A Diagnostic Framework for Identifying Innovation Capability Constraints in Telecommunications Subcontractor Firms

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ABSTRACT

Telecommunications subcontractor firms play a critical role in network deployment, optimization, and service assurance, yet their innovative performance is frequently constrained by misaligned internal capability development processes. While prior research has extensively examined innovation determinants in large operators and technology firms, limited attention has been given to innovation as a process-level challenge within telecommunications subcontractor firms. Addressing this gap, this study develops a structured diagnostic framework for identifying innovation capability constraints in telecommunications subcontractor firms.

The study adopts a diagnostic research design informed by action research principles and business process management logic. Multiple organizational diagnostic tools, including SWOT analysis, Fishbone analysis, Root Cause Analysis, and a qualitative risk matrix assessment, are systematically applied to examine internal processes related to training, knowledge transfer, and career development. Insights from a structured literature review integrating the Technology Acceptance Model and Learning Organization theory are used to interpret diagnostic findings and guide the design of theory-informed intervention pathways.

The diagnostic analysis identifies outdated training processes and weak innovation-linked career development mechanisms as the most critical constraints on innovative performance. These constraints are predominantly internal and process-based, indicating that innovation challenges in subcontractor firms stem primarily from capability development misalignment rather than external environmental pressures.

This study contributes to business process management and action research literature by demonstrating how structured organizational diagnostics can be systematically applied to identify innovation-related process constraints in project-based service contexts. By explicitly positioning innovation capability as a diagnosable process phenomenon, the study contributes a replicable diagnostic framework that bridges BPM, action research, and innovation literature. The framework offers both researchers and practitioners a structured pathway for diagnosing innovation capability constraints and informing targeted capability-building interventions in technology-intensive subcontractor environments. Practically, the framework provides managers with a replicable approach for diagnosing innovation capability gaps and informing targeted process redesign initiatives in telecommunications subcontractor environments.

Keywords: Business process management, Innovative performance; Telecommunications subcontractors; Training and development; Technology Acceptance Model; Learning Organization, Action Research.

INTRODUCTION

The telecommunications industry is undergoing a profound transformation driven by fifth-generation (5G) commercialization, network virtualization, artificial intelligence integration, and early exploration of sixth-generation (6G) technologies (Agarwal and Nanda, 2024; Barakabitze et al., 2019; Dewangan et al., 2025; Shim et al., 2022; Vetrivel et al., 2025). This transformation has expanded innovation responsibilities beyond network operators and technology vendors to include subcontractor firms that execute critical deployment, optimization,

and service assurance processes. As a result, innovative performance is increasingly shaped by how effectively these firms develop and align internal capabilities with rapidly evolving technological demands.

Within this ecosystem, telecommunications subcontractor firms play a pivotal operational role. These firms are responsible for network rollout, performance optimization, capacity management, and service quality assurance, often under compressed timelines and cost constraints (Fridkin and Kordova, 2022; MacKenzie, 2000; Pervaiz & Syed, 2025). Unlike large operators, subcontractor firms typically operate with limited strategic slack, constrained learning infrastructures, and high dependence on externally defined technologies, rendering their innovation capability highly sensitive to internal process design.

As technological complexity increases, subcontractor firms are no longer evaluated solely on operational efficiency. They are increasingly expected to demonstrate innovation-driven problem-solving capabilities, particularly within advanced 5G and Open Radio Access Network environments (Hassan et al., 2024). In emerging market contexts such as Malaysia, these expectations are further intensified by persistent challenges related to skills obsolescence, limited access to structured innovation-oriented training, and constrained career development pathways (Jansson and Hilmersson, 2009; Mgm and Yajid, 2020; Ruffini et al., 2019).

From a business process management perspective, innovation capability should be understood as a process-based outcome rather than an isolated organizational attribute. It emerges from the interaction of interdependent processes such as training, knowledge transfer, performance evaluation, and career progression (Kosieradzka and Rostek, 2021; Plattfaut and Grisold, 2025). When these interdependent processes fail to evolve alongside technological advancement, innovation constraints manifest not as a lack of creativity, but as systemic capability development misalignment (Pervaiz & Syed, 2025). Such misalignment adversely affects network quality, service reliability, and long-term competitiveness.

Despite extensive research on innovation within telecommunications operators and large enterprises, innovation as a process-level challenge within telecommunications subcontractor firms remains underexplored. Existing studies predominantly adopt variance-based approaches that examine isolated determinants of innovative performance, such as leadership style, training effectiveness, or knowledge management practices. While valuable, these approaches provide limited explanatory power for diagnosing systemic process failures that constrain innovation in execution-intensive, project-based subcontractor environments. As a result, managers are often left with fragmented prescriptions that do not translate into actionable process redesign.

Consistent with action research literature, sustainable performance improvement requires systematic organizational diagnosis prior to the design and implementation of targeted interventions (Shani and Coghlan, 2019; Susman and Evered, 1978). However, diagnostic research remains underutilized in business process management–oriented innovation studies, despite BPM's core concern with identifying, analyzing, and redesigning organizational processes (Dumas et al., 2018). This represents a critical methodological and theoretical gap in the literature.

Addressing this gap, the present study develops a structured diagnostic framework grounded in business process management (BPM) principles to identify innovation capability constraints within a telecommunications subcontractor firm. Rather than testing hypotheses or evaluating intervention outcomes, the study adopts a diagnostic research design informed by action research logic to systematically uncover internal process misalignments that inhibit innovative performance.

The originality of this study lies in reconceptualizing innovation capability in telecommunications subcontractor firms as a diagnosable process phenomenon rather than as an abstract behavioral or outcome-based construct. By integrating structured organizational diagnostic tools with the Technology Acceptance Model and Learning Organization theory, the study provides a theoretically grounded basis for informing subsequent process-based intervention design in subcontractor environments.

Accordingly, the study addresses the following research question:

How can structured organizational diagnostics, grounded in business process management logic, be systematically applied to identify innovation capability constraints and inform process-based interventions in telecommunications subcontractor firms?

The remainder of the paper is organized as follows. Section 2 reviews relevant literature and outlines the theoretical foundations. Section 3 describes the diagnostic methodology informed by action research principles. Section 4 presents the diagnostic findings. Section 5 discusses the findings in relation to existing literature. Section 6 outlines implications for business process management practice and research, and Section 7 concludes the study.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

Extant literature consistently demonstrates that innovative performance in knowledge-intensive environments are strongly influenced by the effectiveness of training systems, learning organization practices, and career development mechanisms (Beugelsdijk, 2008; Garvin et al., 2008; Manresa et al., 2019). Within technology-intensive sectors such as telecommunications, the translation of training investments into innovative performance is shaped not only by technical content, but also by employees' perceived usefulness and ease of application of new knowledge, as well as the organization's capacity to institutionalize learning. These dynamics highlight the relevance of the Technology Acceptance Model (TAM) and Learning Organization (LO) theory as complementary lenses for examining innovation capability development (Davis, 1989; Kalıpçı, 2023; Pervaiz & Syed, 2025; Senge & Sterman, 1992).

Rather than providing an exhaustive enumeration of innovation determinants, this literature review synthesizes prior empirical studies to identify recurring capability-related constructs and process-level antecedents that inform organizational diagnosis and intervention design. This synthesis-oriented approach aligns with business process management and action research principles, which emphasize understanding systemic process misalignment prior to implementing performance improvement initiatives.

Despite these insights, three critical gaps persist in the literature. First, telecommunications subcontractor firms remain underrepresented in innovative performance research, despite their central operational role in network deployment, optimization, and service assurance. Second, existing studies predominantly examine innovation determinants in isolation, such as training, leadership, or knowledge management, rather than through integrated diagnostic-to-intervention frameworks capable of addressing systemic process failures. Third, while TAM and Learning Organization theory have each been applied independently, limited research integrates these perspectives to inform capability-building interventions tailored to project-based subcontractor environments.

Collectively, these gaps indicate that while the determinants of innovative performance are well established, the literature provides limited guidance on how organizations can systematically diagnose misalignment across interdependent capability development processes prior to intervention.

This study addresses these gaps by synthesizing organizational diagnostic tools with TAM and Learning Organization theory into a coherent conceptual framework. The framework is designed to guide the identification of innovation-related process constraints and to inform the design of targeted, theory-driven interventions for telecommunications subcontractor firms.

By positioning innovation capability as a diagnosable process phenomenon rather than a static organizational attribute, the framework responds directly to calls for more process-oriented and intervention-relevant innovation research.

Theoretical Foundations

This study is grounded in the Technology Acceptance Model and Learning Organization theory to explain how training and capability development interventions are adopted, embedded, and translated into innovative performance within telecommunications subcontractor environments. These theories are employed not as

standalone explanatory models, but as complementary perspectives that collectively explain individual adoption and organizational-level learning processes.

