Information Management and Business Review (ISSN 2220-3796)
Vol. 17, No. 3(S), pp. 86-101, 2025

Unpacking the Drivers and Outcomes of Management Innovation Using System Dynamics: A Conceptual Approach

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Abstract: This study aims to investigate the dynamic mechanisms underlying management innovation by addressing the limitations of static models that overlook feedback loops and time delays. It aims to identify the key internal and external drivers that influence management innovation within organizations. Drawing on system dynamics principles, this study develops a causal loop diagram as a conceptual framework to explore the interrelationships among factors affecting management innovation. The approach highlights the reinforcing and balancing feedback loops, incorporating the effect of time delays between implementation and outcomes. The study reveals that management innovation operates through multiple reinforcing and balancing loops, driven by internal and external factors. It highlights how feedback mechanisms, resource constraints, and time delays shape the dynamic evolution of management innovation processes and organizational adaptability. The study provides theoretical and practical insights but is conceptual in nature; future empirical research across different industries is needed to validate and generalize the proposed framework. By applying a system dynamics lens, this study advances the theoretical understanding of management innovation processes and offers actionable guidance for managers and policymakers to foster sustainable management innovation.

Keywords: *Management innovation, system dynamics, causal loop diagram.*

1. Introduction

Management innovation involves developing and implementing new management practices, processes, and structures to enhance organizational adaptability and performance (Birkinshaw & Mol, 2006). Unlike product or technological innovation, it focuses on managing personnel, resources, and operations to improve efficiency and competitiveness (Birkinshaw et al., 2008). Birkinshaw et al. (2005) highlighted its role in leadership, decision-making, organizational culture, and strategy. In today's dynamic business environment, global competition, technological advancements, and shifting customer expectations make management innovation essential for maintaining competitiveness (Damanpour & Aravind, 2012). Hamel (2006) emphasized that organizations embracing it adapt more effectively to external pressures and seize new opportunities, fostering agility, resilience, and long-term success.

Despite its significance, research often relies on static models that overlook complex interdependencies, feedback loops, and time delays in the innovation process (Swan et al., 2014; Kline & Rosenberg, 2009). This oversimplification creates a theoretical gap, ignoring key drivers like organizational culture, knowledge management, technological transformation, and consulting expertise (Razali et al., 2024; Lam et al., 2021; Khosravi et al., 2019). In addition, traditional models fail to explain key feedback loops—reinforcing (accelerating innovation) and balancing (introducing resistance or constraints)—which are crucial to the innovation process (Otto, 2008). As a result, managers struggle to identify innovation levers and mitigate challenges such as resource constraints and resistance to change (Morente et al., 2017; Dershin, 2010). Innovation processes are nonlinear, with outcomes often taking time to emerge (Mokiy & Gureev, 2020). This temporal complexity can lead to short-term decisions that undermine strategic goals (Moellers et al., 2019; Größler et al., 2008).

To bridge these gaps, this study proposes a system dynamics-based conceptual framework using a causal loop diagram (CLD) to analyze causal relationships, feedback mechanisms, and emergent behaviors in management innovation. System dynamics provides a comprehensive modeling approach to explain these mechanisms (David & Téllez, 2024; Linnéusson et al., 2022; Größler et al., 2008). Over time, it helps organizations predict outcomes, identify key leverage points, and optimize innovation strategies (Naugle et al., 2023). By modeling the interactions between innovation drivers and outcomes, system dynamics enhances theoretical

understanding and practical application, bridging the gap between research and real-world management innovation.

2. Literature Review

Dynamic Capability Theory

The dynamic capability theory emphasizes the ability of enterprises to adapt, integrate, and reconfigure internal and external capabilities to cope with rapidly changing environments. Since the 1990s, as organizations seek sustainable competitive advantages in volatile markets, it has become increasingly prominent in strategic management (Fernandez et al., 2023; Evayani et al., 2022). This theory includes three main methods: innovation, emergency response, and capacity building, emphasizing continuous adaptation and knowledge exploration (Fernandez et al., 2023). In addition to strategic management, dynamic capabilities also affect marketing, production, and accounting, demonstrating their broad applicability (Evayani et al., 2022; Nooteboom, 2022). This theory focuses on integrating, establishing, and reconfiguring the ability to respond to change (Cai, 2022; Liu, 2022; Kapoor & Agarwal, 2020). Cai (2022) emphasized the role of resource-based and organizational learning in shaping dynamic capabilities, while Liu (2022) highlighted the views of senior managers on enhancing dynamic capabilities and improving performance. Kapoor and Aggarwal (2020) incorporated absorption, innovation, and adoption capabilities into it, refining economic theory. Overall, the theory of dynamic capabilities is a well-developed interdisciplinary framework that centres around knowledge and addresses issues of diversity, development, and uncertainty (Gonzalez-Samaniego et al., 2023).

