new product development to involve external participants in open innovation and to facilitate end-user participation due to the engaging nature of games (Kavaliova et al., 2016; Molasy et al., 2023). Previous research has examined how to design gamified idea competitions (Scheiner, 2015) and how gamified crowdsourcing can be used to gather ideas from different types of stakeholders, including customers (Kavaliova et al., 2016), citizens (Kauppinen et al., 2016), and company employees (Zimmerling et al., 2016). While numerous game-based approaches have been developed to support circular economy, these mainly focus on education (Selvefors et al., 2023). To the best of our knowledge, stakeholders, including end-users, have yet to be involved in an open, circular innovation process by means of gamification.

This study aims to address a gap in multi-stakeholder collaboration in circular innovation by (1) identifying the barriers to collaborating with external stakeholders, especially end-users, and (2) exploring how gamification could be used to assist open circular innovation. We articulate this through the following research questions:

- How do companies want to collaborate for circular innovation, especially with end-users?
- How could gamification support companies and end-users in working collaboratively to advance open circular innovation?

By addressing how co-design approaches can enhance multi-stakeholder collaboration for circular innovation, particularly between companies and end-users, this study contributes to circular innovation literature by (1) integrating and circular co-design processes, and (2) introducing a remote digital game concept to support sustained user engagement across multiple stages of the innovation process.

The rest of this paper is organized as follows. The literature background describes relevant background for the topic. The methods section presents the methods of analysis. The result is divided into two parts; the first part describes the game concept for open circular innovation. The second part describes the company representatives' perspectives on open circular innovation in general and on the game concept. The discussion offers a reflection and connects back to the study's aim. The conclusion points to relevance for open circular innovation in future research and practice.

Literature background

The extent and type of collaboration with external stakeholders is often discussed as an innovation strategy choice for achieving circular business models. This section provides an overview of previous research at the cross section of open innovation and circular economy, which sheds light on collaboration for circular innovation, and specifically, with end-users. The section outlines how previous research discusses gamified end-user engagement and why gamification can be relevant in open circular innovation.

Collaboration for circular innovation

Moving from a linear to a circular way of offering goods and services where products are reused, repaired, and recycled requires transformation across multiple value chains (Ellen MacArthur Foundation, 2013). As illustrated in Fig. 1, different types of multi-stakeholder collaboration are possible in circular innovation. Calabrese et al. (2024) discussed four different types of open innovation strategies for circular business models depending on the depth and breadth of the knowledge search needed: market-based open innovation, with low-depth and low-breadth of knowledge search; crowd-based open innovation, with low-depth and high-breadth; collaborative open innovation, with high-depth and low-breadth; and network-based open innovation, with high-depth and high-breadth. The findings from content analysis of 12 articles presenting 42 case studies show that most companies adopt collaborative or network-based strategies derived from high-depth or high-breadth knowledge search when developing circular business models. Strategies derived from high-depth knowledge search were more important to the companies than those derived from high-breadth. Reaching high-depth requires deep trust-based partnerships with a few selected external partners (González-Moreno et al., 2019) or might even entail engaging in innovation networks to maintain deep collaboration across a broad network.

However, Bocken and Ritala (2022) revealed reasons why companies might lean toward closed innovation when embracing circular business models. A primary motivator is risk reduction and control. Closed approaches allow firms to "maintain control over the coordination of the whole circular process, leading to less uncertainty" in execution and better control over value capture (Bocken & Ritala, 2022). By contrast, opening a circular project to outside collaboration introduces perceived risks and trust barriers. The article points out that an open strategy brings "relational and organizational coordination costs and risks" as firms may worry about relying on partners to uphold quality or sharing profits and data with others (Bocken & Ritala, 2022). Such trust issues and coordination challenges make companies hesitant to pursue open collaborations. The work suggests that a purely closed approach can limit the scale and impact of circular economy transformation. Notably, the authors observe that circular economy leaders tend to combine closed and open strategies to achieve more comprehensive circular models.

Growing research emphasizes that company-to-company partnerships will not alone enable the circular transition. Companies must also focus on customer engagement (Gomes et al., 2022) and on creating a joint circular value proposition where a set of actors contribute to an "integrated, end user facing solution" while addressing environmental sustainability (Konietzko, Bocken et al., 2020). Although open

