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RESEARCH ARTICLE

Tensions in Management Controls: Enabling Radical Innovation for a Circular Economy

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Abstract
Meeting the demands of a circular economy entails substantial organizational change and innovation, particularly by industrial incumbent organizations. This paper aims to deepen understanding of how such organizations use management controls to strengthen circular principles and drive innovation, while also shedding light on tensions in the management control system that may occur following the contrasting logics of linearity and circularity. The study collects qualitatively rich empirical data from three large industrial organizations in Sweden, employing 38 semi-structured interviews and thematic analysis. The study suggests that the management control system serves as a valuable instrument for implementing circular principles through interventions, and conversely, as a system that can entrench a linear logic in organizations. Specifically, the analysis reveals that while circular principles are not fully integrated into all aspects of the management control systems, specific identified factors enable or impede innovation in the circular transformation. Imbalances and inconsistencies in the use of action-, result-, and cultural controls were also identified. The practical implications emphasize a risk of reducing circular initiatives to minor improvements without a comprehensive understanding of the needed radical changes and corresponding adjustments to the management control system. Overall, the research provides valuable and qualitatively rich insights connecting the adoption of the circular economy in incumbent organizations and further strengthens the bridge between literature on innovation management, circular economy, and management control systems, highlighting the importance of addressing tensions and imbalances for successful circular transformations.

Keywords:
Managerial Controls · Innovation Management · Sustainability · Organizational Transformation

Introduction

Practitioners and policymakers increasingly question the sustainability of a continued take-make-waste logic in production and consumption, creating a demand for new approaches. One such approach is that of the Circular Economy (CE), which experts propose as an ideal economic system in which natural resources are refined and maintained at their highest value for as long as possible (Stahel, 2019). The European Commission is a strong proponent for CE as a way to reach net-zero by 2050 through, for example, the Circular economy action plan, introducing legislative and non-legislative measures targeting the entire life cycle of products (European Commission, 2020). A circular system sets new requirements for innovation in technology, products, services, processes, and business models (Geissdoerfer et al., 2020). However, for decades, business organizations have encountered challenges when implementing sustainable innovations (Boons & Lüdeke-Freund, 2013; Hall & Vredenburg, 2003; Hart, 1997). This suggests that industrial

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organizations that have long histories of success in a linear paradigm need particular attention in their CE transformations. To do so, we need better insights into how management can facilitate the organizational changes required to adopt CE logics in incumbent organizations (Santa-Maria et al., 2021). To date, large organizations have focused on "low-hanging fruit," predominantly focusing on cost savings through incremental gains in material efficiency (Bocken et al., 2025), as well as recycling (Opferkuch et al., 2022). This is problematic, since it is precisely large established organizations that have the resources and capabilities to lead a more radical transition towards CE but which at the same time face issues of internal entrenchment that favors business-as-usual, given their history of success following a linear paradigm.

Transitioning towards CE relies on both incremental and radical innovation (Potting et al., 2017). However, the pressing urgency of sustainability (Schaltegger et al., 2016) and the fundamental differences between linear and circular paradigms (Geissdoerfer et al., 2017) have led an increasing number of CE researchers to acknowledge the need for transformational shifts and not just incremental changes to existing businesses (Bocken et al., 2025; Kirchherr et al., 2023). This is especially pertinent for incumbent organizations. Historically, such organizations—influenced by their age and size—have leaned towards processes and measures that favor stability and efficiency. This inclination often means they avoid the inherent uncertainty tied to radical innovation (Merchant & Van der Stede, 2017; Sandberg & Aarikka-Stenroos, 2014), a tendency that becomes entrenched in culture, processes, goals, and other management controls (Nilsson, 2015). Specifically, while such organizations find small steps towards sustainability appealing, and such steps could very well lead to radical change over time (Geels & Schot, 2007), several scholars have questioned whether it is feasible for incumbent organizations to implement the radical and structural changes that sustainable development requires in due time without a particular focus on more radical sustainable innovations (Boons & Lüdeke-Freund, 2013; Hansen et al., 2022; Kennedy et al., 2017).

Management Control Systems (MCS) could serve as a catalyst for CE implementation in incumbent organizations. The definition provided by Malmi and Brown (2008) expands MCS from the narrow scope of accounting to encompass the systems, rules, practices, values, and other activities that management puts in place to direct employee behavior. While research on MCS emphasizes that different forms of management controls interact and need to be considered as a system in order to support innovation and sustainability (Gond et al., 2012; Knels et al., 2024), the CE literature to date has largely overlooked this systematic perspective and instead focused on the role of CE indicators without examining how different management controls might be combined into a system. This approach has proven to be problematic, as more radical circular innovation projects may fare poorly when assessed in incumbent organizations using managerial controls defined under a linear paradigm (Arekrans et al., 2022; Hansen et al., 2018; Meissner et al., 2024). Consequently, researchers should pay particular attention to the use of MCS to achieve radical circular innovation in large and established organizations, a topic that has not been sufficiently investigated to date (Arjaliès et al., 2023; Baker et al., 2023; Svensson & Funck, 2019).

This paper aims to provide greater empirical insight into how organizations use managerial controls to strengthen CE principles and circular innovation within the organization and highlight critical tensions in an MCS that can arise due to the two contrasting logics of linearity and circularity. In this study we specifically ask:

How are management control systems influencing innovation for a CE transformation in incumbent industrial organizations?

To gain a better understanding of the issues above and provide empirical illustrations of the problem, we conducted qualitative interviews with respondents (n = 38) from three large established organizations that are in the process of implementing CE. The knowledge gained from this study is relevant for practitioners considering organizational changes to implement CE. Also, it provides a bridge between research on management control system and that on innovation in the context of CE, using rich empirical data.

Below, we first introduce the general fundamentals concerning MCS and discuss current research on MCS in the context of sustainability and CE more specifically. We then present our research design, data sampling approach, data collection process, and analysis. In presenting the results of our interviews, the paper focuses on the uses of managerial controls in CE transformations, structuring a differentiation between different types of controls. In the discussion section, we analyze the integration and legitimization of CE through managerial controls, the tensions that arise out of the legacy of linear business approaches

and managerial controls, as well as the practical implications and limitations of the study. Finally, we identify promising directions for future research and general conclusions.

Theoretical background

Here we present the relevant bodies of existing theory and discuss them in relation to our aims in this study.

Management Control Systems (MCS)

A significant portion of the management control literature has roots in the field of accounting; this, in turn, implies a historical focus on the use of formal and financially quantifiable data to assist in managerial decision-making. This traditional view frames a MCS as a set of tools for implementing and monitoring predefined goals and as a way to reduce variation as the organization strives to increase efficiency and effectiveness. However, over the years, this perspective has expanded. According to Anthony and Govindarajan (2006), management control systems encompass a broad range of activities, including planning what the organization should do, coordinating the activities of several parts of the organization, communicating information, evaluating information, deciding what action (if any) should be taken, and influencing people to change their behaviors. This evolution and shift is also apparent in the different definitions that MCS scholars have offered over the years (see Table 1).

Table 1 Definitions of Management Control Systems

Definition of MCS	Comment
The process by which managers ensure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives. (Anthony, 1964)	More emphasis on efficiency and less focus on human behavior. No focus on changing objectives.
Mechanisms through which an organization can be managed so that it moves towards its objectives. (Ouchi, 1979)	
The formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities. (Simons, 1995)	Recognizes the need to both maintain some activities and alter others: i.e., organizational change and strategy implementation.
Those systems, rules, practices, values, and other activities that management puts in place in order to direct employee behavior. (Malmi & Brown, 2008)	Broad description and clear link between MCS and employee behavior; also acknowledges *relevant parties other than employees* as targets in the typology.
Managers' most commonly used tools to influence people's minds and behaviors in order to achieve organizational objectives and ensure that company strategies are implemented as intended. (Nilsson, 2015)	Includes both human and organizational perspectives, recognizes the link between strategy and individuals, and implies a multitude of strategies.
MCSs influence employee behaviors in desirable ways and consequently increase the probability that the organization will achieve its goals. (Merchant & Van der Stede, 2017)	Broad description with a human perspective, leaving room for broad inclusion of what "desirable ways" consist of.