Management Innovation

Management innovation introduces new practices, methods, and processes in management systems, structures, and culture to enhance efficiency, optimize resources, and improve adaptability (Anyigba & Addo, 2023). It involves updating management concepts, decision-making, organizational structures, and talent management (Dubey & Yadav, 2021). Beyond improving operations, management innovation fosters sustainable development through approaches like lean management, agile structures, and digital tools, boosting responsiveness, employee creativity, and competitiveness (Ozen & Ozturk-Kose, 2023; Hamel, 2006). Unlike technological or product innovation, which focuses on new technologies and product enhancements, management innovation improves internal processes and models (West et al., 2022; Volberda et al., 2013; Damanpour & Aravind, 2012). While technological innovation advances products or services (Quispe et al., 2024) and product innovation meets changing consumer needs (Rainey, 2005), management innovation enhances efficiency, reduces costs, and strengthens competitiveness (Roy et al., 2018). It helps organizations adapt to environmental shifts through flexible management (Damanpour & Aravind, 2012; Birkinshaw et al., 2005) and facilitates the integration of new technologies into successful product innovation (Heij et al., 2019).

Management innovation has unique characteristics. Firstly, it is often intangible and lacks direct tangible results such as technology or products (Birkinshaw et al., 2005). Its impact is profound, shaping organizational culture, strategic direction, and employee work methods (Khosravi et al., 2019). Secondly, management innovation is a continuous and comprehensive change within an organization that requires collaboration at all levels (Damanpour & Aravind, 2012). Finally, management innovation requires a strong strategic vision and systematic thinking to solve current problems and ensure long-term development (Khosravi et al., 2019; Birkinshaw et al., 2008). Therefore, management innovation provides a lasting competitive advantage, helping businesses cope with dynamic environments and achieve long-term success, but its other innovations are more complex (Khosravi et al., 2019; Hamel, 2006).

The Internal Drivers of Management Innovation

Organizational culture: Organizational culture reflects historical traditions and is a core part of organizational identity, shaped by accumulated successes (Tohidi & Jabbari, 2012). Once established, it becomes deeply ingrained and influences managerial and employee behavior (Linn, 2008). Research explores its impact on management innovation processes (Linnéusson et al., 2022; Alofan et al., 2020) and decisions (Smith et al., 2008; Hamel, 2006). A positive culture fosters open communication, trust, and learning, enhancing innovation (Nguyen & Hoang, 2021). It encourages collaboration, shaping employee behavior and enabling management innovation (Krishna et al., 2024). Supporting creativity and learning, it strengthens adaptability and long-term growth (Lam et al., 2021).

Knowledge management: Knowledge management involves acquiring, creating, sharing, and applying knowledge to enhance decision-making and efficiency (AlMulhim, 2023; Chauhan & Kalkis, 2023). Effective knowledge management fosters continuous improvement (Razzaque et al., 2022), supporting innovation by enabling new processes and technologies (Fan & Shum, 2023; Anyigba & Addo, 2023). Organizations establish knowledge management through strategic acquisition and formal dissemination (Castillo et al., 2024). It facilitates knowledge-sharing platforms, strengthening innovation and learning (Khosravi et al., 2019). A well-structured system integrates resources, transforming knowledge into management innovation (Imran et al., 2021). The process of knowledge sharing includes perception, acquisition, transformation, and application (Fierro & Benalil, 2024; Imran et al., 2021), requires a powerful organizational system composed of specific management and production factors, as well as social networks (Castillo et al., 2024). Successful knowledge management depends on an organization's ability to effectively integrate and transform resources (Imran et al., 2021). Perception identifies external changes, acquisition absorbs and optimizes knowledge, transformation enables sharing, and application enhances strategies, driving continuous learning and innovation.

The External Drivers of Management Innovation

Technological transformation: Technological transformation has fundamentally reshaped organizational operations and management through the rapid development of artificial intelligence (AI), cloud computing, big data, and the Internet of Things (IoT) (Idrisov & Shinkevich, 2024; Ononiwu et al., 2024). Enterprises must adopt innovative management practices to stay competitive in a fast-changing market (Ononiwu et al., 2024). These technologies drive automation, enhance efficiency, and provide data-driven insights for optimizing decisions and strategies (Idrisov & Shinkevich, 2024). This transformation also requires cultural adaptation, continuous learning, and digital thinking (Priyatna, 2024; Ononiwu et al., 2024). Companies that fail to adapt risk elimination, while those leveraging technology can become industry leaders (Idrisov & Shinkevich, 2024). Technological transformation significantly impacts management innovation by driving continuous optimization of management models (Priyatna, 2024). Data-driven decision-making enables real-time access to operations, market dynamics, and customer needs, enhancing strategic planning accuracy (Idrisov & Shinkevich, 2024). AI and machine learning automate tasks, allowing managers to focus on innovation and long-term strategy (Ononiwu et al., 2024). Technology also enhances team collaboration through cloud-based tools and improves productivity via IoT-enabled predictive maintenance (Lu, 2024). Ultimately, enterprises embracing technological change gain competitive advantages and industry leadership (Idrisov & Shinkevich, 2024; Ononiwu et al., 2024).