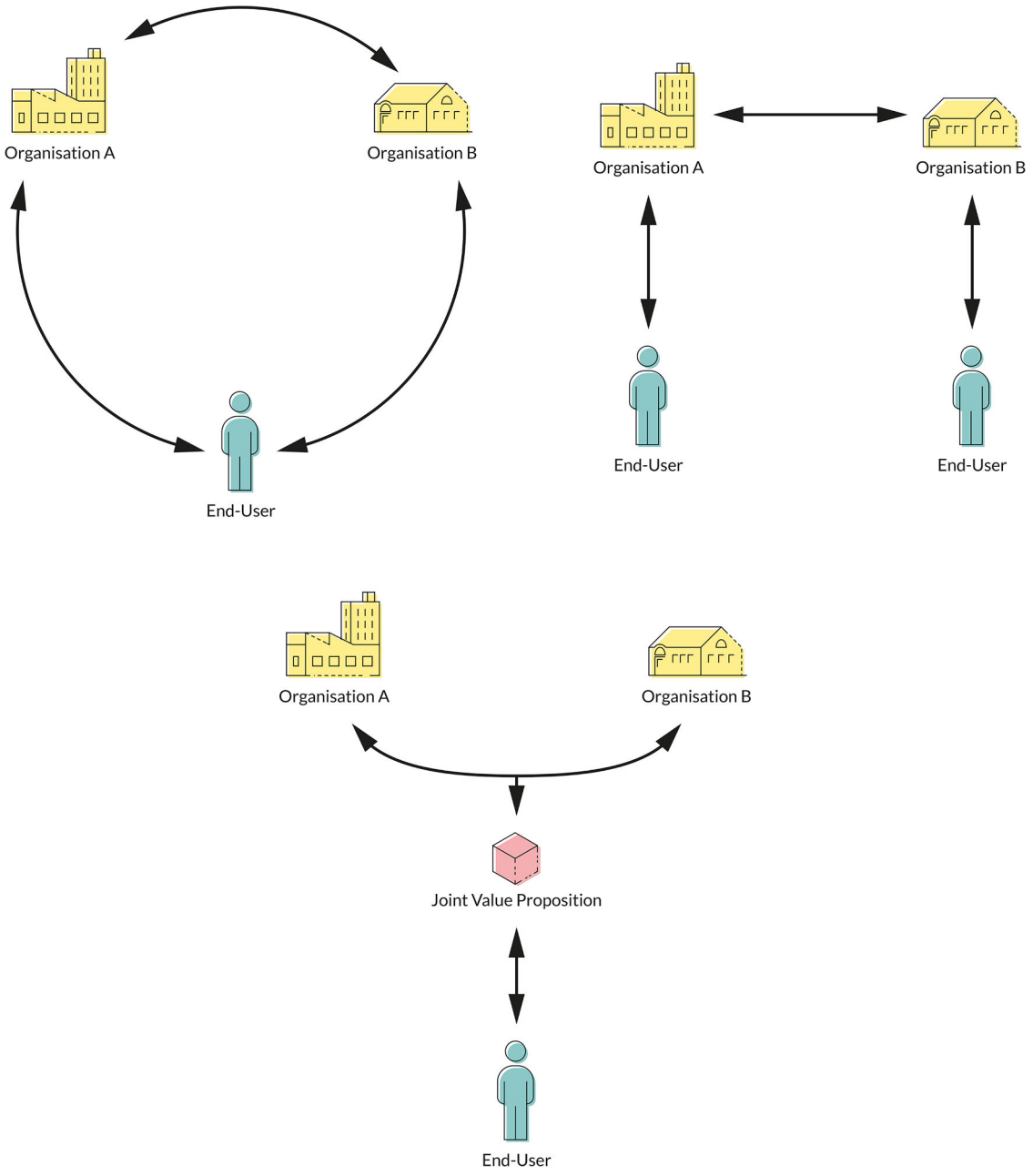

Fig. 1. Different types of multi-stakeholder collaboration for circular innovation. From top left (clockwise): (1) Upstream–downstream: collaboration between organizations positioned at different stages of the value chain; (2) Lateral: collaboration between organizations operating at a similar level of the value chain; (3) Joint value proposition: collaboration in which organizations co-create and deliver an integrated offering to end-users.

innovation and co-creating circular solutions with stakeholders, including consumers, is increasingly recognized as essential for circular innovation, Dorrego-Viera et al. (2025) identified challenges to open circular innovation and co-creation, including lack of circular design expertise within companies as well as resource constraints and difficulties in managing such initiatives within firms—particularly in less-developed regions.

Moreover, approaches for supporting and facilitating multi-stakeholder collaboration for circular innovation are limited and unclear on how to integrate end-user engagement in the development of joint circular value propositions. Previous research has introduced tools for ideation and design of collaborative circular business models. For example, Brown, Baldassarre et al. (2021) combined entrepreneurship principles and design thinking to create a process for collaborative circular proposition ideation. However, they focused on inter-organizational partnerships and did not stipulate how external stakeholders such as end-users can be involved. Another similar approach includes the BM^3C^2 (Boldrini & Antheaume, 2021) which focuses on exploring company-company collaboration by assessing their potential connections including resources and energy as well as shared, combined, or pooled revenues and costs. The authors designed and tested a tool to stimulate innovation and help organizations align their business models to other companies in a circular ecosystem. However, their focus was only on practitioners and end-users were not integrated in the process.

Engaging end-users in open circular innovation

While considering end-users and their needs during circular innovation is crucial (Santa-Maria et al., 2022b), in practice, current

processes that engage end-users focus on surveys, user testing, interviews, and focus groups (Bocken & Konietzko, 2022). These methods capture explicit insights or observable knowledge from end-users, rather than gathering tacit or latent knowledge (Sanders, 2002; Sanders & Stappers, 2012). In this way, involvement of users in circular innovation focuses on users as feedback providers rather than users as collaborators throughout the development process (Selvefors et al., 2024).

One notable exception is van Dam et al. (2021) who demonstrated the potential for involving end-users in the creation of circular value propositions. Drawing from participatory design, they applied a co-design process to generate insights and ideas from washing machine users. Hence, they co-developed ideas for new products and services with a washing machine manufacturer. However, the study focused solely on end-user to company collaboration. Moreover, it relied on physical in-person synchronous workshops, which has been main format for co-design for the last 50 years (Davis et al., 2021).

Open innovation literature has increasingly recognized the value of engaging end-users in innovation processes, especially as conceptualizations of the innovation process have shifted from closed, firm-centric processes to more distributed, collaborative, and user-centric processes (Chesbrough, 2003; Hippel Von, 2005). Users are discussed as valuable sources of knowledge and ideas; involving them in the innovation process can provide access to tacit knowledge on their latent needs and early feedback on new value propositions. This can lead to faster diffusion of innovation (Bogers et al., 2010).

The nature and extent of user engagement ranges from passive to highly participatory and even as a source of innovation in von Hippel's (2005) coining of the term "lead users," that is, users who face needs ahead of the market and innovate or hack the products and services themselves. Ways to engage users highlighted in open innovation literature include: crowdsourcing and idea contests, where users participate in idea generation; co-creation and co-design, where users participate in the design and development phases of innovation; living-labs, where users become part of real-life testing environments of new solutions; and customer integration platforms, where structured user input is collected (Jeppesen & Frederiksen, 2006; Piller et al., 2012; Piller & West, 2014). The evolution of the concept of "prosumers" over the past decade further reflects broader societal and technological shifts, highlighting the increasing importance of assuming a more active role for end-users and consumers in value creation and shaping new economic and social landscapes (Ertz et al., 2025).

However, engaging end-users in open innovation also raises challenges and barriers related to their motivation and willingness to contribute (Antikainen et al., 2010), intellectual property rights and ownership of ideas (de Beer et al., 2017), integration of users insights and ideas into actionable innovations (Bogers & West, 2012; Piller & West, 2014), and making sure that the representation of users ensures that diverse and relevant voices get heard (Dahlander & Gann, 2010; West & Bogers, 2014).

Innovation literature discusses participatory design approaches such as co-design and co-creation to enhance the participation of users and other stakeholders in collaborative and open innovation processes. Co-design enables deeper user engagement and transforms the role of users from merely informants to innovation partners (Sanders & Stappers, 2008). Moreover, co-design can enhance creativity and idea generation (Steen et al., 2011), leading to products and services that are better aligned with user needs and preferences (Hoyer et al., 2010) and eventually create a long-lasting loyalty and relationship between the company and end-users in a collaborative innovation ecosystem (Bogers et al., 2018; Füller, 2010).

In open innovation literature, remote digital tools such as ideation jams, online brainstorming platforms, and crowdsourcing initiatives have already been used. They offer a possibility to attract and reach a broader audience and facilitate large-scale user engagement for idea generation and early innovation activities (Poetz & Schreier, 2012; West & Bogers, 2014). Such approaches often include outsourcing tasks once performed by internal R&D teams and using the crowd for problem-solving instead. In this way, crowdsourcing as a co-creation process blurs the boundaries between consumer and producer, by getting consumers to employ capacities such as time, effort, and knowledge (Christensen & Karlsson, 2019).

While the notions of co-design and co-creation are sometimes treated synonymously, Sanders and Stappers (2008) distinguished between co-creation, as any act of collective creativity, and co-design, as an instance of co-creation where the creativity of designers and non-designers works together. In co-design, the end-user who will eventually be served a new product or service is considered an expert of their experience. Therefore, they play an active role in idea generation and concept creation, working with designer(s) and using participatory design tools to help support ideation and expression.

Gamified end-user engagement

In both open innovation and co-design literature, game-based approaches and gamification are highlighted as methods for enabling participatory design, enhancing user engagement and creativity, and facilitating idea generation, experimentation, and learning (Agogué et al., 2015; Brandt et al., 2012; Scheiner, 2015). Games and gamification are prompted as offering motivating and stimulating environments for engaging in open innovation and co-design. They seek to promote intrinsic motivation (Chapman et al., 2023), that is, doing something because it is inherently interesting or enjoyable (Ryan & Deci, 2000a).

