

# Aiming for bullseye: a novel gameplan for circular economy in the construction industry

Aiming for  
bullseye

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## Abstract

**Purpose** – The paper aims to provide managerial recommendations for implementing circular economy (CE) principles in both organizational and interorganizational contexts, including when using digital tools, such as building information modeling (BIM) and blockchain. Drawn from the construction sector in the Netherlands, the findings can be generalized to similar sectors where a company may receive multiple inputs as part of its supply chain augmented by digital technologies.

**Design/methodology/approach** – Design addresses the research question: what are the strategic and tactical approaches of organizations on the CE pathway? Sub-questions target initiatives pursued by participants, and look toward information, roles and functions for supporting the CE process. Applying a multiple-case study approach (21 semi-structured interviews with 29 participants) the paper explores strategic initiatives of construction companies implementing CE pathways. The strength of the research design comes from facilitation of rich and deep qualitative insights from Netherlands-based managers embedded within global supply chains contributing to conceptual mapping. A limitation is data from one country (though representing both national and multinational companies).

**Findings** – Interviewed managers share guidance for production-related construction companies anchored in materials and product design. Recommendations include to (1) develop both internally and externally the awareness of CE amongst leaders, (2) communicate with internal and external stakeholders for shared vision across the supply chain, (3) start with pilot projects, and (4) ensure product data-integration for CE business models through computer modeling and blockchain for decision-making processes, choices of materials, business model coordination and product (re)design. Continuous learning about CE roles and responsibilities amidst organizational process restructuring is required throughout linear to CE transitions. Extending the time for the CE principles evaluation process would allow for reconsideration of decisions made for CE implemented projects.

**Originality/value** – A novel CE gameplan with a hurdles and recommendations checklist provides an operational interface with decision making points between internal factors for the host organization and external supply chain partners.

**Keywords** Circular economy, Construction, Gameplan, Supply chain, Bullseye, The Netherlands

**Paper type** Research paper

## Introduction: aiming for circular economy

This paper responds to the research question, what are the strategic and tactical approaches of organizations on the circular economy (CE) pathway? Creating a CE and replacing the current linear, take-make-waste economy would minimize human-induced climate change (see for example [Ellen MacArthur Foundation, 2015](#)). Implementation of CE requires complex new business models. This involves collaborations across supply chains ([Bocken et al., 2017](#); [Chen et al., 2022](#)) to navigate barriers to adoption, such as the potential costs and uncertainties of reverse logistics ([Chileshe et al., 2018](#); [Li et al., 2018](#); [Ambekar et al., 2021](#); [Jayasinghe et al., 2019](#)), or efficient recycling of material after usage ([Lemille, 2019](#); [Wijayasundara, 2021](#)),



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notwithstanding the genuine benefits of such approaches. Undoubtedly, governments will facilitate this transition via political, economic and regulatory requirements, compelling companies to adapt strategically and tactically to achieve the CE advantages. This paper focuses attention on the construction sector in the Netherlands, which has complex, multi-lateral supply chain connections and is a major driver of CE improvement. Managerial recommendations will be developed for implementing and evaluating circular principles (see for example, [Khan et al., 2022](#); [Kurniawan et al., 2022](#); [Liu et al., 2022](#); [Yu et al., 2022](#)) including when using digital tools such as building information modeling (BIM) and blockchain in both organizational and interorganizational contexts.

CE is an alternative to a traditional take-make-waste linear economy ([Bocken et al., 2017](#)) and requires ongoing research ([Kirchherr et al., 2018](#)). For this paper, we adopt the [Kirchherr et al. \(2017, p. 224\)](#) definition of CE being:

... an economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production, distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.

CE research is growing ([Geissdoerfer et al., 2017](#); [Van Weelden et al., 2016](#); [Anastasiades et al., 2022](#)) in building and construction management. Many studies have detected key barriers and enablers of CE for the construction industry ([Caldera et al., 2020](#); [Guerra and Leite, 2021](#); [Gorgi et al., 2022](#)). There are some construction-specific frameworks developed out of literature reviews and analyses ([Bilal et al., 2020](#); [Hossain et al., 2020](#); [Mhatre et al., 2021](#)), however, empirical studies with a focus upon construction industry operational frameworks are few. [Wuni and Shen \(2022, p. 575\)](#) identify CE design in construction projects having essential elements for analysis including “longer economic life, deconstruction, zero-waste, and possible valuable applications of by-products and wastes”, which are process and operational scaffolds.

The technological application of BIM is a growing area of research capable of including operational aspects of CE and sustainability in general ([Wu et al., 2017a](#); [Edirisinghe et al., 2021](#); [Sanchez et al., 2021](#); [Mei et al., 2022](#)). Some research exists on process models in manufacturing, however, exemplars useful to operational transition to CE objectives are in short supply ([Widener, 2007](#)). Furthermore, [Wijewickrama et al. \(2021\)](#) in a systematic literature review found a structural hole in research between the construction and operations stages in the CE literature, a gap addressed by this paper to make a pivotal contribution building upon BIM and the broader sustainability literature.

The next section provides context for this research in the construction sector in the Netherlands, a global leader in construction site recycling ([van den Berg et al., 2020](#)) and government and industry engagement with CE. This is followed by the methodology used to collect data, and discussion of the findings to discern a novel conceptual gameplan and checklist. Practical implications with recommendations for business decision-makers and areas for future research conclude the paper.

### **Literature: construction and CE in Netherlands and beyond**

The Glasgow Climate Pact at COP26 intensified environmental approaches in all sectors, including building and construction ([Brodhag, 2021](#); [UNEP, 2021](#)). Furthermore, the European Union (EU) remains committed to the Paris agreement ([United Nations, 2015](#)) by implementing CE. The EU’s 2020 Circular Economy Action Plan promotes the European Green Deal and involves integration of design, CE processes, sustainable consumption and

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resource maintenance within the EU economy (European Commission, 2020). The Netherlands, among EU countries, has a smaller circularity gap with the percentage of recycled materials being 24.5% in 2020 (Circle Economy, 2020). The Netherlands is outperforming in CE regarding global circularity levels and the country's goal is to reach 100% circularity by 2050. Up to 75% of that target could be gained through the four sectors of construction, agriculture, renewable energies and repair and remanufacturing (Circle Economy, 2019). The construction sector in the Netherlands is a major driver of CE improvement ahead of the 2050 target. The sector currently generates 35% of the total waste and 5–12% of national greenhouse gas emissions (Circle Economy, 2020).

