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Enhancing supplier innovation capabilities through digital technology integration: A relational perspective☆

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ABSTRACT

The integration of digital technologies is reshaping global supply chains, yet how these advancements foster supplier innovation remains underexplored. This study examines how multinational corporations' (MNCs) adoption of digital technologies facilitates supplier innovation capabilities through inter-organisational collaboration. Drawing on the Relational View of Competitive Advantage (RVCA), this research adopts a multiple-case study approach, analysing 12 cases through 41 interviews and archival data. The findings highlight how structured knowledge integration, resource complementarity, and digital adaptability drive innovation, while disparities in knowledge accessibility and power asymmetries hinder equitable outcomes. This study offers key contributions. Theoretically, it introduces a layered framework linking digital integration to supplier innovation, extending the RVCA by uncovering how knowledge transfer, resource complementarity, and adaptability drive innovation. Practically, it provides insights for practitioners to foster inclusive digital ecosystems through equitable knowledge-sharing and adaptable infrastructures.

1. Introduction

The advent of Industry 4.0 has ushered in a transformative era characterised by the integration of advanced digital technologies, including the Internet of Things (IoT), Artificial Intelligence (AI), Big Data Analytics (BDA), and Blockchain (Muhammad et al., 2025; Hoang and Bui, 2023; Nguyen et al., 2021). These technologies have enhanced organisational processes and global supply chain efficiencies, creating new opportunities for collaboration and innovation across networks. Much of the existing research, however, has focused on how multinational corporations (MNCs) adopt these technologies internally to optimise their operations and gain a competitive advantage. Far less attention has been paid to how the digital transformation of MNCs reconfigures their relationships with local suppliers, particularly in developing economies where suppliers often lack the resources and infrastructures to adopt these technologies independently (Jiang et al., 2023; Nguyen et al., 2019). This oversight is significant because the capacity of local suppliers to innovate increasingly depends not only on their own digital readiness but also on how MNCs integrate digital tools into their production and collaboration processes. Suppliers in developing economies face persistent challenges, such as resource constraints, infrastructural gaps, and limited access to knowledge, that hinder their ability to keep pace with digital transformation (Blichfeldt and Faullant, 2021; Farajpour et al., 2022; Muhammad et al., 2025). While MNCs' adoption of digital technologies creates new opportunities for knowledge sharing, interoperability, and joint innovation, the mechanisms through which these opportunities are transmitted to suppliers, and the conditions under which suppliers can benefit from them, remain poorly understood.

This study addresses this gap by examining how the integration of digital technologies by MNCs influences the innovation capabilities of local suppliers in developing economies. By analysing the relational

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dynamics and interaction mechanisms that connect MNC digital adoption to supplier learning, adjustment, and innovation outcomes, the study seeks to extend understanding of digital transformation in supply chains. In doing so, it provides a clearer picture of how digital infrastructures and knowledge systems can foster more inclusive and sustainable innovation ecosystems, while also surfacing the structural barriers, such as power asymmetries and unequal access, that constrain these outcomes. Accordingly, we ask: *How does the integration of digital technologies enhance the production processes of multinational corporations, and in turn, how do these enhanced capabilities influence the innovation capacities of their local suppliers in developing economies?*

This study employs the Relational View of Competitive Advantage (RVCA) (Dyer and Singh, 1998; Dyer et al., 2018) as the theoretical framework to examine the relationships between multinational corporations (MNCs) and their local suppliers in the context of digital technology integration. This theoretical perspective emphasises the value derived from inter-organisational relationships and collaborative resource use, making it particularly suitable for exploring how MNCs and suppliers co-create innovation through shared digital infrastructures and knowledge transfer (Viana and Sousa-Filho, 2017; Wang, 2014). The research adopts a qualitative approach, leveraging a multiple case research design (Yin, 2017) to capture the complexity of digital integration across diverse organisational contexts. The investigation centres on 12 cases, encompassing three MNCs operating in Vietnam and three local suppliers for each MNC. This design enables an in-depth exploration of the mechanisms through which digital technologies influence supplier innovation capabilities. To gather rich and contextualised data, this study employs semi-structured interviews with 41 key informants, including managers and experts directly involved in the operational and strategic aspects of supply chain management. The interviews provide detailed insights into the practices, challenges, and outcomes associated with digital integration, ensuring a comprehensive understanding of the dynamics at play. The main contribution of this study lies in extending the RVCA by showing how digital infrastructures and knowledge systems operate as co-created resources that generate new relational rents and redistribute innovation opportunities within supply chains. Also, by analysing digitally mediated collaboration between MNCs and local suppliers, the study advances theoretical understanding of relational mechanisms in developing-economy contexts. It highlights the dual role of digital technologies in both enabling and constraining innovation.

This manuscript is organised into six key sections to provide a comprehensive exploration of the research topic. Section 2 establishes the theoretical foundation by introducing the Relational View of Competitive Advantage and its relevance to understanding digital integration in supply chains. Section 3 details the qualitative research methodology, including the multiple case study design, sampling strategies, and data collection methods employed to capture nuanced insights from the 12 cases. In Section 4, the empirical findings are presented, highlighting the mechanisms through which digital technologies influence supplier innovation capabilities. Section 5 provides an in-depth discussion of these findings, integrating them with the theoretical framework and developing research propositions that extend the understanding of digital integration in supply chains. Finally, Section 6 synthesises the study's theoretical contributions, outlines practical implications, acknowledges the limitations of the research, and identifies promising directions for future investigation.

2. Literature background

2.1. Digital technologies and production processes in MNCs

The integration of disruptive technologies such as the IoT, AI, blockchain, and BDA has become a transformative force in modern supply chains. These technologies enable unprecedented levels of visibility, coordination, and optimisation, reshaping how organisations operate and interact across global networks (Büyüközkan and Göçer, 2018; Jiang et al., 2023). IoT facilitates real-time data collection and monitoring, enhancing operational efficiency and decision-making processes (Hopkins and Hawking, 2018). Similarly, AI and BDA provide advanced predictive analytics, enabling firms to anticipate market demands, optimise inventory, and reduce inefficiencies (Seyedghorban et al., 2020; Yang et al., 2021). Blockchain technology, with its ability to ensure transparency and security in transactions, has further bolstered trust among supply chain partners (Nguyen et al., 2021; Tanveer et al., 2025). Collectively, these innovations have elevated supply chains beyond their traditional logistical roles to strategic drivers of value creation, aligning with broader goals of agility, sustainability, and customer-centricity.

Despite these advances, the adoption of digital technologies within supply chains remains uneven, particularly in developing economies. Structural barriers, including limited financial resources, inadequate infrastructure, and skill gaps, hinder local suppliers' ability to integrate and effectively leverage these technologies (Kache and Seuring, 2017; Jiang et al., 2023). Many suppliers lack access to the digital infrastructures necessary for real-time data sharing and advanced analytics, creating disparities in their ability to engage with MNCs and global supply chain networks (Nguyen et al., 2019). Additionally, the readiness of local suppliers to adopt such technologies varies significantly, often shaped by institutional factors, market maturity, and the availability of external support (Juo and Wang, 2022; Farajpour et al., 2022). These challenges not only slow the diffusion of digital tools but also exacerbate existing inequities within supply chains, limiting the participation of smaller and resource-constrained suppliers in innovation-driven initiatives.

In this context, MNCs play a pivotal role as facilitators of technology transfer within global supply chain networks (Nguyen et al., 2019; Prashantham and McNaughton, 2006). By introducing advanced systems and fostering collaborative relationships, MNCs can bridge the technological divide, enabling local suppliers to enhance their operational capabilities and innovation potential. Technology transfer initiatives, including training programs, infrastructure investments, and knowledge-sharing mechanisms, create pathways for local suppliers to overcome resource and capability constraints (Seyedghorban et al., 2020; Wang, 2014; Ishaq et al., 2025). However, the effectiveness of such efforts is often contingent on the relational dynamics between MNCs and suppliers, as well as the extent to which MNCs balance their strategic priorities with the developmental needs of their partners (Liu et al., 2023; Lu et al., 2023). This interplay underscores the need for a deeper understanding of how digital technologies influence inter-organisational collaboration and innovation within global supply chains.