Self-determination theory (Ryan et al., 2006) is often used to explain how games or gamification support intrinsic motivation. Self-determination theory suggests that humans have universal and innate needs for autonomy, competence, and relatedness (Ryan & Deci, 2000b). Ryan and Deci (2000a) further suggest that intrinsic motivation can be facilitated especially if an activity gives feelings of competence, a sense of autonomy, and a sense of relatedness. Yet, while some empirical studies of gaming seem to support the idea that self-determination theory can explain why games motivate us (Ryan et al., 2006), a recent review claims that self-determination theory is an insufficient explanation for gamification's effectiveness, specifically for learning (Chapman et al., 2023).

Not all people are intrinsically motivated by the same activities (Ryan & Deci, 2000a). Therefore, in addition to motivational theory, gaming and gamification have been understood more practically by game researchers and designers. For example, it is common in gaming to design four types of players: Socializer, Achiever, Explorer, and Killer (Bartle, 1996). Adamou (2018) outlined four types of motivation to build into games: knowledge, narrative, self-discovery, and transcendence. In our view, such game-oriented typologies should not be seen as alternatives to more fundamental theories such as self-determination theory. Instead, they are practical approaches to facilitate intrinsic motivation, and in some cases—extrinsic motivation, in games for different players.

Patrício et al. (2018) introduced design games as structured tools to facilitate collaborative problem-solving. They argued that gamification serves as a valuable tool in open innovation, effectively addressing challenges inherent in the initial phases of innovation. In co-design literature, game-based methods have shown great potential when co-designing in person (Brandt et al., 2012). However, to the best of our knowledge, few games for remote co-design have been developed[1] apart from games for children (e.g., Walsh et al. (2016)). This absence of games for remote co-design is surprising as the use of digital games for

[1] A search in Scopus combining the keywords digital game, online game, or remote game and participatory design, co-design, co-ideation, or co-creation yielded 133 results. After reviewing titles and abstracts, and full papers when needed, we found that no articles were about remote or digital games for co-design for adults. Most of them were instead about co-design of games.

remote public participation in architecture and urban planning indicates that games can both increase the number of participants and the contribution per participant (Prilenska, 2019).

The COVID-19 pandemic instigated a shift toward adapting design methods for remote, digital, and asynchronous participation (Davis et al., 2021; Wallgren et al., 2021). In a post-pandemic globalized world shaped by digitalization, opportunities to participate remotely are required to fit into end-users' expectations as well as into everyday routines, shaped by, for example, remote work. Remote, digital, and asynchronous co-design can also contribute to inclusion by being accessible at times that fit different personal schedules and not requiring travelling. Davis et al. (2021) pointed out that remote, digital, and asynchronous co-design also allows for prolonged engagement over time, rather than a one-time event or workshop. Time pressured individuals may also be more able to participate when the time-period of contribution is extended.

To sum up, studies that explore applications for remote or digital games that could support companies and end-users in working collaboratively in open circular innovations are limited. Remote co-design game approaches are underutilized in developing offerings to support circular-oriented innovation. Hence, there is an opportunity to explore the use of remote co-design games in the development of circular offerings. Such games could help address existing gaps between circular offerings and end-users' everyday needs by engaging end-users in open circular innovation. Creating an open, digital tool for remote and asynchronous participation that integrates both companies and end-users could be an interesting way to enable more inclusive circular collaboration.

Methods

This exploratory study builds both on qualitative methods from social science and design research. The core of our research are online interviews with 15 company representatives about their perspectives on collaboration for circular innovation, especially with end-users, and on how gamification could support such collaboration. As gamified support for circular remote co-design does not currently exist, it could be difficult for interviewees to imagine it. Therefore, we designed a game concept as a mediating object to support reflection and dialogue with professionals. Mediating objects are sometimes used to concretize or provoke thoughts. This is in line with research-through-design methods where artefacts are used to stimulate discussion during the early stages of design, for example, an artefact created as a provocation for reflection (Stappers & Giaccardi, 2014). Additionally, the act of designing an artefact also gives rise to insights and, thus, can also be a way of generating knowledge (Stappers & Giaccardi, 2014). Therefore, the research does not aim to validate the use of a game concept for circular innovation; instead, the game is a mediating artifact to elicit insights from professionals about gamified, open circular innovation processes.

Research-through-design: Design of a game concept

As discussed in the literature background, co-design methods and processes have been used in previous innovation as well as circular innovation studies. To create the game concept, first circular business model co-design processes were mapped with traditional co-design processes to serve as a frame of reference to develop the structure of the game. We selected four case studies following a search of academic literature databases, based on characteristics that could provide an understanding of co-design workshop processes relevant to this work: Of the four, two papers were related to the circular economy (Brown, Baldassarre et al., 2021; van Dam et al., 2021) and two were unrelated (Moju-Igbene et al., 2022; Peters et al., 2024). Additionally, two of the papers featured co-design processes targeted at engaging professionals (Brown, Baldassarre et al., 2021; Peters et al., 2024), whilst two were targeted at engaging customers in the process (Moju-Igbene et al., 2022; van Dam et al., 2021). This was done to provide an understanding of the process from both a company professional perspective and an end-user viewpoint. To help compare and structure the co-design processes of the four selected cases, we used two additional well-known frameworks often applied to co-design processes (Noorbergen et al. (2021), adapted from Sanders and Stappers (2014); and Visser et al. (2005)). These additional frameworks served as a backbone for the mapping of the four initial co-design processes and as a way to understand the stages mentioned in those four papers.

The mapping of co-design processes was done using the digital whiteboarding tool Mural. We mapped out stages of the different co-design processes and actions within the stages and aligned them vertically to enable comparison across cases. The stages and actions were developed into a structure for the game concept by translating actions from the co-design processes mentioned within the papers into actions within the context of a game. We then separated actions into actions for *end-user players* and for players representing a company or another type of organization in a circular collaboration, for simplicity referred to as *provider players*.

On the end-user players' side, we added narrative introductions (i.e., a storyline) to each stage to provide an engaging reason for end-user players to participate and to "set the scene" or introduce them to the premise of the game. Additionally, we evaluated the game structure for end-user players on whether it delivered and addressed different types of player motivation, such as knowledge or self-discovery (Adamou, 2018), and basic psychological needs (Ryan & Deci, 2017). We created and evaluated further iterations based on discussions between the authors and previous research (Whalen et al., 2024). Once the game structure was completed, we created visual representations of the game concept using the web-based interface design tool FIGMA so that it could be presented to company representatives during interviews.

Interviews: Perspectives mediated by a game concept

Participants were recruited through social media via posts by the authors on the professional social networking site LinkedIn at the end of September 2024 and reshared by some from the authors' networks (reposted a total of 16 times). Only professionals working at companies were invited for interviews, to ensure a first-hand company perspective on the topic. Examples of excluded professionals were university researchers and educators. Examples of included professionals were in-house designers, design consultants, and start-up CEOs. Table 1 offers a summary of interview participants.

