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Navigating Knowledge in the Hybrid Era: Critical Success Factors for Managing Knowledge in Commercial and Industrial Hybrid Workplaces

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Abstract: Hybrid work (HW) environments are increasingly prevalent, necessitating effective knowledge management practices (KMPs) to ensure organizational success. This study aims to evaluate the critical success factors (CSFs) of KMPs in hybrid workplaces, emphasizing the integration of quality management systems and structured knowledge management frameworks to enhance industry relevance. The research was conducted in two successive steps. First, the literature review was conducted to derive the CSFs of KMPs. As little literature was found regarding CSFs of KMPs in HW, CSFs of KMPs in traditional office-centric work were also considered. Second, a semi-structured interview was conducted to evaluate these CSFs in HW. The participants were from five global organizations across various industry sectors that adopt hybrid work and practice extensive knowledge management (KM). The study shows that CSFs for effective KM in HW are: well-designed processes and policies, comprehensive training and development systems, strategic use of technology, strong leadership support, a culture of cooperation and participation, seamless integration of KM into daily workflows, adaptability to organizational changes, and continues evaluation through feedback mechanisms. These factors collectively enable organizations to manage knowledge effectively, enhancing overall performance and adaptability in hybrid work environments. This study focused on the unique context of hybrid workplaces, a relatively new and evolving work model, and exploring the critical success factors for effective knowledge management within this setting. By examining diverse industries and utilizing in-depth case studies, this research provides practical insights into how organizations can successfully implement knowledge management practices in hybrid settings, thereby contributing to the broader discourse on quality systems and structured KM frameworks.

Keywords: Critical success factor, Knowledge management practices, Hybrid work, Remote work

1. Introduction

The concept of Knowledge Management (KM) has undergone significant transformation with the emergence of hybrid workplaces, which blend traditional office environments with remote work practices. As organizations increasingly embrace hybrid work arrangements, implementing KM in such settings has become pivotal for maintaining competitiveness and fostering innovation. Hybrid workplaces present unique challenges and opportunities for knowledge sharing and collaboration, necessitating adaptive strategies that cater to both physical and virtual environments (Baker, 2021). Hybrid environments require seamless knowledge transfer across digital and physical spaces, necessitating the use of technology-enabled platforms and cultural reinforcement to sustain knowledge flow.

Global events like the COVID-19 pandemic have significantly accelerated the transition to hybrid workplaces. This unforeseen shift forced many organizations to rethink their operational models. The pandemic highlighted the need for robust Knowledge Management practices (KMPs) that are flexible enough to accommodate a dispersed workforce while ensuring uninterrupted access to critical knowledge resources (Clara, 2021). As a result, organizations had to adapt their KM systems to support not only co-located environments but also remote and asynchronous work setups (Deloitte, 2020; Gartner, 2021).

In hybrid workplaces, traditional KM systems, originally designed for co-located environments, often fall short in supporting the needs of a workforce that is no longer bound by physical office spaces. These systems may struggle to facilitate effective knowledge sharing and collaboration when team members are distributed across different locations and time zones (Deloitte, 2021). Consequently, identifying and understanding the critical

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success factors (CSFs) for KM in hybrid environments is essential for developing strategies that ensure continuity and adaptability in the face of evolving work dynamics.

Given the complexities of hybrid work environments, it is clear that organizations must reevaluate their traditional KM practices. While extensive research exists on knowledge management practices in traditional or remote settings, little attention has been given to the unique challenges and opportunities within hybrid workplaces. This study bridges the gap by identifying and analyzing critical success factors (CSFs) specific to hybrid environments, contributing to a practical framework for KM tailored to hybrid organizational structures.

2. Literature Review

2.1 Knowledge Management Practices (KMPs)

Early conceptualizations of KMPs focused primarily on processes of knowledge creation and transfer as well as emphasized the roles of tacit and explicit knowledge (Dalmarco et al., 2017). According to Nonaka (1994), tacit knowledge exists within each individual and should be transferred to turn into explicit one to be useful within the organization. On the other hand, Alavi and Leidner (2001) further defined KM practices as a set of techniques, systems, and processes aimed at creating, storing, transferring, and applying knowledge within organizations.

Recent conceptualizations of KMPs have expanded to include various perspectives on how knowledge is managed. While some studies, such as those by Alegre et al. (2013), identify dissemination and storage as the primary KM practices, others, like Xie, Zou and Qi (2018), propose a more comprehensive view, incorporating acquisition, assimilation, transformation, and exploitation as key dimensions. Lai and Lin (2012) offer another perspective, identifying knowledge creation and acquisition, knowledge diffusion and integration, and knowledge storage as the three dynamic processes that capture the essence of KM practices.

