

Perspective

# Learning and Knowledge Management in the Transition to Circular Economy (CE): Roots and Research Avenues

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## Abstract

Research has demonstrated the importance of learning and knowledge management in transition experiments. In this perspective, this paper explores how researchers can underline the role of learning and knowledge management in the transition to circular economy (CE). Drawing on research on the concepts of CE and intellectual capital, as well as field observations in CE experiments in the regional county municipality (RCM) of Kamouraska (Quebec), we identify at least three fundamental research perspectives on learning and knowledge management in the transition to CE. The first concerns the types of learning and knowledge that emerge in CE implementation. The second focuses on the learning and knowledge management process. It concerns the trial-and-error dynamics that facilitate mutual learning and effective knowledge management. The third research perspective consists of assessing how learning and knowledge management at the local level fosters a macro-societal transition to CE.

**Keywords:** Circular Economy, Learning, Knowledge Management, Intellectual Capital, Transition

## 1. INTRODUCTION

In recent years, circular economy (CE) has emerged as an essential lever to address the ecological limits of the prevailing economic model (Kirchherr et al., 2023; Korhonen et al., 2018). It is increasingly becoming the consensual pathway for a transition towards sustainable production and consumption that balances the economic and ecological pillars of sustainable development (De Souza Campos & Vázquez-Brust, 2023). Its implementation should contribute to limiting the consumption of resources (Blomsma & Brennan, 2017; Korhonen et al., 2018; Martin, 2020), minimizing the environmental impact of the production and consumption of goods and services (Geissdoerfer et al., 2017; Mongo et al., 2022).

In this perspective, the concept refers to changes at different scales: supply of producers (industrial and managerial processes, products, sectors of activity, etc.), as well as the demand and behavior of consumers, the territories, etc. (Bahers & Durand, 2020; Chembessi et al., 2023; Prieto-Sandoval et al., 2018). CE implies the mobilization of skills and knowledge of a plurality of economic agents to adapt, adopt, and promote new practices that contribute to a substantial modification of the dominant economic model (Chembessi et al., 2022; Eisenreich & Füller, 2023).

This transformation, required at different scales, and the mobilization of a plurality of stakeholders lead many researchers to consider that the paradigm of open innovation (OI), promoting research and development (R&D) collaboration, and technology, knowledge, and talent

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sharing, opens new opportunities for CE (Runiewicz-Wardyn, 2023; Veyssi re, 2021). These authors emphasize the significance of innovation collaboration within CE (Marrucci et al., 2021; Runiewicz-Wardyn, 2023), highlighting a set of activities that integrate CE practices into innovation processes (Brown et al., 2019).

However, research continues to focus on technological and R&D issues, overlooking the importance of the circulation of knowledge and know-how in the process of the transition to CE (Arnold, 2023). One of pillars of knowledge management<sup>2</sup>, the circulation of knowledge or knowledge dissemination processes, refers to the process by which information, ideas, and knowledge are disseminated, shared, and circulated among individuals, groups, organizations, and societies (Abubakar et al., 2019). It encompasses the flow of knowledge through a variety of means or communication channels (Leidner, 2001) in order to foster innovation or enhance the competitiveness of an organization (Serrat & Ordo ez, 2017; Zhou, 2022). Thus, the circulation of knowledge is crucial if organizations have to adopt innovative ideas from both internal and external collaborators – other firms (suppliers, customers, competitors, and consultants) and organizations (such as universities or public research bodies) (Chembessi et al., 2022; Eisenreich & F ller, 2023; Runiewicz-Wardyn, 2023).

The success of the transition to CE demands the circulation of knowledge between stakeholders (Eisenreich & F ller, 2023; Kraaijenhagen et al., 2016). Knowledge sharing or dissemination can play a vital role in achieving innovations or circular technologies and processes, making decisions, or developing effective regulation and incentives for the transition to CE (K hler et al., 2022; Marra et al., 2018; Yousaf et al., 2022). For example, sharing knowledge about sustainable sourcing, materials, and logistics can enhance resource efficiency and supply chain collaboration in the implementation of CE (Sarkis et al., 2011). Moreover, as CE involves changes in consumers' practices (Shevchenko et al., 2023), knowledge dissemination through awareness campaigns and educational programs about CE and how consumers can contribute can lead to more sustainable consumption patterns (Rabiu & Jaeger-Erben, 2022; Shevchenko et al., 2023; Testa et al., 2020).

Therefore, it seems pertinent to examine the process of knowledge circulation in the transition to CE, notably as CE experiments rely on formal and non-formal interactions between different economic agents and their social, organizational, and institutional structures (Chembessi et al., 2022; Prieto-Sandoval et al., 2019). So, this paper attempts to fill this research gap by discussing the significance of learning and knowledge management in the transition to CE. To illustrate the different levers and essential dimensions of learning and knowledge management in the transition to CE, one can reflect on a critical analysis of the various research on organizational capabilities in the transition to CE, and empirical observations in the CE experiments in the region of Kamouraska (Quebec).