In the Netherlands and globally, notwithstanding the war in Ukraine (Harper, 2022), and the ongoing impact of Covid-19 pandemic on supply chains (Alicke *et al.*, 2020; Deep *et al.*, 2022; Sarkar *et al.*, 2022), there are numerous business-related CE hurdles, such as, products being designed for long-term usage (transition from make-to-break economy), the acceptance of second-hand products by consumers, return-logistics of products, amended financial balance sheet structure with reduced investment opportunities for the company and CE friendly business models (Kirchherr *et al.*, 2017). In an organizational context, adopting CE values requires strategic commitment of the management board with a view to the next step of implementing return logistics and CE values (Bernon *et al.*, 2018). The transition to CE also has major implications for establishing trust, transparency (for example, via mechanisms such as blockchain) and collaboration within the supply chain both internal and external to current organizational and industry sector boundaries (De Angelis *et al.*, 2018). It should be noted that, whilst blockchain itself is nascent in its uptake amongst the organizations, other factors, such as, building mutual trust and partnerships can assist in implementation of both CE and blockchain (see, for example, Kayikci *et al.*, 2022; Luis *et al.*, 2022; Rejeb *et al.*, 2022; Rotabi and Ali, 2022; Steenmans *et al.*, 2021).

Moving from linear to CE, companies must create transition pathways together with their supply chain partners (Joseph and Gaba, 2020), however, a roadmap of such pathways is not available, thus heightening uncertainty and potential risks for decision makers. Market transition theory prioritizes a series of interconnected actions to achieve objectives including CE (McDowall, 2014). CE can act as a condition for sustainability (Geissdoerfer *et al.*, 2017). Sustainability is more open-ended, whereas the CE is more specific. The essential principle of the CE concept is to disconnect economic growth from resource use (Kirchherr *et al.*, 2017) so materials can be reused continuously at different stages, reducing detrimental waste in the ecological environment.

Supply chain collaborations and combined risk assessments are foundational tools to initiate change from linear to CE (Miemczyk and Luzzini, 2019). Reducing waste by reusing materials in production is a competitive competency that significantly reduces both energy consumption and extraction of raw materials from nature (Rajala *et al.*, 2019; Brockhaus *et al.*, 2019) contributing real cost savings for companies (Li *et al.*, 2022; Noakes, 2021; Routray, 2022). For example, the CE approach in Europe is expected to contribute €1.8 trillion of economic development by 2030, twice the current €0.9 trillion, and reduce CO2 emission by 48% by 2030, and up to 83% by 2050 (Ellen MacArthur Foundation, 2015; Lewandowski, 2016). Despite such advantages, the implementation of CE is slow. Circle Economy (2019) views the world as 8.6% circular, with many further strategic actions required to close the gap. Successful CE implementation needs policymakers to enable and encourage linear-to-circular transformations by business entities (Lewandowski, 2016) and supply chain partners (Van Weelden *et al.*, 2016).

Transition from linear to circular business models involves all supply chain partners (Batista *et al.*, 2018). Ideally, a closed loop can be created with adjusted product design enabling ease of repair, long-term usage, efficient disassembly and recyclability. Circular incentives incorporated into the business strategies and operational tactics can encourage

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long-term usage and increased collaboration within supply chains. Many organizations focus on short-term profits through increased (and repeat) sales; this contrasts with long-term usage and, therefore, lower sales in a CE. The organizational and supply chain perspective needs changing.

*Frameworks supportive of circular economy in a business context*

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The strategic development of CE in a business context involves expertise in sustainability, supply chains and (new) business models (Geissdoerfer *et al.*, 2017; MahmoudGonbadi *et al.*, 2021; Pieroni *et al.*, 2021; Stumpf *et al.*, 2021; Suárez-Eiroa *et al.*, 2019; Van Weelden *et al.*, 2016). The levers of control framework (Simons, 1995), with its four core aspects elucidates operational control by focusing on interfaces between different stakeholders. The levers of control framework balances the organization's core values, perceived risks, strategic uncertainties and the critical performance variables to facilitate control of organizational processes. This framework has been used by academics and practitioners on the interface between strategy and control (Martyn *et al.*, 2016). Although the levers of control framework is critiqued for potential ambiguity, it is argued this can be overcome when managerial intentions for controls are separated from employee perceptions of controls (Tessier, 2012; Arjaliès and Mundy, 2013). Who has the control, and to what extent, needs to be identified and communicated across partners for CE to be effective beyond academia, policy circles and boardrooms.

Developing strategic relationships between companies helps build sustainable supply networks (Villena, 2019). This dependence plays a role, particularly at the early stage of the formation of CE supply chains so adoption can increase. Shared vision with supply chain partners is a prerequisite to achieving sustainable goals (Fatimah *et al.*, 2020; Suárez-Eiroa *et al.*, 2019), which requires combining social, ecological and economic values across the value chain (Carter and Rogers, 2008). The characteristics of supply chain collaboration, information sharing, incentive alignment, integrated supply chain processes and collaborative performance system, can be adopted and transformed to work towards CE collaboration (Simatupang and Sridharan, 2005). This led us to the question in this paper of what are the strategic and tactical approaches of organizations on the CE pathway? Sub-questions in this research focus on the initiatives that have been addressed, what kind of information is supportive to this process and what roles and functions support linear-CE transitions?

The construction sector is a material-intensive business; therefore, in the transition from a linear to CE, an important step in decision making is the design phase of a building and the requisite choice of materials. BIM (see for example Akbarieh *et al.*, 2022; Charef *et al.*, 2021; Giorgi *et al.*, 2022; Shooshtarian *et al.*, 2022) supported by life cycle analysis (LCA), can evaluate CE principles early in the process of design enabling appropriate evaluation and calculation of the impact of the chosen materials (Wu *et al.*, 2017a; Mei *et al.*, 2022). Strategic selection of materials can minimize energy use and enhance the options for dismantling components after use (Sanchez *et al.*, 2021; Xue *et al.*, 2021). To support linear to CE transitions, the authors suggest a structured process starting at the material selection stage to create a building model based on further requirements of a customer. This should be followed by a sustainability analysis using combination of complementary tools such as energy simulations and LCA methods to evaluate and optimize the choices of materials and design. This combination enables an informed recommendation for sustainable CE improvements. Similar approaches have been applied in case research where BIM and LCA as well as life cycle costing were integrated into the modeling (Akanbi *et al.*, 2018). The authors suggest that this combination of modeling tools has utility not only upfront in the design process but also before demolition of the building to aid decisions about what

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materials will be extracted for different purposes in support of a transparent market for recycled materials (Elghaish *et al.*, 2022; Figueiredo *et al.*, 2022; Kouhizadeh *et al.*, 2022).

Aiming for  
bullseye

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## Methodology

A case study design enabled the research question to be approached multilaterally for a holistic perspective. Case study research offers rich and deep qualitative insights into the how and why questions (Yin, 2018). This methodology has prior application to data collection in the construction sector (Bal *et al.*, 2013; Calabrese *et al.*, 2020; Zangiacomì *et al.*, 2019). The inclusion criteria for the case study companies incorporated public communication of CE ambitions via websites and annual reports. The selections were made broadly across the construction sector recognizing that strategic pathways to CE are the responsibility of individual companies, yet to achieve the CE ecosystem the companies need diverse partnerships. Therefore, companies of different sizes were selected, and these companies occupied several roles and sections in the value chain. Three companies were oriented toward strong social objectives and therefore had more integrated connections to governments than commercial companies (six) in this linear-to-CE development pathway. Two of the companies were multinational, the other seven mostly operated across the Netherlands.

