Learning through relationships: How leadership and learning drive Circular Innovations

Abstract

It is still unclear how organizations can learn to create innovative solutions for the circular economy. This paper examines how leader-employee relationships foster circular economy innovation (CEI) using Leader-Member Exchange (LMX) and Double-Loop Learning (DLL). Findings from 24 semi-structured interviews, participant observations, and secondary documents collected from six organizations pursuing circular initiatives show that leader attention, recognition, and support build trust and psychological safety among employees. Such conditions allow employees to reflect critically on assumed routines, test alternative circular practices, and reframe problems, thereby activating DLL. DLL then transforms into CEI outcomes including increased resource efficiency, proactive problem-solving, and novel circular solutions. We present a relational microfoundations model of how LMX channels DLL into tangible circular economy innovations.

Introduction

The traditional 'take-make-dispose' economy has become unsustainable due to global challenges such as climate change, biodiversity loss, and resource depletion (Ellen MacArthur Foundation, 2015; Kirchherr et al., 2017). Many organizations have turned to the circular economy (CE), a regenerative paradigm that strives to maintain materials and resources at their highest value for as long as possible (Stahel, 2016; Geissdoerfer et al., 2017). Transitioning to the CE is not simply a matter of changing technology; leadership and employee engagement are essential drivers of learning and change during this transformation (Ghisellini et al., 2016; Lewandowski, 2016).

Circular economy innovation (CEI) is a vital component of CE transition (Jakobsen et al., 2021; Molden et al., 2025; de Jesus et al., 2018). CEI is now recognized as a major driver of regenerative business models and resource-efficient strategies (Su et al., 2025; Kirchherr et al., 2023). However, a significant dearth of research remains regarding the organizational, social, and human aspects of CEI, particularly those related to learning, collaboration, and the role of daily interactions and leadership behaviors (Dost et al., 2025; Jabbour et al., 2019). As Jabbour et al. (2019) noted, the 'human' and 'soft' side of CE innovation has received limited attention, including the influence of relational dynamics on circular learning.

Leader-Member Exchange (LMX) theory offers a valuable framework for exploring this dynamic. High-quality LMX relationships, characterized by trust, respect, and reciprocity (Graen & Uhl-Bien, 1995), create the psychological safety through which employees can express concerns, propose ideas, and engage in the deeper, reflective learning necessary for circular transformation. This study combines LMX theory with Double-Loop Learning (DLL) (Argyris & Schön, 1978), the process of challenging and revising the underlying assumptions that govern organizational action, to understand how leader-follower relationships facilitate CEI. Single-loop learning

corrects errors within existing frameworks, whereas DLL challenges the frameworks themselves (Argyris, 1991; Fiol & Lyles, 1985). Achieving circular innovation requires precisely this kind of transformative, assumption-challenging learning (Bocken et al., 2016; Lüdeke-Freund et al., 2019).

Despite growing recognition of leadership and learning in CE, LMX and DLL have never been combined to explain the micro-level processes through which leader-follower interactions result in circular innovation. Our primary research question is:

How do leader-follower interactions and the recognition, support, and attention provided by leaders facilitate double-loop learning, resulting in the generation and implementation of circular economy innovations by employees?

To answer this question, we conducted an inductive qualitative study across six organizations using 24 semi-structured interviews, participant observations, and documentary analysis. Our findings contribute a relational-cognitive microfoundational framework that illuminates how LMX channels DLL into tangible CEI outcomes, thereby bridging leadership theory, organizational learning, and CE innovation research.

Literature Review

Circular Economy and the micro-level perspective

The circular economy (CE) presents a framework that departs from the linear 'take-make-dispose' model by promoting strategies such as reuse, repair, remanufacturing, recycling, sharing, and product life extension, to regenerate value while reducing environmental harm (Ellen MacArthur Foundation, 2015; Geissdoerfer et al., 2017). Although structural and technological dimensions of circularity have received considerable research attention, the relational and human factors enabling CE transition remain underexplored (Ghisellini et al., 2016). The global circularity rate remains low (Circularity Gap Report, 2024), reflecting a large-scale implementation gap at the firm and individual levels. Recent research frames CE as both an economic paradigm and an innovation agenda, requiring new materials, technologies, design approaches, and business models (Kirchherr et al., 2023).