Furthermore, we refer to the main orientations of various theories and conceptual frameworks on innovation processes. We have specifically mobilized the conceptual framework of intellectual capital (Al-Jinini et al., 2019; Mart n-de Castro et al., 2019; Stewart, 1997). Derived from the field of organizational performance, the concept of intellectual capital is essential for understanding the non-physical assets that drive innovation and long-term success (Stewart, 1997). Intellectual capital refers then to the intangible assets and knowledge-based resources that organizations possess or develop for their transformation to respond to the changes imposed by their environment (Cuozzo et al., 2017), create value, and achieve competitive advantages (Aljuboori et al., 2022; Mohapatra et al., 2019). It is a combination of human capital (the skills, expertise, and knowledge of individuals), structural capital (organizational processes, systems, and intellectual property), and relational capital (relationships and networks with stakeholders) (Cuozzo et al., 2017; Stewart, 1997).

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<sup>2</sup> Knowledge management is the process of using meticulous steps to acquire, design, manage and share knowledge within an organization to achieve better performance such as reduced costly rework, faster work, and use of best practices (Aboubacar et al., 2019).

In context of the transition to CE, human capital – individuals with the knowledge and skills to design and implement sustainable processes and products – are critical assets for organizations aiming to transition to a circular model (Lehmann et al., 2022; Mishra et al., 2019). Therefore, knowledge sharing between individuals within organizations must facilitate learning and adoption of CE principles and sustainable practices (Beaurain et al., 2023; Chembessi et al., 2023). The transfer of intellectual capital may help to create a shared understanding of circularity issues (Geissdoerfer et al., 2018). Additionally, the structural capital – specifically the capabilities and intellectual property rights of product design, recycling processes and sustainable technologies – can offer the organizations a competitive advantage in the transition to CE (Tukker, 2015). Finally, relational capital (such as partnerships and networks) is essential for sharing knowledge and resources to promote circular practices on a larger scale (Chembessi et al., 2021; Eisenreich & Füller, 2023). In fact, CE initiatives often require collaboration between diverse stakeholders. Thus, intellectual capital – in its various manners – is related to the issues of learning and knowledge management for the successful transition to a CE.

## **2. RESEARCH AVENUES ON LEARNING AND KNOWLEDGE MANAGEMENT IN TRANSITION TO CE**

CE experiments rely on the mobilization of various external or internal capacities and resources of the stakeholders (Hobson, 2019; Jambou et al., 2022), which may be either tangible or intangible (Gumbau-Albert & Maudos, 2022). Several studies have focused on tangible resources (metals, ores, biomass, water, infrastructure, equipment, organic or inorganic waste, etc.) (Bahers & Durand, 2020). However, intangible resources are still relatively absent from global reflection on the transition to CE (Beaurain et al., 2023). These intangible resources are nonmaterial assets that can support the implementation of CE. They include know-how and skills in resource management, recycling, repair, remanufacturing, etc. (Chembessi et al., 2021; Lenglet & Peyrache-Gadeau, 2020), as well as citizens, businesses, organizations, cultures, values, etc. (Beaurain et al., 2023). The potential mobilization of these resources depends on the ability of CE stakeholders to coordinate with one another (Jambou et al., 2022; Jesus & Jugend, 2023). The mobilization of these intangible resources underlines the question of a mutual learning and knowledge management process between stakeholders in transition experiments (Luederitz et al., 2017; Plummer & Poeck, 2021).

In fact, mutual learning and knowledge management foster a common understanding of sustainable issues, the implementation of concerted and systemic strategies and actions which are able to address the issues (Luederitz et al., 2017; Orderud & Winsvold, 2012; Plummer & Poeck, 2021). From this perspective, several authors emphasize the organizational capabilities and intermediation operations of one or more stakeholders to accelerate and/or strengthen the mobilization of a diversity of stakeholders in the implementation of transition experiments (Kivimaa et al., 2019). These organizational capacities and the intermediation operations of one or more stakeholders are decisive in the implementation of CE projects (Marrucci et al., 2021). They enable the sustainable mobilization of the stakeholders, the pooling of their resources, and the sharing of their knowledge at different spatial scales (Bourdin, 2020; Chembessi et al., 2021). More specifically, the organizational capacities help to address how stakeholders navigate CE issues and opportunities. This issue of learning and knowledge management in the transition to CE appears fundamental for three reasons: the collective and relational nature of CE experiments, the incremental nature of change in CE experiments, and the macro-societal perspective of the transition to CE.