Source: Authors

In their review, Strauß and Zecher (2013) find that Anthony and Govindarajan (2006) adopt a narrower understanding of MCS than Merchant and van der Stede (2017). However, both follow what Strauß and Zecher describe as a "command and control" MCS perspective: i.e., emphasizing a somewhat hierarchical, formal, and active exercise of control to achieve efficiency. In addition, Strauß and Zecher argue that Simons (1995) endeavors to broaden the perspective on MCS from "command and control" to incorporate an understanding of innovation and control, which can give an MCS the capacity to influence strategy. According to Langfield-Smith (1997), a pivotal shift stemming from Simon's work is the idea that the most important thing is not the identification of controls and their relevance for particular strategies but rather the level of attention that management pays to those controls.

There are also several ways of categorizing different types of management controls. Merchant and van der Stede (2017) distinguish between result controls, action controls, and personnel/cultural controls. They also point to several conditions that limit the suitability of each type of management control (see Table 2).

Table 2 Categorization and Limiting Factors of Different Types of Management Controls, as Suggested by Merchant and Van der Stede (2017)

Control type	Control mechanism	Purpose and function	Limiting factors
Results control	Steering through measurable outcomes (e.g., performance targets, KPIs, goal setting).	Direct behavior by defining desired results, monitoring performance, and incentivizing achievement.	Requires clear knowledge of desirable, controllable, and measurable outcomes.
Personnel/ cultural control	Shaping behavior through shared values, group norms, and internal motivation.	Encourage self-regulation and peer-based behavioral alignment via a strong organizational culture.	Depends on emotional bonds, cultural alignment, and intrinsic employee motivation.
Action control	Influencing specific actions via formal rules, standard procedures, and direct oversight.	Ensure correct behaviors are followed by prescribing or prohibiting specific activities.	Requires knowledge of desirable actions and reliable enforcement mechanisms.

Source: Authors

For our purposes, in this study, we follow the categorization of Merchant and van der Stede (2017) as outlined in Table 3, as it is comprehensive and captures many perspectives on managerial controls in three relatively intuitive categories (Strauß & Zecher, 2013).

Individual and organizational factors such as trust, autonomy, and power relations also influence the ability to balance control and empowerment through different combinations of management controls (Chenhall & Euske, 2007; Kärreman & Alvesson, 2004). Failure to balance MCS use can result in slower decision-making, wasted resources, instability, and lower performance (Henri, 2006). Mundy (2010) shows how the simultaneous use of MCS to direct *and* empower requires senior managers to act intentionally so as to create an environment that fosters productive tensions.

Management Control Systems for Innovation and Sustainability

Researchers have discussed CE as a new sustainability paradigm (Geissdoerfer et al., 2017). However, even before the popularization of CE, scholars have been studying how organizations integrate sustainability aspects into their strategies and operations. In a societal context, sustainability is (by definition) a long-term ambition that extends beyond individual organizational boundaries. Therefore, companies working actively to achieve sustainability need to consider long-term strategies that acknowledge their role in the broader achievement of sustainability rather than only focusing on short-term economic performance (Figge et al., 2002). Control systems for sustainability (e.g., environmental budgeting, sustainability performance evaluation etc.) have traditionally been studied separately from the rest of an organization's MCS and scrutinized as distinct tools or methods (Rauter et al., 2023) and has often followed a "business case" logic for sustainability that (Kaplan, 2020) has recently brought into question. These concerns mean we need a deeper understanding of how sustainability is integrated with organizations' overall MCS (Gond, 2012). This includes the performance measurement of managers and how sustainability is operationalized in all activities, processes, and routines and supported by culture (Baumgartner & Rauter, 2017). Discussing individual managers, Hahn et al. (2014) illustrate the complexity that managers face when targeting multiple desirable but conflicting economic, environmental, and social sustainability goals at both the organizational and societal levels. Specifically, these goals often operate within different time frames and are driven by distinct logics, a fact that managers can either embrace or try to reduce and control using an existing business-case mindset. Here, formal and informal controls may play different roles in fostering innovation for sustainability (Frare & Beuren, 2023). Specifically, more formal controls can provide clarity, but they may stifle creativity, whereas informal controls may carry risks of ambiguity and could jeopardize performance outcomes (Knels et al., 2024). Failing to integrate, align, and interactively control for sustainability may lead to ineffective changes that

do not inform strategy or that create internal conflicts (Gond et al., 2012). These MCS issues are arguably relevant when incumbent organizations implement CE innovations that challenge the dominant logic of linear production.

Management Control Systems in a Circular Economy Transition

For industrial organizations, CE presents an attractive scenario where economic growth is decoupled from resource utilization and has captured the attention of several practitioners (Korhonen et al., 2018). Building on Geissdoerfer et al. (2020), CE represents an ideal economic system where natural resources are kept at their highest societal value for as long as possible as a way to minimize additional resource inputs, emissions, and waste outputs. CE aims to achieve sustainable production and consumption by cycling, extending, intensifying, and dematerializing material and energy loops. This is made possible through innovation in technology, products, processes, and business models, including digitalization, servitization, sharing solutions, more durable product design, maintenance, repair, reuse, remanufacturing, and recycling. For industrial organizations, the emphasis on *value* in a CE extends beyond traditional finance-based accounting and represents the broader impacts of production on the environment, society, and the economy (Circle Economy, 2022).

For industrial organizations, CE entails taking control over nonrenewable resource flows through new business models, which creates new interdependencies in the surrounding ecosystem and new exchanges of both information and money (Sakao et al., 2024). Furthermore, the logic underpinning several circular business models entails a shift from a product orientation to a results orientation, which requires a different way of organizing to be viable (Tukker, 2015). For example, decisions made early in product development substantially affect the feasibility of different R-strategies (Rashid et al., 2013; Shahbazi & Jönbrink, 2020), which means that a company's true CE potential can only be reached through closer integration between product development and service development (Ritzén & Ölundh Sandström, 2017). Bocken et al. (2016) suggest that strategies for circular product design and business model design must be considered concurrently with visionary statements and goals. Consequently, this sets up new requirements for MCS to facilitate a fruitful integration between different processes, competencies, and organizational functions.

As mentioned, much of management control literature has roots in accounting, which has led to concerns that accounting scholars have not yet concerned themselves with the transition towards a circular economy (e.g. Arjaliès et al., 2023; Baker et al., 2023). Research on MCS has therefore paid attention to environmental sustainability and reporting rather than the specific challenges and opportunities of circularity (Aureli et al., 2023). In turn, much of the recent work on CE has not been disseminated through traditional journal outlets and is instead based on literature reviews, and furthermore does not address topics of innovation, collaboration, strong sustainability, transaction costs, novel cost calculations, or capabilities and power relationships in networks (Wishart & Antheaume, 2021).

The study most similar in its aims to the present one is Svensson and Funck (2019); in it, they investigated how MCS adapts to circular business models within a specific context. Their key findings emphasized the role of cultural controls in CE, but they also highlight the need for adaptive cybernetic controls (i.e. self-regulating feedback loops), especially as the focus of decision points shifts to early product lifecycle stages that demand a higher level of detail and a longer time horizon for decision-making. While this study is insightful, its scope is limited. In contrast, our research explores large industrial manufacturers, with their complex legacies of linear MCS. This new context could reveal unique challenges or benefits during a transition to CE. Furthermore, we posit a bidirectional relationship: not only does MCS adapt to CE but the MCS that exists at these larger organizations also shapes CE adoption.

CE scholars have made a major effort to develop indicators for different system levels (see e.g. de Oliveira & Oliveira, 2023; Hussmo & Skärin, 2024; Morseletto, 2020; Saidani et al., 2019). These can serve several purposes in an industrial organization: for example, monitoring the progress of adoption of CE practices, creating a common language, and providing a basis for knowledge dissemination and decision making (Saidani et al., 2019). However, if indicators are not carefully managed, they can be problematic. For example, Opferkuch et al. (2021, 2022) note that the indicators that business organizations use in sustainability reporting have been, to date, superficial and inconsistent, and have often focused on waste management and lower-ranking R-strategies and not more radical circular innovation. Bekier and Parisi (2023) have also looked that the problem of selecting appropriate indicators and setting goals for CE, finding that when a vision and concept of "good circular performance" were not clear but rather co-

constructed and developed from the bottom up, performance management for circularity initiatives evolved towards an emphasis on symbolic measures rather than on controlling or offering opportunities for monitoring. Lindahl (2024) has suggested that existing MCSs that promote efficiency in the daily operation of a linear production system could limit circular thinking and ultimately block an organization's broader circularity transition.