Circular Economy Innovation as a micro-level relational phenomenon

CEI builds upon eco-innovation but goes further by changing the logic of value creation for achieving regenerative design by closing resource loops and preventing waste before it occurs (Evertsen et al., 2022; Modic et al., 2021). CEI encompasses a broad spectrum: technological innovation, business model innovation, digital innovation, open innovation, and systemic innovation (Jakobsen et al., 2021; Molden et al., 2025). Despite this richness, existing definitions focus almost exclusively on outputs, for example, what circular innovations are, and largely neglect how they emerge through learning and relationships. This paper conceptualizes CEI as a learning-intensive and relationally-enabled innovation, thereby addressing this under-theorized gap.

LMX and Double-Loop Learning as microfoundations of CEI

LMX theory conceives of leadership as dyadic relationships between a leader and each follower, wherein relationship quality determines attitudinal and behavioral outcomes (Graen & Uhl-Bien, 1995; Dansereau et al., 1975). High-quality LMX relationships engender autonomy,

recognition, and support, all of which contribute to psychological safety (Edmondson, 1999; Carmeli et al., 2010). DLL refers to the process by which individuals and organizations question and revise their governing assumptions rather than merely correcting errors within existing frameworks (Argyris & Schön, 1978). For circular innovation, this means moving beyond optimizing waste management toward rethinking product design, business models, and value creation entirely (Bocken et al., 2016). DLL requires psychological safety, as individuals must feel confident to question accepted organizational logic, admit mistakes, and experiment (Edmondson, 1999; Schein, 1996). We hypothesize that high-quality LMX acts as a catalyst for DLL, thereby transforming leader-follower exchanges into agents of circular innovation. Figure 1 illustrates the proposed intersection of leadership, learning, and CE.

Research Design

An inductive qualitative approach was adopted, using the Gioia methodology (Gioia et al., 2013) to achieve conceptual rigour while preserving the richness of participants' lived experiences. This approach is suitable for examining relatively unknown phenomena involving complex social processes and emergent meanings.

Sample and Research Setting

Six organizations in both the public and private sectors, spanning manufacturing and service industries, were selected through purposeful sampling (Patton, 2015) based on demonstrated circular economy commitments. This diversity enabled examination of how leadership-learning dynamics evolve across different institutional settings. Twenty-four semi-structured interviews were completed: eighteen employees ('members') and six managers or executives ('leaders'). Recruitment occurred through professional networks and snowball sampling, with priority given to depth over breadth.

Data Collection

Semi-structured interviews served as the primary data source, supplemented by sustainability reports, internal memos, organizational press releases, and researchers' field notes, thus totaling approximately 600 pages of transcribed material. The interview guide addressed three areas aligned with theoretical constructs: (1) leadership and relationship dynamics (LMX), e.g., 'How does your leader support or challenge you in pursuing CE initiatives?'; (2) learning and reflection (DLL), e.g., 'Tell me about a time when assumptions or routines were challenged'; and (3) innovation and outcomes (CEI), e.g., 'How did this reflection result in circular economy innovations?' Interviews ranged between 48 and 72 minutes (mean 61 minutes), conducted via MS Teams, Zoom, or in-person from August 2025 to January 2026. Sessions were recorded, transcribed verbatim, and anonymized using unique identifiers (P1-P24).

Data Analysis

Analysis proceeded through three Gioia stages. In the first stage (first-order coding), open coding identified discrete statements referring to leader behaviour, member perception, and learning outcomes, kept close to participant language. In the second stage (second-order theorizing), related first-order codes were grouped into higher-level theoretical themes representing underlying mechanisms. In the third stage (aggregate dimension development),

second-order themes were integrated into three aggregate dimensions: (1) the CEI-conducive Relational Space; (2) the CEI-conducive Cognitive Bridge (DLL); and (3) CEI Outcomes. Iterative team discussion maintained analytical robustness throughout.

Findings

Our analysis reveals a relational-cognitive pathway through which LMX enables CEI. Across 24 interviews and six organisations, a consistent sequence emerged: leaders who invested in genuine relational exchange generated the psychological safety necessary for reflective inquiry; that safety catalyzed DLL in which taken-for-granted assumptions were jointly surfaced and reframed; and those reframing processes ultimately produced CEI outcomes from embedded operational practices to systemic transformations. The Gioia data structure is presented in Table 1.