The Technology Acceptance Model explains individual-level adoption of training and new technologies through perceived usefulness and perceived ease of use (Davis, 1989; Venkatesh et al., 2003). In contrast, Learning Organization theory explains how individual learning becomes institutionalized through shared routines, collective reflection, and organizational systems that support continuous improvement (Marsick and Watkins, 2003; Pervaiz & Syed, 2025; Senge & Sterman, 1992).

Together, these theories provide complementary explanatory power. TAM addresses the initial acceptance and practical application of training and technological knowledge, while Learning Organization theory explains how such learning is sustained, diffused, and embedded within organizational routines. Action research operationalizes these insights by providing an iterative logic through which diagnosis informs intervention design, implementation, and reflective learning (Shani and Coghlan, 2019).

Importantly, both theories are applied as diagnostic lenses rather than predictive models, consistent with the study's action research and business process management orientation.

Technology Acceptance Model (TAM)

The Technology Acceptance Model posits that perceived usefulness and perceived ease of use are key determinants of individuals' willingness to adopt new technologies and work practices (Davis, 1989). Rooted in the Theory of Reasoned Action (Hill et al., 1977), TAM has been extensively applied in technology-intensive environments to explain user adoption behavior and learning transfer. In telecommunications subcontractor firms, training interventions must demonstrate clear operational relevance to encourage adoption and application. When engineers perceive training as useful and easy to apply in real network environments, they are more likely to transfer learning into optimization activities, problem solving, experimentation, and innovation.

In this study, TAM provides the theoretical basis for understanding how training usability and perceived relevance influence employees' willingness to apply newly acquired competencies, positioning perceived usefulness and ease of use as key antecedents to innovative behavior within telecommunications subcontractor firmss.

Consistent with the diagnostic orientation of this study, TAM is not used to predict adoption outcomes statistically, but to identify potential adoption barriers arising from misaligned training design and delivery processes.

Learning Organization (LO) Theory

Learning Organization theory emphasizes continuous learning, knowledge sharing, and systems thinking as fundamental drivers of sustainable innovation and adaptive performance (Senge & Sterman, 1992). Rather than focusing solely on individual learning, the theory highlights the importance of organizational structures and cultures that enable learning to be retained and leveraged over time. Learning organizations institutionalize learning routines that enable individuals and teams to continuously improve work practices and respond effectively to technological change (Kalıpçı, 2023; Pervaiz & Syed, 2025; Senge and Sterman, 1992). Learning emerges through both internal and external interactions, as employees interpret information and adapt practices to organizational needs (Yang et al., 2004).

Marsick and Watkins' Learning Organization framework highlights learning at individual, team, and organizational levels, integrated through systems thinking and strategic alignment (Kalıpçı, 2023; Marsick & Watkins, 2003; Pervaiz & Syed, 2025; Yang et al., 2004). This perspective directly aligns with the diagnostic findings of this study, which indicate weak knowledge sharing, fragmented learning structures, and limited institutional support for innovation within the subcontractor firm. In telecommunications contexts, learning organization practices are associated with improved service quality, innovation, and competitive advantage (Islam & Tariq, 2018; Opoku & Nyarku, 2022).

From a diagnostic perspective, Learning Organization theory highlights that persistent innovation constraints often stem from failures to institutionalize learning routines, rather than from deficiencies in individual competence alone.

For telecommunications subcontractor firms, applying Learning Organization principles involves fostering an adaptive learning culture, embedding team-based learning through practical technology projects, and aligning training outcomes with evolving 5G and network optimization requirements to ensure that individual learning is translated into organizational-level innovation.

Integration of TAM and Learning Organization Theory

When integrated, the Technology Acceptance Model and Learning Organization theory provide complementary diagnostic insights into innovation capability constraints. TAM explains whether individuals perceive training and technological knowledge as usable and operationally relevant, while Learning Organization theory explains whether such learning is embedded, shared, and sustained at the organizational level. Together, these perspectives enable diagnosis of both individual-level adoption barriers and organizational-level learning failures that constrain innovative performance in subcontractor environments. Within the diagnostic framework, TAM constructs are operationalized through observable indicators such as engineers' perceived relevance of training to live network tasks, ease of applying newly acquired skills in operational environments, and willingness to experiment with optimization techniques. Learning Organization constructs are reflected in observable practices including structured knowledge-sharing routines, cross-project learning mechanisms, and formal linkage between skill development and career progression.

Although the literature identifies a wide range of enablers of innovative performance, this study deliberately prioritizes diagnostically salient organizational mechanisms that address the most critical risks identified through diagnostic analysis. This prioritization reflects a process-oriented perspective, consistent with business process management principles, which emphasizes focused intervention pathway design over variable proliferation.

Accordingly, two targeted intervention pathways are identified. The first is competency-based advanced telecommunications training, aligned with emerging technologies and designed to enhance perceived usefulness and ease of application (Davis, 1989; Kalıpçı, 2023; Pervaiz & Syed, 2025). The second is innovation-linked career development frameworks, intended to institutionalize learning, motivation, and knowledge sharing within the organization (Garvin et al., 2008; Pervaiz & Syed, 2025; Senge & Sterman, 1992)

These intervention pathways were derived from diagnostic findings and translated into theory-informed design inputs for training and capability-building mechanisms intended to enhance innovative performance in telecommunications subcontractor environments.

To support the selection and prioritization of these identified pathways, selected empirical studies examining innovative performance, capability development, and learning-related constructs were systematically synthesized. The key patterns identified from this synthesis informed the grouping of intervention variables relevant to the telecommunications subcontractor context, as summarized in Tables 1 and 2.

Table 1: Summary of Past Studies

Authors Name	**Research Title**	**Year**	**Country of Research**	**Research Index**	**Dependent Variable**	**Independent Variable**		**Conclusion**
						Variable Name	**Result**	
Yanjun Liu and Hui Zhang	Making things happen: How employees' paradox mindset influences	2022	China	WoS	Innovative performance	Paradox mindset	Significant: Strong positive impact on RBSE and individual ambidexterity,	A paradox mindset can significantly enhance an employee's innovative performance

	innovative performance						which in turn significantly affect innovative performance.	by fostering greater role breadth self-efficacy and enabling them to manage explorative and exploitative tasks effectively.
Celia Sama-Berrocal, Beatriz Corchuelo Martínez-Azúa	Agri-food cooperatives: what factors determine their innovative performance?	2023	Spain	WoS	Innovative performance of agri-food cooperatives	Strategy, Culture, Work Climate, Management, Organisation, Market Orientation	All variables were found to significantly impact innovative performance positively.	The study concludes that specific business variables significantly influence the innovative capacity of agri-food cooperatives and that these variables interact differently in cooperative environments compared to other business types.
David Baxter, Nicholas Dacre, Hao Dong, Serkan Ceylan	Institutional challenges in agile adoption: Evidence from a public sector IT project	2023	UK	WoS	Innovative performance and improvement in IT project management	Agile practices, institutional logics	significantly contribute to the success of IT projects in the public sector if institutional logics are carefully managed to support Agile principles.	The research concludes that Agile methodologies can significantly contribute to the success of IT projects in the public sector if institutional logics are carefully managed to support Agile principles.
Sama-Berrocal, Celia; Corchuelo Martinez-Azua, Beatriz	Agri-food cooperatives: what factors determine their innovative performance?	2023	Spain	WoS	Innovative performance	Management strategies, organizational culture	Not applicable in qualitative research.	Strategic management in cooperatives crucially impacts innovation.
Chughtai, Muhammad Salman;	Knowledge oriented leadership and employees'	2024	China	WoS	Employees' innovative performance	Leadership style, engagement,	Significant positive effects	Effective leadership fosters