In total, we interviewed 15 company representatives. The goal was to explore a range of perspectives on multi-stakeholder collaboration in circular innovation and to inform possible future development of the game concept. The sample size was considered sufficient as thematic saturation was reached when no substantially new themes emerged in

Table 1
Overview of the interviewed company representatives.

Participant	Job Type	Company Type	Country
P01	Design Consultant	B2B	Sweden
P02	In-House Designer	B2C & B2B	Sweden
P03	Start-up CEO	B2C & B2B	Sweden
P04	Start-up CEO	B2C & B2B	Sweden
P05	Design Consultant	B2B	UK
P06	In-House Designer	B2C	Sweden
P07	Design Consultant	B2B & B2C	UK
P08	Design Consultant	B2B & B2C	India
P09	Start-up CEO	B2B & B2C	Sweden
P10	In-House Designer	B2B	Sweden
P11	In-House Designer	B2B & B2C	Sweden
P12	Design Consultant	B2C & B2B	UK
P13	Design Consultant	B2B & B2C	USA
P14	In-House Designer	B2B	USA
P15	In-House Designer	B2C	Sweden

later interviews.

All interviews were conducted by the first author, with one assistant taking notes. The interviews were semi-structured and followed an interview guide (see Appendix A) that covered the following topics: perception of what a circular co-design game could be, the companies' current ways of ideating, if and how they include end-users in current processes, and current challenges. Then the game concept was explained to the interviewees, and they were asked to comment on the game concept and to provide feedback. The interviewees were encouraged to give honest feedback, meaning that negative feedback was also welcome. The game concept was shown as a slide show with visual representations of different parts of the game and explained verbally to the interviewees.

Data analysis

The interviews were recorded and transcribed using an AI transcription feature available in the software Dovetail. The transcripts were primarily analyzed using a structured analysis approach focused on exploring pre-identified topics of interest. Themes were initially organized according to the topics in the interview guide which covered existing company practices, end-user involvement, and feedback on the game concept. Two additional themes emerged from reviewing the transcripts: (1) potential use cases for the game and (2) job roles suited to use the game in the companies.

Both the lead author and an assistant independently and manually reviewed the transcripts, tagging excerpts in Dovetail according to the themes. The analysis was iterative, with the two comparing and discussing their tagging to ensure alignment. Within each theme, the tagged content was reviewed and grouped based on commonalities and differences between interviewees' responses. Finally, a simple quantitative summary was created based on how interviewees ranked three brainstorming concepts shown during the interviews. These preferences were grouped by participants' job roles to identify any patterns across different role types.

Co-design game concept for open circular innovation

Mapping co-design processes resulted in an overarching structure for a remote co-design process for open circular innovation, as Appendix B shows. The general stages were then translated into a game concept called "Moving Planets." Fig. 2 shows both the general game stages and the games stages of Moving Planets, for provider players and end-user players. Appendix C describes the specific actions for each stage.

In the game concept Moving Planets, Earth has become unsustainable due to poor environmental practices, prompting humanity to relocate to spaceships. End-user players are recruited as leaders of new societies on these spaceships, tasked with maintaining a thriving society through circular economy training, proposing solutions, and implementing new products or services. As leaders, end-user players must respond to the various issues raised by their citizens, implement new products and services, and anticipate their citizens' reactions. There are four mini-games within the game with their own challenges, rewards, and narratives that align with the overall narrative. Fig. 3 describes the narratives, challenges, and rewards associated with the different stages for end-user players.

Provider players set up the mini-games for end-user players, thus acting as game masters. For example, provider players decide the content for the different mini-games and come up with specific challenges. For provider players, the interface is not gamified and has no game-like narrative. As such, it could be described as a tool to facilitate a co-design game for end-users.

An important aspect of open circular innovation is the collaboration between different organizations, such as two companies or a company and a non-profit organization. In Moving Planets, provider players from different organizations can match and jointly set up mini-games as a first

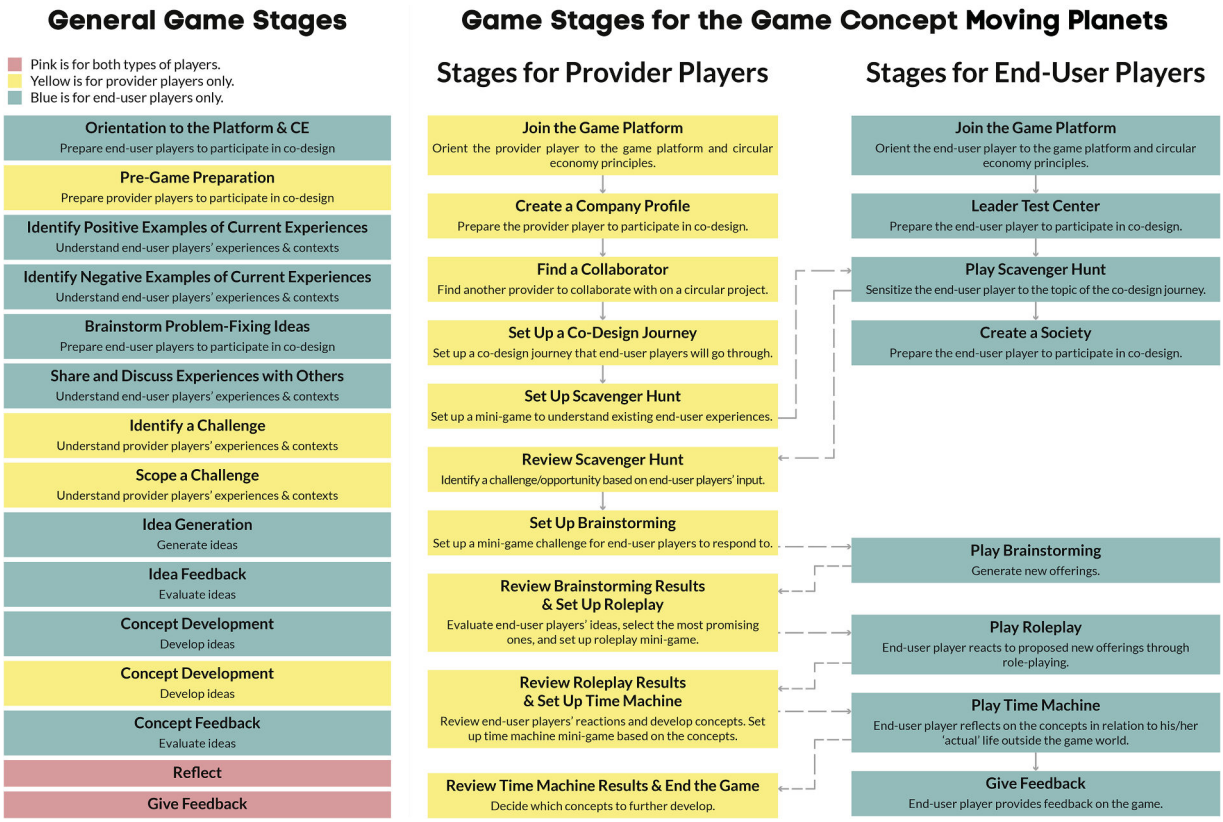

Fig. 2. Translation of general co-design game stages into game stages of the game Moving Planets, for both provider players and end-user players.