Table 1: Gioia Data Structure

First-Order Concepts (Informant Language)	Second-Order Themes (Researcher Constructs)	Aggregate Dimensions
FC-1: Leader follow-through converts ideas into viable initiatives	**Leader Attention as Institutional Signal**	**CEI-Conducive Relational Space**
FC-2: Public visibility of CE work creates organizational legitimacy		
FC-3: Reframing imperfect results as learning sustains engagement		
FC-4: Consistent resource delivery builds predictive trust	**Reliable Backing and Delegated Ownership**	
FC-5: Leader protection under uncertainty enables risk-taking		
FC-6: Autonomous ownership shifts identity from executor to partner		
FC-7: Informal curiosity prompts sustain a rhythm of CE reflection	**Dialogic Safety as Relational Practice**	
FC-8: Non-punitive response to failure enables early voice		
FC-9: Early inclusion creates genuine participatory engagement		
FC-10: Collaborative questioning of routines reveals hidden value	**Joint Questioning of Operational Assumptions**	**CEI-Conducive Cognitive Bridge (Double-Loop Learning)**

First-Order Concepts (Informant Language)	Second-Order Themes (Researcher Constructs)	Aggregate Dimensions
FC-11: Waste-as-resource reframing reconstitutes production logic		
FC-12: Compliance-to-prevention shift redefines the learning goal		
FC-13: Failure tolerance converts setbacks into generative learning	**Iterative Experimentation Under Relational Safety**	
FC-14: Bounded pilot logic enables safe assumption-testing		
FC-15: Temporal horizon shift from efficiency to circular resilience		
FC-16: Bidirectional expertise exchange builds cognitive breadth	**Reciprocal Sensemaking and Expertise Exchange**	
FC-17: Collective interrogation of circular adequacy		
FC-18: Relational dialogue converts tacit knowledge into shared meaning		
FC-19: Circular principles embedded in daily operational routines	**Circular Mindset and Embedded Behavioural Change**	**CEI Outcomes**
FC-20: Psychological safety enables proactive voice beyond formal role		
FC-21: Learning-driven process redesign closes circular loops		
FC-22: Cross-boundary partnerships scale circular value creation	**Systemic Circular Innovation and Ecosystem Extension**	
FC-23: Circular criteria institutionalized into operational decisions		
FC-24: Localized experiments evolve into replicable circular systems		

Aggregate Dimension 1: CEI-Conducive Relational Space

The first dimension captures how LMX quality shapes the relational environment from which learning and innovation emerge across three themes.

Theme 1.1: Leader Attention as Institutional Signal

Leaders who followed through on circular ideas transformed one-off conversations into sustained collaborative commitments (FC-1). Public recognition repositioned CE work from organizational margins to its center: P13 noted that when a leader mentioned their CE work in a wider forum, others suddenly took it seriously (FC-2). Framing imperfect results as learning opportunities sustained circular engagement: P14 described how their leader asked to see the learning rather than stopping the work, maintaining engagement even when results were imperfect (FC-3).

Theme 1.2: Reliable Backing and Delegated Ownership

Consistently delivering on commitments established predictive trust: P3 stated that when a leader promises resources and delivers, that reliability builds mutual respect (FC-4). Leader protection under uncertainty redistributed reputational risk from the individual to the dyad: P2 described how a managing director offered backing for an out-of-budget initiative, which made the team confident to experiment (FC-5). Delegation of responsibility enabled employees to transition from executors to co-creators: P15 articulated how being given autonomy with a simple directive to keep the leader posted created conditions for acting as a partner rather than a subordinate (FC-6).

Theme 1.3: Dialogic Safety as Relational Practice

Informal curiosity prompts created a continuous shared cognitive space about circularity beyond formal meetings. For example, P1 and P6 both described receiving late-night messages asking whether a circular practice observed elsewhere could apply to their context, keeping learning alive (FC-7). Non-punitive responses to failure allowed early problem surfacing: P17 noted that when a leader listens first before responding to problems, it becomes safe to report issues early (FC-8). Early inclusion in decision-making transformed supervision into collaborative inquiry: P22 described how being invited to contribute early rather than at the end created a sense of real participation (FC-9).