Khan, Hira Salah ud din	innovative performance: a moderated mediation model					knowledge behaviors		significant innovation.
Ahmed, Syed Saad; Guozhu Jia; Khan, Muhammad Mumtaz	Examining intellectual capital and knowledge absorptive capacity for high innovative performance	2023	Pakistan	WoS	Innovative performance	Intellectual capital components	Knowledge acquisition: Negative; Other dimensions: Positive	Intellectual capital, when effectively managed, significantly enhances innovative performance through proper knowledge management and absorption, except in cases where excessive external knowledge acquisition may disrupt internal processes.
Corchuelo Martinez-Azua, Beatriz; Eugenio Lopez-Salazar, Pedro; Sama-Berrocal, Celia	Determining Factors of Innovative Performance: Case Studies in Extremaduran Agri-Food Companies	2020	Spain	WoS	Innovative Performance	Management, Strategy, Structure, Culture, Climate, Market Orientation	Not applicable as it's qualitative research.	Comprehensive management and strategic innovation are critical for advancing innovative performance in agri-food sectors. Emphasizes the importance of integrating various business variables for effective innovation management.
Carvache-Franco, Orly; Carvache-Franco, Mauricio; Carvache-Franco, Wilmer; Bustamante-Ubilla, Miguel A.	The Relationship between Human-Capital Variables and Innovative Performance: Evidence from Colombia	2022	Colombia	WoS	Innovative performance	R&D workers, Workers with higher education	R&D workers: Significant; Workers with higher education: Significant	Human capital is crucial for driving innovation in manufacturing, with significant contributions from educated and R&D-

								involved workers.
Liu, Jili; Liu, Guoxin; Cui, Hainan; Chen, Yuehua	The Chinese automobile industry's research and development capability and innovative performance	2023	China	WoS	Innovative performance	Distributed innovation, R&D capabilities	Significant	Distributed innovation enhances R&D and innovative performance in the automobile industry.
Gu, Wenjun; Shu, Luchengchen; Chen, Wanning; Wang, Jinhua; Wu, Dingfeng; Ai, Zisheng; Li, Jiyu	Evaluation of Chinese healthcare organizations' innovative performance in the digital health era	2023	China	WoS	Innovative performance	Digital health metrics, Healthcare worker count	Sci-tech relevance indicators showed strong positive correlation with innovative performance scores.	The study provides a robust framework for assessing healthcare innovative performance, highlighting the critical role of digital health integration.
Samie, Mohammad Ebrahim; Jazghani, Farshad	Effect of knowledge management on innovative performance with the mediating effect of unlearning	2022	Iran	WoS	Innovative performance	Knowledge management processes	Significant	KM significantly enhances innovation through effective unlearning, highlighting the need for strategic unlearning in organizational contexts.
Sarwar, Uzma; Zamir, Samina; Fazal, Kiran; Hong, Yang; Yong, Qi Zhan	Impact of leadership styles on innovative performance of female leaders in Pakistani Universities	2022	Pakistan	WoS	Innovative performance	Leadership styles	Significant	Effective leadership styles significantly enhance innovative performance in educational settings.
Ting, Irene Wei Kiong; Sui, Hai Juan; Kweh, Qian Long; Nawanir, Gusman	Knowledge management and firm innovative performance with the moderating role of transformational leadership	2021	Malaysia	WoS	Firm innovative performance	Knowledge management processes, Transformational leadership	Knowledge management: Significant; Transformational leadership: Negative moderation	Knowledge management is crucial for innovation but requires careful leadership to harness its full potential effectively.

Li, Tong; Tang, Ningyu	Inclusive Leadership and Innovative Performance: A Multi-Level Mediation Model of Psychological Safety	2022	China	WoS	Innovative performance at individual and team levels	Inclusive leadership, Psychological safety	Significant positive impact of inclusive leadership on psychological safety and innovative performance.	Inclusive leadership effectively enhances innovative performance by fostering an environment of psychological safety.
Dinu, Elena; Vatamanescu, Elena-Madalina; Staneiu, Roxana-Maria; Rusu, Mihaela	An Exploratory Study Linking Intellectual Capital and Technology Management towards Innovative Performance in KIBS	2023	Romania	WoS	Innovative performance in KIBS	Intellectual capital components	Not applicable as it is qualitative research.	Integrating IC and technology management enhances innovation in KIBS, with transformational leadership playing a key role.
Elayan, Malek Bakheet; Hayajneh, Jamal Abdelrahman M.; Abdellatif, Mamdouh Abdallah Mohamed; Abubakar, A. Mohammed	Knowledge-based HR practices, π-shaped skills and innovative performance in the contemporary organizations	2023	Saudia Arabia	WoS	Innovative performance	Knowledge-based HR practices, π-shaped skills	Significant	Knowledge-based HR practices effectively foster π-shaped skills, enhancing innovative performance.
Zhang, Lizhe	Impact of psychological contract breach on firm's innovative performance: A moderated mediation model	2022	China	WoS	Innovative Performance	PCB, KH, MD, PSS	PCB to KH: Not Significant; PCB to MD: Significant	Psychological contracts are crucial in managing firm innovation, especially with moderating and mediating roles considered in organizational behavior.
Liu, Bing; Liu, Mengli; Wang, Huijuan; Yang, Yuanqi; Ma, Ying; Wei, Xin	Can patient gratitude expression boost innovative performance? The role of work meaningfulne	2022	China	WoS	Innovative performance	Patient gratitude expression, Work meaningfulness, Supervisory support	Significant	Patient gratitude and supervisory support are crucial for enhancing nurses' innovative performance

	ss and supervisory support							through increased work meaningfulness.
Dominguez Gonzalez, Rodrigo Valio	Innovative performance of project teams: the role of organizational structure and knowledge-based dynamic capability	2022	China	WoS	Innovative performance in project teams	Organizational structure, Knowledge-based capabilities	Significant	Integrating structured management and dynamic capabilities is crucial for maximizing project team innovation.
Carvache-Franco, Orly; Carvache-Franco, Mauricio; Carvache-Franco, Wilmer; Bustamante-Ubilla, Miguel A.	The Relationship between Human-Capital Variables and Innovative Performance: Evidence from Colombia	2022	Colombia	WoS	Innovative performance	R&D workers, Workers with higher education	R&D workers: Significant; Workers with higher education: Significant	Human capital is crucial for driving innovation in manufacturing, with significant contributions from educated and R&D-involved workers.
Jiang, Daokui; Zhang, Yiting; Zhu, Honghong; Wang, Xiaoyu	Effect of empowerment: how and when do high-involvement work practices influence elder employees' innovative performance?	2023	China	WoS	Innovative performance	Empowerment, High-involvement work practices	Significant	Empowerment in work practices is crucial for enhancing innovative performance among elder employees, with organizational support playing a key role.
Meidute-Kavaliauskiene, Ieva; Davidaviciene, Vida; Karakaya, Gencay; Ghorbani, Shahryar	The Measurement of Organizational Social Media Integration Impact on Financial and Innovative Performance: An Integrated Model	2021	Lithuania	WoS	Financial and innovative performance	Social media integration, Social capital, Knowledge management	Significant	Social media, when integrated effectively, can significantly enhance organizational performance through better social capital and knowledge management.

Wei, Minming; Dong, Baiyu; Jin, Pingbin	Do Science Parks Promote Companies' Innovative Performance? Micro Evidence from Shanghai Zhangjiang National Innovation Independent Demonstration Zone	2022	China	WoS	Innovative performance	Location in science parks, Collaboration, R&D investments	Significant	Science parks are vital for fostering innovative performance in companies, primarily through collaboration and R&D.
Huang, Yufang; Chen, Xin	A moderated mediation model of idiosyncratic deals and innovative performance of R&D employees: roles of vitality	2021	China	WoS	Innovative performance	Task and work responsibilities i-deals, Flexibility i-deals	Significant for task and work responsibilities i-deals; not significant for flexibility i-deals with age as moderator.	Idiosyncratic deals tailored to individual strengths can significantly enhance innovative output, especially among older employees.
Li, Bin; Lei, Yongxin; Hu, Minqi; Li, Wenjing	The Impact of Policy Orientation on Green Innovative Performance: The Role of Green Innovative Capacity and Absorptive Capacity	2022	Lithuania	WoS	Green innovative performance	Policy orientation, Green innovative capacity, Absorptive capacity	Significant positive effects of both mediators on green innovation.	Effective policy orientation significantly boosts green innovative performance through enhanced capacities and absorptions of new knowledge.
Xu, Xiaofeng; Chen, Xiangyu; Xu, Yi; Wang, Tao; Zhang, Yifan	Improving the Innovative Performance of Renewable Energy Enterprises in China: Effects of Subsidy Policy and Intellectual Property Legislation	2022	China	WoS	Innovative performance	Subsidy policy, Intellectual property legislation	Significant	Government policies play a critical role in fostering innovation within the renewable energy sector, with subsidies and intellectual protections as key drivers.
Yuan, Yue; Wang, Ping; Tian, SongYuan	How to recover from difficult condition? The relationship between	2022	China	WoS	Innovative performance	Leader creativity goals, Employee creativity goals	Congruence: Significant; High dissatisfaction: Enhanced effect	Congruence in creativity goals underpins recovery and sustained innovative

	leader-employee congruence in creativity goal and innovative performance							engagement in challenging conditions
Ye, Jiangfeng; Wan, Qunchao; Li, Ruida; Yao, Zhu; Huang, Dujuan	How do R&D agglomeration and economic policy uncertainty affect the innovative performance of Chinese high-tech industry?	2022	China	WoS	Innovative performance	R&D personnel agglomeration, R&D capital agglomeration	Personnel: Significant; Capital: Significant	R&D agglomeration significantly drives innovation in high-tech sectors, with economic policy uncertainty moderating this relationship in complex ways.
Karakitapoglu-Aygun, Zahide; Gumusluoglu, Lale; Scandura, Terri A.	How Do Different Faces of Paternalistic Leaders Facilitate or Impair Task and Innovative Performance? Opening the Black Box	2020	Turkey	WoS	Innovative Performance	Benevolent, authoritarian, and authoritative leadership	Benevolent and authoritative: Positive; Authoritarian: Negative	Paternalistic leadership influences employee performance through PsyCap, with varying effects based on leadership style
Delsart, Alienor; Moreau, Maxim; Otis, Colombe; Frezier, Marilyn; Drag, Marlene; Pelletier, Jean-Pierre; Martel-Pelletier, Johanne; Lussier, Bertrand; del Castillo, Jerome; Troncy, Eric	Development of Two Innovative Performance-Based Objective Measures in Feline Osteoarthritis: Their Reliability and Responsiveness to Firocoxib Analgesic Treatment	2021	Canada	WoS	Innovative performance metrics in cats	Objective measurement methods	Significant	Reliable and responsive measures are crucial for effective management of feline osteoarthritis, with clear clinical benefits observed from Firocoxib treatment.
Al-Khatib, Ayman Wael; Al-Fawaeer, Moayyad A.; Alajlouni,	Conservative culture, innovative culture, and innovative performance:	2022	Jordan	WoS	Innovative performance	Conservative culture, Innovative culture	Innovative culture: Positive; Conservative	Organizational culture significantly influences innovative performance,