2.2. The relational view of competitive advantage (RVCA)

The RVCA emphasises the value derived from inter-organisational relationships, focusing on how firms achieve competitive advantage not only through their internal resources but also by leveraging the complementary capabilities of their partners (Dyer and Singh, 1998; Juo and Wang, 2022). Central to this perspective are collaborative mechanisms, resource pooling, and joint value creation, which are particularly relevant in supply chain contexts where firms are deeply interconnected. In global supply chains, the ability to co-create value depends on mutual knowledge sharing, strategic alignment, and the development of relational-specific assets that enhance the innovation potential of all parties involved (Viana and Sousa-Filho, 2017; Wang, 2014). By foregrounding interdependencies, RVCA provides a robust lens for analysing the dynamics between multinational corporations (MNCs) and their local suppliers, especially in the adoption and integration of digital technologies.

This theory is particularly useful for understanding the mechanisms of supply chain innovation, as it focuses on how collaborative

relationships foster resource complementarity and innovation outcomes. For example, MNCs often bring advanced digital tools, infrastructure, and global expertise, while local suppliers contribute contextual knowledge and localised practices (Nguyen et al., 2019). The interplay between these assets allows for the development of innovative solutions tailored to specific operational environments. However, achieving such outcomes requires overcoming challenges such as power asymmetries, unequal access to resources, and technological readiness (Yang et al., 2021; Jiang et al., 2023). The RVCA framework also emphasises the importance of governance mechanisms, including trust and strategic alignment, in ensuring that collaborative efforts translate into sustainable innovation gains. These relational dynamics are particularly salient in the context of digital integration, where the effectiveness of technology transfer and adoption depends on the quality of inter-organisational relationships.

Despite its relevance, notable gaps exist in the application of RVCA to the context of digital technology integration in supply chains. Existing studies often focus on operational efficiencies or knowledge-sharing outcomes but overlook how relational dynamics mediate the impact of digital technologies on innovation capabilities (Lawson and Samson, 2001; Dyer et al., 2018). For example, while the theory highlights resource complementarity, there is a lack of understanding about how digital infrastructures, such as IoT or blockchain, specifically enhance this complementarity within supply chain networks. Similarly, there is limited exploration of how digital adoption processes unfold unevenly across suppliers with varying levels of technological readiness, creating disparities in innovation outcomes (Piening and Salge, 2015; Lu et al., 2023). These gaps highlight the need for a more nuanced application of RVCA to capture the complexities of digital transformation in inter-organisational settings.

2.3. Linking enhanced production processes to supplier innovation

This study leverages the RVCA by emphasising five critical dimensions to explore the mechanisms through which digital technology integration in MNCs facilitates the innovation capabilities of local suppliers. Knowledge and Technology Transfer lies at the core of RVCA, as it highlights how MNCs disseminate technical expertise, processes, and digital tools to their suppliers. This transfer is essential for bridging the technological and knowledge gaps that often constrain suppliers in developing economies, enabling them to engage effectively in innovation ecosystems (Scuotto et al., 2020: Liu et al., 2023). Resource Complementarity and Utilisation is another fundamental dimension, focusing on how MNCs and suppliers combine their unique resources to co-create value (Lu and Wang, 2024). In the context of digital integration, this involves leveraging advanced digital infrastructures from MNCs alongside the localised knowledge and operational strengths of suppliers, fostering collaboration and competitive advantage (Juo and Wang, 2022; Lu et al., 2023).

Digital Adoption and Adaptability capture the dynamic process through which suppliers integrate and tailor digital technologies to their specific needs. This dimension is critical for understanding how variations in technological readiness and the ability to adapt to digital tools influence suppliers' capacity to innovate. RVCA emphasises adaptability as a strategic capability, particularly in supply chains where the seamless adoption of technologies is crucial to maintaining a competitive position (Ishaq et al., 2024; David et al., 2024). Innovation Outcomes reflect the tangible results of these collaborative and integrative efforts, including enhanced process efficiencies, new product development, and market competitiveness. By linking these outcomes to relational dynamics, RVCA provides insights into how inter-organisational collaboration translates into measurable innovation gains (Lee and Berente, 2012; Dyer and Singh, 1998; Wang et al., 2017). Finally, Strategic Alignment with Innovation Goals underscores the importance of shared objectives and governance mechanisms in ensuring that the collaborative efforts between MNCs and suppliers are focused and sustainable. Misaligned priorities or power asymmetries can undermine these efforts, underscoring the need to align strategies to achieve mutual innovation benefits (Correani et al., 2020; Juo and Wang, 2022). Together, these dimensions form a comprehensive framework for analysing the interplay between digital integration, relational dynamics, and innovation in global supply chains.

3. Methodology

3.1. Research design

This study adopts a research design informed by the RVCA and grounded in the broader literature on digital technology integration and inter-organisational innovation. The aim was to develop a nuanced understanding of how digital technologies embedded within MNCs' production processes influence the innovation capabilities of their local suppliers in developing economies. By focusing on relational dynamics, this design aims to capture the complexity of interactions and the mechanisms driving innovation throughout the supply chain.

To achieve this, the study employed a process perspective of sensemaking (Weick, 1995; Langley and Tsoukas, 2010), which emphasises understanding phenomena in their dynamic and evolving contexts rather than reducing them to static, variance-based models. Sensemaking, as conceptualised by Brown et al. (2015), involves processes through which individuals and organisations plausibly interpret ambiguous or complex situations. This approach aligns well with the study's focus, as supply chains and innovation systems are inherently fluid, characterised by dualities such as collaboration and competition, or alignment and misalignment. Drawing on this perspective, the study recognises that firms and their relationships are in constant states of flux, shaped by technological changes, power dynamics, and evolving strategic priorities.

The investigation began by examining the broader changes in Vietnam's industrial and manufacturing sectors since the 2020s, with a particular focus on the adoption of digital technologies. This contextual exploration provided insights into the events and mechanisms shaping the integration of advanced technologies by MNCs and their diffusion to local suppliers. Data collection involved 'sensing' from a combination of primary sources, such as interviews with managers and experts, and secondary sources, including industry reports and organisational documents. This abductive approach, which iteratively connects data with theoretical constructs, enabled the study to move beyond linear cause-and-effect relationships and develop a more comprehensive understanding of the relational and systemic complexities of digital integration.

Through this iterative process, the research design ensured that the interplay between digital technologies and supplier innovation capabilities was examined rigorously within the RVCA framework. By integrating theoretical insights with empirical data, the study not only aligns with established research traditions but also addresses the contextual specificities of digital transformation in Vietnamese manufacturing. This dual focus on theoretical grounding and empirical relevance enhances the robustness and credibility of the study's findings.

This study employs a multiple-case research design (Yin, 2011) to rigorously examine how the integration of digital technology within multinational corporations (MNCs) influences the innovation capabilities of their local suppliers. The use of this methodological approach allows for the collection and analysis of rich, contextualised data across twelve cases, comprising three MNCs operating in Vietnam and their respective local supplier networks. The selected organisations demonstrate a proactive engagement with digital transformation initiatives, ensuring their suitability for providing in-depth insights into the relational and technological dynamics central to the study's research purpose. A multiple-case design offers several advantages, particularly in exploring complex, context-dependent phenomena. By allowing for systematic comparison across cases, this approach enhances the study's

capacity to identify patterns, draw theoretical insights, and account for contextual variations. This design aligns with established methodological frameworks that emphasise the value of multiple-case research in providing both depth and breadth of understanding (Yin, 2017; Gioia et al., 2013). This study enables a nuanced examination of the interplay between digital infrastructures, collaborative mechanisms, and innovation outcomes across distinct industrial and organisational contexts.