While business model innovation is a well-investigated instrument to implement CE, this process holds specific challenges when seeking to facilitate it through an MCS, a subject that researchers such as Aaltola (2018) and Ruiter et al. (2022) have examined. Aaltola (2018) stresses that most research connecting management control and innovation concerns new product development and not business model innovation. They argue that this is problematic, given that non-technological innovations are often created and implemented in a less structured manner compared to purely technical innovations, a fact that necessitates greater control. Their analysis showed the importance of having (1) a strategic story, (2) co-created projects, and (3) experimentation for the purpose of validation. In a similar vein, Ruiter et al. (2022) used Simons (1995) to study management control and business model innovation in the context of CE through a case study approach to the construction industry, arriving at conclusions largely in line with what Aaltola (2018) suggests. Specifically, they found that belief systems (i.e. core values communicated by top management) and interactive controls (i.e. controls used in ongoing dialogue about strategic uncertainties) were the most relevant levers for circular business model innovation aiming to achieve multiple values. Belief systems functioned to drive a shift in focus from short-term profitability to long-term value creation and unified significant number of stakeholders affected by the industry shift towards CE.

This review of the literature puts into relief the need to understand how large industrial organizations are using MCS in a CE transition. While MCSs may evolve to suit CE practices, an entrenched MCS might simultaneously shape how CE is interpreted and incorporated.

Method

The following section describes the research design, data sampling and collection, and data analysis of the present study.

Research Design

This study's research problem (management controls in a CE transformation) has not been extensively studied. The phenomena of organizational change in light of CE is relatively new and complex. Moreover, since these changes are situated within organizational settings, which are inherently social contexts, it is not surprising to encounter divergent views. In light of these factors, we determined that a qualitative approach was the most suitable research method, as it allows the researcher to collect rich data that can give greater contextual information, capture individual experiences, and appreciate the nuance of complex phenomena (Creswell, 2014). This aligns Langfield-Smith's (1997) recommendation that the complex interaction between strategy and MCS calls for in-depth qualitative research.

Data Sample

Three large, incumbent industrial organizations were studied in 2022-2023 as part of a research project focusing on the organizational-level phenomena of managerial controls and CE practices in established organizations. Given that the goal of our research design was not to achieve statistical generalizability but to capture qualitatively rich and in-depth data, we used a purposive sampling approach (Saunders et al., 2009, p. 234). In other words, we intended to learn a great deal about how a small set of organizations use management controls in their CE transformation rather than to achieve a representative or randomized sample, justifying the use of purposive sampling (Emmel, 2013). The chosen organizations fit certain criteria that aligned with the focus of the study, and our informed judgment steered us to cases with potential for providing rich information (Patton, 1990, p. 169). Specifically, all organizations had a considerable history (50+ years) with significant economic success, many employees (5,000+), and large market-shares in sales of physical goods in their respective markets, and more recent ambitions specifically relating to CE. In terms of the objectives of the study, the size, age, and success of an organization has implications for how it manages organizational change and what managerial controls govern it (Merchant

& Van der Stede, 2017). Second, the dominant business model for these organizations is linear, as they all rely on selling ownership of physical goods, and they all embrace a value proposition that is linearly coupled to material consumption; these characteristics must undergo change to ensure CE regulatory compliance and to adopt a CE logic. Table 3 presents an overview of the case organizations studied.

Table 3 Description of the Included Case Companies

	Trucks	Tools	Mining
Industry	Heavy trucks, buses, construction equipment.	Professional and consumer gardening, forestry, and construction equipment	Mining and infrastructure equipment, robotics, tooling
Market	B2B	B2B, B2C	B2B
CE approach	Long history in remanufacturing. A 2022 initiative laid the foundations for a corporate CE strategy. A new central business unit for CE activities was established in 2022 and tasked with coordinating CE activities, learning, and governance.	Formal CE strategy adopted in 2020. Goal of 50 circular innovations by 2025, with metrics set. Several circular innovation projects underway.	Initiative launched in 2022 to lay the foundations for a corporate CE strategy. Several scattered circular B2B offerings. Lack of MCS interventions for CE to date.
Interviewees	18	8	12
Examples of key interviewees	Director of Circular Economy, Circular Business Developer, VP of Remanufacturing, Director of Environment and Innovation, Director of corporate Strategy, CTO of Trucks division	Circular innovation target lead, VP of Sustainability Group, Divisional Head of Sustainability, Director of Innovation Lab, Director of Technology Development	VP Shared R&D and Strategic Projects, strategic sourcing manager, global engineering manager, global technology and methods manager, senior mechanical engineer

Source: Authors

All cases were headquartered in Sweden. The geographic location was partly driven by convenience, such as reducing language barriers and enabling in-person meetings. It was also considered a helpful way to encourage interviewees to speak openly—particularly when discussing potentially sensitive topics such as organizational culture—with a Swedish research team. To support this openness and to protect anonymity, the company names are not disclosed in this paper. Instead, we refer to the organizations using the labels “Trucks” (a heavy vehicle manufacturer), “Tools” (a gardening equipment producer), and “Mining” (a manufacturer of mining equipment).

Data Collection

The researchers conducted semi-structured interviews remotely with a total of 38 interviewees from the three different organizations, most of which with two interviewers present. Discussions with company representatives identified potential interviewees who were knowledgeable about or experienced with the subject of the study (Palinkas et al., 2015). Specifically, interviewees were purposefully selected based on their roles and experience with sustainability strategies and current or potential responsibilities in the area of CE initiatives. To capture a variety of perspectives, we requested interviewees from several departments and key functions, such as product development/R&D, business model development, procurement/supplier collaboration, and service/repair. This ensured a mix of strategic and operational insights relevant to CE transformation. All interviews were conducted using an interview guideline that allowed for ad-hoc follow-up questions and digressions depending on the interviewee and their expertise. In broad terms, the interview guideline consisted of (1) basic questions on the interviewee’s role, (2) how the company relates to and works with CE, (3) organizing for radical innovation, and (4) the use of managerial controls (see Appendix A). Interviewees were asked to reflect on all interview topics in relation to their current reality, as well as in relation to a CE transformation. When the interviewee could not address these questions

directly (for example, due to lack of experience with a formally labelled "CE project"), they were instead asked to reflect on sustainability work or innovation management. All the interviews were recorded, and each lasted about 50 minutes. The recordings were transcribed verbatim.

Data Analysis

The transcribed interviews were coded using the qualitative data analysis software NViVo as a way to give structure to the analysis and allow for traceability across the large volume of raw data, codes, and themes. The analysis followed the four phases of thematic analysis suggested by Braun and Clarke (2006), complemented by techniques from Miles, Huberman and Saldana (2014). Because the case companies are at different stages of CE maturity, the interview data was used cumulatively rather than being used to compare and contrast between the different companies.

In the first phase, all the transcripts were read in an active way (Braun and Clarke, 2006), leaving annotations wherever the text seemed to offer interesting observations with respect to the research topic. In the second phase, initial codes were developed. The codes were both data-driven and theory-driven, using the same theoretical background as the interview guideline. In the third phase, the codes were scrutinized and refined in a search for overarching themes. The included text excerpts were re-read and an assessment was made as to the representativeness of the code and any relationships among codes. In this stage, particular attention was paid to codes that were used frequently or recurred across several different interviews, as Miles, Huberman and Saldana (2014) suggest. This process led to the refining of overly inclusive codes and merging of overlapping ones. Potential themes emerged both from the data and from the guiding theory (i.e., interview guideline and theoretical background), maintaining particular attention on unexpected and data-driven themes as a way to stay true to the exploratory nature of the study.