Mohammed Iqbal; Rifai, Firas A.	a multi-group analysis of the moderating role of the job type						culture: Negative	highlighting the need for cultural alignment in fostering or inhibiting innovation.
Enad Al-Qaralleh, Rawan; Atan, Tarik	Impact of knowledge-based HRM, business analytics and agility on innovative performance: linear and FsQCA findings from the hotel industry	2022	Jordan	WoS	Innovative performance	Knowledge-based HRM, Business analytics, Organizational agility	All factors found significant	Organizational agility is crucial for driving innovation in the hospitality sector, enhanced by HRM and analytics.
Elshaer, Ibrahim A.; Azazz, Alaa M. S.; Fayyad, Sameh	Green Human Resources and Innovative Performance in Small- and Medium-Sized Tourism Enterprises: A Mediation Model Using PLS-SEM Data Analysis	2021	Saudia Arabia	WoS	Innovative performance	Green HR practices, Innovative performance	Significant	Green HR practices are vital for fostering innovation in SMEs within the tourism industry, particularly through sustainability initiatives.
Wahab, Faridah Ab; Subramaniam, Anusuiya; Ho, Jo Ann; Mahomed, Anuar Shah Bali	Augmenting Effect of Inclusive and Ambidextrous Leadership on Public University Academic Staffs' Innovative Performance: The Mediating Role of Innovative Work Behavior	2021	Malaysia	WoS	Innovative performance	Inclusive leadership, Ambidextrous leadership, Innovative work behavior	Significant	Leadership styles significantly determine innovative outcomes in academia, mediated by behaviors fostering innovation.
Wang, Jianhua	Research on the Influence of Dynamic Work Environment on Employees' Innovative Performance	2021	China	WoS	Innovative performance	Dynamic work environment, Job crafting, Voice behavior	Dynamic work environment to Job crafting: Significant; Job crafting to Innovative performance: Significant	Dynamic environments encourage innovation through job crafting, enhanced by proactive

	in the Post-epidemic Era - The Role of Job Crafting and Voice Behavior							voice behavior.
Murrieta-Oquendo, Maria Elena; De la Vega, Ivan Manuel	State and Dynamics of the Innovative Performance of Medium and Large Firms in the Manufacturing Sector in Emerging Economies: The Cases of Peru and Ecuador	2022	Peru	WoS	Innovative performance	Organizational strategies, External business environments	Not specified	Innovative performance in manufacturing is influenced by strategic decisions and external conditions in emerging markets.
Beugelsdijk, S.	Strategic Human Resource Practices and Product Innovation	2008	Netherlands	Scopus	Product innovative performance	Training and development practices	Significant	Strategic HR practices enhance product innovation.
Herrera, C. G. N.	The Relationship Between Training and Innovation in Companies	2017	Colombia	Scopus	Technological and non-technological innovation	Training dimensions	Significant for non-technological innovation; Non-significant for technological innovation	Training impacts non-technological innovation more.
Bikfalvi, A.	The Impact of Training and Development Practices on Innovation and Financial Performance	2019	Spain	Scopus	Innovative performance; Financial performance	TD4CI practices	Significant	TD4CI enhances firm performance.
Shamsuddin, A., & Othman, R.	Perception on Training and Employee Innovativeness: An Evidence from Small Firms	2014	Malaysia	IEEE Xplore	Employee innovativeness (opportunity exploration, idea generation, promotion, implementation)	Perception of training	Significant	Training perception influences innovativeness.
Kalıpçı, M. B.	The mediation model of learning organization, technology acceptance	2023	Turkey	WoS	Service innovation	Learning organization; Technology acceptance (perceived usefulness, perceived ease	Significant	Learning organization significantly mediates the relationship between technology

	and service innovation: Part I					of use, facilitating conditions, social factors)		acceptance and service innovation, indicating that continuous learning structures enhance employees' ability to adopt technology and generate service innovation.
Vargas-Halabi, T. & Yague-Perales, R. M.	Organizational culture and innovation: exploring the "black box"	2024	Costa Rica	Scopus	Innovative Performance (IP); Organizational Performance (OP)	Organizational Culture Dimensions (Denison Model): Mission, Adaptability, Consistency, Involvement	Mission → IP (Positive, strong); Adaptability → IP (Positive, strongest); Consistency → IP (Negative); Involvement → IP (Not significant)	Organizational culture influences innovative performance through complex direct, mediating, and suppressing effects. Mission and adaptability significantly enhance innovation, while excessive consistency constrains it. Innovative performance strongly improves organizational performance.

(Source: Author's Own Work)

While Table 1 presents individual empirical studies and their key outcomes, these findings were further synthesized to identify recurring patterns, dominant variables, and common intervention themes across the broader literature. Accordingly, Table 2 consolidates the Literature Review Matrix by aggregating study characteristics, variable distributions, and methodological trends, thereby providing a theoretically informed and diagnostically oriented foundation for intervention pathway development.

Table 2: Summary of Literature Review Matrix

Parameter	**Result (%)**
Total of Articles Reviewed	42 articles

Article's Index	Web of Science: 37 articles (88%); Scopus: 04 articles (9.52%); IEEE / Others: 1 articles (2.38%)
Year Published	Published from 2021 onwards: 36 articles (85.71%); Published before 2021: 6 articles (14.29%)
Dependent Variable	Innovative performance / Employee / Work / Organizational performance
Independent Variables	Training and training effectiveness; skills and competency development; digital competency; learning organization practices; technology acceptance factors; leadership and HR practices; motivation; knowledge sharing; career development; innovation support mechanisms (multiple variables examined across 41 articles; >100% cumulative occurrence)
Industries Related	Knowledge-Intensive Services (HRM, KM, Innovation) (35%); Technology & ICT (30%); Healthcare (15%); Manufacturing / Industrial (12%); Public Sector / Policy Context (8%).
Subject	Employees / Knowledge Workers (45%); Professionals (Engineers, R&D, ICT staff) (25%); Managers / Leaders (15%); Healthcare Personnel (10%); Academics / Students (5%).
Discipline	Human resource–focused studies: 37 articles (88.09%); Other disciplines (information systems, innovation management, organizational studies): 5 articles (11.91%)
Country of Origin	Malaysia: 3 articles (7.14%); Other countries (China, Turkey, Indonesia, South Korea, Pakistan, Europe, etc.): 39 articles (92.86%)
Type of Study	Cross-sectional studies: 41 articles (97.6%)

(Source: Author's Own Work)

Overall, the Literature Review Matrix indicates a strong concentration of studies linking training effectiveness, competency development, learning organization practices, and technology acceptance factors to innovative and performance outcomes, predominantly within human resource and knowledge-intensive service contexts. However, the evidence also reveals fragmentation in how these variables are operationalized and combined across studies, underscoring the need for an integrated, process-oriented diagnostic and intervention-framing framework that consolidates recurring constructs into coherent intervention pathways.

Action research operationalizes these theoretical insights through iterative cycles of diagnosis, intervention planning, and reflection (Shani and Coghlan, 2019). Within a business process management context, action research provides a structured logic for diagnosing process misalignment and informing the design of targeted interventions, while empirical evaluation is typically addressed in subsequent research cycles.

METHODOLOGY

This study adopts a diagnostic research design informed by action research principles to systematically identify and prioritize innovation capability constraints within a telecommunications subcontractor firm. The primary objective of the study is analytical diagnosis and theory-informed problem structuring, rather than hypothesis testing or statistical generalization. This approach aligns with action research literature, which emphasizes rigorous organizational diagnosis as a prerequisite for effective intervention design and learning (Dumas et al., 2018; Shani and Coghlan, 2019; Susman and Evered, 1978).