Competition transformation: Competitive transformation, marked by rapid shifts in market dynamics, is a major driver of management innovation. Intense competition forces organizations to adopt innovative strategies to maintain an edge (Nemashkalo et al., 2024). Enterprises enhance competitiveness by reducing costs, improving quality, and increasing customer value (Zhang et al., 2019). This transformation stimulates operational efficiency and management improvements (Nemashkalo et al., 2024), with business model innovation playing a key role (Łęgowik-Świącik, 2023; Zhang et al., 2019). However, competition-driven innovation entails uncertainty and risks, as shifting customer demands and market fluctuations can disrupt management practices (Nemashkalo et al., 2024). Organizations undergoing major change face higher risks in experimentation and implementation (Mazzarol & Reboud, 2019). To navigate these challenges, companies must foster resilience and agility, encouraging teams to embrace change despite setbacks (Priyatna, 2024). Although competition forces businesses to manage risks, it also stimulates creativity and management improvement. Enterprises that actively innovate to cope with competition are more capable of achieving success in dynamic markets.

Outcomes of management innovation

Management innovation brings both advantages and challenges, such as resistance to change. Employees and managers who are accustomed to traditional methods may find it difficult to accept new methods, leading to reluctance or opposition (Rehman et al., 2021). This resistance can manifest as passive disengagement or open conflict, hindering implementation (Kiryakov & Shiyapov, 2024; Martínez et al., 2020). Additionally, introducing new management practices often causes short-term disruptions, resulting in inefficiencies, confusion, or performance declines, particularly when implementation lacks proper support (Sutcliffe, 2021; Reeves & Whitaker, 2022). While management innovation enhances efficiency, adaptability, and

competitiveness, organizations must carefully manage the process to minimize negative impacts and ensure long-term success (Alofan et al., 2020).

Positive outcomes: One of the most significant benefits of management innovation is its ability to improve organizational efficiency. By introducing new management practices, technologies, and structures, organizations can simplify operations, reduce costs, and improve productivity (Walker et al., 2010). Innovations such as digital management, agile management techniques, and lean processes enable companies to respond faster to market changes and optimize resource utilization (Dahmer, 2024). In addition, management innovation promotes adaptability, enabling organizations to better respond to constantly changing customer demands, competitive pressures, and technological advancements (Priyatna, 2024). This adaptability often brings competitive advantages, as companies are better equipped to navigate complex and dynamic markets (Mol & Birkinshaw, 2014). In the long run, these positive outcomes can improve the organization's market positioning and contribute to its sustained success (Yang, 2024).

Negative outcomes: Management innovation also brings negative impacts. One of the most common challenges is resisting change. Employees and managers who are accustomed to traditional work methods may find it difficult to accept new approaches, leading to reluctance or even active opposition (Rehman et al., 2021). Resistance may manifest in various forms, ranging from passive detachment to open conflict, which may hinder the successful implementation of innovative management practices (Kiryakov & Shiyapov, 2024; Martínez et al., 2020). In addition, as organizations adapt, introducing new management practices often leads to short-term interruptions (Sutcliffe, 2021). These interruptions may result in temporary inefficiencies, confusion, or performance degradation, especially in cases of inadequate innovation implementation or insufficient transitional support (Reeves & Whitaker, 2022; Hamel, 2006).

Overall, although management innovation can provide substantial benefits in terms of efficiency, adaptability, and competitiveness, its results are not without challenges (Alofan et al., 2020). Understanding these results is crucial for organizations seeking to effectively implement management innovation. Organizations must recognize the potential benefits and drawbacks of managing innovation, carefully manage this process to minimize negative outcomes, and ensure long-term success.