All the interviewed companies were founded in the linear economy and must make the linear to CE transition that the Netherlands construction industry is benchmarking. Although the backgrounds and roles of each organization were different, common patterns in the development pathway approach of the linear to CE transition could be recognized in the selected cases, indicative of theoretical saturation being reached. Following approved research ethics procedures, the connections of the researchers' organizations were first approached, and a snowballing method applied to identify, approach and select organizations to be interviewed. Encouraged by governmental CE target-setting, most of the companies working on visible projects in the CE space had a link to the construction sector. 21 semi-structured interviews with 29 interviewees (Appendix 1) were conducted in nine organizations in the construction sector in the Netherlands.

The interviews identified and captured the broad approaches of CE development. Involved were an eclectic mix of general managers (2), sustainability managers (11), operational managers (4), project managers (2) and representatives from other disciplines and functions (10). Four interviews had multiple participants and lasted one to two hours. In these combined meetings the participants were of complimentary backgrounds which created a broader picture of the development process. The reliability of the interview process was validated by investigating annual reports on published CE progress and internal documents. The other interviews were conducted with one participant each and lasted forty-five to sixty minutes. Based on participant language preferences, interviews were conducted either in Dutch (translated to English) or English. With informed consent, the interviews were recorded and written notes were kept. The interview data was supplemented with information collected from secondary sources, such as, internal reports, annual reports and websites. The publicly reported CE approaches formed the basis of a timeline and participants shared some internal documents on CE development. When discussing the findings, participants were structured per company (C1-9) and in chronological order of interviews.

The interviews commenced with a project overview and the first question was to introduce the participant, their positions within the case organization, and how their formal position could be related to CE ideas and actions. Next set of questions explored and described the development of CE within the company. Accordingly, participants were asked to illustrate the organizational initiatives and practical case outcomes. Additionally, the participants described the strategic and tactical decision-making processes and, specifically

for CE development, the role of partnerships, business models and measurements of CE progress. The last question of an interview was to share the next steps of the organization for subsequent years.

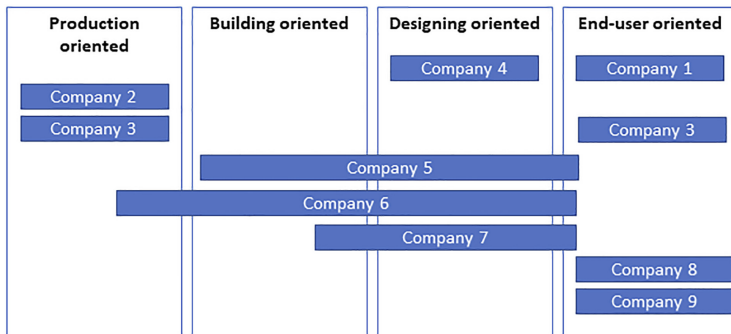
Figure 1 indicates the single or boundary-spanning role of each company in the construction value chain. Some were production oriented, having access to raw materials; the building-oriented companies had dominant focus on operational building processes. Design companies had influence in designing buildings and infrastructure, based on end-user-oriented companies and operated on behalf of the end-users of the buildings. Some companies contributed to multiple supply chain roles. A description of the CE organizational initiatives for the companies in Figure 1 is overviews in Appendix 1.

A template analysis was applied to the data collected (King and Brooks, 2016) to iteratively draw out themes related to supply chain management, and levers of control (King, 2012). Next, from participants' narratives, the initial template with first order concepts included individuals showing leadership in initiating projects beyond company guidelines, and the importance of learning, collaboration and strategic embeddedness. The second step involved several iterations of data coding which led to a refined final template with second order concepts shown in Figure 2. Although the development paths of the companies were different, a rising maturity level could be recognized, along with both internal and external development topics. Structured themes enabled combined internal and external elements and CE pathways to generate findings and conceptual graphics reflective of CE development. An example of analysis of the strategic interventions in development pathways for one of the companies is included in Appendix 2.

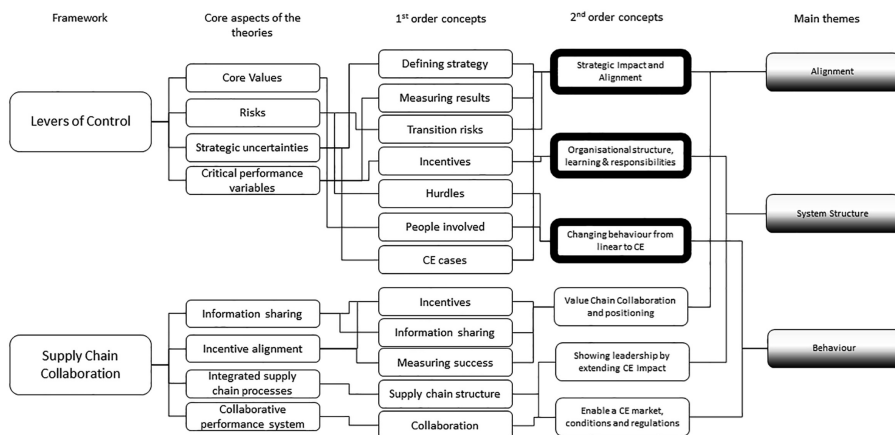
The discussion section next is designed around 2nd order themes. The authors acknowledge the main themes of alignment, system structure and behavior were higher order concepts underpinning the strategic approach and tactical decisions in the 2nd order which were the focus for addressing the specific research question. Data and themes emergent from the interviews with both internal and external orientations are discussed next. Please note that quotations in the discussion are verbatim from both native and non-native English participants and, in the interest of keeping the data as authentic as possible, the authors have chosen not to impose their own translation to the quoted text, but to keep the original spoken words.

**Discussion of the findings: construction of a gameplan**

This section discusses the participants' experiences and reflections of their pathways and accompanying successes or failures discernible from both internal and external orientations. The participants were able to identify the typical CE choices in the construction sector for



**Figure 1.**  
Positioning of selected cases in the value chain



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**Figure 2.** Approach for the development of the thematic template

implementation being: (1) the multipurpose applicability of buildings, (2) the use of recyclable or bio-based materials, (3) easy-to-remove connections (e.g. no sealant but nails), (4) smart solutions reducing energy and optimizing usability (product-as-a-service propositions replacing ownership to the supplier to make accountable for durable, energy saving products). The interviews furthermore revealed adopting technological tools such as implementing building information management (BIM) models to evaluate CE principles in strategic decision making (Edirisinghe *et al.*, 2021; Sanchez *et al.*, 2021; Mei *et al.*, 2022) as an additional step to evaluating sustainable choices in a structured way which, in turn, can assist to streamline and frame the decision-making process. Analysis also pays attention to the intersection of levers of control (Simons, 1995) with the empirical data.

### Internal orientation

The following three themes captured the participants' experiences of reflections upon CE pathways from internal orientation.