In terms of research context and unit of analysis, the study focuses on a telecommunications subcontractor firm operating in a developing market context, where rapid technological evolution from 4G, particularly in 5G-

related deployment and optimization activities, places increasing demands on organizational learning and innovation capability. The unit of analysis is the organization's internal capability development processes, specifically training, knowledge transfer, and career development mechanisms that shape innovative performance at the process level. The case organization is a medium-sized telecommunications subcontractor operating in Malaysia, employing approximately forty technical and engineering staff and primarily engaged in 4G network deployment, optimization, and service assurance projects for Tier-1 operators. The firm exhibits moderate organizational maturity, characterized by project-based execution and vendor-dependent technology adoption (Pervaiz & Syed, 2025).

For data sources and diagnostic inputs, the primary diagnostic insights were obtained through a semi-structured interview (Gawlik, 2017) with a senior director responsible for network operations and capability development, selected based on strategic oversight of innovation-related processes rather than representativeness of individual experience. To enhance analytical rigor, interview insights were triangulated with internal process documentation and evidence from an extensive structured literature review covering innovation capability, training effectiveness, technology acceptance, and learning organization practices. This triangulation was intended to strengthen diagnostic validity rather than to achieve data saturation (Barbour, 2018).

Diagnostic procedure wise, a multi-stage diagnostic procedure was employed to ensure systematic analysis and internal consistency. First, SWOT analysis was conducted to provide a high-level assessment of internal strengths and weaknesses, as well as external opportunities and threats influencing innovation-related processes. This stage enabled the initial identification of capability-related concerns requiring deeper investigation. Second, Fishbone analysis was applied to categorize and visualize potential contributors to innovation capability constraints across multiple dimensions, including technology, processes, people, resources, environmental conditions, and organizational policies. This step supported structured exploration of interrelated causal factors rather than isolated symptoms. Third, Root Cause Analysis was conducted to refine and validate the Fishbone findings by distinguishing critical constraints that directly affect innovative performance from secondary issues with lower strategic priority. This stage emphasized internal process failures and capability misalignments that are amenable to managerial intervention, consistent with business process management principles. Finally, a qualitative 5×5 risk matrix assessment was employed to prioritize identified root causes based on their perceived likelihood of occurrence and potential impact on innovative performance. Diagnostic constraints were prioritized using a two-stage logic. First, Root Cause Analysis was applied to distinguish primary capability-related constraints from secondary contextual factors. Second, the qualitative risk matrix was used to rank only these primary constraints based on likelihood and impact. Constraints classified as high-likelihood and high-impact were advanced for intervention pathway design. This prioritization translated diagnostic insights into focused intervention targets, rather than serving as a quantitative risk evaluation.

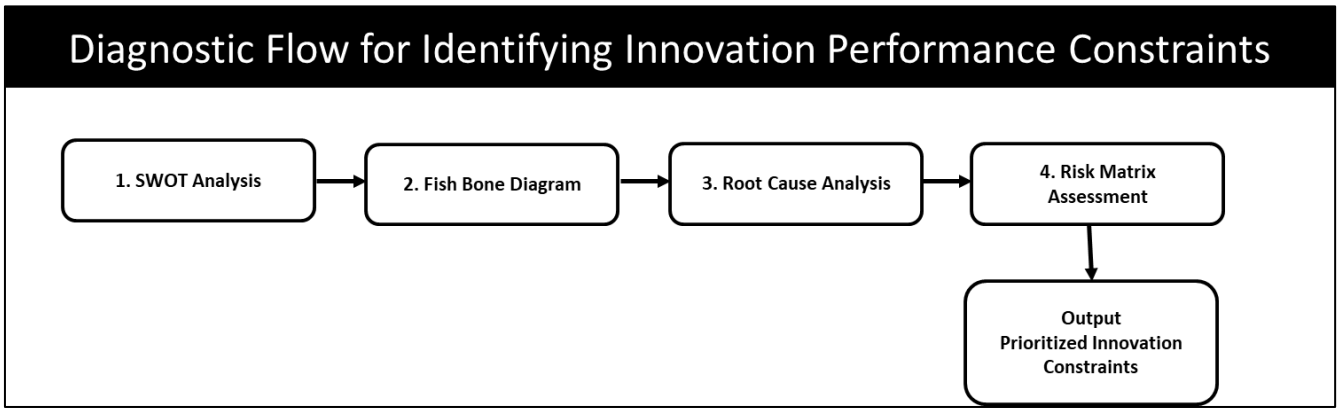
Analytical orientation and research scope, wise the research consistent with its diagnostic and conceptual orientation does not seek statistical generalization. Instead, it provides analytical generalization by demonstrating how structured organizational diagnostics can be systematically applied to identify innovation capability constraints within telecommunications subcontractor environments. The findings inform theory-driven intervention pathways grounded in the Technology Acceptance Model and Learning Organization theory, thereby supporting future empirical testing and subsequent action research cycles. Accordingly, the study prioritizes internal validity and analytical rigor over sample representativeness.

Findings: Diagnostic Analysis of Innovation Processes

A structured diagnostic methodology was employed to examine innovation-related process challenges within the telecommunications subcontractor firm, consistent with action research principles emphasizing systematic inquiry and reflective learning (Chen et al., 2017; Coghlan and Brannick, 2014). The triangulation of multiple diagnostic tools was deliberately adopted to move beyond surface-level symptoms and to identify underlying, systemic organizational constraints affecting innovative performance.

SWOT analysis, Fishbone analysis, Root Cause Analysis, and Risk Matrix assessment were sequentially applied to ensure a structured progression from broad situational assessment to diagnostically prioritized intervention focus areas (Helms and Nixon, 2010; Kovačević et al., 2019; Sakdiyah et al., 2022), as illustrated in Figure 1.

Figure 1: Diagnostic Flow for Identifying Innovative performance Constraints



(Source: Author's Own Work)

Swot Analysis

SWOT analysis was used as an initial diagnostic tool to assess internal and external factors influencing innovative performance within the telecommunications subcontractor firm. By systematically identifying strengths, weaknesses, opportunities, and threats, the analysis provided a high-level overview of organizational positioning and highlighted areas requiring deeper diagnostic investigation (Borthakur, 2024; Chambers et al., 2018; Harding and Long, 2017). Table 3 presents the SWOT analysis of the telecommunications subcontractor firm, summarizing key internal and external factors relevant to innovation capability.

Table 3: SWOT Analysis of a Telecommunications Subcontractor Firm

SWOT Category	**Sub-Category**	**Description**
Strengths (Advantages)	Leading Sub-Contractor Company	Leading telecommunications subcontractor firms in Malaysia.
	Strategic Alliances	Strong partnerships with major telecom vendors such as Huawei and ZTE.
	2G 3G 4G Skilled Workforce	Technology-competent engineers.
Weaknesses (Areas to Improve)	Skill Gaps	Insufficient skills for handling new technologies such as 5G.
	Challenges in Collaboration and Interaction	Inefficient practices; delays in technology transfer due to lack of training.
	R&D Budget	Limited R&D budget and over-dependence on vendors.
Opportunities (Situations to Apply Advantages)	Technological Advancements	Opportunities for learning new technologies through collaboration with vendors and operators.
	Multi-Dimensional Collaboration	Potential for further partnerships.
	Remote Resources Expansion	Opportunities in remote support from lower-cost countries.

Threats (At Risk)	Intense Competition	Increasing competitive pressure driven by continuous technological advancement.
	HR Challenges	Recruitment and retention difficulties.
	Economic Uncertainties	Economic conditions affecting innovative capabilities.

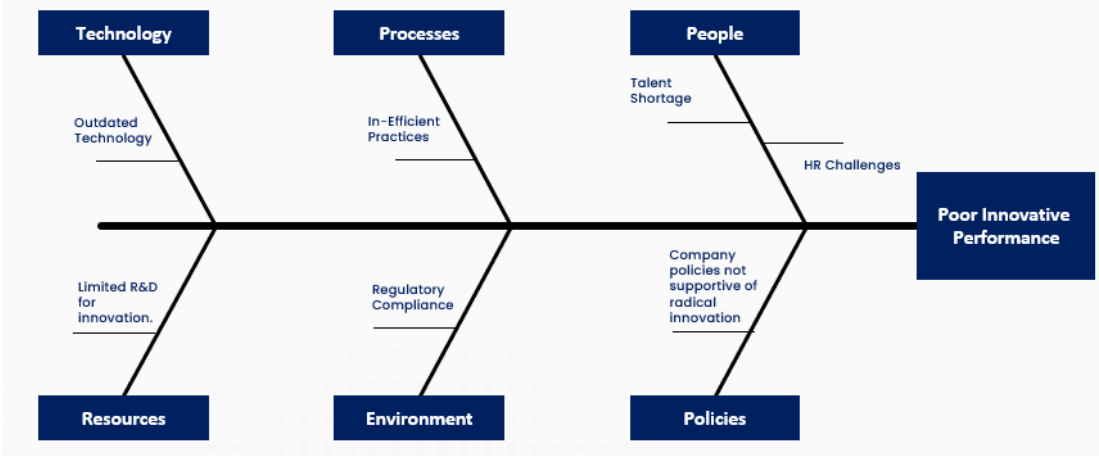
(Source: Author's Own Work)

The SWOT analysis indicates that, despite strong market positioning, strategic partnerships, and an experienced workforce, internal capability-related constraints represent the most salient inhibitors of innovation-related processes. Specifically, skills gaps related to emerging technologies, limited R&D investment, and inefficiencies in collaboration and knowledge transfer were identified as key weaknesses (Ungan, 2006). While external opportunities exist, they are insufficient to compensate for these internal structural limitations, thereby necessitating deeper root cause investigation through subsequent diagnostic tools.