In addition to these evolving views, Alegre et al. (2013) describe KM practices as organizational activities focused on the application and use of knowledge. Contemporary research, such as that by Alcoforado et al. (2019), emphasizes the role of technology in enhancing the accessibility and usability of knowledge across organizations. Al-Sulami et al. (2023) explicitly define KMPs as a collection of processes involved in knowledge creation, storage, acquisition, sharing, and application, with these processes being interconnected to ensure high-quality knowledge that boosts overall performance. The authors approach the five processes (knowledge creation, storage, acquisition, sharing, and application) as a stacked and intertwined set of ingredients that produce an engine for change with robust, valuable knowledge. To this end, effective KMPs are critical to fostering innovation and decision-making as well as staying competitive in fast-evolving industries (Li et al., 2020).

2.2 Critical Success Factors (CSFs) of Knowledge Management Practices (KMPs)

The success of Knowledge Management Practices (KMPs) is essential for enhancing organizational efficiency and innovation, as it directly influences the ability to leverage collective knowledge (Lam et al., 2021). Effective KMPs not only improve decision-making processes but also foster a culture of continuous learning and adaptation within organizations (Donate & Guadamillas, 2011). Researchers highlighted that the effectiveness of KMPs hinges on several critical success factors, as listed in Table 1. To better understand how these factors interrelate and contribute to successful knowledge management practices, Figure 1 illustrates a theoretical framework developed from previous studies.

Table 1: CSFs of KMPs from various authors

Critical Success Factors (CSFs)	Author(s)
People	(Abu-Alsondos, 2023)(Ali, Bajwa & Rehman, 2021)(Kulkarni, Ravindran & Freeze, 2007) (Mostofa, Othman & Zulkifli, 2023)
Process	(Abu-Alsondos, 2023) (Ali, Bajwa & Rehman, 2021)((Mostofa, Othman & Zulkifli, 2023)
Strategy	(Abu-Alsondos, 2023) (Jennex & Olfman, 2003) (Mostofa, Othman & Zulkifli, 2023) (Nadison & Elezi, 2022)
Technology	(Abu-Alsondos, 2023)(Detjen & Webber, 2023)(Dutta, Vedak & Sawant, 2023)(Herlina et al., 2024)(Jennex & Olfman, 2003) (Kanagasabapathy, n.d.) (Kulkarni, Ravindran & Freeze, 2007) (Mostofa, Othman & Zulkifli, 2023) (Ali, Bajwa & Rehman, 2021)

Critical Success Factors (CSFs)	**Author(s)**
Culture	(Abu-Alsondos, 2023) (Detjen & Webber, 2023) (Herlina et al., 2024)(Kanagasabapathy, n.d.) (Kulkarni, Ravindran & Freeze, 2007) (Mostofa, Othman & Zulkifli, 2023)(Nadison & Elezi, 2022) (Ali, Bajwa & Rehman, 2021)(Septari & Latief, 2020)
Leadership	(Cheak et al., 2022) (Detjen & Webber, 2023) (Dutta, Vedak & Sawant, 2023)(Herlina et al., 2024) (Kanagasabapathy, n.d.) (Kulkarni, Ravindran & Freeze, 2007) (Mostofa, Othman & Zulkifli, 2023) (Septari & Latief, 2020)
Employee Training	(Cheak et al., 2022) (Detjen & Webber, 2023) (Kanagasabapathy, n.d.) (Mostofa, Othman & Zulkifli, 2023)(Ali, Bajwa & Rehman, 2021)(Septari & Latief, 2020)
Empowerment	(Detjen & Webber, 2023) (Kanagasabapathy, n.d.)
Communication	(Lewis-Pryde & Evans, 2016)
Organizational Structure	(Mostofa, Othman & Zulkifli, 2023)
Policy	(Arias Velásquez & Mejía Lara, 2021)