*Strategic impact and alignment.* Distinctive pathways were identified for enhanced awareness of CE involving communication from government and other regulatory agencies (including industry associations), clients asking for circularity, a sustainability manager (or equivalent) advocating CE principles and chief executive officer (CEO) or senior manager becoming a champion for CE (Puntillo *et al.*, 2021). Participant C1P1 mentioned the orientation in society as a logical starting point predisposing towards CE: *We are an organization with a role in society. So, we are not lagging behind when it comes to a concept such as circularity. We are running, I do not want to say at the very front, but it landed at this company quite quickly. Sometimes by individuals, people who say, we do not have to do anything with that, sometimes by leaders.* This comment addressed core values as a key strategic component and driver (in this case for the context of CE), which is one of the main elements of the levers of control framework (Simons, 1995).

When positions on CE were articulated in the organizational hierarchy, the pathway to credibility and adoption of CE practices grew. Subsequently, more stakeholder dialog (imperative for an integrated annual report) and public commentary on CE (Guerra and Leite, 2021; Giorgi *et al.*, 2022) created staff engagement and organizational commitment, as participant C3P1 highlighted: *What you see, it is the right time. Because you just see a lot, it's buzzing in the organization. A lot of people find it interesting to get started.* Annual reports

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analysis found improved strategic alignment, from simply mentioning CE intention, to more explicit description in the following year(s). Participant C5P1 reflecting on this process said the company: . . . *needed targets, [we] created targets. For circularity that was a little bit different, because that was the new kid on the block so to speak. So, on purpose, I put circularity on, but I did not put a target in.* Participants generally expressed those external partners were willing to invest in circularity target-setting to assist an influential client, with participant C5P1 stressing the need to communicate within the supply chain about the required changes: *From suppliers' point of view, there should be a development path together.*

Often awareness grew out of governmental intentions, clients asking for circularity, the sustainability manager aiming for next steps, or a change of the CEO or another senior executive. The topic increased in importance if it was mentioned by a senior executive (Routray, 2022), or if formal CE positions were created and made visible in the organizational hierarchy, such as the strategy department. The sustainability manager of company 1 (C1P2) reiterated this point by sharing: *I mean the operational director is the most important man for circular. He embraced circularity; he participates in the task force. So that is really important. That it is valued highly in the organization.* Once CE was brought to the fore as a conversation topic, it rapidly escalated on the priority list. The first step generally involved a vague intention being mentioned in the annual report which, in the following year(s), was consolidated by communication of more explicit aims and strategies. As intentions clarified and integrated into the strategic roadmap, evidence of CE in internal and external measures became visible. In this vein, C1P2 mentioned:

The roadmap is actually about [four] topics about circular economy, about energy, about making our business and the environment more sustainable. And for circular economy we made a distinction between infrastructural residual flows and operational residual flows and we looked at the front and back and set up about 10 actions. So, these 10 actions need to be taken to ensure that we will be a zero-waste company by 2030.

As CE-related awareness, communication and strategy crystallized, the external partners showed willingness to invest in circularity by collaborative target-setting with an influential client (Simatupang and Sridharan, 2005). Clear communication of priorities was manifesting as one lever of control (Simons, 1995) for the minimization of strategic uncertainties in the pursuit of CE, and smooth communication of information was helping stakeholders (internal and external) come aboard for the CE journey.

*Organizational structure, learning and responsibilities.* The first steps of external collaboration involved gathering information and participating in workshops and pilot projects. Such proactive learning involved, for example, hiring interns to explore possibilities for positioning the organization in the CE, and creating insights into a future vision for the organization. C5P1 explained some learning process steps for them:

But when I start, climate was on, nature was on, safety was on, all topics were on, but not circularity yet. We also used the principles I had interns working for me. You should know, I had in the last few years working 15 or 20 students working for me. And I was already have working 5 interns working on circularity. Obviously in university the topic was already a little bit bigger, in the sustainability arena, the topic was already there, but it was not yet on my action plan.

Other forms of proactive learning included exploring with universities, nongovernmental organizations (NGOs), or other knowledge partners, and educating internal employees for mutual understanding of the CE concept. Noted was the significance of involving influential decision-makers in CE, like a famous architect who had worked on a CE building, and with task forces, to become a champion disseminating CE learning internally. The taskforce needed to have a portfolio of projects (supervised by a program manager) accelerating progress and enhancing visibility amongst employees. Part of this process, as viewed by

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C3P1, involved exploring diverse project options, as encapsulated in their words: *you are going to investigate things to see if that might become a project. Not only do you have to start up studies to do the next 5 years, but you also have to start up studies to work towards that long term vision. So that's why we cut it down into practical things we do over the next 5 to 6 years. But we do keep that dot on the horizon in mind in order to deploy things that are long-term development.* This was essentially an expression of risk factoring as one of the levers of control (Simons, 1995). Organizational departments needed to integrate circular thinking into their practice, sometimes by procurement managers asking different questions from the market, or contract managers attending to return logistics or financial managers thinking beyond existing collaborative structures, legal contracts and known risks. Accordingly, integrated, decentralized responsibility was emerging from the data as the next level of maturity in learning on the CE journey (Wu et al., 2017b). Moving forward, companies will need to analyze how the potential of decentralized responsibility fits with their overall organizational and decision-making structure.

*Changing behavior from linear to CE.* Interviews revealed individuals who led in circular development conversations were driven internally. To motivate others, these individuals then incorporated external drivers as part of the CE topic on different meeting agendas (Giorgi et al., 2022). The external drivers involved examples of investors asking for circular approaches, external influencers requesting the host organization to participate in a CE initiative, or internal employees generating new circular ideas. Participant C3P1 described this:

as a company, we want to become circular. So that also means something for the canteen, the coffee mugs and so on. So, it really has to get into the DNA of the company. And people who do projects always have to ask themselves: are we really making the most sustainable choice here? Not just in purchasing, but everyone has to do something with it. So it's much more of an organizational issue than projects as it were. That's why this is becoming even more complicated.

A training priority was for procurement professionals to understand different tender structures and processes for documenting and sharing information. Training consumes time and involves identifying the nature, sources, methods of data collection, data analysis and subsequent sharing of data along the supply chain. Accordingly, the time-intensive reality of CE tendering compared with linear tenders may not always fit into the organizational requirements, project requirements and deadlines. The CE is based on reusing materials; therefore, to structure and create a market for second-hand materials, data gathering is necessary. Part of a changed behavior path is the gathering of data on materials, especially facilitated by BIM applications (Mei et al., 2022) acting as a strategic lever (Simons, 1995). The interview data was flagging risks and strategic uncertainties across different department priorities, which could lead to identification of critical performance variables that could be better monitored. Participant C5P1 discussed development of a materials passport together with other similar companies: *the raw materials passport we are using is not developed by us. It is developed together with others on these measures in all of our companies, because we are quite alike.*

Madaster (2020) was mentioned by participants as an example of creating a platform for the storage of the data structure and sharing with the clients. Organizations gather information independently, or in partnership with similar client organizations, to organize logistics of materials and waste just-in-time. For example, organized logistics would prevent a building being demolished while simultaneously demolishing the circular materials (Chileshe et al., 2018). It is hence better to design for reuse of materials to facilitate circularity back to the suppliers. The message was emphasized by two participants as an important enabler of successful CE. Participant C1P3 mentioned the relevance of these logistics: *you see, all is logistics. It is important, however, that the residual flows are as clean as possible. You really have*

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*to separate everything on the construction site. Only glass, no sealant edges or fasteners. A rubber or aluminum should be collected separately. The more it is mixed with other materials, the less the residual flow is worth.* In terms of levers of control (Simons, 1995), the interview discussion data was showing circularity as a core performance value to be linked with critical performance indicators through organized logistics.