Fishbone Analysis

The Fishbone diagram was employed to systematically visualize and categorize the root contributors to declining innovative performance within the telecommunications subcontractor context. As a structured root cause identification tool, the Fishbone diagram facilitates the classification of contributing factors across multiple dimensions, thereby supporting analytical clarity and targeted intervention design (Coccia, 2020; Sakdiyah et al., 2022).

Figure 2: Fishbone Diagram of Innovative Performance in a Telecommunications Subcontractor Firm



(Source: Author's Own Work)

Figure 2 illustrates that poor innovative performance within the subcontractor firm arises from interconnected technological, process, people, resource, environmental, and policy-related factors rather than from a single isolated cause. The analysis highlights how outdated technologies, inefficient operational practices, talent constraints, limited R&D resources, regulatory pressures, and insufficiently supportive organizational policies collectively constrain innovation capability.

To validate and refine these contributing factors, a Root Cause Analysis was subsequently conducted to examine each category in greater depth and to distinguish critical causes requiring immediate intervention from secondary issues.

Root Cause Analysis

Identifying the fundamental causes of innovation constraints is essential for designing effective and sustainable interventions (Rodríguez-Álvarez et al., 2024; Wahyudiyanto and Wahyuni, 2023). As presented in Table 4, and

guided by the Fishbone analysis, the Root Cause Analysis was further categorized based on insights obtained from a semi-structured interview with a senior telecommunications subcontractor director. The analysis distinguished between critical challenges that directly constrain innovative performance and secondary issues with lower immediate impact.

Table 4: Possible Root Causes of Poor Innovative Performance

Category	**Cause Effect (Level 1)**	**Cause Effect (Level 2)**	**YES (Issues)**	**NO (No Issues)**
Technology	Outdated Technology	Skill gaps: Insufficient skills for handling new technologies	✓	
Processes	Project Management	Inefficient practices: Structured approach required for change	✓	
People	Talent Shortage	Qualification: Lack of qualified human resources	✓	
People	HR Challenges	Retention: Recruitment and retention difficulties	✓	
Resources	R&D Investment	Limited R&D budget; over-dependence on vendors		✓
Environment	Regulatory Compliance	International standards compliance		✓
Policies	Innovation Policy Support	Policy support: Company policies not supportive of radical innovation		✓
SUMMARY			**4**	**3**

(Source: Author's Own Work)

The Root Cause Analysis indicates that the primary contributors to innovation capability constraints are concentrated in technology, process, and people-related factors. In particular, skill gaps associated with emerging technologies, inefficient work practices, and challenges related to talent availability and retention were identified as critical constraints. In contrast, environmental and policy-related factors were classified as secondary, suggesting that innovation limitations are predominantly driven by internal organizational capability alignment rather than external conditions.

To prioritize these identified root causes based on their likelihood and impact on innovative performance, a Risk Matrix Assessment is subsequently applied to systematically determine the most critical areas requiring immediate intervention.

Risk Matrix Assessment

The risk assessment process was employed to prioritize identified root causes based on their relative severity and urgency. Risk assessment is a structured decision-making approach that relies on expert judgment to evaluate the likelihood and potential impact of identified risks using established methodologies. While multiple risk assessment methodologies exist, a pragmatic qualitative 5×5 risk matrix was employed to prioritize the identified issues based on likelihood and consequences for innovative performance (Kovačević et al., 2019).

Table 5: Risk Matrix Assessment

Category	**Description**	**Likelihood (1-5)**	**Consequences (1-5)**	**Priority**	**Category Summary**
Technology	Skill gaps: Insufficient skills for handling new technologies	**5**	**5**	**25**	Likelihood: Almost Certain; Consequences: Catastrophic
Processes	Inefficient practices: Structured approach required for change	3	3	9	Likelihood: Possible; Consequences: Moderate
People	Lack of qualified human resources / engineers	**5**	**5**	**25**	Likelihood: Almost Certain; Consequences: Catastrophic
SUMMARY	**Technology & People Needs most Attention**				

(Source: Author's Own Work)

The Risk Matrix Assessment indicates that technology and people-related issues represent the highest-priority diagnostic concerns, based on their perceived likelihood and potential impact on innovation-related processes. In contrast, process-related inefficiencies were assessed as presenting a moderate but non-trivial level of concern. These results suggest that innovation challenges within the subcontractor firm are primarily driven by capability and talent constraints rather than procedural factors alone. This prioritization ensured that intervention design focused exclusively on constraints that were structurally embedded within internal processes and directly amenable to managerial action, rather than dispersing effort across lower-impact or externally driven issues.. Accordingly, diagnostic prioritization points toward interventions targeting skills development and human capital capability.

Based on the prioritized diagnostic concerns identified through this assessment, subsequent sections integrate relevant theoretical perspectives and empirical evidence to inform the conceptual design of targeted intervention mechanisms, rather than to evaluate intervention effectiveness.

Building on the synthesized patterns, dominant variables, and methodological trends identified in the Literature Review Matrix, a Research Model Matrix was developed to consolidate recurring constructs and align them with targeted intervention mechanisms and outcome variables. Rather than treating innovation determinants as isolated factors, this matrix groups conceptually related variables based on their functional role in capability development and innovation processes.

Research Model Matrix

Accordingly, Table 6 presents the Research Model Matrix, which systematically maps clustered independent variables derived from prior empirical studies to corresponding intervention categories and innovation-related outcomes. This structure provides an integrative bridge between fragmented empirical findings and the targeted, process-based interventions proposed in this study.

Table 6: Research Model Matrix

No.	Independent Variable (Grouped from Literature)	Intervention	Dependent Variable
1	Knowledge-based HR practices, π-shaped skills (Elayan, Malek Bakheet; Hayajneh, Jamal Abdelrahman M.; Abdellatif, Mamdouh Abdallah Mohamed; Abubakar, A. Mohammed, 2023) Training and development practices (Beugelsdijk, S., 2008) Training dimensions (Herrera, C. G. N., 2017) TD4CI practices (Bikfalvi, A., 2019) Perception of training (Shamsuddin, A., & Othman, R., 2014)	Training / Competency Development	Innovative Performance / Innovation
2	Digital health metrics, Healthcare worker count (Gu, Wenjun; Shu, Luchengchen; Chen, Wanning; Wang, Jinhua; Wu, Dingfeng; Ai, Zisheng; Li, Jiyu, 2023) Location in science parks, Collaboration, R&D investments (Wei, Minming; Dong, Baiyu; Jin, Pingbin, 2022) R&D personnel agglomeration, R&D capital agglomeration (Ye, Jiangfeng; Wan, Qunchao; Li, Ruida; Yao, Zhu; Huang, Dujuan, 2022) Benevolent, authoritarian, and authoritative leadership (Karakitapoglu-Aygun, Zahide; Gumusluoglu, Lale; Scandura, Terri A., 2020)	Technology Adoption Enablers (TAM / Digital)	Innovative Performance / Innovation
3	Learning organization; Technology acceptance (perceived usefulness, perceived ease of use, facilitating conditions, soci... (Kalıpçı, M. B., 2023)	Learning Organization Practices	Innovative Performance / Innovation
4	Intellectual capital components (Ahmed, Syed Saad; Guozhu Jia; Khan, Muhammad Mumtaz, 2023) Knowledge management processes (Samie, Mohammad Ebrahim; Jazghani, Farshad, 2022) Organizational structure, Knowledge-based capabilities (Dominguez Gonzalez, Rodrigo Valio, 2022) Social media integration, Social capital, Knowledge management (Meidute-Kavaliauskiene, Ieva; Davidaviciene, Vida; Karakaya, Gencay; Ghorbani, Shahryar, 2021)	Knowledge Sharing & KM Routines	Innovative Performance / Innovation
5	Leadership style, engagement, knowledge behaviors (Chughtai, Muhammad Salman; Khan, Hira Salah ud din, 2024) Leadership styles (Sarwar, Uzma; Zamir, Samina; Fazal, Kiran; Hong, Yang; Yong, Qi Zhan, 2022) Knowledge management processes, Transformational leadership (Ting, Irene Wei Kiong; Sui, Hai Juan; Kweh, Qian Long; Nawanir, Gusman, 2021) Inclusive leadership, Psychological safety (Li, Tong; Tang, Ningyu, 2022) Objective measurement methods (Delsart, Alienor; Moreau, Maxim; Otis, Colombe; Frezier, Marilyn; Drag, Marlene; Pelletier, Jean-Pierre; Martel-Pelletier, Johanne; Lussier,	Leadership & HR Enablement	Innovative Performance / Innovation