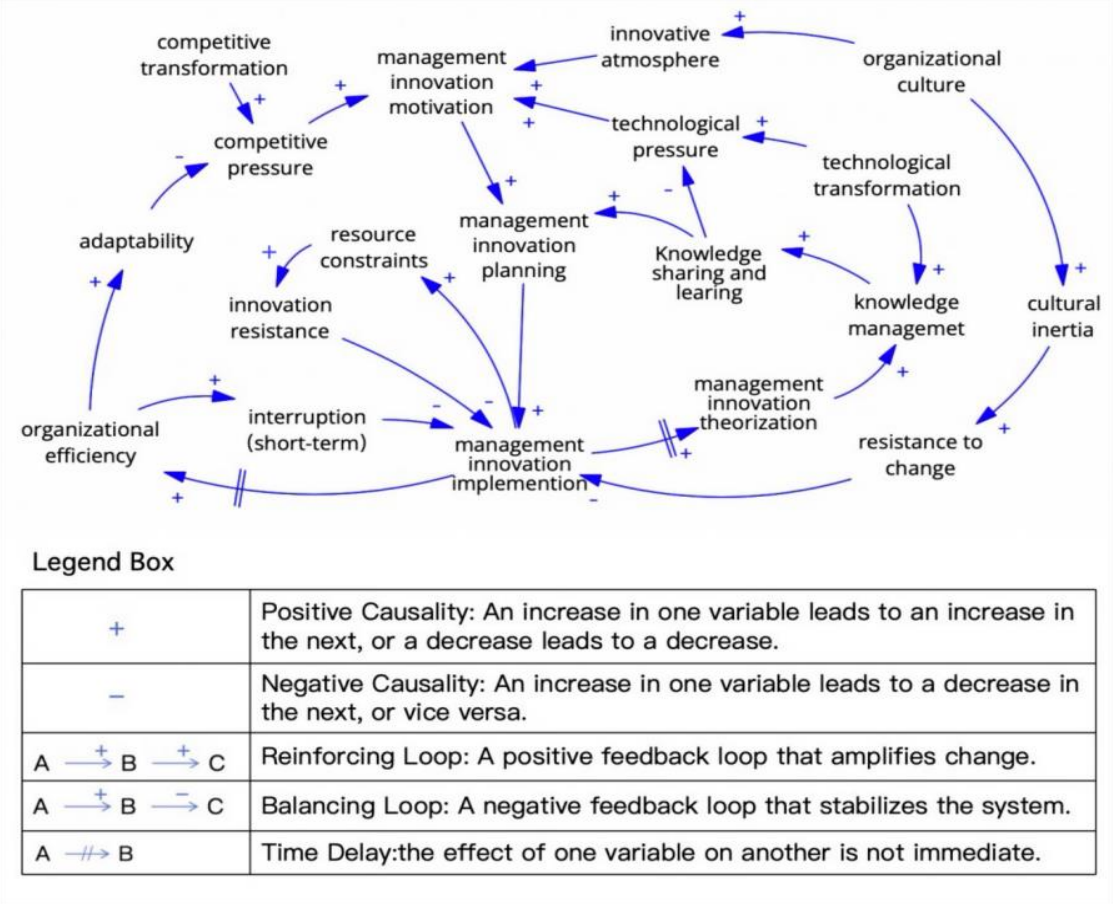
Systems Dynamics

Proposed by Forrester in the 1950s, system dynamics studies feedback mechanisms and dynamic behavior in complex systems through mathematical modeling and variable interaction analysis (Forrester, 2012). Initially applied to industrial management, it has expanded to economics, environment, public policy, and social research, fostering systems thinking (Naugle et al., 2023; Moellers et al., 2019; Größler et al., 2008). It utilizes feedback loops, causal relationships, time delays, and emergent behavior to analyze system dynamics (Naugle et al., 2023). Feedback loops influence system stability or change, causal relationships define factor interactions, time delays highlight lag effects in decision-making, and emergent behavior reveals unexpected patterns at the global level (Forrester, 2012). By analyzing these elements, system dynamics helps managers optimize decisions and address market uncertainties (Moellers et al., 2019). It has been widely applied in business to model systemic interactions, forecast outcomes, and design strategies (Moellers et al., 2019). Forrester (2012) introduced dynamic models like the "production-wholesale system" and "user-producer-employment system" to optimize operations, while later scholars expanded applications to learning organizations, supply chains, and policy analysis (Sterman, 2000; Senge, 1991). System dynamics enhances management innovation by using tools like causal loop diagrams to visualize business complexities, aiding knowledge management and strategic decision-making (Moellers et al., 2019). It applies to corporate strategy, logistics, and marketing, offering insights into system dynamics and supporting business growth and innovation (Naugle et al., 2023).

3. Conceptual Framework for Management Innovation Using System Dynamics

This study establishes a system dynamics conceptual framework for management innovation to illustrate the causal cycle between driving factors, processes, and outcomes. It emphasizes the positive reinforcement and negative regulatory cycle.