Next, we focus on themes from interview data highlighting the externally oriented organization development concepts initiating the transition of supply chains to CE design.

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#### *External orientation*

The following themes reflect the participants' experiences and observations of external orientation in CE pathways.

*Value chain collaboration and positioning.* Participants embraced collaborative learning of capabilities and identification of resources for overcoming challenges in CE implementation. Collaboration helps external positioning and subsequent publicity through dialog with internal and external stakeholders. This serves multiple purposes, from sharing of organizational ambitions for CE, to proactive dialog with stakeholders to build future vision, right down to initiatives for collaborative consumption (Stumpf *et al.*, 2021). After a phase of sharing ideas and learning together with other partners, new partnerships facilitate the future circular journey of the company. In the experience of one participant (C5P1), these dialogs and partnerships either initiate or cull the strategy of mergers and acquisitions in alignment with CE objectives. This participant shared the example of broadening of the value chain: *if you look at the CE, broadening the chain is extremely important. We do not have all the links in the chain itself, but that is what we are looking for, partners. Our takeover strategy is also along those lines.* By broadening the supply chain, exchanging data will become more important, for example, by integrating blockchain applications. Recognition that strategic uncertainties had significant external origins as a lever of control (Simons, 1995) was providing impetus for respectively expanding informal and formal collaborations and partnerships.

Internal learning and joint CE pathways proved important for enabling CE business. Sustainability departments generally do not have their own budgets and are, therefore, reliant upon the CE interventions of their internal colleagues, like asset management. Internal learning and joint development paths are thus important to enable a CE business, especially in BIM-enabled construction (Chen *et al.*, 2022). One of the participants (C5P2) describes how this is perceived: *We are still engineering customer-specifically but must change to modeling more process- [and], production-specifically. You have to move together towards standardization and a degree of modularity. Once you have that, you can organize reuse.*

*Enable a CE market, conditions and regulations.* Next comes the defining and finalizing of the CE conditions. Undertaking pilot projects with partners was the first step for all interviewed organizations, which involved exploring alternatives for new materials, and engaging with fresh collaborations or new circular business models. The benefits of piloting are economical investment, speedy decision making and collaboration between finance, legal and procurement departments with clearly defined protocols. Collaborative updating of regulations becomes an important step, whether in areas of waste and/or financial and/or accounting regulations (Ellen MacArthur Foundation, 2020). Another hurdle to overcome as part of CE journey is the criteria of certain profit ratios in a sector being used by financial investors. These ratios determine the working capital for different business models. Participant C2P7 described frustrations on the CE-boundaries: *financing laws, rating agencies, et cetera. There is a whole series of laws, a change in legislation is needed to allow this type of deal. What does the (EU) committee say, we are in strange times. Climate is in such times, you have to question laws that have been passed in order to get over them. There are also big*

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*interests that are against it, and they are very powerful.* In context with the levers of control framework (Simons, 1995) the data was showing risk areas and strategic uncertainties adding to frustration in the CE transition.

New companies can be started to bring market and supply together for current second-hand materials or share data on future available second-hand materials. Standardization for a sector can also be beneficial to practice. When a window, door or wall has the same standard measures as part of the fittings, it can easily be given a second life after demolishing a building. This would amplify the second-hand reusability of materials and modules. Another example of a practical CE condition is optimizing logistics of materials and waste by storing and sorting second-hand materials (Chileshe *et al.*, 2018; Ambekar *et al.*, 2021). Thus, matching of supply and demand on modular materials is required.

*Optimize CE structure and profitability.* This phase involves optimization of CE implementation after learning from the pilot projects. Accordingly, it requires championing by senior management and key stakeholders, and identification of a current profitable product with large market value (that continues to generate return for the company), and a new circular product that incorporates reuse of second-hand materials (as a market pilot test case). There is risk involved for the company because value from the new circular product cannot be predetermined when the market is not yet established (Miemczyk and Luzzini, 2019). For example, it is hard to accurately predict the value of untested new asphalt after 15 years of usage. Therefore, integrating data in circular concepts to create long-term value is important for measuring long-term profitability. The latter was explained by participant C1P3: *you can dismantle it and rebuild it somewhere else. That is a great advantage. But just the steel. That has a daily price. So, if you have a material passport for everything with the data from Madaster, you know what materials are in a building. Steel simply has a daily price. You can quantify that in this way.* Here was further evidence of the need to control and monitor critical performance variables.