The contextual nuances embedded in the selected cases are crucial for understanding the varying effects and implications of digital technology adoption in diverse supply chain environments. These organisations operate within a rapidly evolving Vietnamese manufacturing landscape, where differences in technological readiness, resource availability, and relational dynamics significantly shape the effectiveness of digital integration. By focusing on these contextual variables, the research aims to develop a comprehensive understanding of the mechanisms by which MNCs facilitate supplier innovation while addressing the challenges that arise in such settings. Through a detailed examination of these cases, this study aims to provide a robust framework for understanding the relational and technological dynamics of digital transformation. The findings are anticipated to contribute to broader discussions on the role of digital technologies in fostering innovation within global supply chains, offering valuable theoretical and practical insights. Table 1 and Fig. 1 provide the background and relationship of our case studies.

3.2. Data collection

Data collection for this study involved a combination of in-depth interviews and archival document analysis to ensure a comprehensive understanding of the integration of digital technologies and its impact on supplier innovation. A particular focus was placed on engaging leaders and senior managers, given their pivotal roles in shaping strategic decision-making and overseeing collaborative initiatives within supply chains. To further enrich the data collection process, a snowball sampling strategy was employed, enabling the identification of diverse and relevant participants while ensuring a wide range of perspectives were captured.

A total of 41 in-depth interviews were conducted with key stakeholders from both the MNCs and their local suppliers, including supply chain managers, operational managers, and innovation leads in the period from June 2023 to August 2024. These interviews employed a semi-structured format, which allowed for the flexibility to explore emerging themes while maintaining a focus on the core topics of interest. This approach allowed for an in-depth exploration of how digital technologies were integrated into production processes, the collaborative dynamics between MNCs and suppliers, and the subsequent effects on innovation capabilities.

In addition to the interviews, archival documents, including internal reports, communication records, and documentation of technological adoption, were analysed. These materials offered valuable contextual insights into the operational and strategic dimensions of MNC-supplier relationships. By triangulating data from interviews and archival sources, the study ensured a robust and nuanced understanding of the mechanisms driving digital integration and innovation within the selected cases. This multifaceted approach provided both the depth and context needed to address the research objectives effectively. Table 2 summarises the interview details.

3.3. Data analysis

The data analysis was conducted using thematic analysis, a methodological approach well-suited for identifying, interpreting, and synthesising patterns within qualitative data (Gioia et al., 2013). This process commenced with an in-depth familiarisation phase, wherein interview transcripts and archival documents were meticulously reviewed to ensure a comprehensive understanding of their content and

Table 1
Case description.

Cases		Business description	Digital technologies used	Technological intervention in supply chain
Case A	MNCs	Case A is a prominent multinational automotive manufacturer operating in Vietnam. Renowned for its expertise in vehicle production and assembly, the company upholds global standards in quality and efficiency.	Blockchain and IoT	Its operations are supported by the Blockchain Procurement System (BPS), which leverages blockchain and IoT technologies to enhance supply chain transparency, ensure ethical sourcing, and monitor the real-time flow of parts and materials. This system allows Case A to streamline procurement processes and strengthen its supplier relationships.
Case A1	Case A's local suppliers	Case A1 is a leading supplier of precision automotive components, specializing in the production of brake systems and suspension parts.	IoT	This supplier collaborates with Case A by integrating IoT sensors into its shipment packages, allowing real-time tracking data to be uploaded to BPS. This ensures that deliveries are precisely coordinated and traceable.
Case A2		Case A2, a manufacturer of plastic components, focuses on precision plastic injection molding for automotive interiors and exteriors.	Blockchain	Through BPS, Case A2 records material certifications and ensures compliance with Case A's stringent sourcing policies, fostering transparency and accountability.
Case A3		Case A3, an electronics supplier, develops advanced electronic control units and sensor systems	IoT and Blockchain	It utilizes BPS to connect IoT-enabled components, providing real-time quality verification during the procurement process and transparent transaction logging.
Case B	MNCs	Case B is a global leader in semiconductor manufacturing, with operations in Vietnam focusing on the assembly and testing of advanced components.	Big Data Analytics, Machine Learning	The company employs the Smart Quality Assurance System (SQAS), a platform built on big data analytics and machine learning technologies. This system optimizes component quality

(continued on next page)

Table 1 (*continued*)

Cases		Business description	Digital technologies used	Technological intervention in supply chain
				through predictive analytics and automated defect detection, ensuring high standards in semiconductor production.
Case B1	Case B's local suppliers	Case B1, a printed circuit board (PCB) manufacturer, supplies critical components to Case B by ensuring high precision and quality.	Big Data Analytics	It interacts with SQAS by uploading defect analysis data from its PCB production processes, enabling the system to predict and prevent recurring issues.
Case B2		Case B2, a specialist in semiconductor assembly and testing	Data Analytics, Machine Learning	Case B2 integrates real-time test results into SQAS, allowing Case B to monitor production performance and refine its processes.
Case B3		Case B3 focuses on silicon wafer fabrication, providing precise processing services	Big Data Analytics, Machine Learning	This supplier collaborates with Case B by sharing detailed inspection data with SQAS, supporting quality control improvements and alignment with Case B's defect detection protocols.
Case C	MNCs	Case C is a global electronics powerhouse operating in Vietnam, producing consumer electronics, smartphones, and semiconductors.	Cloud Computing, IoT, Cloud Data Integration.	The company has adopted the Cloud Procurement Platform (CPP), a centralized system powered by cloud computing and IoT technologies. CPP facilitates real-time collaboration, transparent procurement processes, and streamlined transaction management, allowing Case C to maintain seamless supply chain operations.
Case C1	Case C's local suppliers	Case C1, a display panel manufacturer, produces high-quality OLED and LCD screens for Case C's devices.	IoT	It connects with CPP by synchronizing production schedules through IoT-enabled dashboards, ensuring timely delivery and coordination.
Case C2		Case C2, a battery manufacturer, specializes in producing lithium-ion batteries with a focus on energy efficiency and performance.	IoT, Cloud Data Integration	It uploads battery performance data to CPP, where Case C uses the information to make procurement decisions and establish quality benchmarks.
Case C3		Case C3, an electronics assembly provider, manages component requests and delivery confirmations through CPP	Cloud Computing	This integration allows Case C to maintain its high standards and operational reliability.

contextual nuances. This iterative engagement with the data facilitated the emergence of preliminary insights while grounding the analysis in the empirical realities of the cases.

The subsequent phase involved systematic coding, wherein significant segments of data were identified and categorised. The coding process employed a dual strategy, combining inductive and deductive approaches. Inductive coding enabled the identification of emergent patterns directly from the data, capturing context-specific dynamics and unique insights. Simultaneously, deductive coding was informed by the theoretical framework of the study, ensuring alignment between the data and the study's conceptual underpinnings. This methodological rigour ensured a balanced approach, integrating the richness of the data with the theoretical dimensions guiding the research.

Following the coding phase, related codes were synthesised into overarching themes that encapsulated key phenomena, such as the influence of digital technologies on inter-organisational collaboration and innovation. These themes were analysed to identify patterns and interconnections across cases, providing a comparative lens that highlighted both commonalities and contextual divergences. The analysis further examined these themes in relation to the research questions and theoretical framework, elucidating the mechanisms through which relational dynamics mediate the effects of digital technology integration.

The final stage of analysis involved an interpretative synthesis, wherein the identified themes were connected to broader theoretical constructs such as knowledge and technology transfer, resource complementarity, and strategic alignment. This stage aimed to uncover both facilitators and barriers to successful innovation, providing a nuanced understanding of the relational and technological dynamics at play. To enhance the validity and reliability of the findings, triangulation was employed by cross-verifying data from multiple sources, ensuring analytical rigour and robustness. This comprehensive and theoretically grounded approach facilitated a deep exploration of how digital technologies impact the innovation capabilities of local suppliers, advancing both empirical insights and theoretical contributions. Fig. 2 outlines the data structure.