### **2.1 The Collective and Relational Nature of CE Experiments in Learning and Knowledge Management**

CE experiments are only possible if stakeholders work together (Eisenreich & Füller, 2023; Kirchherr et al., 2018). Our observations in the local CE experiment in Kamouraska show that the mobilization of local intangible resources (e.g., know-how, past experience, skills, and culture) is, above all, rooted in a relational dynamic between local stakeholders. Moreover, in transition experiments, the collective processes are analyzed as learning space between stakeholders (Luederitz et al., 2017; Plummer & Poeck, 2021; van Mierlo & Beers, 2020). Thus, CE can be associated to a learning process within a network of actors to collectively enhance their capabilities to address the ecological issues (Healy & Morgan, 2012).

In addition, a number of studies on intellectual capital in organizations have shown actor relationships help to manage resources, and involve resources properly in the projects at stake (Chesbrough et al., 2018; Hoffmann et al., 2018). They underlined that change and/or adapting to change requires individuals and organizations to involve themselves in collaborations or partnerships to support each other to enhance their strengths and capabilities. In their perspective, the network relationships help to build knowledge, community, competence, attitude, and intellectual agility (Lyons & Brennan, 2019). Thus, the collective process in the implementation of CE experiments suggests that the stakeholders are enriched by new forms of organization, knowledge, practices, etc., to overcome cognitive, material, and institutional constraints, and identify the circularity initiatives they can develop. Therefore, one of the critical research avenues in CE is to examine the reality of collective learning in the transition to CE, in particular the forms of learning, knowledge and actors involved.

## **2.2 The Incremental Nature of Changes in CE Experiments in Learning and Knowledge Management**

Transition experiments were long seen as the result of radical innovations from influential and/or historical players (Arekrans et al., 2023; Berggren et al., 2015; Köhler et al., 2019). Nevertheless, many authors acknowledge the existence and non-negligible role of incremental innovations in transition processes (F. Geels & Schot, 2010; Smith & Stirling, 2010; Stiles, 2020). This incremental nature of change in transition processes is strongly present in CE experiments (Chembessi et al., 2022). It refers to the idea that, in transition experiments, the stakeholders want to learn from their initiatives and understand the drivers and barriers (Orderud & Winsvold, 2012; Van Mierlo & Beers, 2020). For example, the implementation of CE in Kamouraska is more a matter of gradually adapting existing circularity technologies and practices. Stakeholders are not developing new products or techniques. Changes are incremental, not abrupt or disruptive. Furthermore, stakeholders do not perceive unsuccessful circularity initiatives as failures. Rather, they see these initiatives as opportunities for discovery and/or collective learning, enabling them to develop a repository of knowledge adapted to their reality in the transition to CE (Chembessi et al., 2023).

Therefore, CE seems to align with the particularity of transition experiments, which presuppose learning through trial-and-error dynamics (Huesemann, 2004; Turnheim & Sovacool, 2020). A number of studies on intellectual capital have demonstrated the role of trial-and-error dynamic, learning by doing as the fundamental strategy for development to appropriate and implement changes that enable the stakeholders to adapt to new frameworks and their environment (Callander, 2011; Yüksel et al., 2021). Thus, one of the research avenues that can be related to this trial-and-error dynamic, particularly around non-conclusive initiatives to help to build more resilient CE experiments, is for actors at various levels to create a standard frame of reference about their CE projects (Chembessi et al., 2021). In other words, exploring the role of failures in CE scaling-up will help initiate a sustainable transition by mobilizing a diversity of actors to create acquire new skills and knowledge, and enhance their CE experiments by learning from their circular initiatives, notably those that have failed.

### **2.3 Learning and Knowledge Management in the Macro-societal Perspective of the Transition to CE**

In transition experiments, the learning and knowledge management between stakeholders contributes to identifying and developing a political and institutional framework for fostering the large-scale implementation of the projects (Beaurain et al., 2023; Chembessi et al., 2021; Moreau et al., 2017). For example, the learnings from the local CE experiments in Kamouraska contribute, among others, to the identification and redefinition of the national framework of public policies for scaling-up CE in Quebec (Chembessi et al., 2021). Indeed, scaling CE implies the sustainable commitment of public policies at various levels (Fan & Fang, 2020; Lazarevic et al., 2022). In this way, public policymakers can build their reference frameworks for action based on the experience, knowledge, and learning from grassroots projects. The learning and knowledge from CE experiments help to reinforce a more structural cultural change within society as a whole, conducive to a macro-societal transition to CE (Beaurain et al., 2023; Chembessi et al., 2021).