In the fourth and final phase, the selected potential themes were reviewed to increase the coherence between each theme and the included data and to reinforce distinctions among the themes (Braun and Clarke, 2006). In addition, in this phase the researchers reviewed interview notes and secondary material, such as publicly available information, company presentations, and documents shared with the research team. When the final set of themes was reached, the researchers extended the analysis using the academic literature in order find additional patterns, as well evidence from comparable studies that supported or contradicted our findings. This analysis resulted in the identification of a set of factors that are influenced by MCS and that can either enable or impede CE transformation at an organization.

Results and analysis

The following three sections describe how managerial controls are used in a CE transformation, looking at differences between action controls, results controls, and cultural controls, respectively. Each section lists the identified controls in a table, together with a set of identified factors that determine whether the managerial control enables or impedes CE transformation.

Action Controls

Interviewees offered relatively few examples of action controls relating to CE transformations at their organizations. Organizational structure is the clearest example of an action control that interviewees were able to reflect upon in relation to CE (e.g., having CE activities as a separate division). A majority of the interviewees also questioned the fit between current business activities and CE and often noted the lack of traceability and control needed to handle end-of-life processes when products were sold through traditional ownership models. Interviewees reflected upon new business model configurations—such as offering products as services—as a way to retain product ownership. These alternatives, in turn, required strategic decisions concerning organizational structure and vertical integration of the supply chain, along with new organizational capabilities such as dismantling and remanufacturing. These requirements set the boundaries of organizational activities.

We need to consider that we need to have control over this product in the end, and that is a fundamental question—how do we do it? It has nothing to do with goals. It is a completely different set of questions that we need to consider, then. How do we make sure that there is an industrial infrastructure, either

internally or externally, that handles end-of-life products? We spit out 200,000 trucks a year. Should we build an industrial operation that can take care of 200,000 [EoL] trucks as well? [Trucks, Interviewee 1]

In addition, interviewees offered several examples of action controls relating to integration among different organizational functions, integrated work with sustainability, and action controls that inhibited radical innovation. In particular, a large portion of interviewees associated circular offerings with novelty, not only for the company but sometimes also for customers, policymakers, and society at large. Consequently, they also described a need for experimentation and new ways of working (e.g., through pilot projects with new circular business models or the use of different materials) in order for the organization to gain experience and learn. Interviewees frequently mentioned conducting pilot projects that involved real customers as a success factor that was critical for making such experiments as valuable as possible. In contrast, when thinking about challenges interviewees often described a concern with moving away from practices that had a long track record of success, where products and services could be developed in-house and not revealed until established performance standards were met.

Our change in R&D is that we have to be more agile, we have to start to test and fail, and we have to see as well with the right group of customers, the early adopters, to see where we can go. Because if we're listening to the majority of the market, there's hardly anybody that says right now, "We need anything other than a diesel machine." So, that is the change in the whole process from an R&D perspective. [Trucks, Interviewee 16]

The vast majority of interviewees stated the need to have sustainability function as an integrated part of their daily jobs rather than the responsibility of a separate organizational unit. In addition, interviewees at all three organizations described a shift in which this more-decentralized approach to sustainability work had become increasingly prevalent compared to earlier years. Their organizations were moving away from centralized sustainability units focused on monitoring and using sustainability reporting and policies as their main tools, towards a more supportive and guidance role for these units in operational activities. However, even though sustainability had become increasingly better integrated across their organizations, very few interviewees believed that CE had reached the same level of maturity and prevalence in operational activities to date.

We have no huge sustainability teams, or, we don't even have a sustainability officer or something like that. We have, in all companies, small efficient teams…who support everyone to bake sustainability into all decisions. We do [this] because we think the magic has to happen at every desk. So, [they] help with guidelines, help with networks, where should we have a voice, where not, help with tools… set up, for example, workshops where we inspire our team member with good examples.…We really think it will only happen if everyone has [sustainability] as a natural part of the daily work. And we don't believe there is one strong central position that will make it happen. [Trucks, Interviewee 11]

Several interviewees felt that a large portion of the complexity behind circular offerings might derive from the large number of internal and external actors, competencies, and organizational functions involved in the required changes. Therefore, they largely advocated for cross-functional ways of working. However, some described such an approach as a challenge, since it is time-consuming to coordinate in an organization that is structured towards a linear business model. Interviewees provided examples of successful cross-functional circular pilot projects that had fallen by the wayside due to a lack of clear responsibilities and defined ownership under this way of working.

You need a supplier, you need purchasing involved, you need quality assurance involved, you need product testing involved, you need manufacturing involved… It's a long process to make this work.…Currently, R&D doesn't have to understand the business model. Today, it's enough if they know that they're selling a robotic lawn mower. But if they should understand how a robotic mower works in a service offering, that's something different. Then they need to be much more involved. And, sales needs to be more involved as well, so that they can sell that type of service, and the maintenance department needs to be involved as well, to service and maintain the product. This requires a different way of

structuring your company, if you really want to work with circular business models at their fullest. We don't have that organization. We have a linear organization. [Tools, Interviewee 6]

For an outline of identified action controls, see Table 4.

Table 4 Identified Managerial Action Controls, With Enabling or Impeding Factors Noted in Brackets

Control mechanism	Enabler	Lock-in
Standards and directives	Restrictions include, e.g., critical raw materials to avoid or plastics that can't be recycled [Integrated work with sustainability]	Sticking with existing materials and suppliers, since they are known to meet certain criteria as a resistance to change [Optimizing for efficiency in linear business]
Consolidated purchasing	Enables close monitoring of suppliers through consolidated purchasing, greater opportunity to impose CE on suppliers [Integrated work with sustainability; Broad scope of responsibility]	Mass production of standardized modules with limited power over supplier could inhibit radically new solutions [Standardization]
Resource allocation planning		Mission statement and resource allocation of R&D channels attention towards exploiting current knowledge and incremental changes [Optimizing for efficiency in linear business]
Product and project planning	Large CE-focused projects to look at multiple aspects concurrently [Integrated work with sustainability; Integration of different organizational functions]	Having an abundance of projects and long-term product plans narrows search activities [Standardization; Optimizing for efficiency in linear business]
Defined new product development processes	Sustainability checkpoints in stage-gate processes to implement R-strategies in early NPD [Integrated work with sustainability]	NPD process focused on reducing risks may hinder radical innovation [Standardization]
Partnership agreements	New partnership agreements that include circularity dimension in obligations enables CE in early product development [Integrated work with sustainability]	Fear of transparency, NDAs and IPRs that hinder new partnerships aiming to achieve radical innovation [Standardization]
Organizational structure: cross-functional responsibility for sustainability	Cross-functional responsibility for sustainability ensures greater relevance for individual organizational functions [Integrated work with sustainability; Integration of different organizational functions]	
Organizational structure: separate organizational entity for CE innovation	A separate unit for CE initiatives enables greater management attention. A cross-functional business line makes it possible to allocate resources to radical innovation [Legitimacy of CE; Integration of different organizational functions]	Treating CE initiatives as a separate business may result in less influence on the main business organization [Marginalization of CE activities]
Customer requests and involvement in NPD	Working closely with customers in product development is a frequently mentioned enabler of circular innovation [Experimentation]	Customer requests may favor development towards incremental innovation and improvement for the first use phase versus radically new offerings or improvements for other users along the lifecycle [Standardization]

Source: Authors

Result Controls

Overall, interviewees shared many reflections concerning the use of result controls within their organizations, several of which related directly to their CE transformation. Measuring circularity or corporate goalsetting for CE are clear examples of controls that the interviewees had experience with. It is clear that a majority of the respondents saw the need to be able to measure circularity and recognized the challenges in getting accurate data.

What we, and I personally see, is that [measuring] is incredibly difficult within circular economy. It is very challenging to find measurements so that you can compare...a circular process with another linear or circular process, and see which one is really most circular and most useful. The question of environment is actually really easy, if I'm pushing it. There, we know that it's about greenhouse gases, which we need to reduce. And we know where they come from, and how we can affect it. But circular economy is something which we have not really understood yet, in my opinion. [Tools, Interviewee 5]

However, several interviewees were also skeptical results controls were a necessity in order for their organization to transform. In fact, besides goalsetting and incentives such as bonuses, few respondents were optimistic about using traditional results controls in CE transformations. Instead, they highlighted several problematic tensions between a CE transformation and existing results controls.