4. Research findings

4.1. Knowledge and technology transfer

During the interview, two key dimensions of knowledge and technology transfer were discussed, including structured knowledge integration and challenges in knowledge accessibility. Across the three cases, structured knowledge integration emerges as a critical enabler for local suppliers to effectively engage with MNC systems. MNCs employ system-specific training programs, standardised onboarding procedures, and ongoing feedback to facilitate the adoption of new technologies. For instance, the Supply Chain Coordinator of Case A1 highlighted that *"[the blockchain training provided] gave us clarity on how to manage real-time*

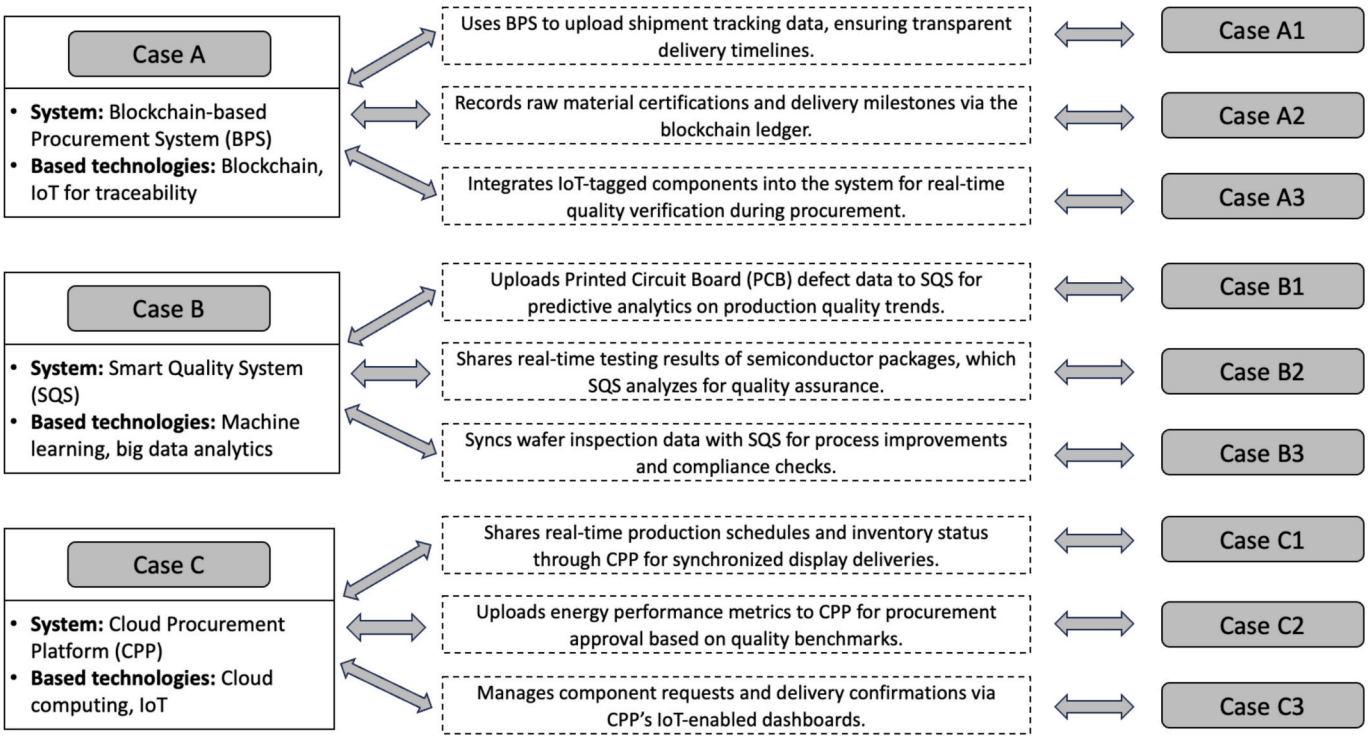

Fig. 1. Case relationship description.

data efficiently," showcasing how training programs build supplier expertise. Similarly, Quality Control Manager of Case B2 noted, "*The initial onboarding process was so detailed that we quickly aligned with the new quality assurance system*," reflecting the role of standardised processes in smoothing technology transitions. Ongoing feedback mechanisms were emphasised by the System Integration Specialist from Case C3, where a supplier stated, "*Their [MNC's] regular updates ensured we stayed on track with system requirements*."

Despite these structured efforts, challenges in knowledge accessibility remain evident across cases. MNCs often prioritise compliance-focused knowledge-sharing efforts over fostering innovation, which limits suppliers' ability to adapt creatively. For example, the Product Manager of Case A2 observed, "T*he training was more about meeting their standards, with little room for exploring our own ideas*." Pre-existing technical expertise also creates disparities in integration outcomes, as suppliers with advanced capacities adapt more readily. Operations Manager of Case B3 reported, "*Those who had prior experience with analytics tools found it easier to use the new system, but for us, it was a steep learning curve*." Similarly, the Technical Manager of Case C2 reflected on the inequities, noting, "*We felt left behind compared to larger partners who were already familiar with these technologies*."

The findings underscore the importance of structured knowledge integration in enabling suppliers to engage with MNC technologies, while also highlighting the persistent inequities and limitations in knowledge accessibility that impact the potential for innovation.

4.2. Resource complementarity and utilisation

The interplay between MNCs and their suppliers reveals critical insights into the resource complementarity and utilisation theme. Across cases, aligned digital infrastructures emerge as a significant enabler, fostering seamless operational integration. MNCs leverage technical systems to synchronise supply chains, enhance resource pooling, and enable complementary use of analytics tools. For instance, the Logistics Coordinator of Case A2 remarked, "*their IoT-based procurement system let us align deliveries precisely, reducing downtime on both sides*." Similarly, the Technical Trainer of Case B1 reflected on the efficiency gained through resource pooling, noting, "*the predictive analytics dashboard allowed us to optimise production schedules, minimising waste and ensuring on-time delivery*." IT Specialist of Case C1 provided another perspective, highlighting the value of shared tools: "*Their cloud-based analytics helped us track inventory and adjust operations dynamically*."

However, power asymmetry in resource use also emerges as a cross-case challenge, particularly for smaller suppliers. These suppliers often face constraints in accessing and fully leveraging the advanced tools provided by MNCs. For example, the Logistics Manager of Case C2 acknowledged, "*While the cloud platform was effective, the cost of integration made it hard for us to adopt at scale*." Heavy dependency on MNC-provided systems also raises operational risks, as emphasised by the Supply Chain Manager of Case A3: "*If their system goes down, we're stuck waiting; we have no fallback plan of our own*."

Despite these asymmetries, synergistic resource use showcases how complementary capabilities can drive mutual gains. Suppliers utilise their localised expertise to co-create value with MNCs, often through digital integration that eliminates inefficiencies. As the System Integration Specialist of Case B3 explained, "*We combined their defect prediction algorithms with our process insights, which helped us reduce rework significantly*." The Procurement Specialist of Case C3 similarly noted, "*Working with their cloud tools, we streamlined procurement processes and cut redundancies*."

These findings illustrate the dual dynamics of alignment and asymmetry in resource complementarity, underscoring the importance of fostering equitable and innovative collaborations in supply chains.

4.3. Digital adoption and adaptability

Across cases, variable technological readiness emerges as a key factor shaping suppliers' ability to adopt new systems. Suppliers with prior digital experience often demonstrate faster readiness to align with MNC tools, as illustrated by the Supply Chain Analyst of Case B2: "*having worked with predictive analytics before, we adapted to their quality system without major delays*." Conversely, infrastructure gaps remain a

Table 2
Interview details.