Aggregate Dimension 2: CEI-Conducive Cognitive Bridge (Double-Loop Learning)

DLL in our data was not an isolated cognitive exercise but a relational, dialogical, and iterative process occurring through sustained leader-member interaction.

Theme 2.1: Joint Questioning of Operational Assumptions

Jointly naming assumptions made the invisible visible, that was the prerequisite for subsequent innovation. 'We always assumed that milk tank cleaning had to be done at fixed intervals. We questioned that together and tested sensor-based cleaning instead' (P2; FC-10). Waste-as-resource reframing reconstituted the governing logic of production: 'Whey water disposal was simply discarded before. By questioning that routine, we developed a method to convert it to cattle feed' (P1; FC-11). A compliance-to-prevention paradigm shift redefined the governing variable from meeting regulatory requirements to creating systemic renewal: 'We previously treated compliance as the objective; then we questioned why we were not preventing the problem upstream' (P14; FC-12).

Theme 2.2: Iterative Experimentation Under Relational Safety

Leaders who responded to setbacks with curiosity rather than criticism transformed failure into generative learning: 'Each pilot teaches us something, even when they fail. Without learning, circular economy is merely a slogan' (P1; FC-13). Bounded pilots allowed safe assumption-testing: 'We challenged our default mindset that single-use was safer and conducted a small-scale trial to demonstrate otherwise' (P13; FC-14). Continuous experimentation shifted the temporal frame from short-term efficiency to long-term circular resilience: 'We realized we were optimizing the wrong item that is efficiency for today versus circular resiliency for tomorrow' (P16; FC-15).

Theme 2.3: Reciprocal Sensemaking and Expertise Exchange

The learning within leader-member dyads was highly mutualistic. Rather than unidirectional information transfer, both parties exchanged complementary expertise: 'I've educated him on life-cycle analysis; he has educated me on cooperative decision-making' (P1; FC-16). Joint interrogation of circular adequacy, that is questioning whether methods were truly circular or linear in disguise constituted the most advanced DLL form observed (FC-17). Sustained relational dialogue converted tacit knowledge into collective understanding accessible for collaborative action: 'He learns the technical aspects from me, and I learn the strategic aspects from him' (P20; FC-18).

Aggregate Dimension 3: CEI Outcomes

CEI outcomes varied in scale: from incorporating circular principles into daily routines, through learning-driven process redesigns, to constructing inter-organizational circular partnerships and institutionalizing circular criteria.

Theme 3.1: Embedded Behavioural Change and Circular Mindset

Circular principles became embedded in day-to-day operational routines, marking the moment when changed thought patterns became habitual: P13 described embedding reuse checkpoints into routine so that circularity is no longer an additional task (FC-19). Psychological safety enabled proactive voice beyond formal job responsibilities: P3 noted feeling confident enough to suggest efficiency improvements because the relational environment is non-punitive (FC-20). Process redesigns institutionalized circular principles through cumulative individual and dyadic learning: P14 described moving from end-of-pipe recycling to upstream flow design minimizing waste at origin (FC-21).

Theme 3.2: Systemic Circular Innovation and Ecosystem Expansion

Relational learning practices generated inter-organizational trust essential for circular ecosystems: 'We developed long-term relationships with recyclers who extract rare earth metals from e-waste' (P7; FC-22). Circular criteria became institutionalized into formal operational decisions, that is the organizational manifestation of dyadic learning: 'Now circular criteria appear in procurement and design evaluations, not merely in sustainability reports' (P3; FC-23). Localized experiments evolved into replicable systems involving organizational capabilities rather than singular efforts: 'Those experiments became a scalable solution that is currently part of how we operate' (P19; FC-24).

Discussion

Our findings establish that high-quality LMX serves as the relational infrastructure through which employees develop the cognitive openness, mutual trust, and psychological safety to engage

in DLL, and that DLL is the cognitive bridge facilitating CEI across individual, dyadic, and system levels. Three theoretical propositions emerge from this relational-cognitive pathway.