Figure 1: Conceptual Framework for Management Innovation (a Causal Loop Diagram Using System Dynamics)



Concept Definitions in Causal Loop Diagrams (OLD)

Table 1: Concept Definitions in Causal Loop Diagrams (OLD)

Content	Concept Definitions	Sources
Driving Factors	1. Technological transformation: New or improved technologies drive innovation in management, production, and products, accelerating information flow and knowledge updates, increasing technological pressure, and enhancing knowledge management.	Lu (2024); Alomari (2023); Nemashkalo et al. (2024).
	2. Knowledge management: Managing knowledge acquisition, sharing, and application helps break information barriers, promote learning, and enhance innovation	AlMulhim (2023); Castillo et al. (2024)
	3. Organizational culture: Shared values and norms shape an innovation-supportive environment, while cultural inertia may hinder change.	Christou and Piller (2024); Nguyen and Hoang (2021).
MI Process	1. Motivation: External factors (technological and competitive changes) or internal demand drive the initiation of management innovation.	Mol and Birkinshaw (2014); Birkinshaw et al. (2008); Hamel (2006).
	2. Planning: Based on motivation, organizations develop implementation plans and designs.	
	3. Implementation: Innovation is executed through specific actions.	

	4. Theorization: Experience is accumulated and theorized to guide future innovation.	
MI Outcomes	1. Improved organizational efficiency and adaptability: Management innovation enhances internal efficiency, optimizes resource allocation, and strengthens adaptability to external changes.	Roy et al. (2018); Hamel (2006).
	2. Temporary disruption due to limited resources: Innovation implementation may face temporary disruptions from uneven or tight resource allocation, affecting progress.	Levitin et al. (2023).
	3. Theoretical progress enhancing knowledge Management: The theorization of management innovation summarizes experience and offers new insights, advancing knowledge management.	Birkinshaw et al. (2005)
Time Delay	In causal loop diagrams, a double-line arrow represents time delay, indicating that one variable's impact on another is not immediate. This highlights the lag effect in causal relationships, clarifying that complex system responses take time to manifest. Such representation aids in analyzing long-term accumulation and feedback loops.	Qiao et al. (2024); Avila-Palencia (2023).

Causal Loop Diagrams of Management Innovation and Its Drivers

In Causal Loop Diagrams (CLD), arrows indicate causal relationships, while circular arrows represent feedback mechanisms. CLDs illustrate management innovation as a dynamic process influenced by internal and external factors. Reinforcing loops (R) show how successful innovation drives further improvements, while balancing loops (B) highlight resource constraints and resistance that may hinder progress.

a) Reinforcing Loops

R1: *Technological transformation → Rising technological pressure (+) → Stimulating management innovation motivation (+) → Promoting management innovation planning (+) → Triggering management innovation implementation (+)*

Technological transformation in the external environment creates pressure on organizations to adapt and adopt new technologies for competitiveness (Alomari, 2023). This pressure drives management innovation by optimizing processes and changing management models, stimulating innovation motivation among managers and employees (Tarasov, 2024; Vittorio et al., 2024). Enterprises then invest resources in designing new management methods, processes, or structures (Birkinshaw & Mol, 2006) and implement these innovations to address technological challenges (Yusupova et al., 2024).

R2: *Technological transformation → Improving knowledge management level (+) → Promoting knowledge sharing and learning (+) → Improving management innovation planning (+) → Enhancing the effect of management innovation implementation (+)*

Technological transformation improves knowledge management, as new technologies generate new knowledge that enterprises must effectively utilize (Razzaque et al., 2022). This drives investments in knowledge bases and employee training (Tokal, 2022), enhancing information flow, knowledge sharing, and learning (Odhiambo, 2024). These improvements foster innovation by deepening management innovation planning (Wielgórka, 2023; Mol & Birkinshaw, 2014) and enhancing implementation effectiveness through accumulated knowledge and experience (Wielgórka, 2023; Anyigba & Addo, 2023).

R3: *Competitive transformation → Competitive pressure (+) → Stimulating management innovation motivation (+) → Promoting management innovation design (+) → Triggering management innovation implementation (+)*

Intensified market competition and competitor innovation drive companies to reassess management models and seek new solutions (Chen et al., 2024). Competitive pressure compels proactive measures, with

management innovation being a key response (Hamel, 2006). This pressure stimulates innovation motivation, leading to design and implementation (Ozen & Ozturk-Kose, 2023). Managers and employees, driven by competition, push for change (Birkinshaw & Mol, 2006), prompting enterprises to develop new management models or processes to strengthen competitiveness (Walker et al., 2010). Implementing management innovation enhances efficiency, reduces costs, and improves market responsiveness (Volberda et al., 2013).