No.	Interviewees' position	Age	Gender	Experience (years)	Interview time (minutes)
Case A					
1	Supply Chain Manager	45	Male	20	65
2	Assurance Officer	38	Female	13	85
3	IT Systems Coordinator	40	Male	15	80
4	Innovation Strategy Consultant	35	Female	12	65
Case A1					
3	Production Manager	38	Male	13	70
4	Supply Chain Coordinator	34	Female	10	80
5	Quality Control Supervisor	36	Male	10	75
Case A2					
6	Technical Manager	43	Male	20	75
7	Product Manager	39	Female	17	75
8	Logistics Coordinator	33	Male	10	70
9	Digital Coordinator	35	Male	12	80
Case A3					
10	R&D Engineer	33	Male	10	65
11	IT System Administrator	29	Male	8	65
12	Supply Chain Manager	36	Female	22	85
Case B					
13	Operations Manager	40	Male	18	70
14	Supplier Development Manager	45	Male	20	65
15	Data Analytics Specialist	38	Male	15	80
16	Compliance Officer	35	Female	13	90
17	Digital Transformation Lead	48	Male	25	80
Case B1					
18	Operations Supervisor	45	Female	22	75
19	Process Improvement Analyst	33	Female	9	65
20	Technical Trainer	30	Male	7	65
Case B2					
21	Assembly Line Supervisor	44	Male	20	75
22	Supply Chain Analyst	29	Male	7	85
23	Quality Control Manager	35	Female	13	80
Case B3					
24	Operations Manager	42	Female	20	90
25	System Integration Specialist	37	Male	15	75
26	Supply Chain Coordinator	37	Female	14	65
Case C					
27	Procurement Manager	39	Female	17	65
28	Innovation and R&D Liaison	37	Male	15	80
29	Digital Coordinator	42	Male	19	90
30	Technical Support Engineer	39	Male	17	80
31	Supply Chain Manager	45	Female	21	90
Case C1					
32	Production Planner	48	Female	26	80
33	IT Specialist	38	Male	15	90
34	Process Improvement Analyst	35	Female	13	75
Case C2					
35	Procurement Manager	40	Female	15	75
36	Technical Manager	38	Male	13	90
37	Logistics Manager	36	Male	13	75
Case C3					
38	Production Manager	43	Female	20	60
39	Procurement Specialist	33	Female	9	60
40	System Integration Specialist	35	Male	13	65
41	Manufacturing Engineer	37	Male	14	85

significant barrier for smaller suppliers, as the Innovation and R&D Liaison of Case C2 explains, "*Our limited bandwidth and older systems slowed down the integration process, making it hard to keep up*."

Learning and adjustment also play a crucial role in bridging readiness gaps, as iterative feedback loops and collaborative efforts enable suppliers to align with the digital systems of MNCs gradually. Production Manager of Case A1 reflected on this process, stating, "*The regular feedback we received after initial onboarding helped us refine our use of the IoT-enabled procurement system*." Suppliers also benefit from customisation of MNC tools to fit their specific operational contexts. Production Manager of Case C3 noted, "*The cloud tools were flexible enough to adapt to our production schedules, which made the transition smoother*." Furthermore, collaboration fosters deeper alignment, as emphasised by Process Improvement Analyst of Case B1: "*working together on system refinements helped us align our workflows more effectively with their predictive algorithms*."

However, cross-case findings also reveal significant barriers to integration. Legacy system incompatibilities slow down the adoption of advanced tools, as highlighted by the R&D Engineer of Case A3: "*Integrating their blockchain system with our older platforms took months longer than expected*." Cultural resistance adds another layer of complexity, particularly in adjusting workflows to fit digital systems. Production Planner of Case C1 observed, "*convincing staff to adopt cloud-based monitoring tools required a complete mindset shift, which took time*."

These findings reflect a dynamic interplay of readiness, learning, and barriers in digital adoption, emphasising the need for tailored strategies to support suppliers at varying levels of technological maturity.

4.4. Digital adoption and adaptability

This section highlights how these technologies contribute to both incremental process improvements and competitive advancements, while also revealing structural inequities in the distribution of innovation benefits. Across cases, incremental process gains are consistently observed, as suppliers utilise MNC tools to streamline workflows and optimise inventory management. The Digital Coordinator of Case A2 remarked, "*With the IoT-enabled procurement system, we reduced*

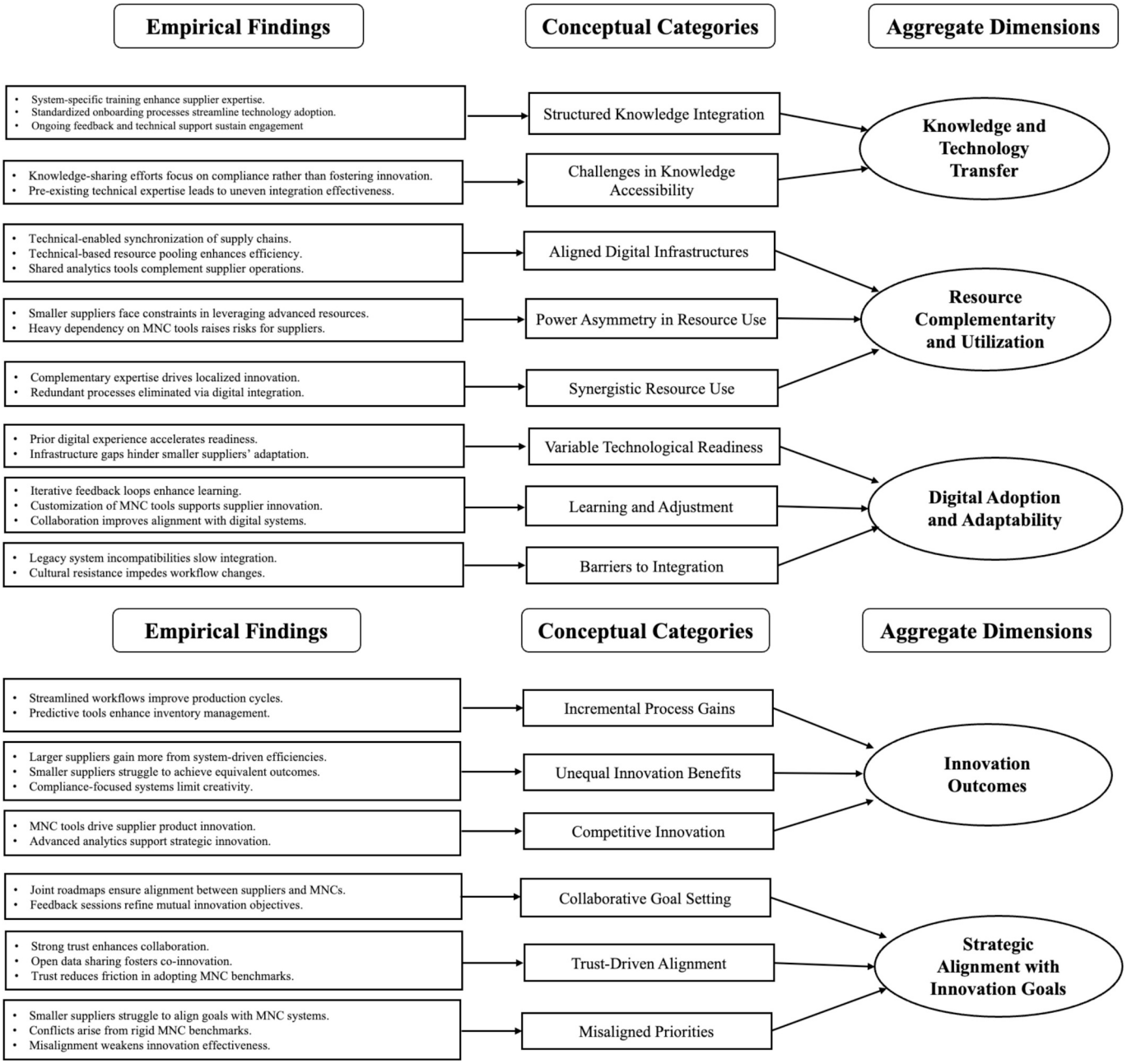

Fig. 2. Data structure.

production delays by aligning our schedules with real-time data." Similarly, the Operations Supervisor of Case B1 highlighted, "*the predictive analytics dashboard minimised overstocking and improved inventory turnover, enhancing efficiency*."

Despite these gains, the distribution of innovation benefits remains uneven, with larger suppliers reaping more advantages due to their capacity to integrate advanced systems. The Production Planner of Case C1 reflected, "*Having the resources to implement their cloud platform fully gave us a clear edge in the market."* In contrast, smaller suppliers often struggle to achieve equivalent outcomes. The Supply Chain Coordinator of Case B3 shared, "*We couldn't afford the same level of integration, so the benefits we saw were minimal compared to larger players*." Additionally, compliance-focused systems can stifle creativity, as the Supply Chain Manager of Case A3 explained: "*Their blockchain tools were great for tracking, but they didn't leave much room for innovation on our end*."