It's pretty easy since the only real measurement that I'd say that the company is really working towards, that is the next quarterly report… 20 percent profit and above. So, in that regard, it's pretty easy, because then everyone moves in that direction. [Mining, Interviewee 8]

If you are about to go through with these R-strategies in a good way, well then, these products will not have the same short-term profitability as our traditional products.…Then there are certain KPIs that will not be fulfilled, so, I think that is something you need to change. You need to allow this transformation for a period of time. [Trucks, Interviewee 12]

Many respondents shared the view that the purpose of management controls was to create an efficient, profitable, and productive organization. Typically, this was in relation to the company's long history, and encompassed results controls that controlled factors such as cost, quality, and variance. Several interviewees problematized an operational focus on a short-term time horizon, meaning that attention is paid to deliverables and goals that are near in time and decisions that serve the first product user. Some interviewees framed this as a challenge in relation to decisions that could impact circularity potential throughout the product or component lifecycle.

We follow up on volumes and profitability most of all, I would say. Of course, if we now want to sell fewer cars and become more circular, then we can't be measured on volume anymore; we need something different. We don't know what yet. [Trucks, Interviewee 12]

In contrast, interviewees described company ambitions and goals linked to climate change and other sustainability challenges as both requiring a significantly longer time horizon and as effective ways to shift away from myopia.

It's also the time perspective that, I mean, if you look too short term all the time, it also means that you can't take in this new and radical [thing] that stir things up too much. Instead, with a short time perspective, it's much more about optimizing here and now all of the time. So, I think that is both structurally and that…maybe, that we need to be even more far-sighted. But there I'd say that we have undergone an enormous change thanks to the climate focus. [Trucks, Interviewee 2]

For an outline of identified results controls, see Table 5.

Table 5 Identified Managerial Results Controls, With Analysis of Enabling or Impeding Factors Marked in Brackets

Control mechanism	Enabler	Lock-in
Productivity, production and profitability metrics		Radical circular innovation may not initially be profitable, leading to lower production volumes and fewer traditional sales, which goes against established goals and metrics [Optimizing for efficiency in linear business; Incremental innovation; Marginalization of CE activities]
KPIs in research and development and product requirements	KPIs can incentivize change and adaptation of products for CE early in product development [Integrated work with sustainability]	Established KPIs can have relatively short time horizons, favor incremental improvements and the existing portfolio over radical innovation [Short-range planning]
Board monitoring and discussion of long-term strategic goals	Board and top management team prioritizing long time horizons and monitoring sustainability goals [Long time horizon; Integrated work with sustainability]	
Quarterly financial reporting		Quarterly reporting favors a short time horizon and activities that are known to yield positive short-term results, not the risk-taking needed for radical innovation or long-term results from sustainability efforts [Short-range planning]
Cost controls in purchasing and partnerships	Metrics such as Total Cost of Ownership (TCO) may include strategic goals and R-strategies such as salvage grade [Integrated work with sustainability]	A low-cost mentality may lead away from quality suppliers and new partnerships and towards products not designed with R-strategies in mind [Optimizing for efficiency in linear business]
Incentives and bonuses	Bonuses and incentives can be tied to sustainability targets and modified to incentivize a circular business model [Integrated work with sustainability]	Existing incentives rely on a traditional linear business model: e.g., volume of product sales [Optimizing for efficiency in linear business]
Goals for learning and knowledge sharing	Goals that incentivize best-practices sharing and knowledge creation to help the organization tackle unfamiliar topics [Integration of different organizational functions]	
CO_2 goals and commitments at a corporate levels	Corporate commitments to targets that challenge the status quo and create urgency to shift [Integrated work with sustainability; Broad scope of organizational responsibility].	CO_2 goals are more concrete than circularity, which may steer attention towards incremental reduction over radical circular transformation [Short-range planning; Optimizing for efficiency in linear business]
Corporate goalsetting for circularity and implementation at the division level	Corporate goals show top management's commitment to CE and incentivize new projects with clear requirements and criteria adapted to CE [Legitimacy of CE; Experimentation]	Enforcing change in an organization built for a linear business model, rather than exploring alternative organizational structures such as a separate business unit for CE [Optimizing for efficiency in linear business]

Measuring circularity	Measuring circularity induces ideation, learning, and knowledge sharing and enables monitoring of progress towards CE aims [Legitimacy of CE; Experimentation]	R-strategies that are easier to measure and yield fast results (e.g., recycling) may divert attention from other R-strategies that could have higher impacts [Short-range planning]

Source: Authors

Cultural Controls

In general, most interviewees were very positive about the use and power of cultural controls. In relation to achieving a CE transformation, controls such as communication, training, vision, and mission are examples of controls directly used in implementing CE. In contrast, few respondents expressed negative views or discussed tensions between existing cultural controls and CE transformations. One example of such a tension is the shared striving for product performance, where continuous improvements tend to be incremental and measurable, diverting attention from radical alternatives.

I think the absolutely most important thing is, once again, daring to stick our noses in things that we don't have any clue about. That's a pretty big challenge…and it will demand a cultural change and a behavioral change in the organization. [Mining, Interviewee 4]

One challenge that several interviewees described concerned the low propensity for risk-taking they had experienced in their organizations. Typically, they contrasted CE with traditional business areas in their organizations where risks were easier to determine. In contrast, factors such as financial viability, customer value, and product performance were associated with risks or uncertainties when it came to circular offerings. Addressing the greater level of risk was described as a cultural change, and acceptance of failure was particularly emphasized.

I think the difficulty is to be able to [idiom, get acceptance] in the organization and convince people that it's something worth trying, with the risk of failure as well, because you know, in the beginning, you don't always know if you're going to make money. [Trucks, Interviewee 5]

There were several interviewees who pointing towards top management and the leadership styles present in the different organizations, in all cases describing decentralized organizations that empowered employees and put less emphasis on hierarchy. However, interviewees also felt that this might differ between countries as well. In terms of controls to achieve this, interviewees described, for example, how the company's vision and mission as defined from the top, management communication, and company credos emphasized leadership ambitions in terms of sustainability and individual responsibility for making the required changes.

At least in these first phases I would say that the management control is me.…You don't need to put numbers on it, but you need to drive, you need to communicate, you need to be a bit on the barricades as a leader when you do these types of things.…There's a pretty big difference in the way that I can communicate with my Swedish colleagues and in the U.S., compared to China, where you need…Well, it's trickier there, because they're a lot more governed and it's more hierarchical. [Mining, Interviewee 4]

For an outline of identified cultural controls, see Table 6.

Table 6 Identified Managerial Cultural Controls, With the Analysis of Enabling or Impeding Factors Marked in Brackets

Control mechanism	Enabler	Lock-in
CE in internal and external communications materials	Legitimacy, alignment, and new partnerships by communicating CE internally and externally [Legitimacy of CE; Integrated work with sustainability]	

Company credos and values: emphasize change and transformation	Company credos encourage change and individual responsibility to challenge the status quo [Broad scope of organizational responsibility].	
Company credos and values: emphasize risk-taking and experimentation	Encouraging the risk-taking that is often associated with radical innovation [Experimentation]	
Sustainability and CE integrated in long-term vision and mission	Company vision and mission acknowledge a sustainable future, create alignment, and guide decisions [Long time horizon; Integrated work with sustainability; Broad scope of organizational responsibility]	
Values which strive for product performance	Changing the concept of performance to reflect a circular logic (i.e. hierarchy in the R framework) could be an incentivizing factor [Legitimacy of CE]	Resource allocation leans towards incremental improvements, where targets such as performance and quality are based on a linear logic in which deviations due to innovation are avoided [Short-range planning; Optimizing for efficiency in linear business]
Communication channels and plans, internally and externally	Competence building and alignment through internal communication channels and networks, promoting learning across different organizational functions and divisions [Integration of different organizational functions]	
Use of brand heritage and history as a motivation and cultural foundation	History of surviving a number of radical and disruptive shifts in technology and markets eases the idea of a new shift [Long time horizon]	Company history may enforce business-as-usual [Optimizing for efficiency in linear business]
Shared language, concepts, and definitions within the company	Creating alignment and awareness and promoting discussions by creating a shared language [Legitimacy of CE; Integration of different organizational functions]	Disagreement on definitions and concepts may result in failure to create legitimacy [Marginalization of CE activities]
Top management's attention and communication	Clear commitment and drive from top management on topics that fall outside of business-as-usual help draw attention and priority. Top management communicates a clear ambition in a sustainability transition [Legitimacy of CE; Integrated work with sustainability]	
Creating training, seminars, workshops, and dedicated support teams	Awareness, knowledge creation, best-practices sharing, and support teams to help the organization tackle unfamiliar topics [Integration of different organizational functions]	