R4: *Organizational culture → Shaping innovative atmosphere (+)→Stimulating management innovation motivation (+)→Promoting management innovation planning (+)→Triggering management innovation implementation (+)*

Organizational culture plays a crucial role in driving management innovation (Alsaqqa, 2024). Cultural values, trust, and innovation tendencies influence employee behavior and innovation activities (Ansori et al., 2024). A supportive culture fosters continuous innovation through positive feedback, encouraging management and employees to engage in innovation design and implementation (Alsaqqa, 2024). Emphasizing communication, collaboration, and experimentation stimulates motivation for management innovation (Nguyen & Hoang, 2021). With an innovative atmosphere, enterprises can effectively implement new management designs and address challenges (Ozen & Ozturk-Kose, 2023; Lam et al., 2021), ultimately improving management models and operational efficiency (Birkinshaw et al., 2008).

R5: *Management Innovation Implementation → Accumulation of Management Innovation Theorization (+) → Improvement of Knowledge Management Level (+)*

The implementation of management innovation fosters theoretical accumulation, providing new frameworks and experiences while transforming work methods and processes (Grynova et al., 2024). It helps refine experiences into a theoretical system, forming the foundation for future innovations (Birkinshaw et al., 2008). As theory accumulates, enterprises can better manage and apply knowledge, translating new theories into practical operations (Zhang, 2022), thereby enhancing knowledge management and creating a continuous cycle of improvement.

Realistic cases can provide imaginative space for these reinforcing loops. For example, General Electric established GE Digital under the promotion of the "Industrial Internet" strategy and launched the Predix platform to improve data collection and analysis capabilities (Chandratreya, 2024). The management pressure brought about by technological upgrades has driven innovation in data-driven management processes (R1), while also improving knowledge management and cross-departmental learning (R2). Another well-known enterprise, Siemens, launched the "top+" plan in the 1990s to address global competition through the redesign of organizational structure and management models, which stimulated management innovation momentum (R3) (Hofer-Alfelis, 2003). The company promoted mechanisms such as community practice (CoP) to promote knowledge sharing and cultural shaping (R4), and transformed successful experiences into knowledge platforms such as ShareNet, continuously improving knowledge management and innovation capabilities (R5) (Coakes et al., 2004).

b) Balancing loops

B1: *Organizational culture → Forming cultural inertia (+) → Triggering resistance to change (+) → Hindering management innovation implementation (-)*

The culture of an organization may form a certain inertia, especially if the culture is too conservative and fixed; employees may hold a resistant attitude towards change (Ashok et al., 2021). Adhering to traditional culture can lead to resistance among organizational members towards change, forming cultural inertia (Nguyen & Hoang, 2021). The resistance to change caused by cultural inertia hinders the implementation of management innovation, and employees are unwilling to accept new management methods or processes (Belak & Ušljebrka, 2017), which directly affects the implementation process of management innovation and reduces its effectiveness.

B2: *Management innovation implementation → Organizational efficiency improvement (+) → Adaptability improvement (+) → Reduction of competitive pressure (-)*

Management innovation enhances organizational efficiency through process optimization and improved decision-making (Anyigba & Addo, 2023; Khosravi et al., 2019). It strengthens resource utilization, execution,

and decision-making capabilities (Roy et al., 2018), increasing adaptability to external changes (Khosravi et al., 2019). Improved adaptability helps organizations effectively respond to competitive challenges and reduce external pressures (Abdellatif et al., 2017).

B3: *Management Innovation Implementation → Causing Resource Shortage (+) → Increasing Innovation Resistance (+) → Hindering Management Innovation Implementation (-)*

Management innovation requires substantial resource investment (funds, personnel, time), potentially causing constraints in other areas (Issa et al., 2023). Resource redistribution may create shortages and tensions, increasing resistance, especially if allocation is perceived as unfair. Scarcity and resistance heighten implementation challenges, leading to delays or incomplete innovation execution.

B4: *Management Innovation Implementation → Organizational Efficiency Improvement (+) → Short-term Interruption (+) → Decreased Progress in Management Innovation Implementation (-)*

Management innovation may cause short-term work interruptions or process confusion (Sutcliffe, 2021). While it enhances efficiency long-term, implementation can temporarily disrupt workflows and daily operations (Reeves & Whitaker, 2022). These short-term disruptions may slow progress and impact overall innovation effectiveness (Levitin et al., 2023).

In a real business environment, Apple Inc. typically experiences issues of cultural inertia (B1) and resource scarcity resistance (B3): research has shown that "cultural inertia significantly inhibits employee innovation behavior" (Neumann et al., 2024), while concentrated resource investment in the early stages of agile reform can easily cause resource constraints on other projects, thereby increasing organizational resistance to change and execution difficulty (Findsrud, 2020). However, by optimizing resource allocation promptly and effectively controlling short-term interruptions (B4), it has significantly improved organizational adaptability and weakened external competitive pressure (B2) after achieving initial results (Ndou et al., 2024).