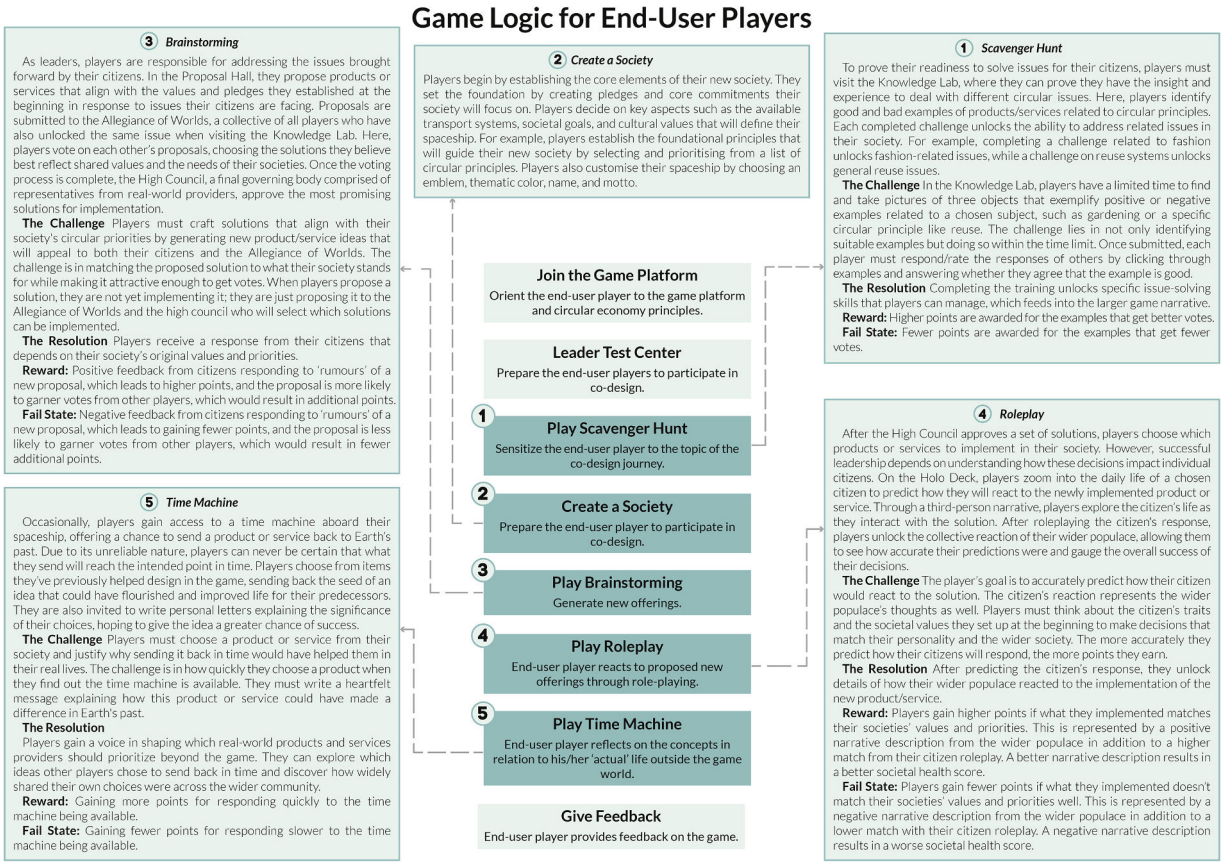

Fig. 3. Narratives, challenges, and rewards for end-user players in the game concept Moving Planets.

step toward creating a joint value proposition.

To make the game concept more concrete for the interview study, hence more usable as a mediating tool, we created visual representations (wireframes) of the game. Figs. 4 and 5 present examples of these wireframes. These have been designed for end-user players to play on mobile phones and for provider players to use on computers.

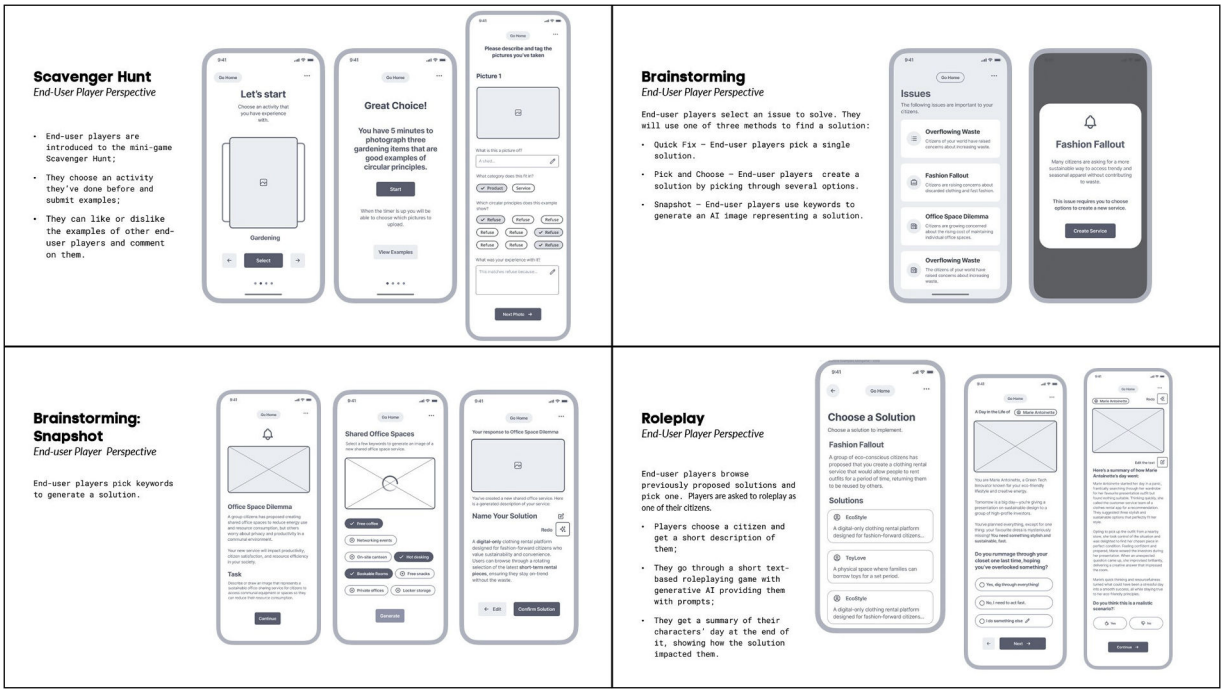

Fig. 4. Wireframe screenshots of Moving Planets from the end-user player perspective, with explanations that present the game concept during interviews—the interface for the end-user players is adapted for mobile phones.

Fig. 5. Wireframes of Moving Planets from the provider player perspective, in which the player is a game master—the interface is less gamified and adapted to computer screens.