Source: Authors

Discussion

Through this study we set out to achieve greater insight into how organizations use managerial controls to strengthen CE principles within their organizations and to highlight tensions in the MCS that may occur following the contrasting logics of linearity and circularity. Our finds reveal that despite CE's relatively

early stages of implementation, our case companies are making changes in their MCS. In addition, they do experience tensions between CE implementation and the MCS currently in use in their organizations. Figure 1 summarizes these findings, illustrating key factors within industrial organizations that MCSs influence in favor of radical or circular innovation in their CE transformations.

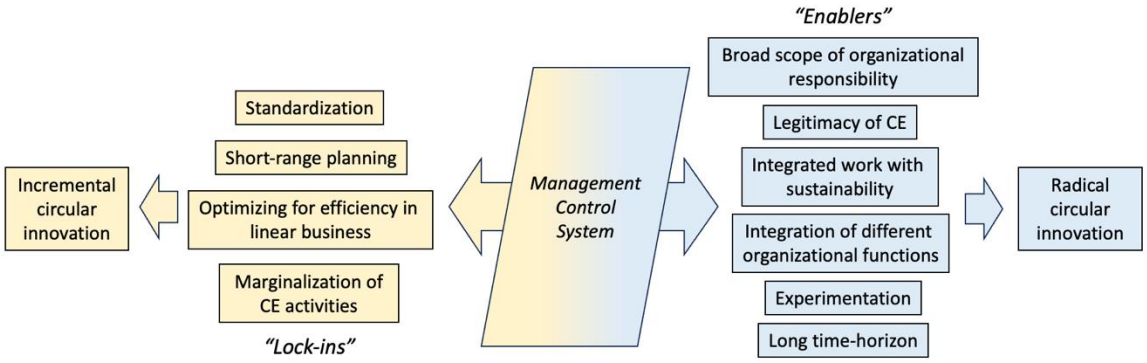

Figure 1 Summarizing the influence that an MCS has over innovation in a CE transformation

Source: Authors

Unlocking Circular Innovation: Management Controls as Levers

The most prevalent enabling factors are related to the presence of managerial controls that favor: (1) integrated work with sustainability, (2) the integration of different organizational functions, (3) the legitimization of CE, (4) experimentation, (5) a broad scope of organizational responsibility, and (6) a long time horizon. Table 7 describes these enabling factors.

Table 7 Description of the Enabling Factors Influenced by MCS

Enabling factor	Description
Broad scope of organizational responsibility	Taking proper action when able to do so: i.e., the accountability of the organization
Legitimacy of CE	Conceptualizing, accepting, and recognizing CE
Integrated work with sustainability	Operationalizing and including sustainability aspects in day-to-day activities
Integration of different organizational functions	Encouraging and facilitating cross-functional work
Experimentation	Testing novel things with unknown and sometimes risky outcomes
Long time horizon	Valuing long-term planning in contrast to short-term objectives

Source: Authors

The integration of sustainability considerations in daily work was found to be a recurring enabler in our findings. Specifically, this integration was most commonly supported in action controls and result controls, with cultural controls playing a supplementary role. The most notable action controls interventions to support integration of sustainability concern changes in new product development processes and new business units or organizational functions. Process changes were often intended to ensure that aspects of sustainability and CE were considered in the early stages of product development, in line with what previous research has suggested (Rashid et al., 2013; Shahbazi & Jönbrink, 2020). This was exemplified both as a small and simple add-on of asking whether employees working on a new product idea had investigated CE potential (a small change that may still result in large and continuous changes) or whether it would demand entirely new ways of working (e.g., the lean startup methodology of build-measure-learn with customers, or large cross-functional projects). However, despite experimenting with new working methods aimed at organizational transformation, interviewees noted that a lack of clear roles and responsibilities often led to promising radical projects being overlooked when clear roles and responsibilities were lacking. This highlights misalignments in managerial controls, and how dominant controls can suppress more radical endeavors. Specifically, our interviewees indicated a move towards

more iterative and experimental processes in CE projects, such as customer involvement in pilot projects, these initiatives required corresponding formal adjustments of key functions, responsibilities, or organizational structures, which has been found to be a barrier to successful integration of CE and radical sustainability-oriented innovation (Hansen et al., 2018; Ritzén & Ölundh Sandström, 2017).

We found that the organizations had introduced a few new results controls to promote CE principles. These included both specific targets, such as increasing the salvage grade in remanufacturing, and broader strategic objectives such as the goal of achieving 50 circular innovations by 2025. Our findings here resonate well with Svensson and Funck (2019) in that strategic objectives acted as internal communication to align the organization and signal top management's priorities. However, comparing CE with other sustainability ambitions, it is clear that our case organizations have come further in integrating goals such as CO_2 reduction technically, methodologically, and mentally (Gond, 2012). A number of factors could explain this. For example, the organizations' CO_2 ambitions were laid out earlier than CE goals, there are well-established metrics for monitoring CO_2 reduction, and CO_2 reduction goals may be less of a challenge to linear business models.

We identified legitimizing CE as an essential enabler in the ongoing CE transformation. Interestingly, this enabler appeared to be strongly and almost exclusively supported by cultural controls (e.g., communication materials, attention from top management, and shared CE language and definitions). This might be explained by the timing of the study, as the integration of CE has not yet reached a sufficient level of maturity to be incorporated into processes and performance indicators in the same way as other sustainability efforts. However, going forward, this imbalance should be noted so that CE achieves legitimacy within organizations through a systematic consideration of combinations of managerial controls.

Competing Priorities and the Marginalization of CE

Our analysis identified linear lock-ins related to factors such as (1) short-range planning, (2) optimizing for efficiency in linear businesses, (3) the marginalization of CE, and (4) standardization. These hindering factors are described in Table 8.

Table 8 Description of the Hindering Factors Influenced by MCS

Hindering factor	Description
Short-range planning	Focusing on operations and objectives that are near in time
Optimizing for efficiency in linear business	Striving to maintain business-as-usual in a way that minimizes waste
Marginalization of CE	Treating CE activities as peripheral or insignificant
Standardization	Standardized processes built to support the linear business

Source: Authors

Our findings suggest that the organizations are to a large extent guided toward incremental innovation through standardization and short-term planning based on legacies of their linear business models. This is most prevalent in action and results controls. In contrast, relatively few controls support the experimentation, long time horizons, and broader scope of organizational responsibility that radical circular innovation requires (Weissbrod & Bocken, 2017; Svensson & Funck, 2019). Notably, many of the tensions are closely related to the challenges of radical innovation in large organizations. For example, Sandberg and Aarikka-Stenberg's (2014) review highlights unsupportive organizational structures (such as conflicts with the main business), restrictive mindsets (such as following established routines and patterns), and the lack of competencies in discovery (for example, using inappropriate methods).