This framework for management innovation equips managers and policymakers with a systems-based perspective to anticipate barriers, design targeted interventions, and foster sustainable innovation practices. For managers, it highlights the importance of cultivating a supportive organizational culture, implementing robust knowledge management systems, adapting to competitive transformations, and leveraging technological advancements to modernize management practices. For policymakers, it underscores the need to promote knowledge-sharing platforms, drive technological progress, and implement policies that enable organizations to navigate competitive shifts, fostering innovation and resilience across industries. This framework thus provides actionable insights to enhance innovation capacity and strategic adaptability in dynamic environments. In addition, this conceptual framework lays a foundation for future empirical studies and provides a dynamic lens to understand and manage innovation processes effectively in complex organizational systems.

4. Discussion

Management innovation is a nonlinear process driven by interdependent internal and external forces (Yadav & Dubey, 2023). This study conceptualizes management innovation as a dynamic system, capturing its causal complexity, feedback loops, and emergent behaviors often overlooked by static approaches, thereby contributing to theoretical advancement. The causal circuits reveal organizational adaptability and how factors interact under resource constraints. In reinforcing loops of OLD, competitive transformation, technological transformation, knowledge management, and organizational culture do not exert a single linear driving force on management innovation.

The five reinforcing loops (R1-R5) reveal the dynamic evolution path of the management innovation system from five dimensions: resource allocation, knowledge management, external pressure, organizational culture, and theoretical summary.

Firstly, technological change drives enterprises to initiate management innovation processes and demonstrate their dynamic capabilities (Alomari, 2023). However, the effective utilization of this ability highly depends on the internal resource base possessed by the enterprise (Yayha et al., 2024). Organizations need to view

technological transformation as a growth opportunity rather than just a response to challenges (Alomari, 2023), and continuously invest in employee training, technical support, and management design by strengthening innovation motivation and effective execution mechanisms (Yusupova et al., 2024), thus forming a positive cycle between resources capabilities innovation, gradually improving their technological adaptability and strategic flexibility.

At the same time, knowledge management constitutes a key mechanism for promoting the deepening of management innovation. Enterprises can enhance the quality of innovative design and implementation by strengthening knowledge sharing and organizational learning (Georgakellos et al., 2024; Suleman et al., 2023). The continuous accumulation and reuse of knowledge strengthen the evolutionary ability of the innovation system itself (Satar et al., 2024; Zhang, 2022). Organizations should prioritize optimizing knowledge flow mechanisms, strengthening collaboration and the ability to learn new technologies (Felani et al., 2024), to establish endogenous innovation capabilities (Mol & Birkinshaw, 2014), and enhance the responsiveness and effectiveness of management change (Karwowska & Kucharska, 2024; Georgakellos et al., 2024; Birkinshaw & Mol, 2006).

Thirdly, driven by external competitive pressure, enterprises maintain their competitive advantage by dynamically adjusting their management models (Li & Keita, 2021). Every management innovation can not only alleviate current pressure, but also enhance the future resilience and strategic initiative of the enterprise (Giustiziero et al., 2022). Therefore, organizations should not passively wait for external environmental improvements but should actively initiate change, using dynamic capabilities as a pivot to build an adaptable and responsive management system and achieve sustained competitiveness enhancement (Su et al., 2023).

Fourthly, organizational culture, as an important driving force for promoting management innovation, plays an amplifying role in feedback mechanisms. The organizational atmosphere that supports innovation not only enhances employees' ability and willingness to take action (Alofan et al., 2020), but also strengthens cultural identity through successful experiences, forming a culture innovation two-way reinforcement mechanism (Birkinshaw et al., 2008). Enterprises should encourage employees to challenge existing management paradigms, provide them with the freedom to explore new ideas (Alsaqqa, 2024), and organically integrate innovative culture with organizational strategic goals, thereby enhancing innovation success rates and long-term organizational resilience (Nguyen & Hoang, 2021; Tohidi & Jabbari, 2012).

Finally, the theoretical summary and knowledge systematization process not only reflect the phased achievements of management innovation but also provide feedback practice through structured experience (Grynova et al., 2024; Zhang, 2022). The management theories formed by enterprises during the implementation of innovation can serve as part of organizational capabilities to support future innovation activities (Birkinshaw et al., 2008). The integration of theory and practice has promoted the continuous evolution of enterprise innovation capabilities and established a replicable and scalable management framework (Damanpour & Aravind, 2012). This culture of continuous improvement based on theoretical knowledge (Lam et al., 2021) enhances the effectiveness of management methods and ensures that organizations have the drive for sustained innovation in long-term development (Suleman et al., 2023).