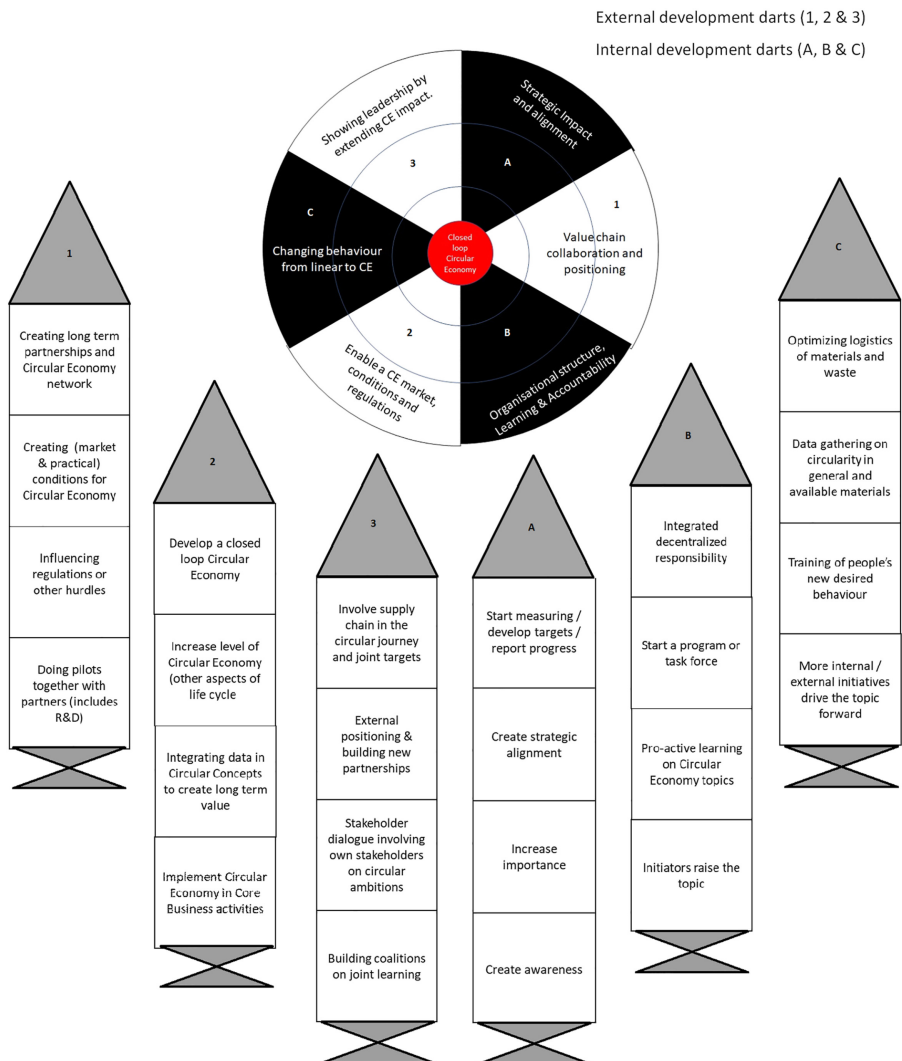
CE can be integrated into the design, use and after-use phases. Organizations often only redesign their products or introduce a circular business model in the use-phase. The pinnacle of CE is to develop an entirely closed loop CE, where each of design, long-term usage and optimized recycling and reusing are integrated (Krausmann *et al.*, 2009; MahmoudGonbadi *et al.*, 2021). The participants considered production organizations, with large investments in machinery and a need to increase profitability. The pilot projects are initiated in noncore products as a reality-testing step allowing for evaluation by senior management and significant stakeholders. C2P7 in industry described the challenges: *... to build that machinery takes 3 years. And then you have to build up the sales, then it would take 5 years from now until that thing runs well. Then you have to make sure that the return of investment of the invested money is allowed to take longer than usual, since, you will only get a return in 5 years. You have to prefinance everything. The balance sheet of the industry cannot stand that, but the balance sheet of a pension fund probably can. That is why we are now working on how to tie these things together.* This statement identifies all four levers of control (Simons, 1995) being critical in the lifeblood aspects of finance and return on investment relative to CE. Circularity may be the core value, but then the risks and strategic uncertainties are exacerbated by longer transition time, thus putting emphasis on monitoring critical performance variables.

Integrating data creates long term value. The challenge of data uncertainty for long-term profitability is significant and reiterates the need to integrate data in circular concepts to create long term value (Kirchherr *et al.*, 2018). CE data should integrate into the design, use and after-use phases. Over time, the aim is to entirely develop a closed loop CE where both design, long-term usage and optimized recycling and reusing are integrated. In accordance with existing knowledge about reverse logistics (Chileshe *et al.*, 2018; Li *et al.*, 2018), the role of closed loops to assist that objective would be among the highest contributions of CE.

**Contribution of the research: gameplan with hurdles and recommendations**

The structural hole identified by [Wijewickrama et al. \(2021\)](#) between the construction and operations stages in the literature may be partly filled by the findings of this paper. Furthermore, gaining early insight into the structure and design process of CE can improve understanding of the impacts ([Wu et al., 2017a](#); [Mei et al., 2022](#)). [Figure 3](#) recasts the interview findings in a dartboard visualization with interview data formulated as darts representing tactical normative gameplays based on the levers of control framework ([Simons, 1995](#)) of core values, risks, strategic uncertainties and critical performance variables.

The CE pathways start for incumbents on the outside of the dartboard with either internally focused strategic approaches (the black areas on the dartboard), or the externally



**Figure 3.** Dartboard visualization of the conceptual framework

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focused strategic actions (the white areas). Due to learning and collaboration, companies can move systematically and strategically towards bullseye, included here as a closed loop CE. The practical strategic actions to accelerate CE (Figure 3) are derived from analysis of the empirical interview data and drawn from different principles than traditional linear approaches. In applied scenarios, situational analyses can lead to strategic and tactical priorities, like the analogy of a dart game, with the targets being strategic outcomes and the darts being tactical manoeuvres. Sometimes an internal pathway strategic element is weighted more heavily as a starting priority and then the approach moves systematically through the other internal priorities before going to the external. More often, companies will experience simultaneous internal and external priority mixes based on the situational analysis, and/or pressures from their internal and external stakeholders. Figure 3 presents the strategic field and weightings may vary according to prevalent conditions until internal (A, B and C) and external tactics (1, 2 and 3) drive closer to the desired CE bullseye. Together the changes in these elements frame the CE principles for an organization which can then be translated into action through BIM and other established tools.

The dartboard is the strategic field with CE as bullseye, and the surrounding darts are tactical normative gameplay capable of aligning with desired strategic thematic sections moving toward the bullseye. Reconfiguring product-design, business models and return logistics, requires a value chain redesign in collaboration with supply chain partners. With this novel gameplan conceptualized, we move now to conclusions and recommendations to facilitate CE transitions.

### Conclusion and recommendations

The aim of the paper was to provide managerial recommendations for implementing CE principles in both organizational and interorganizational contexts. A limitation of the research was that data was obtained only from Netherlands-based managers. Nevertheless, the participants were, at the time of writing this paper, immersed in global supply chain situations and dealing with issues cutting across sectors that ally with construction sector representing both national and international companies. In that sense, some of the broader strategic findings have generalized application for CE transitions beyond the construction sector.

The research questioned the strategic and tactical approaches of organizations on the CE pathway to overcoming the barriers (Ambekar *et al.*, 2021; Caldera *et al.*, 2020; Guerra and Leite, 2021; Giorgi *et al.*, 2022). Findings from the multi case study interviews (Figure 3) and accompanying hurdles and recommendations checklist (Table 1) contributed towards a gameplan helping fill a structural hole in research between the construction and operations stages in the CE literature. The high-level, cross-disciplinary profiles of interviewed participants added new insights to the CE conversations by bringing forth priority bullseye points and CE strategic initiatives tactical guidance questions. These points are crucial because the dartboard represents how a CE bullseye is central, but sometimes internal or external starting priorities take precedence on the pathway and may vary according to situational analysis.

Acknowledging the rules of this new game have not previously been well-defined, Table 1 is a compilation of hurdles and recommendations as a checklist for decision-makers to identify starting points on the CE pathway for their respective organizations. The hurdles and recommendations are generalizable across industry sectors and represent precursors for pathway decisions during strategy formulation. Alignment of the relevant tactics (darts) with the strategic priorities (dartboard sections) should be an organization's necessary aim, because a misalignment of these crucial elements leads to cost blowouts, environmental damage and general failure to achieve CE.