Examining action controls in particular, we find that few interviewees identified controls that enabled their organizations to engage in and experiment with external actors or facilitate long-term relationships. This is problematic for a CE transformation. Conventional management controls focused on internal organizational processes or actions, as Lowe and Puxty (1989) have pointed out, and as indicated by our results. This inward-looking philosophy of control overlooks the crucial aspect of governing the organization's relationship with its environment and fails to discuss specific ways of doing so. Therefore, an internal focus will fail to support an organization's transformation toward CE, which has an inherently external focus and may depend on external actors in an innovation ecosystem in order to succeed

(Frishammar & Parida, 2019; Konietzko et al., 2020). Notably, the inward focus of management control is less apparent in certain management control literature. For instance, Ruiter et al. (2022) used Simons (1995) levers-of-control framework to show how management controls were utilized by construction companies to search for value creation activities in the external environment, and important control measures for introducing CE in a conservative industry. These insights suggest the need to embrace alternative approaches to management control systems, such as those proposed by integrating complexity theory (Uhl-Bien & Marion, 2009) or systems thinking (Senge, 2006), is an appealing way to consider the importance of engaging stakeholders both inside and outside the organization to achieve CE transformations.

The interviewees widely discussed the use of results controls in their organizations, a common type of control to give direction in large, decentralized organizations (Merchant and Van der Stede, 2017, p35). One significant challenge concerned the incompatibility between CE principles and well-established organizational goals. Many interviewees emphasized that top management closely monitored and prioritized traditional metrics monitoring productivity, production, and profitability. This has been observed in previous studies as limiting circular transitions in organizations (Lindahl, 2024). The interviewees framed this as a challenge in light of CE, considering that circular innovation might not be immediately profitable. Moreover, efforts to dematerialize or extend the product use phase, for example, starkly contrast with conventional business aims to increase production and consumption (Geissdoerfer et al., 2020). These challenges might compromise CE ambitions and lead to their marginalization versus incremental ambitions that fit better with dominant results controls. This could reduce CE to something easily measured and less of a radical shift (e.g., % of recycled material inputs in a product), or it could create destabilized organizations because of conflicting results controls, in line with what Gond et al. (2012) describe.

Researchers have discussed targets, goals, measurements, and indicators for CE (Morseletto, 2020). Practitioners have increasingly implemented these metrics, yet few studies have investigated them from a MCS perspective. Our results show that targets can spur ideation and create alignment within an organization, as previous work has suggested (Saidani et al., 2019), but they can also lead to unintended consequences. Specifically, when there is a lack of consensus on definitions and standardized ways of measuring, it can lead to resistance to change or rebound effects, which is detrimental to the legitimacy of CE. This does not suggest that one single MCS design fits all scenarios; rather, it points to the importance of carefully considering combinations of different controls (Knels et al., 2024). In addition, the comprehensiveness and timing of targets can also be considered in relation to novelty. McGrath (2001) and Locke and Latham (2006) have found that concrete and measurable goals might prematurely cut the discovery and learning processes too short, shifting focus away from skills required to achieve goals and towards measurable performance. This is interesting in relation to CE transformation of organizations, where certain R-strategies, such as recycling, may be easier to measure than rethink or refuse, for example, even though the latter two are suggested to have a greater potential to drive a truly circular economy (Morseletto, 2020).

Despite the tension experienced in results controls, most interviewees did not consider the situation problematic, as there were other control mechanisms in play. Specifically, many respondents brought up cultural controls as a remedy: i.e., their organization's cultural controls provided guidance when results or action controls were conflicting or lacking. Even though most interviewees did not perceive CE to be embedded in the company culture, they did believe that cultural controls were in place that were beneficial for a CE transformation. For example, concepts such as empowerment, sustainability, transformation, and change were explicitly highlighted in their companies' written credos, and they described these concepts as frequently emphasized by top management. This adds to Bekier and Parisi's findings (2023), as it exemplifies how performance measurements and cultural controls evolve together when ideas about good performance are lacking. Furthermore, it expands the framework developed by Bocken et al. (2016), who suggest that companies need to start with an overall CE vision and goals before developing their circular business model and design strategies in detail. Our analysis suggests that these goals do not have to be specific to CE but can instead challenge the status quo of current business activities and empower employees. In fact, interviewees in our study frequently emphasized employee empowerment and trust as enabling factors. These findings support the idea that MCS must balance control with empowerment (Ahrens & Chapman, 2004; Simons, 1995). As Henri (2006) suggests, it is this dynamic tension that needs to be combined to provide competitive advantages.

Practical Implications

First, our study suggests that MCSs are deeply embedded in daily activities and routines, and therefore, how they align with CE ambitions needs to be considered. In the early stages of CE transformation, it is suggested that traditional notions of MCS as control, determination, and prediction may need to be weighed against concepts such as influence, support, and direction-setting to support exploration before exploitation. This is a shift in mindset towards a less formal view of management's role and emphasizes the use of cultural controls. While many managerial controls remain applicable and are likely to continue to be used, they must be considered in conjunction with this new perspective.

Emphasizing measuring CE without providing ample training or allocation of time to learn may reduce CE to what can be easily measured and achieved in the short term. Likewise, radical and experimental pilot projects with customers can easily be forgotten, even if they are successful, if they are not accompanied by sufficient changes in roles, responsibilities, or organizational structures. Hence, organizations should consider combinations of control types, as well as timing and comprehensiveness.

An inventory of existing managerial controls, such as ours, can help identify misalignments with CE ambitions. For example, several of our interviewees described an organizational prioritization of CO_2 reduction. In the best of worlds, this objective can be achieved in conjunction with circular innovation. However, because it is less well established and more difficult to quantify, CE efforts are at risk of being marginalized in pursuit of ambitions that are more easily measured, controlled, and communicated.

Limitations and Future Research

Our study has several limitations. First, our data stems from three case companies in Sweden and 38 interviews. While our findings are contextually rich, it is probable that a larger number of organizations and interviewees would have provided additional experiences and perspectives. Because this was an exploratory study, we did not seek statistical generalizability (Yin, 2002); however, we suggest that future quantitative studies could investigate a larger number of cases to achieve this. Furthermore, national cultures and regulations can shape MCS (Malmi et al., 2022), which suggests that future studies could aim for a cross-country comparisons. Secondly, the present study only captured a snapshot at a point in time when all the case organizations were at a relatively early point in their CE transformation and their MCSs were likely to continue to evolve. Considering the continued CE transformation of several additional industrial organizations, further longitudinal research designs could shed light on how MCS tensions appear and are managed within organizations. This does indeed limit the validity and comparability of many studies on MCS and strategy, as the MCS needed to support a particular strategy may only be partially developed at the time of the study, and the change process may be ongoing or span many years (Langfield-Smith, 1997). Third, because our study focuses on the “messiness” in the early stages of CE transformation at these large organizations, performance outcomes such as actually launched circular innovations (whether radical or incremental) were not explicitly considered. Future studies could use a different level of observation and analysis to retrospectively capture the influence of an MCS on successful and failed CE innovation projects.

From a theoretical standpoint, the tensions we identified in our study would be viewed as problematic in the traditional management control literature, offering ways to resolve them. In contrast, an emerging stream of literature accepts tensions by acknowledging them as necessary paradoxes (Hahn et al., 2014, 2018; van der Meer-Kooistra & Scapens, 2008). Organizations that succeed in managing these paradoxes move away from centralized control in the classical sense, shifting responsibility towards managers and individuals rather than formal control systems (Mundy, 2010). Several interesting theoretical areas could be relevant to understanding how MCS needs to adapt to CE, such as complexity theory (Uhl-Bien & Marion, 2009) or systems thinking (Senge, 2006). This opens up conceptual discussions, but would be even more interesting if applied to practitioners and operationalized using tools or methods to provide pragmatic guidance.

Conclusions

Researchers are calling for radical changes in business organizations in order to achieve CE. In practice, however, organizations are struggling to make sufficient changes to implement CE, and research on

organizational change processes in light of CE is still nascent. Consequently, CE risks being reduced to minor incremental improvements if the radical changes needed are not better understood. This study adds to this body of knowledge by describing the MCS interventions that incumbent industrial organizations are making when implementing CE, and analyzing how MCS leads them towards incremental or radical innovation in their CE transformations.