Compared to the positive feedback mechanism, the balancing loops (B1-B4) reveal the inherent constraints and practical challenges that organizations may face in implementing management innovation, which may slow down or interrupt the continuous advancement of the innovation system.

Firstly, the B1 loop reflects the issue of inertia in organizational culture. Although a positive culture of innovation can drive management change, deeply ingrained cultural patterns can also become obstacles to resisting change (Belak & Ušljebrka, 2017). Employees' dependence on existing processes and rejection of uncertainty will affect the acceptance and implementation of new management models. Therefore, organizations must gradually transform employee attitudes, promote cultural renewal, dissolve inherent resistance, and create a more supportive cultural environment for innovation through cultural change, incremental innovation strategies, and systematic training (Alofan et al., 2020).

Secondly, the B2 loop emphasizes a sustained perception of external competitive dynamics. Although management innovation can alleviate external pressures to some extent, this relief is often temporary (Chen et al., 2024). If a company misjudges that competition pressure has permanently weakened as a result, it may reduce its emphasis and investment in innovation, leading to lax innovation and ultimately weakening long-term competitiveness (Janjić & Raženović, 2019). Therefore, enterprises should always maintain sensitivity to environmental changes and view management innovation as a continuous strategic task rather than a phased response, to avoid falling into passivity due to complacency.

Furthermore, the B3 and B4 loops jointly reveal the constraint effect of resource allocation, where uneven allocation or temporary scarcity of resources may directly affect the efficiency and effectiveness of project progress (Karwowska & Kucharska, 2024). If a project occupies too many resources, other projects may be forced to postpone or terminate, resulting in resource conflicts and internal games (Levitin et al., 2023; Issa et al., 2023). To achieve this, organizations need to improve resource utilization efficiency and maintain flexible adjustment capabilities through rational allocation and phased implementation strategies, to achieve overall optimization under limited resource conditions (Grynova et al., 2024; Issa et al., 2023).

On the other hand, time delay indicates that time plays a crucial role in the process of management innovation, as it is often a complex and gradual process involving multiple levels and stages of change (Dubey & Yadav, 2021). The implementation of each stage requires time, especially in areas such as personnel training, process adjustments, and technological adaptation (Birkinshaw et al., 2008). Due to the complexity of these changes, the effectiveness of management innovation will not be immediate, but will need to be achieved through the accumulation of time and gradual adjustments (Janjić & Rađenović, 2019). Feedback and adjustment are essential in this process, and companies will continuously optimize innovative solutions to ensure their effectiveness. In the short term, some initial effects may be seen, but long-term strategic goals such as enhancing competitiveness, changing organizational culture, and establishing new management models usually take longer to show results (Damanpour & Aravind, 2012). As time goes on, the profound impact of management innovation gradually accumulates. Managing innovation requires continuous resource investment and may face resource constraints and pressure accumulation (Khosravi et al., 2019; Birkinshaw et al., 2008). It is necessary to address these challenges through time extension to ensure the advancement of innovation.

In summary, these loops reflect the linkage and complexity of the positive feedback mechanism in system dynamics. Only by coordinating these elements can enterprises truly achieve self-strengthening, continuous promotion, and strategic upgrading of management innovation.

5. Conclusion and Recommendations

This study develops a system dynamics framework to examine the driving factors and outcomes of management innovation, offering a comprehensive perspective on its temporal and causal complexity. By introducing a dynamic system thinking approach, it advances the literature with new theoretical insights into how organizational culture, knowledge management, technological transformation, and competitive pressure interact as key drivers. The CLD illustrates how organizations adjust their behavior through different dimensions of management innovation in response to these influences. This framework provides managers with a valuable tool for addressing innovation challenges while paving the way for empirical validation.

Future research should further refine the specific mechanisms of key variables within the causal loop diagram and integrate empirical data to develop a comprehensive quantitative system dynamics model. This model can simulate the dynamic evolution of management innovation across different organizational contexts and scenarios. In particular, sensitivity analysis can be employed to identify the most critical leverage points and feedback loops within the system, thereby assisting managers in designing targeted intervention strategies. Future research can also adopt cross-industry case study methods to compare and analyze the applicability and adjustment needs of system dynamics models in different organizational types, enhancing the universality of the theory and practical guidance value. By combining these in-depth simulations and empirical evidence, we can more comprehensively reveal the dynamic complexity of management innovation and provide more

forward-looking and effective decision support tools for enterprise managers. These approaches establish a strong foundation for advancing management innovation theory and practice.

Declaration of Competing Interest: The authors have no competing interests.

Acknowledgement: Sincere thanks to previous scholars for their research, which laid the theoretical foundation for this study. At the same time, special thanks to Dr. Debbra Toria Nipo and Dr. Ang Hong Loong's careful guidance and valuable suggestions enabled the smooth completion of this study.

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