	Bertrand; del Castillo, Jerome; Troncy, Eric, 2021) Knowledge-based HRM, Business analytics, Organizational agility (Enad Al-Qaralleh, Rawan; Atan, Tarik, 2022) Green HR practices, Innovative performance (Elshaer, Ibrahim A.; Azazz, Alaa M. S.; Fayyad, Sameh, 2021) Inclusive leadership, Ambidextrous leadership, Innovative work behavior (Wahab, Faridah Ab; Subramaniam, Anusuiya; Ho, Jo Ann; Mahomed, Anuar Shah Bali, 2021)		
6	R&D workers, Workers with higher education (Carvache-Franco, Orly; Carvache-Franco, Mauricio; Carvache-Franco, Wilmer; Bustamante-Ubilla, Miguel A., 2022) Distributed innovation, R&D capabilities (Liu, Jili; Liu, Guoxin; Cui, Hainan; Chen, Yuehua, 2023) Task and work responsibilities i-deals, Flexibility i-deals (Huang, Yufang; Chen, Xin, 2021)	R&D / Capability Investment	Innovative Performance / Innovation
7	Paradox mindset (Yanjun Liu and Hui Zhang, 2022) Strategy, Culture, Work Climate, Management, Organisation, Market Orientation (Celia Sama-Berrocal, Beatriz Corchuelo Martínez-Azúa, 2023) Agile practices, institutional logics (David Baxter, Nicholas Dacre, Hao Dong, Serkan Ceylan, 2023) Management strategies, organizational culture (Sama-Berrocal, Celia; Corchuelo Martinez-Azua, Beatriz, 2023) Management, Strategy, Structure, Culture, Climate, Market Orientation (Corchuelo Martinez-Azua, Beatriz; Eugenio Lopez-Salazar, Pedro; Sama-Berrocal, Celia, 2020) Intellectual capital components (Dinu, Elena; Vatamanescu, Elena-Madalina; Staneiu, Roxana-Maria; Rusu, Mihaela, 2023) PCB, KH, MD, PSS (Zhang, Lizhe, 2022) Patient gratitude expression, Work meaningfulness, Supervisory support (Liu, Bing; Liu, Mengli; Wang, Huijuan; Yang, Yuanqi; Ma, Ying; Wei, Xin, 2022) Empowerment, High-involvement work practices (Jiang, Daokui; Zhang, Yiting; Zhu, Honghong; Wang, Xiaoyu, 2023) Policy orientation, Green innovative capacity, Absorptive capacity (Li, Bin; Lei, Yongxin; Hu, Minqi; Li, Wenjing, 2022) Subsidy policy, Intellectual property legislation (Xu, Xiaofeng; Chen, Xiangyu; Xu, Yi; Wang, Tao; Zhang, Yifan, 2022) Leader creativity goals, Employee creativity goals (Yuan, Yue; Wang, Ping; Tian, SongYuan, 2022) Conservative culture, Innovative culture (Al-Khatib, Ayman Wael; Al-Fawaeer, Moayyad A.; Alajlouni, Mohammed Iqbal; Rifai, Firas A., 2022) Dynamic work environment, Job crafting, Voice behavior (Wang, Jianhua, 2021) Organizational strategies, External business environments (Murrieta-Oquendo, Maria Elena; De la Vega, Ivan Manuel, 2022)	Other Enablers	Innovative Performance / Innovation

	Staff training and development (Vargas-Halabi, T. & Yague-Perales, R. M., 2024)		

(Source: Author's Own Work)

Table 6 demonstrates that the reviewed literature converges around a limited set of dominant construct groupings, particularly training and competency development, technology adoption enablers, learning organization practices, knowledge management routines, and leadership and human resource enablement. These groupings reflect recurring mechanisms through which innovative performance is theorized to be supported across diverse empirical contexts.

Importantly, the consolidation highlights that innovative performance is rarely driven by single variables in isolation. Instead, it emerges from coordinated capability-building processes supported by organizational structures, leadership practices, and learning systems. This insight aligns with the diagnostic findings of the study, which identified capability misalignment and human capital constraints as the most critical innovation-related risks.

By translating fragmented empirical evidence into structured intervention categories, the Research Model Matrix provides a theoretically grounded and process-oriented foundation for informing intervention pathway design. This approach is consistent with business process management principles, which emphasize systemic alignment, intervention focus, and the prioritization of high-leverage organizational mechanisms.

Accordingly, the proposed interventions are intentionally limited to high-leverage organizational mechanisms that directly address the most critical capability gaps identified through the diagnostic analysis and literature synthesis. These mechanisms were selected due to their recurrent association with technology adoption, learning sustainability, and innovative performance across prior empirical studies.

Table 7: Proposed Interventions

Intervention	**Theoretical Alignment**	**Intended Outcome**
Competency-based advanced telecom training	Technology Acceptance Model (TAM); Learning Organization (LO)	Improved conditions for technology acceptance, skill application, and innovation capability.
Innovation-linked career development framework	Learning Organization (LO)	Organizational conditions supporting innovation sustainability through motivation, retention, and knowledge sharing.

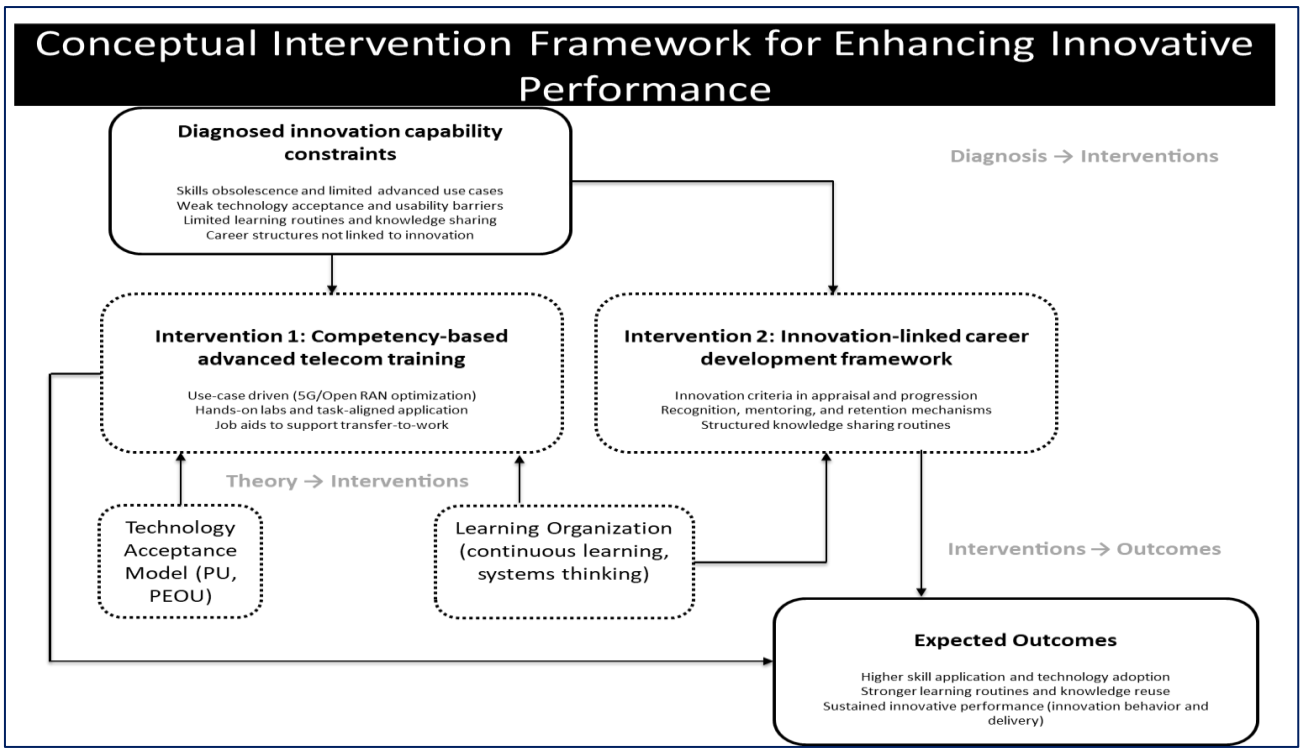
(Source: Author's Own Work)

Together, these interventions operationalize the Technology Acceptance Model and Learning Organization principles by linking skill acquisition, technology usability, and organizational learning mechanisms to conditions that support sustained innovative performance. The competency-based training pathway primarily addresses capability creation by strengthening perceived usefulness, ease of application, and technical proficiency, while the innovation-linked career development framework supports capability retention and diffusion through motivation, recognition, and structured knowledge sharing. Collectively, the interventions address both individual capability development and organizational structures, with the intent of embedding innovation practices institutionally rather than episodically.