## ECAM

Internal or external	Pathway priority decision themes	CE hurdles and recommendations
Internal development	Strategic impact and alignment	Strategy, goals and targets are essential for CE development and therefore the guidelines to model BIM and evaluate sustainable choices
	Organizational structure, learning and accountability	Knowledge, organizational, structure and the stakeholder perspectives should be integrated for CE principles BIM implementation
	Changing behavior from linear to CE	BIM should be modeled with CE principles, the CE-principle based input for this model needs to contain willingness to change behavior
External development	Value chain collaboration and positioning	At an early stage in the design process, stakeholders have to be engaged in CE principles for design. This increasing complexity of collaboration requires transparency of requirements of the building process and design
	Enable a CE market, conditions and regulations	Current building requirements, but also certifications may conflict with optimal CE choices. This may create conflicting guidelines for BIM.
	Showing leadership by extending CE impact	Integrating BIM and CE evaluation steps take time, more than regular (linear) design processes. It will take leadership to invest this time and restructure processes together with a broad range of stakeholders

**Table 1.** Hurdles and recommendations from pathway priorities for CE

The guidance of [Table 1](#) can shape the development of weighted criteria over the course of strategy development meetings. Mapping the criteria to tactical darts relevant to pathways toward the bullseye on the strategic field diagram of [Figure 3](#) enables managers to hit the CE bullseye more reliably for all internal and external stakeholders.

The practical guidance for construction and other industries varies from crafting both internal and external development paths, to working on strategy and measurement, building new markets and propositions, and restructuring respectively the value chain, collaborations and stakeholder behavior. The findings support managers to develop transition pathways for their organizations specifically by using the dartboard framework ([Figure 3](#)) to establish strategic priorities and weightings then, guided by [Table 1](#) decisions and actions, to create relevant operating policies and procedures. Computer modeling tools for the construction sector are already used and could be further refined via CE principles to evaluate the choices for design in material and energy use for building performance for the life cycle of the building. This would require a more structured pathway and additional time to learn and optimize choices towards sustainable and circular outcomes. Findings of this research provide a foundation to design pathways in a more coordinated way and to engage internal and external stakeholders at an earlier stage of the process. This gameplan may be applied in other contexts to build upon BIM, ongoing blockchain developments and the broader sustainability literature.

The participants also shared recommendations for peers thinking of embarking on the CE journey. First and foremost, collaboration between different value chain partners on the client and production sides, and even competitors, must occur for joint learning about CE pathways. Whilst some business operation decisions will be patented, certain levels of transparency and trust (as shown in examples of blockchain) will be required for new standards to be set in the market, and CE effectively achieved. This leads onto the second recommendation to build interdependency between client and production for a continuous learning process in the value chain. The process involves together identifying and making

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respective resource investments and, when required, sharing resources (as seen in cases of “shared economy”).

Partners in value chains need to collaboratively resolve conflicting regulatory targets in their quest for CE. For example, between the use of virgin (energy intensive) versus recycled material whilst paying for mandated CO<sub>2</sub> emissions from their production facilities. Similarly, there needs to be mutual understanding of any investments being made by partners to deliver circular products. This is imperative when large investments in machinery upgrades and research and development, for example, may have to be made upfront, with limited clarity about return on investment based on future market developments.

In summary, transition from a linear to a circular business model, requires a gameplan with strategic involvement of all supply chain partners. Circular incentives may be added to the business model to encourage long-term usage or reuse of materials post-production. Prioritized actions aiming for bullseye help the construction sector manage its complex, multilateral supply chain connections as a major driver of CE improvement.

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### Further reading

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## Appendix 1

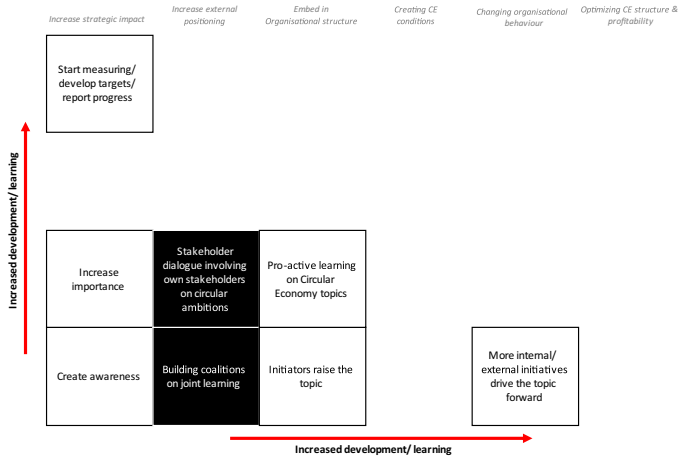
Aiming for  
bullseye

Company	People interviewed	Description of activity	CE time path
Company 1 Real-estate exploitation in logistic environment	<ul style="list-style-type: none"> <li>Operational Manager</li> <li>Sustainability Manager</li> <li>Sustainability Manager</li> <li>Project Manager</li> <li>Procurement Manager</li> </ul>	Organization exploitation of real estate in a metropolitan area	Since 2014
Company 2 Producer of wood-based products and packaging	<ul style="list-style-type: none"> <li>General Manager</li> <li>Sustainability Manager</li> <li>Operational Manager</li> <li>Product Manager</li> <li>Operational Manager</li> <li>Sustainability Manager</li> </ul>	Manufacturing business, large manufacturing production sites, main source wood	Since 2011
Company 3 Water processing company – residual products for other industries	<ul style="list-style-type: none"> <li>General Manager</li> <li>Project Manager</li> <li>Sustainability Manager</li> <li>Sustainability Manager</li> </ul>	Manufacturing business, having utilities functions – and production sites creating new raw materials	Since 2011
Company 4 Engineering company	<ul style="list-style-type: none"> <li>General Manager</li> </ul>	Engineering company, facilitating services in redesigning construction sites utilizing CE principles and materials	Since 2019
Company 5 Construction company	<ul style="list-style-type: none"> <li>Sustainability Manager</li> <li>Procurement Manager</li> <li>Project manager</li> <li>Operational Manager</li> </ul>	Construction company, designing and building real estate and other construction projects	Since 2017
Company 6 Utilities-related company	<ul style="list-style-type: none"> <li>Strategy Manager</li> <li>Sustainability Manager</li> </ul>	Construction company, designing, constructing and building real estate and other construction projects	Since 2016
Company 7 Company related to decorating real estate	<ul style="list-style-type: none"> <li>Sustainability Manager</li> </ul>	Construction company for specific components, designed for real estate	Since 2016
Company 8 Construction and infrastructure company	<ul style="list-style-type: none"> <li>Finance Manager</li> <li>Finance Manager</li> <li>Board Member</li> </ul>	Company fulfilling the customer role in the construction process, owning specific buildings for utilities purposes	Since 2017
Company 9 Design and producer of construction-related products	<ul style="list-style-type: none"> <li>General Manager</li> <li>Finance Manager</li> <li>Product Manager</li> </ul>	Company fulfilling the interior decorating role in construction, influencing their own value chain	Since 2018