In fact, while many CE experiments are sector-based (Korhonen et al., 2018), CE refers to all economic agents, including producers, consumers, public actors, etc. (Beaurain et al., 2023; Ho et al., 2021). It fundamentally implies the transformation of all practices of the linear functioning of the economy, and which concern the supply of producers, the demand and behavior of consumers, and waste management practices (Bahers & Durand, 2020; Prieto-Sandoval et al., 2018). It involves decarbonizing the economy, through a set of disruptive or relatively incremental technological processes that help reduce the carbon intensity of human activities, both in the design and use of products and services (Ghisellini et al., 2023; Mongo et al., 2022).

The transition to CE is thus a macro-societal process of changes in practices that affect economic activities, institutional structures and cultural patterns (Ghosh, 2020; Gutberlet et al., 2023; Velenturf et al., 2019). It involves adapting the production and consumption structures of the economy as a whole to the challenges of sustainability (Gutberlet et al., 2023; Velenturf et al., 2019). This macro-societal perspective on the transition to CE hinges on learning and the circulation of knowledge between different spheres and different stakeholders in the economic system, notably around the innovations they carry or that emerge from their interactions (Chembessi et al., 2022; Eisenreich & Füller, 2023; Suchek et al., 2021; Veyssi re, 2021). Indeed, it implies, at the very least, three kinds of changes that all stakeholders in the economic system must consider (Beaurain et al., 2023; Chembessi et al., 2022).

The first change – or object of learning and knowledge circulation – is technical. It refers to the necessary transformation and adaptation of production processes to ensure that business activity is highly circular (Arekrans et al., 2023). The second is organizational, based on the reorganization of services at the level of economic agents, particularly companies, and in the exchange of flows (economic interactions) between these agents (Bocken et al., 2023). Finally, the last change is institutional, and relates specifically to the entry of (new) public players in the transition to CE, the implementation of (new) collective mechanisms, and (new) forms of intermediation enabling the global scaling-up of the CE issue (Beaurain et al., 2023; Chembessi et al., 2023; Hartley et al., 2022). This third and final lever relies on the emergence or appropriation of social and political dynamics that are essential for mobilizing stakeholders and conducive to a transition to CE. These three dimensions of change are essential for better engagement and a better transition to CE, and raise the question of their appropriation by all stakeholders in the economic system.

In this perspective, research on CE could seek to measure and emphasize how learning and knowledge management at the local level helps to identify the contours of a macro-societal transition. As demonstrated by many authors, intellectual capital plays an important role to respond individually and collectively to the mutations of the contemporary world (Yüksel et al., 2021). Moreover, the structural nature of intellectual capital refers to the construction of a global understanding of issues and opportunities through data, organizational routines, and a collective

culture, etc. (Isaac et al., 2010). Knowledge enablesthe imposition of new rules, new methods, new organizations, the ability to anticipate resistance to change, etc.

Research on CE could also explore the role of public policymakers in the learning and knowledge management process. Their role seems important as some power and asymmetric relations between stakeholders are present in various CE experiments (Babri et al., 2018; Cramer, 2020). Yet, power dynamics can reduce the intensity of mutual learning and knowledge management between stakeholders (Van Mierlo & Beers, 2020). Furthermore, research on intellectual capital shows the influence of institutions, and in particular the legal system, on the approach of organizations in terms of the production, dissemination, and sharing of knowledge on specific issues and projects (Swart, 2006). Moreover, as several cultural variables (hierarchical distance, individualism, control of uncertainty, attitude towards risk, etc.) are considered when addressing and analyzing the issue of building intellectual capital, public policies may adapt from the experiences acquired with CE experiments to structurally address the possible cultural obstacles of the macro-societal transition to CE (Beaurain et al., 2023; Chembessi et al., 2023; Hartley et al., 2022).

### **3. CONCLUSION**

Learning and knowledge management can play an important role in the transition to CE. To this end, CE research must address the roles and conditions of learning and knowledge management to foster the transition to CE. The avenues of research are multiple. In this paper, we explore this question through the conceptual framework of intellectual capital (-Al-Jinini et al., 2019; Martín-de Castro et al., 2019). However, several other theoretical and conceptual frameworks can be mobilized for this purpose: theory of proximities (Balland et al., 2015; Boschma, 2005; Filippi et al., 2022), organizational management (Sheldon, 1980; Weiner, 2020), sustainable transition studies (Geels, 2020; Grin, 2016; Köhler et al., 2019), etc. Furthermore, the analyses could focus on several structuring elements of learning and knowledge management: causes (motivation), process (a mechanism), context, and types of learning and knowledge, etc. Finally, research on learning and knowledge management in CE experiments will provide insights into defining trajectories and strategies for a more global and systemic transition to sustainable modes of production and consumption.

## **AUTHOR CONTRIBUTIONS**

**Chedrak Chembessi:** Conceptualization, Methodology Design, Data Collection, Formal Analysis, Writing, Review & Editing

## **DECLARATIONS**

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

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