Company response

Results from the interview are distilled in the following subsections, in line with the guiding research questions. The first three address the interviewees' perspectives on open circular innovation while the fourth more directly relates to using gamification to support open circular innovation processes. Example quotes are provided to support transparency.

Collaborating with end-users in open circular innovation

Interviewees had various perspectives on collaborating with end-users. Several participants appeared to place more value on ideating with other stakeholders over ideating with end-users. Interviewee's own experiences collaborating and co-creating with users varied. Most (8/15) mentioned that they currently engage with end-users by extracting end-user insights through user research such as questionnaires. Few (4/15) mentioned that they engage with end-users by generating ideas with them. One interviewee thought their company was currently engaging *"not nearly enough"* with end-users (P10). Another indicated they did not think end-user involvement was necessary in their work (P15). Another dismissed altogether end-user involvement, stating they did not see the value of co-creating with users, instead preferring to extract insights and using their own knowledge to develop new offerings: *"We should be the professionals within our area, and we should actually understand what [end-users] are doing and we shall not ask them about the problem. We should actually try to find you a solution"* (P11).

Multiple interviewees mentioned using the game to generate user insights from players instead of solutions or concepts: *"I think this would give you a very rich set of data to work on your concepts"* (P7). A theme mentioned by a few participants that contributed to their hesitancy to collaborate with end-users was that incorrect outcomes could be generated when trying to get end-users to generate "new" ideas. Lack of good input from end-users was also raised by another participant who doubted the honesty of end-users' responses: *"It will always be a challenge to get people to be honest with you, and it's especially hard when they like you or when they have some kind of relationship with you"* (P9).

Collaborating with other companies in open circular innovation

Interviewees generally reacted positively to the collaboration section of the game concept which allowed companies to match with other companies. One participant remarked, *"It's nice because it seems like a way to find your collaborators as a matchmaking tool"* (P7). Several interviewees expressed desire for the matching to be based on a personal level rather than a company-to-company level: *"It is hard to sort of find each other on the other sides of organizational lines that are made up between us"* (P6). Another interviewee suggested customizable collaboration settings that would allow companies to set the parameters they would like to match (P5) or the ability to include more information on the company profiles such as circular history (P6).

However, not all interviewees were convinced in collaborating with other companies through the game. Concerns around intellectual property and sharing co-design processes with other companies were raised: *"Okay, how does this work? Do I help other people with their problem without getting anything back? The classic issue with the sharing? Like, how much do I want to solve someone else's problem? Not draw my own problem? And that, that's the question that pops up already now"* (P4). Another interviewee mentioned how the existing pool of companies in the game would be a key consideration in whether they used the collaboration section to work and partner with other companies (P2). This interviewee also felt the entire collaboration section should be optional, allowing professionals to opt-out of company-to-company collaboration.

Other interviewees expressed interest in using the game for internal collaboration and ideation within their companies—instead of with other companies. *"I would love to do this with my senior management team and my owners"* (P4). The game concept was viewed as a way to help gather feedback and ideas from employees across different departments and levels to continuously improve products and services: *"I imagine [a] structured tool for helping different stakeholders within an organization to maybe evaluate or propose strategies, circular strategies, for the development of products and services"* (P13). Some interviewees also viewed it as a potential way to contribute to circular economy education in their organization: *"I would even see this as something that we could run in a company…I work in a company of 100,000 people…I could see this as something that we make part of our sustainability academy"* (P14).

Other use cases were also brought up such as using the game with existing company partners or facilitating workshops and ideation sessions with clients (P5). Another interviewee suggested using it to build up a personal community of circular companies and businesses or as a marketplace for ideas or challenges that people would wish to collaboratively develop (P7). Finally, a design consultant mentioned using it to find clients interested in sustainability or circularity (P1).

Challenges of open circular innovation

We identified two main challenges associated with open circular innovation from the interviews: knowledge-based challenges and procedural challenges. Knowledge-based challenges primarily centered around the ability to create good formats for co-creation sessions and

manage participants. For some, the difficulty was in the competencies and knowledge within their team required to set up sessions, such as knowing which digital tools to use for remote sessions and what methods, activities, or tools to incorporate in such a session: *"How do we meet? What are the tools, what can we do? Is there a digital help system for this or should we just do it in the dashboard? How do we do this? What's the best way of actually generating ideas… We can't do this ourselves, so we must include the others. But how…do you do that?… So it's been very much trying to co-design but not really knowing and having the tools to do so"* (P4). Aside from setting things up, knowledge of how to design engaging sessions and meetings was a concern as well as how to enable creativity in the sessions so that imaginative new ideas are encouraged, with one participant calling their existing meeting methods *"not very creative"* (P1).

Another knowledge-based challenge was having the know-how to generate circular offerings in the first place. Some interviewees stated they would find it difficult to generate new circular offerings that are substantially different from the ones they are already doing, with one interviewee stating a major challenge they faced when attempting prior collaborations was general knowledge about circularity (P4). Similarly, one participant mentioned that working with intangible things like services can be difficult for everyone in a session to grasp (P7).

Procedural challenges were those that occur during implementation of a co-design or a stakeholder engagement process. These included not having engagement with end-users budgeted for (in the case of consultancies), not having the time to do it (in the case of in-house designers), or the project being far past ideation to engage customers in a co-design process (as mentioned by start-up founders). Another challenge included difficulty finding end-user participants interested in taking part in the co-design process. This was mentioned in cases where end-users are employees or other professionals as they tend to be too consumed by work to provide meaningful input (P2). Procedural challenges centered on internal company policies and legal issues also came up: *"If it's like something that I need to purchase or buy a license… I need to go [through] a certain series of protocol[s] to be able to get a permission from both in terms of a budget [and] also an NDA and legal issues and things like that"* (P15).

Using games for open circular innovation

Participants' views on the game concept and its relevance to their work appeared to depend on their professional role in their organization. Designers were concerned there was not enough data on the "why" collected throughout the current game concept. In other words, they wanted to know why a player chose one action over another. As one designer put it, *"What is much more interesting data is to understand why they do or do not like something in a concept… it's rarely an A or B answer"* (P7).

The difference between interviewees can be best illustrated by their responses to the **Brainstorming** section of the game, where each interviewee was presented with three different potential methods to allow end-user players to generate new ideas for circular offerings: (1) Quick Fix, where players chose from a number of pre-made offerings; (2) Pick and Choose, where players selected multiple options to construct a new offering which was then described using generative AI; and (3) Snapshot, where players selected or wrote keywords to generate an AI visual that described their offering. In-house designers rated. "Snapshot" as being the most useful brainstorm method, while design consultants ranked "Pick and Choose" as the most useful. Both, however, ranked "Quick Fix" as being the least useful option. Yet, start-up CEOs ranked "Quick Fix" as being the most preferred method, with "Pick and Choose" as the second-best method. Still, these findings should be interpreted with caution given the limited number of total interviews and the fact that only three start-up CEOs were interviewed. Reasons designers disliked "Quick Fix" included: believing it does not match how people normally ideate; it is too shallow because participants are "just" selecting options to put into AI; it does not provide enough depth to use in a co-design process to generate new offerings; it is too similar to a survey; responses would need to be further probed to understand why they have chosen an option; and it could require too much effort to set up because of numerous options. In contrast, CEOs liked it as they viewed it as a way of getting proof of concept and understanding what to prioritize. In their view, it could give more of a quantitative result as to whether their product is wanted in the market.