Nevertheless, competitive innovation emerges as a critical cross-case finding, where MNC tools enable suppliers to enhance their product offerings and strategic positioning. The Quality Control Manager of Case B2 credited their predictive quality systems with enabling new product designs: "*The analytics helped us refine a new semiconductor product that reduced defects by 15%."* The Technical Manager of Case C2 similarly noted, "*their cloud-based systems supported us in developing a battery model with improved energy efficiency*." These examples underscore the role of advanced technologies in driving supplier innovation and boosting competitiveness.

The findings highlight a dual dynamic in innovation outcomes: while MNC-driven systems foster incremental gains and competitive advantages, smaller suppliers often face structural barriers that limit their ability to capitalise on these opportunities fully.

4.5. Strategic alignment with innovation goals

This section investigates how MNCs and their suppliers align strategically to achieve innovation goals, revealing both synergies and tensions in these relationships. Collaborative goal setting emerges as a vital mechanism for fostering alignment, with joint roadmaps and regular feedback sessions playing a central role. The Quality Control Supervisor of Case A1 illustrated this dynamic, noting, "*the roadmap discussions gave us clear directions on how to integrate our production goals with their system requirements*." Similarly, the Supply Chain Analyst of Case B2 emphasised, "*their feedback helped us refine our quality benchmarks to better align with their innovation objectives*." In Case C3, these efforts ensured mutual clarity, as the Production Manager explained, "*We adjusted our workflows in sync with their strategic updates, avoiding delays*."

Trust-driven alignment further reinforces these collaborative efforts, with strong trust relationships facilitating smoother interactions and fostering co-innovation. The Supply Chain Manager of Case A3 observed, "*Their transparency in sharing data made it easier to develop solutions together*." Open data sharing also emerged as a critical enabler, as highlighted by the Technical Manager of Case C2: "*the shared analytics platform allowed us to contribute meaningfully to their design process*." Trust significantly reduced resistance to adopting MNC benchmarks, as the Operations Supervisor of Case B1 noted, "*we felt confident aligning with their standards because of the trust established during prior collaborations*."

However, misaligned priorities present a notable challenge, particularly for smaller suppliers. These suppliers often struggle to align their goals with MNC systems, as described by the Product Manager of Case A2: "*The benchmarks didn't match our capabilities, leaving us constantly behind schedule*." Rigid standards can create friction, with the Production Planner of Case C1 stating, "*their metrics sometimes felt out of reach, limiting our ability to innovate*." Ultimately, such misalignments weaken the effectiveness of innovation, as the System Integration Specialist of Case B3 reflected, "*without adjustments to their expectations, we couldn't fully contribute to their innovation goals."*

These findings underscore the duality of strategic alignment: while trust and collaboration enable alignment and co-innovation, rigid benchmarks and misaligned priorities continue to constrain the contributions of smaller suppliers.

5. Discussion

5.1. A conceptual model for facilitating supplier innovation through digital integration

Our proposed model, motivated by the findings of this study, demonstrates how the integration of digital technologies in MNCs' production processes facilitates the innovation capabilities of local suppliers through interconnected input, process, and output layers, moderated by relational dynamics. This layered perspective highlights the mechanisms, uncertainties, and relational influences that underpin how digital tools reshape supplier capabilities, offering insights into both enablers and barriers to innovation in global supply chains.

The Input Layer reflects foundational mechanisms for disseminating digital technologies, providing significant benefits while also revealing critical uncertainties. Structured knowledge integration serves as a core enabler, with training programs, standardised processes, and ongoing support enabling suppliers to engage effectively with advanced systems. This aligns with studies emphasising formalised mechanisms as essential for transferring technological know-how and fostering innovation within supply chains (Kache and Seuring, 2017; Büyüközkan and Göçer, 2018). Similarly, aligned digital infrastructures, such as IoT and cloud-based platforms, facilitate seamless data exchange and resource pooling, enhancing operational alignment between MNCs and suppliers (Hopkins and Hawking, 2018). However, knowledge accessibility poses a significant challenge, as smaller suppliers often face barriers to in-depth training and technological adoption, echoing literature on the structural inequities inherent in global production networks (Jiang et al., 2023; Yang et al., 2021). These disparities limit smaller suppliers' ability to fully participate in co-innovation, creating a gap between system-level integration and inclusive innovation outcomes.

The Process Layer captures mechanisms that directly influence supplier adaptability and collaborative capabilities. Synergistic resource use emerges as a key benefit, as suppliers and MNCs combine their distinct resources, advanced analytics from MNCs and localised market knowledge from suppliers, to foster innovation. This dynamic reflects theories of resource complementarity as a driver of competitive advantage within inter-organisational networks (Juo and Wang, 2022; Dyer and Singh, 1998). Learning and adjustment further enhance this process, with iterative feedback enabling suppliers to refine their adoption of digital tools, consistent with the literature on absorptive capacity and organisational learning (Correani et al., 2020; Liu et al., 2023). However, several uncertainties complicate this layer. Variable technological readiness leads to uneven adoption outcomes, with technologically mature suppliers being better equipped to integrate digital tools. Power asymmetry in resource use exacerbates these disparities, as smaller suppliers become overly reliant on MNC systems, limiting their autonomy. Barriers to integration, including legacy system incompatibilities and cultural resistance, align with studies on organisational inertia, underscoring how path dependencies hinder technological transformations (Kache and Seuring, 2017; Büyüközkan and Göçer, 2018).

The Output Layer highlights the tangible outcomes of digital technology integration, showcasing both benefits and persistent disparities. Incremental process gains, such as improved production cycles and reduced defects, demonstrate how digital tools enhance supplier operational efficiency. These outcomes align with research linking digitalisation to supply chain process improvements (Farajpour et al., 2022; Lu and Wang, 2024). Competitive innovation, driven by advanced analytics and co-innovation efforts, reflects the potential for suppliers to leverage MNC tools to align with shifting market demands, enhancing their strategic positioning. Yet, unequal innovation benefits remain a significant concern. Smaller suppliers often struggle to achieve the same level of gains as their larger counterparts, reflecting broader inequities in global supply chains. This disparity not only limits individual suppliers' growth but also perpetuates systemic imbalances, challenging the inclusivity of digital transformations.

Finally, relational moderators play a crucial role in shaping the effectiveness of these layers. Collaborative goal setting fosters alignment between MNCs and suppliers, enabling mutual commitment to shared innovation objectives. This aligns with studies emphasising the importance of joint planning in achieving strategic alignment (Correani et al., 2020; Juo and Wang, 2022). Trust-driven alignment further facilitates co-innovation, enhancing transparency and reducing friction in inter-organisational processes. However, misaligned priorities can undermine these relational benefits, exacerbating uncertainties and limiting the effectiveness of digital integration (Liu et al., 2023). These relational dynamics underscore the need for MNCs to prioritise equitable partnership models that balance operational priorities with sustainable innovation ecosystems, ensuring that all suppliers can effectively contribute to and benefit from digital transformations.

5.2. Proposition development

Building on the proposed model, this section develops propositions that articulate the causal relationships between the input, process, and output layers, moderated by relational dynamics. Our propositions extend the theoretical understanding of how the integration of digital technology facilitates supplier innovation capabilities.

The combination of structured knowledge integration and aligned digital infrastructures has a positive influence on learning and adjustment, while challenges in knowledge accessibility and power

asymmetry in resource use moderate this relationship (Lu et al., 2023; Piening and Salge, 2015). Findings from the case studies underscore that structured knowledge integration, characterised by standardised training programs and ongoing feedback mechanisms, establishes a robust foundation for supplier engagement. For instance, local suppliers for Case A benefitted significantly from detailed onboarding processes that aligned their workflows with MNC systems, enabling iterative learning. Similarly, aligned digital infrastructures, such as IoT-enabled procurement systems in Case C, enhanced technical compatibility, facilitating seamless coordination between MNCs and their suppliers. The literature corroborates these findings, emphasising the critical role of knowledge diffusion and infrastructural compatibility in fostering supplier adaptability (Viana and Sousa-Filho, 2017; Jiang et al., 2023). However, persistent barriers such as knowledge accessibility challenges and power asymmetry constrain this relationship. Smaller suppliers of Case B reported limited access to advanced tools and training, reflecting structural inequities that inhibit their ability to engage fully. Power asymmetry exacerbates this issue, with MNCs exercising disproportionate control over resource allocation, thereby limiting the agency of smaller suppliers. Thus, Proposition 1 is drawn:

Proposition 1. The combination of structured knowledge integration and aligned digital infrastructures has a positive influence on learning and adjustment, while challenges in knowledge accessibility and power asymmetry in resource use moderate this relationship.