Proposition 1: LMX as Cognitive-Relational Architecture for Circular Learning

Prior LMX research has largely conceptualized relationship quality as a predictor of task performance, affective commitment, and citizenship behaviors (Graen & Uhl-Bien, 1995; Gerstner & Day, 1997). Our findings reveal a deeper cognitive role: high-quality LMX serves as an attentional architecture directing employees' learning energy toward circularity. Leaders' repeated dyadic behaviors such as sharing articles, providing cover under budget uncertainty, and involving employees in problem-framing, functioned as micro-level attentional cues that cumulatively redirected cognitive energy toward circular possibilities (Ocasio, 1997, 2011). Crucially, leaders who reliably fulfilled commitments produced predictive trust, distinct from affective trust: employees who trusted that institutional support would materialize were more inclined to question assumptions and pursue circular experimentation, as the relational space dispersed risk across the dyad rather than concentrating it on the individual. Thus, based on this we propose,

Proposition 1: *High-quality LMX, defined by leader follow-through, reliable resource commitments, and psychologically safe dialogue, creates a relational space conducive to CEI that functions as both an attentional and cognitive architecture, directing employees' learning energy toward circular economy challenges and lowering the perceived costs of assumption-challenging and experimentation.*

Proposition 2: DLL as Relational Achievement - From Collective Sensemaking to Circular Reframing

Argyris and Schön (1978) originally conceived DLL as occurring mainly within individual cognition. Our findings fundamentally recontextualize this: DLL in circular transformation is not merely an individual cognitive activity but a relational and dialogical achievement occurring through prolonged reciprocal leader-member interaction, with the psychological safety generated by high-quality LMX as an essential precondition. Three DLL mechanisms were identified: (1) collaborative questioning of assumptions, in which leaders and employees jointly identify and test long-standing operating assumptions rendered invisible through routine repetition; (2) iterative experimentation under relational safety, in which bounded pilots translate abstract reframings into empirical learning; and (3) reciprocal sensemaking, in which leaders and employees exchange complementary technical and strategic expertise, producing cognitive complementarity beyond what either could construct alone. The compliance-to-prevention paradigm shift involved questioning why problems are generated rather than how to manage their consequences, and it represents a distinctly circular form of second-order reorientation, consistent with Argyris's (1991) model of overcoming defensive routine. Thus we propose,

Proposition 2: *Within the CEI-conducive relational space, DLL emerges as a relational process of collaborative assumption-questioning, iterative experimentation under protection, and reciprocal sensemaking, thus serving as the cognitive bridge through which governing logics of production, waste, and value are reframed toward circular regeneration.*

Proposition 3: From Cognitive Bridge to multi-Level CEI Outcomes

The data indicate a multi-level CEI architecture progressing from individual embedded practices (daily resource efficiencies), through dyadic process redesigns (loop closure, prevention

at source), to system-wide circular innovations (inter-organizational partnerships, institutionalized circular criteria, and scalable closed-loop systems). This architecture reflects the progressively institutionalized learning process described by Crossan et al. (1999) in their 4I framework, beginning from individual intuition, through dyadic interpretation and integration, to organizational institutionalization. Crucially, these structural outcomes are downstream of relational-cognitive processes: inter-organizational partnerships and scalable systems originated in dyadic conversations in which assumptions were named and transformed. Thus based on this we propose,

Proposition 3: *The CEI-conducive cognitive bridge translates circular reframing into multi-level CEI outcomes, from embedded individual practices, through learning-driven process redesigns, to system-wide circular innovations, with the scalability of those outcomes determined by the extent to which learning is institutionalized into operational processes, cross-boundary partnerships, and organizational decision-making criteria.*

Theoretical Contributions

This study makes three interconnected contributions advancing scholarship across leadership, learning, and CE innovation, each of the domains that have developed largely independently but whose integration is both analytically necessary and theoretically productive.