**Table A1.**  
Details of participants

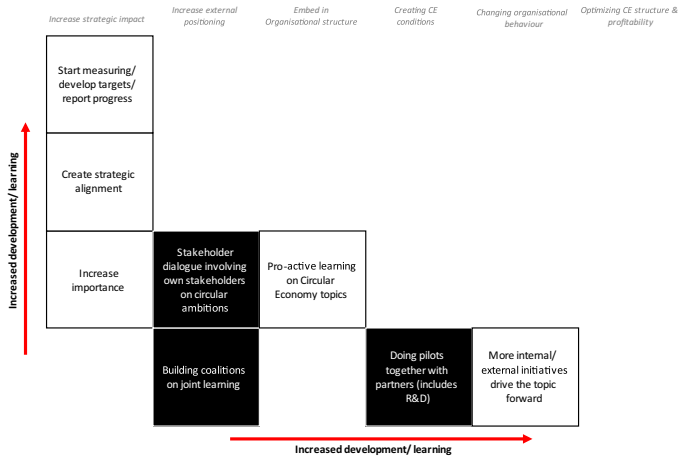
Draft Maturity Model Circularity–company 1 year 2014  
6 August 2020

External development  
Internal development



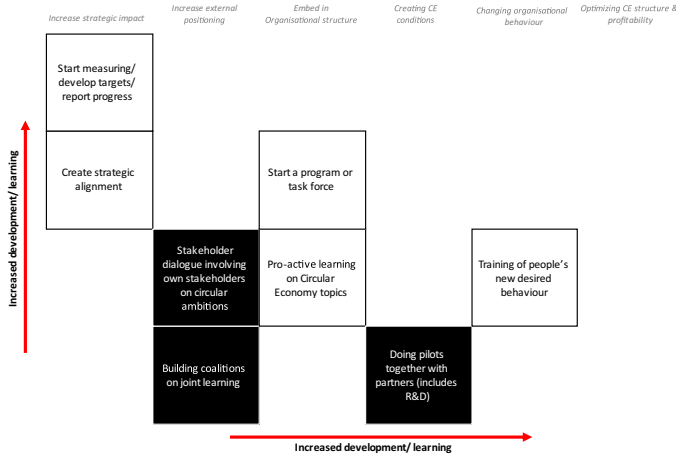
Draft Maturity Model Circularity– company 1–Year 2015  
5 August 2020

External development  
Internal development



**Figure A1.**  
Example of analysis of the strategic interventions in development pathways (company 1)

Draft Maturity Model Circularity – company 1 Year 2016  
5 August 2020



Aiming for bullseye

Draft Maturity Model Circularity – Company 1-2017  
5 August 2020

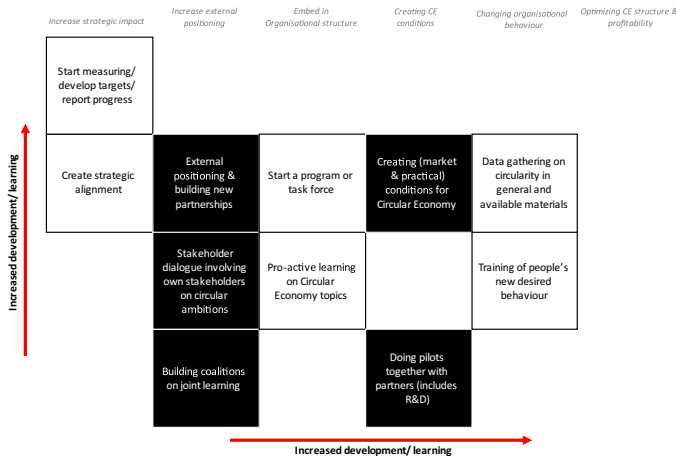
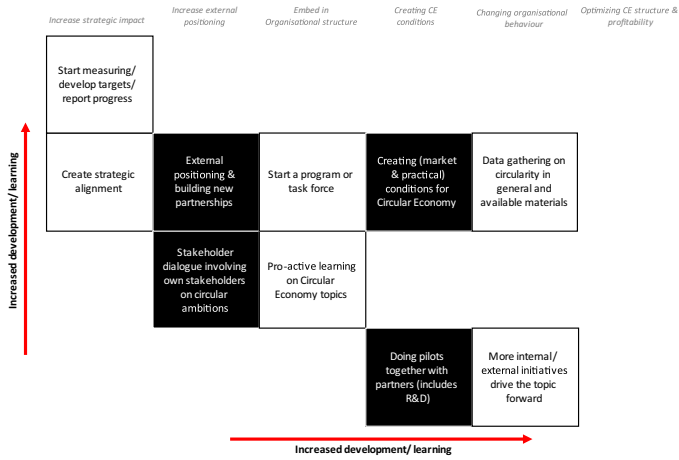


Figure A1.

Draft Maturity Model Circularity – Company 1 – Year 2018  
5 August 2020

External development  
Internal development



Draft Maturity Model Circularity – Company 1 – Year 2019  
5 August 2020

External development  
Internal development

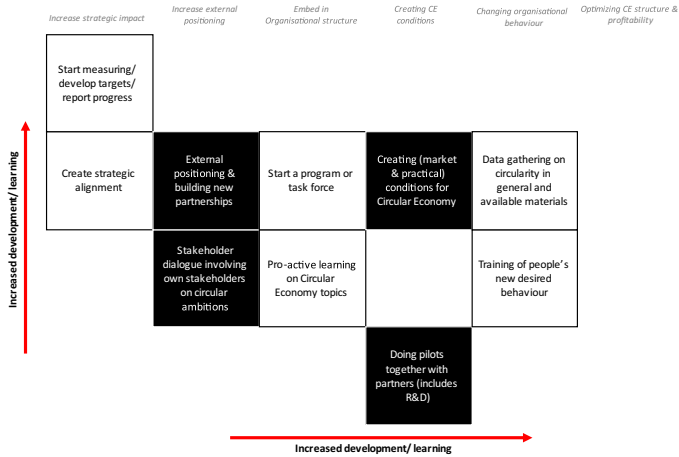


Figure A1.

### About the authors

Diane Zandee has a business background and is a registered controller. Diane has held various executive positions in the corporate world at mainly socially oriented companies. In her PhD-research she focuses on finding the connection between sustainability and finance, with a focus on the circular economy. Diane is member of the Circular Accounting Coalition. A coalition where parties such as the Circle Economy, the Dutch Professional Association for Accountants and various parties from the business community, are jointly exploring circular cases in a financial context.

Ambika Zutshi teaches and researches corporate social responsibility, business ethics, higher education and supply chain management. She publishes with impact in *International Journal of Management Reviews*, *Journal of Cleaner Production*, *European Business Review* and the *International Journal of Environmental and Sustainable Development*. She is Australasian Associate Editor of *European Business Review*, Emerald.

Andrew Creed teaches, researches, and consults in organizational behavior, change, learning and sustainability. He is published in quality journals, including *Journal of Cleaner Production*, *Sustainability*, *Current Issues in Tourism*, *Journal of Business Research*, *European Business Review* and top imprints including, Palgrave, Emerald, Cengage and Oxford University Press. Andrew Creed is the corresponding author and can be contacted at: [andrew.creed@deakin.edu.au](mailto:andrew.creed@deakin.edu.au)

André Nijhof is full professor in the fields of Sustainable Business and Stewardship. Much of his recent work has focused on embedding long term value creation in the core processes of an organization and the advancement of market transition theory.