In addition, synergistic resource use and effective learning and adjustment mechanisms positively drive incremental process gains and competitive innovation, but barriers to integration and unequal innovation benefits weaken this relationship. Across cases, synergistic resource use emerged as a critical driver of co-innovation, where suppliers leveraged MNC-provided digital tools in conjunction with their localised expertise. For example, local suppliers of Case C combined cloud-based analytics with their production insights, leading to optimised inventory management and reduced cycle times. Effective learning processes also played a significant role, as suppliers refined their use of predictive quality systems through iterative feedback, aligning with theories of absorptive capacity. These mechanisms resulted in measurable process improvements and competitive innovations, enabling suppliers to enhance their market positioning (Correani et al., 2020; Scuotto et al., 2020). However, barriers such as legacy system incompatibilities and unequal distribution of benefits hinder these outcomes. As seen in Case A, suppliers with outdated infrastructure faced delays in adopting new technologies, limiting their ability to innovate. Unequal innovation benefits, often favouring larger suppliers, further perpetuate disparities within the supply chain.

Proposition 2. Synergistic resource use and effective learning and adjustment mechanisms positively drive incremental process gains and competitive innovation, but barriers to integration and unequal innovation benefits weaken this relationship.

Moreover, collaborative goal setting and trust-driven alignment amplify the positive effects of learning and adjustment on incremental process gains and competitive innovation, while misaligned priorities exacerbate the negative impacts of barriers to integration (Juo and Wang, 2022; Wang, 2014). Case studies illustrate the critical role of collaboration in fostering alignment between MNCs and suppliers. Joint planning sessions in Case B facilitated clear communication of innovation objectives, enabling suppliers to align their workflows with those of the MNC. Trust-driven alignment further enhanced these outcomes, as transparency in data sharing and cooperative problem-solving fostered co-innovation, consistent with the literature on relational governance. Conversely, misaligned priorities emerged as a significant constraint, particularly in Case A, where local suppliers reported frustration over the rigid benchmarks of MNCs that did not align with their operational realities. Thus, Proposition 3 is proposed:

Proposition 3. Collaborative goal setting and trust-driven alignment amplify the positive effects of learning and adjustment on incremental process gains and competitive innovation, while misaligned priorities exacerbate the negative impacts of barriers to integration.

Finally, incremental process gains and competitive innovations achieved by suppliers feed back into structured knowledge integration and aligned digital infrastructures, fostering iterative improvements. However, unequal innovation benefits limit the reinforcement of collaborative efforts (Wang et al., 2017; Prashantham and McNaughton, 2006; Nguyen et al., 2019). The case findings indicate that successful innovation outcomes incentivise MNCs to reinvest in structured knowledge-sharing mechanisms and adapt their digital infrastructures. For instance, Case C expanded their training programs to accommodate suppliers that demonstrated significant process improvements, fostering iterative learning cycles. Competitive innovation also prompted MNCs to refine their digital platforms, ensuring compatibility with the needs of their suppliers. These feedback loops align with the literature on the recursive nature of supply chain innovation, where outcomes influence subsequent investments in capability development. However, the unequal distribution of innovation benefits undermines this reinforcement. Smaller suppliers for Case B, unable to achieve comparable gains, reported diminished trust and engagement, constraining future collaboration.

Proposition 4. Incremental process gains and competitive innovation achieved by suppliers feed back into structured knowledge integration and aligned digital infrastructures, fostering iterative improvements, while unequal innovation benefits limit the reinforcement of collaborative efforts.

Fig. 3 outlines our conceptual framework.

6. Concluding remarks

6.1. Theoretical contributions

This study offers significant theoretical contributions to the fields of supply chain management, digital technology integration, and inter-organisational innovation, particularly in the context of developing economies. By investigating how the production processes of multinational corporations (MNCs) influence the innovation capabilities of local suppliers through digital technologies, this study extends existing theories (Büyüközkan and Göçer, 2018; Farajpour et al., 2022; Seyedghorban et al., 2020) and provides nuanced insights into the dynamics of global supply chain ecosystems.

First, we extend the RVCA (Dyer and Singh, 1998; Dyer et al., 2018) by theorising a class of digitally enabled relational assets and the distinctive rents they generate. In classic RVCA, relational rents stem from idiosyncratic linkages, specialised investments, knowledge sharing, complementary resources, and governance. Our analysis reveals that digital infrastructures (e.g., shared data architectures, IoT telemetry, traceability ledgers, analytics pipelines) serve not as generic conduits for knowledge transfer, but as co-created, co-governed assets whose affordances qualitatively reshape how complementarities are formed, protected, and scaled. We conceptualise “digitally enabled relational rents” as rents arising from three mechanisms under-specified in RVCA: interoperability rents (from co-developed data schemas and APIs that reduce cross-firm adaptation frictions), algorithmic complementarity rents (when partner-specific data raises the predictive performance of embedded models in production and quality control), and verification rents (from shared auditability that lowers counterparty risk and enables innovation with sensitive process data). By specifying these mechanisms and their enabling conditions, we move beyond merely relabeling “knowledge sharing” and “complementarity” (Lawson and Samson, 2001; Piening and Salge, 2015; Lu et al., 2023) and equip RVCA to navigate digitally intensive supply chains.

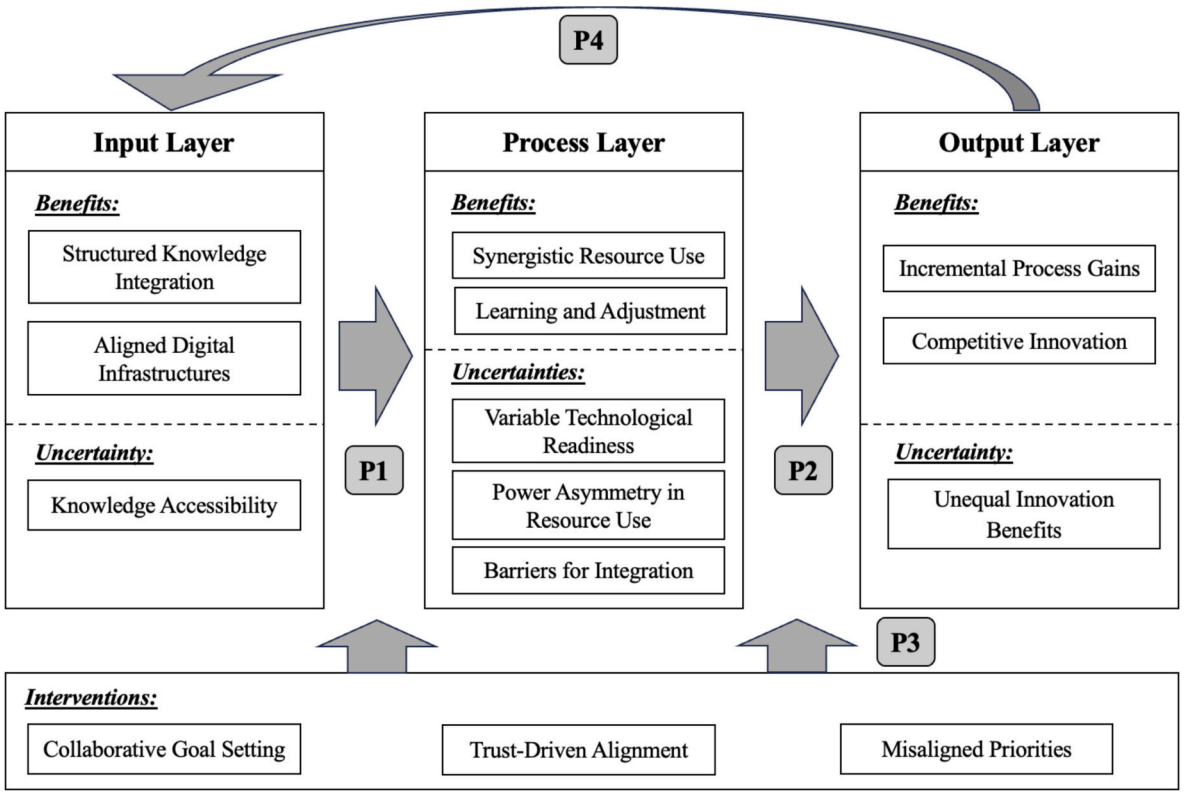

Fig. 3. Conceptual framework.