In terms of the other main sections of the game, **Scavenger Hunt** was generally viewed as a good way to get people to reflect and to gain insights into end-users' mindsets, thoughts, preferences, and the problem landscape. Still, some voiced concern that it did not contain enough data as to why it was chosen: *"There needs to be a follow up… Would [it] give enough insight for me as a designer or to understand why"* (P1). Professionals reacted positively to the idea of role-playing, but voiced concerns that the current embodiment of this in the game concept through the **Roleplaying** section would not be a true reflection of how the player would react. Moreover, participants stated that reflecting back on real life (the purpose of the **Time Machine** section) is good. However, there was a concern that the setting would not equate to real-life situations and therefore the results would be difficult to extrapolate: *"I hope then that people haven't selected the too sci fi solutions… then you wouldn't be able to really utilize it in present day"* (P10).

While the interviewees were not openly critical of game-based approaches, the asynchronous aspect of the game concept was questioned. When reflecting on the **Brainstorming** section, for example, one participant expressed: *"Having this in a setting where you work together and can bounce off each other's ideas has a lot of value"* (P7). Some also wondered if a lack of circular economy knowledge in players would lead to less accuracy and expressed desire for the game to provide more guidance on how to innovate with circular strategies. This included requesting inspirational examples (P4) and clear direction to be presented in the game itself (P3).

Using AI to simplify co-creation with users was interesting to participants, with one interviewee calling it an "*added bonus*" (P8). Rather than having to sift through text and quantitative measures, participants recognized the generative AI aspect could help the player visualize new ideas whilst also aiding providers to creatively view user generated content. However, using AI also brought up concerns. Participants expressed concerns about being able to trust AI to accurately represent players' intentions. Some companies would be *"less comfortable with having an AI kind of interpretation of what people are suggesting"* (P12).

Finally, at least two participants mentioned that end-user players need to understand the problem to be able to generate new solutions, and currently in the game, there is not enough opportunity to jointly develop the problem with the end-user players and understand their problems (P1, P7). Therefore, some participants wondered, would the end-user players even be generating solutions for the right things? To address this, one interviewee suggested the addition of a process or mini-game after **Scavenger Hunt** and before **Brainstorming** to help define and understand the problem: *"At least you give people space to input on the problem space or like give feedback on how we're defining the problem or how we're agreeing on what the problem is that needs to be solved"* (P7).

Discussion

This study sought to address two research questions (1) How do companies want to collaborate for circular innovation, especially with end-users? and (2) How could gamification support companies and end-users in working collaboratively to advance open circular innovation?

To this end, we have shown how an open circular innovation process could be embodied in a digital game through the creation of the game concept Moving Planets. By putting end-users in the position of players tasked with setting up a new world, the game concept aimed for providers to gain insights and ideas from end-users in an engaging way. The mini-game set-up aimed to enable a collaborative, back-and-forth process between providers and end-users where both can provide input and

build from each other. This provides the possibility allowed by asynchronous and remote participation to engage with end-users over longer time periods (cf. Davis et al., 2021). Enabling providers to partner and collaborate to create joint circular value propositions also intended to facilitate matchmaking and support open innovation for circular economy by encouraging the creation of partnerships needed to create new circular business models.

Results from the interview study provided insight into how companies want to collaborate for circular innovation, especially with end-users. By using the Moving Planets game concept as a mediating tool, the study suggested that professionals may be hesitant to collaborate with end-users but are more open to collaborate company-to-company. This echoed Laursen and Salter (2006) who found that firms tend to work more with suppliers, customers, and competitors (other firms) than with end-users or individual customers. This is explained by firms perceiving other firms as more legitimate and trustworthy while perceiving challenges with extracting usable knowledge from end-users due to internal resistance (Enkel et al., 2009). Sanders and Stappers (2008) also argued that, although all users can be creative, not all users can become designers. In the business community, co-creation is commonly based on the assumption that only an "elite" group of lead users or customers can engage in participatory design.

How company representatives want to collaborate with end-users for circular innovation also appears to depend on their company role. While not generalizable, the findings suggested designers were more open to gathering ideas and collaborating with end-users, whereas start-up CEOs wanted to gather quantitative data from end-users to inform their decisions. This resonated with previous literature that highlighted hidden internal costs of evaluating external ideas when crowdsourcing idea generation (Christensen & Karlsson, 2019) and was in line with Calabrese et al. (2024) who found that companies favor a circular open innovation strategy stemming from high-depth or high-breadth of knowledge search. Mortati et al. (2023) showed that both are needed when dealing with innovation processes and firms should have the capability to use both types: thick data being especially useful in the early stages of innovation, while big data contributing more during the later stages to validate and scale solutions.

Some interviewees expressed a desire to use the game to generate user insights, and not "solutions" from end-user players, suggesting they did not value user input during certain innovation phases such as ideation. Bogers et al. (2010) differentiated between users as innovators by drawing on tacit, local knowledge and users as sources of innovation-related knowledge, contributing to a provider's effectiveness in innovating. However, dismissing users as a source of knowledge was a potentially limiting view, especially considering research such as that of Poetz and Schreier (2012) who used blind evaluation to find that user-generated ideas had somewhat lower feasibility scores but scored significantly higher in terms of novelty and customer benefit compared to professional-generated ideas. Moreover, other interviewees outrightly expressed desire to use the game with other companies but not end-users. Interviewees' interest to match with other companies through the game—and particularly the desire to match on an individual level—echoed the findings of Brown et al. (2019) that collaborative circular innovation is built on relational aspects, often started by motivated and enthusiastic professionals who form personal connections with other likeminded professionals.

The findings are extremely relevant to ongoing open circular innovation discussions: If companies are hesitant to collaborate with end-users, how does this impact open circular innovation? Interestingly, Pedersen and Clausen (2019) indicated one potential way to increase interest in engaging with end-users. They found that when circular collaboration between companies occurred along a value chain, interest in understanding the end-users increased among the participating companies. Therefore, we propose a practical approach: Instead of pushing for full external collaboration with end-users, companies might start with internal alignment and then transition to external engagement. Thus, different stakeholders may still be integrated within a circular transition process, but in a staged approach that reflects the findings of Dorrego-Viera et al. (2025) highlighting the need to build capacity, coordination capabilities, and trust in multi-actor collaboration processes.