Based on this intervention logic, the transition from diagnostic findings to intervention pathways was guided by a process-to-capability mapping logic. High-priority constraints identified in training processes and career development mechanisms were systematically aligned with theory-informed intervention categories derived from the Technology Acceptance Model and Learning Organization principles. Figure 3 presents the resulting

conceptual intervention framework, illustrating the progression from diagnosed innovation capability constraints to targeted intervention pathways and anticipated innovation-related outcomes.

Figure 3: Conceptual Intervention Framework Linking Diagnosis, Interventions, and Outcomes



(Source: Author's Own Work)

Collectively, the conceptual intervention framework integrates diagnostic findings, theoretical foundations, and intervention mechanisms into a coherent process-based logic tailored to telecommunications subcontractor environments. By linking diagnosis, intervention design, and instended outcomes, the framework reflects the action research approach adopted in this study and provides a structured basis for examining how targeted capability-building interventions enhance innovative performance. The following section discusses these interventions in relation to existing literature and theoretical contributions.

DISCUSSION

This study set out to examine innovation capability constraints within a telecommunications subcontractor firm through a structured diagnostic lens grounded in business process management and action research principles. The findings extend existing innovation literature by demonstrating that innovation-related challenges in subcontractor environments are not primarily attributable to isolated resource shortages or individual skill deficits, but rather to systemic misalignment across interdependent capability-building processes.

Consistent with prior studies emphasizing the role of training, learning organization practices, and technology acceptance in shaping innovative outcomes (Garvin et al., 2008; Kalıpçı, 2023; Pervaiz & Syed, 2025; Senge & Sterman, 1992) the diagnostic findings reveal that the absence of coordinated process alignment constrains the translation of technical expertise into sustained innovative performance. In particular, skill development initiatives that are not perceived as operationally relevant, and learning practices that are not institutionally embedded, limit the organization's ability to adapt to rapidly evolving telecommunications technologies.

The integration of the Technology Acceptance Model and Learning Organization theory provides a coherent interpretive framework for understanding these constraints. From a TAM perspective, the findings suggest that perceived usefulness and ease of application of training interventions are critical antecedents to knowledge utilization among technical personnel. However, diagnostic evidence indicates that favorable individual

perceptions alone are insufficient when organizational learning mechanisms fail to support knowledge retention, sharing, and reinforcement over time.

From a Learning Organization perspective, the findings underscore the importance of institutional structures that enable continuous learning beyond episodic training events. Although the diagnostic findings indicate that innovation constraints are predominantly internally driven, external environmental pressures such as rapid technological evolution, vendor-led innovation cycles, and competitive cost pressures indirectly intensify internal capability misalignment by increasing the consequences of weak training alignment and limited learning institutionalization. The diagnostic analysis highlights that innovation capability is weakened when learning remains individualized rather than systematized, corroborating arguments that sustainable innovation depends on organizational routines rather than ad hoc initiatives (Kalıpçı, 2023; Marsick and Watkins, 2003; Yang et al., 2004).

Importantly, the study's findings align with empirical literature indicating that innovative performance emerges from bundled and coordinated capability-building mechanisms rather than single-variable effects. However, this study advances the literature by reframing these mechanisms as diagnostically identifiable process configurations, thereby addressing a key limitation of variance-based innovation studies that provide limited guidance for intervention design in execution-intensive subcontractor contexts.

Overall, the discussion highlights that innovation capability constraints in telecommunications subcontractor firms are best understood as process-level phenomena, shaped by the interaction between training design, technology acceptance, learning institutionalization, and career development structures. While the diagnostic findings are derived from a single organizational context, the study does not seek statistical generalization. Instead, it aims for analytical generalization by demonstrating how structured BPM-oriented diagnostic tools can be systematically applied to identify innovation capability constraints in execution-intensive subcontractor environments operating under comparable technological and organizational conditions. This perspective reinforces the value of diagnostic approaches that precede intervention implementation, particularly in environments characterized by rapid technological change and limited organizational slack.

Implications for Business Process Management

This study offers several important implications for business process management (BPM) research and practice. First, it demonstrates the value of BPM as a diagnostic discipline capable of identifying innovation capability constraints beyond operational inefficiencies. By applying structured diagnostic tools such as SWOT analysis, Fishbone analysis, Root Cause Analysis, and qualitative risk prioritization, BPM provides a systematic logic for uncovering capability-related process misalignment that inhibits innovation.

Second, the findings suggest that BPM research should move beyond process optimization toward capability-oriented process diagnosis, particularly in knowledge-intensive service environments. Innovation capability in subcontractor firms is not solely a function of process efficiency, but of how processes support learning, technology adoption, and human capital development over time. This insight expands the scope of BPM from efficiency-driven improvement to innovation-enabling process design.

Third, the study highlights the relevance of integrating BPM with established organizational and behavioral theories. The combined application of the Technology Acceptance Model and Learning Organization theory illustrates how BPM can be theoretically enriched to diagnose both individual-level adoption barriers and organizational-level learning failures. This integration strengthens BPM's explanatory and prescriptive relevance in innovation-focused research.

From a practical perspective, the findings imply that managers in telecommunications subcontractor firms should adopt diagnostic BPM approaches prior to implementing innovation initiatives. Rather than investing in fragmented training or incentive programs, managers can use BPM-oriented diagnostics to identify high-leverage intervention pathways that address root causes of innovation constraints. This approach supports more targeted resource allocation and reduces the risk of ineffective or misaligned interventions.

Finally, the study reinforces the role of BPM in supporting action research and organizational learning. By embedding diagnostic rigor within iterative learning cycles, BPM can facilitate evidence-informed intervention design while maintaining flexibility for adaptation across subsequent action research phases. This positions BPM as a critical methodological and practical bridge between diagnosis, intervention planning, and long-term capability development.

CONCLUSION

This study examined innovation capability constraints within a telecommunications subcontractor firm using a structured diagnostic approach grounded in business process management and action research principles. By integrating organizational diagnostic tools with the Technology Acceptance Model and Learning Organization theory, the study demonstrates that innovation challenges in subcontractor environments are predominantly internal, process-based, and capability-driven rather than externally imposed.

The diagnostic findings indicate that misaligned training processes, weak technology acceptance conditions, fragmented learning routines, and the absence of innovation-linked career development mechanisms represent the most critical constraints on innovative performance. These constraints limit the organization's ability to translate technical expertise into sustained innovation, particularly in the context of rapidly evolving 5G and emerging telecommunications technologies.

In response, the study proposes two targeted, high-leverage intervention pathways. The first focuses on competency-based advanced telecommunications training designed to enhance perceived usefulness, ease of application, and practical knowledge transfer. The second emphasizes innovation-linked career development frameworks aimed at institutionalizing learning, motivation, and structured knowledge sharing. Together, these interventions address both capability creation and capability retention, thereby embedding innovation within routine organizational processes rather than treating it as an episodic outcome.

The study contributes to innovation and business process management literature in three key ways. First, it addresses a significant empirical gap by focusing on telecommunications subcontractor firms, an operationally critical yet under-researched organizational context. Second, it advances a replicable diagnostic-to-intervention framework that integrates BPM tools with established behavioral and organizational theories. Third, it demonstrates how fragmented innovation determinants identified in prior studies can be consolidated into coherent, process-oriented intervention mechanisms that are directly actionable.

From a practical perspective, the findings underscore the importance of treating training, career development, and knowledge sharing as strategically governed business processes. For telecommunications subcontractor firms operating under high delivery pressure and limited strategic slack, structured diagnostic approaches provide a disciplined basis for prioritizing innovation investments and reducing the risk of misaligned capability development initiatives.

As a diagnostic and conceptual study, the proposed interventions have not yet been empirically evaluated. The findings are context-specific and not intended for statistical generalization. However, the study offers analytical generalization by providing a transferable process logic applicable to similar project-based and knowledge-intensive service environments. Future research should empirically test the proposed interventions through longitudinal or multi-cycle action research designs to examine capability evolution, sustainability of innovative performance, and applicability across organizational and national contexts.

Overall, this study demonstrates that enhancing innovative performance in telecommunications subcontractor firms requires a deliberate shift from ad hoc innovation initiatives toward structured, process-oriented capability development grounded in diagnostic rigor and theoretical integration.

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Ethical Approval

Not applicable.

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Author contributions

Umar Pervaiz conceived the idea, drafted the manuscript, and refined the final version. Obed Rashdi Syed and Rosmini Omar contributed to improving the manuscript through their valuable comments and suggestions throughout the writing process.

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Not applicable.

Declarations

Competing interest

The authors declare that they have no conflict of interest.

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