Second, we challenge RVCA's implicit linearity (Viana and Sousa-Filho, 2017; Wang, 2014) by introducing a recursive, layered process model in which innovation outcomes feed back to reconfigure the inputs that produced them. The proposed input–process–output layering is not a cosmetic re-sorting of known factors; it provides a temporal micro-foundation that explains how incremental capability gains at the process layer (e.g., first-pass yield improvements from shared analytics) shift bargaining positions, data-sharing thresholds, and co-investment logics at the input layer (e.g., expanding the shared data perimeter, joint sensor acquisition, redesigning API governance). This feedback loop formalises a path-dependent escalation dynamic, relational capability reconfiguration, which RVCA has not theorised. Our findings thus advance RVCA from an essentially static account of rent antecedents toward a dynamic process theory of rent accumulation and dissipation in digitally mediated supply relationships.

Third, the study deepens understanding of relational dynamics as moderators in inter-organisational collaboration. While prior work underscores the importance of trust and alignment in fostering innovation (Lu and Wang, 2024; Liu et al., 2023), we show how collaborative goal setting and trust-driven alignment amplify the innovation effects of digital integration, whereas misaligned priorities exacerbate systemic inequities (Büyüközkan and Göçer, 2018; Farajpour et al., 2022). These insights contribute to relational governance theories (Juo & Wang, 2022; Viana and Sousa-Filho, 2017; Wang, 2014) by demonstrating how strategic alignment and technological integration jointly condition rent creation and appropriation.

Lastly, we enrich the literature on inclusive digital transformation by specifying the mechanisms through which digital technologies facilitate, or constrain, supplier innovation. Prior research recognises the transformative potential of IoT (Hopkins and Hawking, 2018; Wang et al., 2017), blockchain (Nguyen et al., 2021), and BDA (Hoang and Bui, 2023). We extend this work by demonstrating how these technologies interact with localised supplier expertise to produce synergistic resource use and iterative learning–adjustment cycles, while also highlighting persistent disparities in access, capability, and benefit sharing (Wang, 2014; Yang et al., 2021). The layered framework thereby offers a design-oriented lens for structuring digital infrastructures and knowledge systems to enhance supplier innovation capabilities in developing-economy contexts. It sets an agenda for future research on technology-mediated, equitable innovation.

6.2. Practical implications

The findings of this study provide several context-specific implications for multinational corporations (MNCs) and local suppliers in developing economies that go beyond generic recommendations for supply chain collaboration. The focus here is not only on enhancing digital adoption but also on addressing the structural inequities and relational asymmetries that shape how innovation benefits are distributed across global supply chains.

For MNCs, the results highlight that knowledge integration programs must evolve from basic compliance-oriented training to context-sensitive, multi-layered development pathways. This means designing training models that account for suppliers' diverse levels of digital maturity, ensuring that more advanced suppliers receive sophisticated co-innovation toolkits. In contrast, less digitally mature suppliers are supported through ongoing mentoring, simplified digital literacy modules, and continuous feedback loops. Importantly, these programs should not be conceived as top-down transfers but as opportunities for two-way knowledge exchange, allowing local suppliers' experiential knowledge to inform the adaptation of digital systems. Equally, digital infrastructures must be implemented in ways that reduce dependency and avoid reinforcing power asymmetries. Inclusive platform governance, including transparent data access protocols, modular integration options, and shared oversight of technology upgrades, can prevent MNCs from exercising unilateral control and instead foster a collaborative innovation environment. By institutionalising these practices, MNCs not only strengthen operational efficiency but also build more

resilient and equitable supply chain ecosystems.

For local suppliers, the findings underline the importance of simultaneously building technical capacity and strengthening organisational agency. On the technical side, suppliers must prioritise incremental modernisation of legacy systems, invest in basic analytics or IoT-enabled tools, and upskill their workforce to align with evolving MNC requirements. On the organisational side, however, suppliers also need to adopt strategies to mitigate structural disadvantages. This involves developing negotiation capabilities to secure equitable access to shared resources, using their localised expertise as leverage in co-innovation projects, and seeking opportunities for collective action through supplier networks or associations. By strengthening both their digital capabilities and their bargaining position, suppliers can shift from being passive adopters to becoming active contributors in shaping innovation outcomes.

From a broader perspective, the implications emphasise that the challenge is not merely digital adoption but ensuring the fair distribution of digital innovation benefits. If MNCs continue to centralise control over digital infrastructures and if suppliers lack voice in how these systems are designed and governed, then innovation outcomes will remain unevenly distributed, reinforcing dependency rather than enabling empowerment. Conversely, by investing in inclusive knowledge-sharing structures and equitable governance mechanisms, MNCs can foster supply chain ecosystems where digital transformation serves as a driver of shared value. At the same time, suppliers that proactively strengthen their internal capacities and collective representation can ensure they are better positioned to capture innovation rents.

6.3. Limitations and future research directions

While this study provides valuable insights into how the integration of digital technologies in multinational corporations' (MNCs) production processes facilitates the innovation capabilities of local suppliers, several limitations must be acknowledged. These limitations not only highlight areas for caution in interpreting the findings but also open avenues for future research.

First, the study's scope is limited to three MNCs operating in Vietnam and their respective local suppliers and business partners, totaling twelve cases. While this multinational research design enables an in-depth exploration of digital technology integration within a specific geographical and industrial context, it limits the generalizability of the findings to other regions or industries. Future research could expand the scope to include a broader range of countries, particularly those with varying levels of technological infrastructure and supply chain maturity. Comparative studies across regions could reveal differences in the dynamics of digital integration and innovation.

Second, the reliance on interviews as the primary method of data collection, while valuable for capturing detailed insights, presents limitations related to subjectivity and potential response bias. Participants' perspectives may reflect organisational priorities or individual experiences, which may not fully capture the complexities of the broader supply chain. Future studies could adopt mixed-method approaches, incorporating quantitative data such as performance metrics, technology adoption rates, and innovation outputs, to complement qualitative findings. Longitudinal studies tracking the impact of digital integration over time would also provide deeper insights into its long-term effects on supplier innovation capabilities.

Third, the study focuses on three MNCs and their local suppliers, which are likely to represent varying levels of technological maturity and collaboration. While this diversity enriches the analysis, it may not capture the full spectrum of relationships, particularly those involving less engaged or peripheral suppliers. Future research could explore the experiences of suppliers that are excluded from formal collaboration mechanisms or face significant technological and resource constraints. Such studies would provide a more comprehensive understanding of the systemic barriers to inclusive supply chain innovation.

Finally, this study centers on the integration of specific digital technologies, such as IoT, blockchain, and predictive analytics, in the MNC-supplier relationship. However, the rapidly evolving nature of digital technologies, including artificial intelligence and advanced automation, necessitates further exploration. Future research should examine how emerging technologies reshape supply chain relationships and whether they exacerbate or mitigate existing disparities in innovation benefits.

Authorship statement

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in the *Technological Forecasting and Social Change*.

CRediT authorship contribution statement

Umair Tanveer: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Thinh Gia Hoang:** Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Shamaila Ishaq:** Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Muhammad Mustafa Kamal:** Writing – review & editing. **Rekha Attri:** Methodology.

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Data availability

Data will be made available on request.

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