The interviews revealed a need for support in open circular innovation processes as well as for education to help stakeholders learn about circular economy. The latter was slightly unexpected as there are numerous circular economy education support tools, including games (Manshoven & Gillabel, 2021; Whalen, Berlin et al., 2018). Perhaps they are unknown to the interviewed professionals or not specific enough to the professionals' contexts. Nevertheless, interviewees viewed circular economy support as necessary for themselves as well as for other stakeholders. In fact, we can view company support in becoming more circular as a prerequisite for open circular innovation with end-users. If companies do not understand circular strategies and end-users do not understand circular strategies, then we have a situation where the lost leads the lost. In this regard, the current game concept may be too advanced or take too much for granted regarding player's circular economy knowledge. Future iterations of the game concept could focus on providing more support for ideating circular solutions with end-users in the game. It could draw on previous work such as the Use2Use framework and toolkit which focused on designing circular products and services from end-users' perspectives (Rexfelt & Selvefors, 2021; Selvefors et al., 2019).

Finally, the study suggested that the game concept in its current form could not fully support open circular innovation and identified several ways the game could evolve to address interviewees' concerns. For example, some interviewees were skeptical the game in its current form would be able to provide crucial information to do their jobs, such as understanding the "why" behind end-users' choices. A hybrid approach or combining the use of games with more traditional, in-person co-design methods could potentially address these concerns. Instead of using remote, asynchronous games for brainstorming (where deep discussions and justification matter), they may support gathering initial insights from end-users or structuring internal decision-making before engaging externally. There are also other potential benefits to using games in open circular innovation. Remote games could be used as a selection tool to help identify end-users relevant to circular innovation processes. Creating inter-company connections and joint value propositions through a game could also be a relatively low-risk, first step for companies to experiment with potentially new roles and respond to emergent factors, both of which are needed for collaborative circular innovation (Brown et al., 2020; Konietzko, Bocken et al., 2020).

Conclusion

This research addressed a gap in multi-stakeholder collaboration in circular innovation by identifying barriers to collaborating with external stakeholders, especially end-users, and exploring how gamification could be used to assist open circular innovation. The study revealed an important tension around how some companies were not as eager to do open innovation with end-users as they were to engage with other companies, especially if collaboration could be done on their own terms. The results further suggested that companies wanted to engage with end-users to extract insights and obtain feedback on ideas generated by professional designers. However, companies could see a possibility to engage with users for idea generation on circular products and services under the condition that the end-users were adequately knowledgeable about circular economy. Finally, remote games were perceived as a promising approach and platform for co-design, but companies had hesitations toward the presented form. The findings suggest that fully digital, remote gamification might not replace traditional, in-person co-design. Instead, hybrid formats combining digital and in-person approaches may be more effective. Furthermore, we highlighted the importance of balancing qualitative and quantitative data in open

circular innovation processes.

Theoretical contributions

The study addressed a knowledge gap at the intersection of co-design, open innovation, and circular economy literature by exploring how multi-stakeholder collaboration for circular innovation, especially between companies and end-users, could benefit from co-design approaches. Particularly it offered a theoretical contribution to open circular innovation by mapping and merging co-design processes with a circular co-design process.

The study also contributed to innovation management literature by outlining a remote digital game format intended to enhance user engagement during the innovation process. Earlier research has primarily examined user engagement during specific isolated stages of the innovation process. Our research offered a potential format that might support user involvement for longer time-periods across multiple stages of the innovation process. While exploratory, this research provided a foundation for future work on how to structure end-user engagement in open innovation, particularly through gamified, remote formats. It also addressed a gap in open innovation literature which focused on digital tools for singular idea generation events such as crowdsourcing ideation jams.

Moreover, the hesitancy of companies to engage directly with end-users, preferring instead company-to-company collaboration, provided a critical reflection point for open innovation research. The findings suggested companies may be more comfortable initiating circular innovation first through internal or company-to-company collaborations before extending externally to end-user co-creation. Notably, participants were positive about the matchmaking component of the game that could enable them to connect with like-minded individuals at other organizations. This aligned with prior research (e.g., Brown et al. (2019)) that highlighted the importance of individual-level relationships as instrumental in multi-stakeholder collaboration for circular innovation.

Practical implications

This study provided actionable insights for practitioners, particularly designers and innovation managers in organizations aiming to transition toward circular business models. Designers are encouraged to adopt a hybrid, gamified approach to co-design that combines internal ideation and structured co-design possibilities with end-users. This hybrid model may help address some of the potential limitations associated with using purely remote digital games to facilitate co-design.

Moreover, the remote game concept enables reflection on how to design more accessible and effective digital co-design tools. Our results highlight two categories of challenges: knowledge-based and procedural. To address potential content knowledge gaps, educational components, such as an integrated digital help system, could be embedded. Procedural challenges, such as reaching diverse user groups and ensuring compliance with legal and procedural frameworks, should also be considered.

Gamified tools may help bridge the structural tensions between openness and control in circular economy innovation (Bocken & Ritala, 2022) by: (a) creating bounded, rule-based environments that allow companies to engage in open innovation selectively. The gamified format may help ensure that external input is targeted and time-limited, reducing the perceived risk of intellectual property loss or uncontrolled outcomes (Antikainen et al., 2010); (b) gamification could help build trust and shared understanding among diverse stakeholders. Playing together may foster collaborative mindsets, helping partners visualize mutual gains; and (c) gamified co-design tools could allow firms to explore new roles in a circular ecosystem and provide a sandbox to experiment without having to commit real resources upfront. Firms can pilot open circular models with selected groups, evaluate outcomes, and refine their approach.

For managers, this type of game could enable organizations to have a bottom-up sourcing for innovation where multiple company-company and company-user exchanges can take place. Given potential hesitancy to immediately engage deeply with end-users, managers may consider an incremental approach. Initial stages could rather focus on strengthening internal understanding and company-to-company collaboration, followed by structured and strategic integration of end-user perspectives at a later stage.

Limitations and directions for future research

Limitations of the study offer opportunities for future research. Given the qualitative nature of the research, the findings are not intended to be generalizable. Further research, such as a quantitative survey study, could complement the findings by capturing broader patterns in companies' perspectives on circular innovation and end-user engagement across company sizes, sectors, or geographic contexts.

The current game concept may be too advanced for stakeholders unfamiliar with circular economy and some concepts may need to be explained more clearly. Future research could focus on how to make such tools easier to understand and use. Moreover, the game concept was not actively played and tested; future research should involve testing with companies and end-users to evaluate its role in open circular innovation processes. Piloting the game in real-world, multi-stakeholder settings would move the game from a conceptual prototype to a validated tool. To this end, exploring how different player groups and company types affect game outcomes could also be a valuable direction for future research.

Finally, future research could further explore the dynamics between stakeholders in open circular innovation processes, including: (1) the conditions under which user-generated ideas are more valuable than those generated internally by companies; (2) potential biases in how companies choose stakeholders for circular innovation; and (3) the criteria for selecting ideas, such as novelty versus feasibility. A more detailed analysis of the complex interactions between stakeholders in co-design processes could be conducted to map how relationships and interdependencies impact open circular innovation, both generally and within the context of gamified tools such as the one proposed in this study.

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CRediT authorship contribution statement

Princess Woy: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft. **Katherine A. Whalen:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Sara Renström:** Conceptualization, Methodology, Visualization, Writing – original draft, Writing – review & editing, Funding acquisition. **Sara Fallahi:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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