Our study identifies six enabling factors for radical circular innovation that are influenced by management controls: (1) work integrated with sustainability, (2) the integration of different organizational functions, (3) the legitimacy of CE, (4) experimentation, (5) a broad scope of organizational responsibility, and (6) a long time horizon. Importantly, we find that no single type of control is sufficient. Instead, we find that combinations of different managerial controls are required, as they serve different functions in enabling a CE transformation. For example, while new ways of working with pilot projects and customer involvement may result in radically new solutions, they may not be sustained if they are not coupled with corresponding adjustments of key functions, responsibilities, and structures. Comparing the integration of sustainability and the legitimacy of CE, there were significant differences in the types of managerial controls employed. In particular, the legitimacy of CE is, to date, almost exclusively supported by cultural controls rather than action or results controls, unlike the more balanced case of sustainability integration. The timing and comprehensiveness of different types of controls need to be considered.

Conversely, our analysis also suggests factors that risk leading to a lock-in of linear business models: (1) short-range planning, (2) optimizing for efficiency in linear business, (3) marginalization of CE, and (4) standardization. In this case, it is clear that action and results controls have a large influence in comparison to cultural controls. This should be considered in relation to the relatively limited number of controls found that supported factors typically associated with radical innovation. These concern experimentation, a long time horizon, and the broader scope of organizational responsibility that an organization with a leadership ambition in a CE transition arguably should have. In addition, we found significant incompatibility between CE principles and well-established organizational goals. This puts organizations at risk for stagnation in their CE transformation or could result in unstable organizations that pursue goals with different and competing logics. This also illustrates conflicts with conventional perspectives on MCS, which may require new insights on how to deal with dynamic tensions, complexity, and paradoxes.

In closing, our analysis emphasizes that MCS plays an important role not only as an instrument for implementing CE through interventions but also as a system that can entrench a linear logic in organizations. Recognizing this duality opens up important opportunities. Rather than viewing MCS as static or inherently limiting, our study suggests that they can be reconfigured to support more experimental, collaborative, and long-term approaches to innovation for CE. In this light, MCS are not just mechanisms of control and alignment, but also potential levers for organizational learning and systemic change. For organizations seeking to lead in the transition to CE, this perspective offers a practical pathway forward—one that acknowledges existing constraints but also affirms the possibility of transformation through thoughtful design and use of MCS.

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Author contributions

Johan Arekrans: conceptualization, methodology, investigation, formal analysis, writing draft and revising, funding acquisition.
Sofia Ritzén: conceptualization, methodology, investigation, supervision, writing - review & editing, project administration, funding acquisition.
Susanne Nilsson: formal analysis, writing - review & editing.

Declarations

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Data availability
The datasets generated and analyzed during the current study are not publicly available due to the nature of the qualitative research. The data consist of interview transcripts containing potentially identifiable information. Sharing this material would compromise the anonymity and confidentiality of the participants, and would not be consistent with the terms of informed consent provided. To protect the privacy and trust of the informants, and in accordance with ethical research guidelines, the data cannot be made publicly accessible.

Competing interests
The authors declare no competing interests.

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Appendix A – Interview guideline

Opening information: In this project, we are examining how different organizations are governed and how that may influence their transformation towards a more circular business model. In this interview, we want to understand more about and what types of management control measures your organization has in place currently, and how your organization relates to CE. A special interest for us in this is how different types of governance can impact innovation, so you will be asked some questions on this as well. When answering, you can choose to reflect upon your organization at large, your division specifically, or answering for yourself as an individual as long the distinction is clear (we may ask you to reflect upon if there is a difference between these).

[Ask for questions, clarifications, NDA agreements, permission to record, inform about anonymity, handling of data and how the results of the study will be used]

A. The respondent, in general

1. What is your formal role at the organization? What are your main tasks and responsibilities?
    a. For how long have you worked at the organization?
        i. [If they have worked for a long time, 5+ years] – How has the view on sustainability shifted during these years?

B. Circular Economy

1. How does CE relate to your work with sustainability? Do you have a sustainability strategy, and how does that relate to the overall (business) strategy of the company?
2. What would you say CE is for your [company/division] today?
    a. There are a number of different aspects in circular economy (e.g. R-strategies… Recycle, Reuse, Remanufacture etc.) and changes that these may require (e.g. new product design, manufacturing processes, recycled materials etc.). What do you think is most relevant for your [company/division]? What are you working on?
    b. Which aspects of circular economy would you say are of a more strategic or visionary nature, and which are more operational? Internal and external? Near in time, future?
    c. Do you have a clear idea of where your company is heading (vision) in relation to CE? How far have you come in relation to that?
3. What effects have you seen already within the organization from your work with CE? Direct and indirect impacts/effects?
4. Within your own organization, what are the challenges/barriers to CE you have encountered or foresee?
    a. What do you see as key changes that must occur within your organization in order for you to become more mature in becoming circular?
    b. What form of support or incentives do you think would intensify the work that is being done with circular innovations?

C. Radical and disruptive innovation, ambidexterity, dynamic capabilities

1. Could you describe how your innovation work looks like? What function/who develops new offerings to the markets and is that mainly: products, services, business models, processes…
    a) Is the work mainly conducted inside a specific function or how do you work cross-functionally?
    b) When there are new challenges or changes in your environment which you need to adapt to, what does that look like? Is that different from your ordinary development processes? Are your development processes primarily oriented around existing customers with minor adaptations, or, more forward-looking and/or fundamental? Is the latter within specific areas? [SENSE]
    c) Do you have a specific function or department for innovation work that is more forward-looking or fundamental? Does this setup work according to you? Why or why not?

   d) What does the balance between incremental and radical innovation work look like today? Are there conflicts between incremental and radical innovation work? What are they and how are they handled?
   e) How are new and risky projects that do not fit the current business model managed? How do they get recourses? [SEIZE] What criteria are they evaluated on? How do you see CE initiatives fitting in?
2. Would you say that your organization is best characterized by flexibility (e.g. in relocating resources, experimentation, learning, sharing of experiences) or efficiency (e.g. following clear procedures, rigid time plans, predictability in deliverables, clear roles and responsibilities). Could you reflect upon the effects of this?
   a) How do you make use of experiences? Do you have routines for learning? [TRANSFORM]
   b) How are you working with developing capabilities? How do you work with coordinating different capabilities within and outside of the company? [TRANSFORM]

D. Governance

1. How would you describe how your innovation work is governed? What control mechanisms are used? E.g. a formal strategy, defined targets, KPIs, etc. ?
2. How is this connected to sustainable development and innovation—what we have discussed previously?
3. How do you work with goals and measurements? What types of goals and what do you measure?

[IF YOU ARE SHORT ON TIME – Explain briefly]
In the research literature, there is normally a distinction made between three different types of management controls:

1. Action controls, steering individual actions (i.e., *what you should do* through clear guidelines, instructions, etc.)
2. Results controls, steering following the results/output (i.e., using goals and measuring how well they are met), and
3. Personnel or cultural controls, creating an environment that stimulates certain behavior (i.e., values, norms, attitudes, shared company culture)

Do you recognize these? What is most prevailing/used in your organization? Could you describe how they are used?

4. **[Action controls]** First, how much of work is guided by formal procedures, guidelines and instructions to reach a specific outcome?
   a. Is there monitoring in place to make sure these procedures are being followed? Where do these instructions stem from?
5. [**Results controls]** Second, how are the output or results of work activities evaluated?
   a. What is measured and why? Is there a reward system in place?
   b. In what way are you steered by the company's overall targets, goals, and vision? Are these well reflected in how you govern?
   c. Would you say that you have a lot of room to play or freedom in goals, or are they narrow? Effects?
6. **[Personnel/cultural controls]** Third, how does your organization work with motivating personnel and creating a common culture?

   a. What type of norms, values, and attitudes do you think are shared in your organization? Where do they stem from? Are they affected somehow by the CE initiative?
   b. How are collective achievements awarded?
7. What effect do you think different types of controls or governance have on innovation? Do they steer you towards experimentation and exploring new things or to be more efficient and make smaller improvements to existing products and services?
   a. Do you see a conflict between different types of governance?
8. What do you think the purpose of governance should be? Detecting undesirable behavior? Preventing it? Motivating "good" behavior? How would you describe that balance currently?
   a. How do you think the balance between different types of management controls should look like?

E. Closing

1. Is there anything you would like to add on this topic?
2. Do you know other interviewees that might be of interest to us?
3. Can we contact you again if we have any follow-up questions?