Contribution 1: Extending LMX Theory - from Socio-Emotional Exchange to Cognitive-Relational Foundations

The dominant theoretical premise of LMX remains largely socio-emotional: high-quality exchange motivates employees through recognition, belonging, and security. This study advances LMX theory by identifying a cognitive function neglected by this framing: the capacity of high-quality LMX to establish what we term a CEI-conducive relational space, an interpersonal architecture shaping not only how employees feel, but what they notice, question, and choose to experiment with. This connects LMX to the microfoundations movement in strategy and organization (Barney & Felin, 2013; Felin & Foss, 2005), which holds that macro-level outcomes including circular transformation are generated through micro-level relational mechanisms. Our three-concept model involving leader attention as institutional signal, reliable backing under delegated ownership, and dialogic safety, specifies these mechanisms with a level of contextual detail LMX research has not previously achieved in sustainability contexts.

Contribution 2: Recontextualizing DLL as a Socially Enacted, Circularity-Specific Learning Process

DLL has been criticized for its individualistic assumptions and for providing little guidance about the relational conditions under which assumption-challenging becomes possible (Maitlis & Christianson, 2014; Weick, 1995; Newman et al., 2017). Our study addresses both critiques simultaneously: DLL in circular transformation is fundamentally relational before it is cognitive because psychological safety must be created through the dyadic relationship before cognitive work can begin. The concept of bidirectional cognitive complementarity, involving leaders and employees exchanging technical and strategic expertise to produce shared understanding beyond what either could construct alone, advances Crossan et al.'s (1999) 4I framework and Vera and Crossan's (2004) concept of strategic leadership and learning by grounding mutual learning in the specific dynamics of the leader-member relationship.

Contribution 3: Developing a Relational-Cognitive Microfoundational Framework for CE Innovations

The third contribution is the relational-cognitive framework for CE innovations itself. The field of CE innovation has made progress in describing what circular innovations look like and in which systems they exist (Jakobsen et al., 2021; Molden et al., 2025), but has lacked a theorized account of the human and relational processes generating those innovations. Our framework, grounded in 24 first-order concepts, nine second-order themes, and three aggregate dimensions, traces CEI from its relational antecedents (LMX quality) through its cognitive mechanisms (DLL processes) to its multi-level outcomes. It establishes that CE innovation is not primarily a downstream outcome of technology, regulation, or strategy, but is upstream generated through relational learning. It also demonstrates that localized experimentation can evolve into reproducible circular systems through institutionalization of learning, thus linking CEI research to dynamic capabilities (Teece et al., 1997) and learning organization frameworks (Senge, 1990).

Managerial Implications

Our results demonstrate that circular innovation cannot be achieved solely through top-down directives or technological solutions, but requires trust-based, learning-oriented relationships. Leaders can promote CEI by: (i) consistently signaling priority for CE through attention and recognition of circular work; (ii) providing stable support and delegated autonomy, ensuring access to necessary resources and permission to experiment; (iii) maintaining open dialogic communication with curiosity-driven questions about circularity; and (iv) normalizing learning from failure. Organizations should develop structured reflection routines such as learning reviews and cross-functional debriefs, and extend the same relational learning rationale to partnerships with suppliers, recyclers, and regulators to scale circularity across ecosystems.

Conclusion

This study demonstrates that leader-member exchange (LMX) acts as the relational base that facilitates double-loop learning (DLL) and the emergence of circular economy innovation (CEI). Leaders who provide attention, recognition, and support establish conditions of psychological safety and trust, encouraging employees to reflect upon and experiment with existing routines without fear of censure. The reflective and dialogical interactions occurring between leaders and members constitute the social fabric of DLL, thus facilitating individual and collective reframing of problems and generating innovations directed at circularity. This study frames leadership as 'leading the loop': directing circular transformation through curiosity, empathy, and reflection rather than control or command, and demonstrating that circular innovation is fundamentally a human process of shared understanding.

Limitations and Future Research

Whilst insights are drawn from 24 interviews across six organizations, the scope remains limited. Future research should broaden organizational and geographic scope to test transferability, and use configurational approaches (e.g., fsQCA) to identify boundary conditions. Data relied heavily on member perceptions; future research should include longitudinal and multi-source designs such as shadowing, and process-tracing to capture behavioural enactment over time. All participating organizations were already engaged in CE initiatives; future studies should examine

organizations at earlier CE stages or with more linear business models. Finally, future research should investigate how trust, reciprocity, and shared reflection function at team and inter-organizational ecosystem levels to facilitate systemic circular innovation.

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