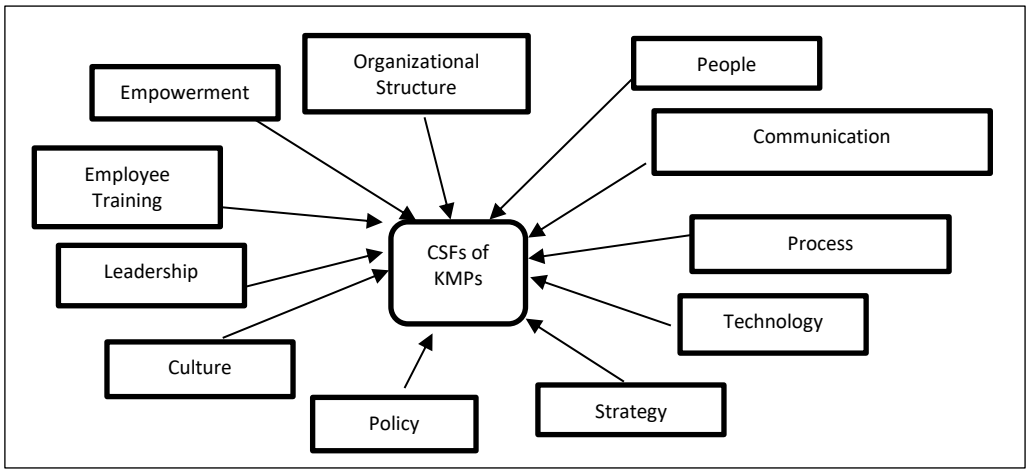


Figure 1: Theoretical Framework of CSFs of KMPs from previous studies

Figure 1 shows the theoretical framework of CSFs of KMPs from previous studies. The success of knowledge management (KM) largely depends on the people involved and the quality of communication within the organization. Effective communication between internal and external stakeholders is crucial for the open sharing, retrieval, organization, and leveraging of knowledge, particularly through social networks (Lewis-Pryde & Evans, 2016). People play a significant role in KM, as their willingness to share knowledge and engage in KM activities directly influences the overall success of KM systems (Abu-Alsondos, 2023). Trust and collaboration among employees are essential for fostering an environment where knowledge is freely exchanged, leading to improved organizational performance.

The processes that govern the creation, sharing, and utilization of knowledge are fundamental to KM success. Clear and standardized processes ensure that knowledge is effectively managed and exploited, promoting better information sharing, collaboration, and decision-making within the organization (Abu-Alsondos, 2023). Technology also plays a critical role in KM, providing the tools and platforms necessary to support these processes. The adoption of advanced technologies, such as intranets, intelligent search techniques, and knowledge management systems (KMS), enhances the organization's ability to apply existing knowledge and create new knowledge, thereby gaining a competitive advantage (Abu-Alsondos, 2023; Kulkarni, Ravindran & Freeze, 2007).

One of the key drivers of success in KM is a well-defined strategy, which provides an alignment of KM initiatives with an organization’s objectives. Strategic planning ensures that knowledge management systems are deployed effectively, allowing organizations to maximize the return on technology investments and achieve their goals (Abu-Alsondos, 2023). Additionally, an efficient KM policy provides a framework for implementing KM practices and advancing organizational objectives such as teaching, research, and operational efficiency (Arias Velásquez

& Mejía Lara, 2021). The integration of KM strategies into the broader organizational strategy is essential for sustaining KM practices and ensuring their long-term success.

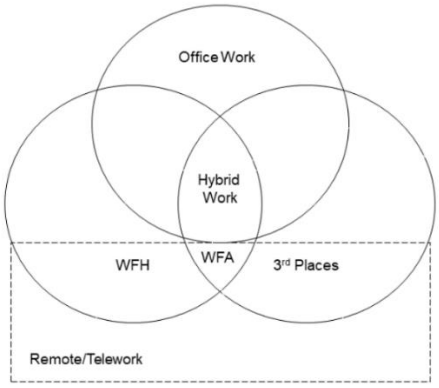
Organizational culture is the most critical moderating factor in KM systems' effectiveness. Positive culture, which supports knowledge sharing, cooperation, and trust, has a highly significant impact on the efficacy of strategic planning, processes, and technology of KM success (Abu-Alsondos, 2023). Leadership also plays a pivotal role in KM, as strong leadership is needed to provide strategic direction, foster a supportive environment, and encourage the creation, sharing, and use of knowledge within the organization (Detjen & Webber, 2023; Herlina et al., 2024). Transformational leadership, in particular, is effective in creating a knowledge-rich environment that promotes innovation and the dissemination of knowledge. Transformational Leadership refers to a leadership style that inspires and motivates employees to go beyond their immediate self-interests to achieve organizational goals (Phong, 2021). This leadership approach fosters a knowledge-sharing culture, encourages innovation, and supports the continuous development of employees, aligning with KM objectives

Employee training is essential for equipping individuals with the necessary knowledge and skills to effectively manage KM systems and contribute to the organization's knowledge base (Cheak et al., 2022). Continuous training programs help employees adapt to the evolving demands of KM, ensuring that they are well-prepared to utilize KM tools and processes. Empowerment is also crucial, as it enables employees to take ownership of their roles in KM, fostering a culture of fluidity and adaptability (Detjen & Webber, 2023). Finally, the organizational structure must support KM initiatives by providing the necessary resources and infrastructure to facilitate knowledge-sharing and collaboration (Mostofa, Othman & Zulkifli, 2023). A well-designed and outcome-defined organizational structure, aligned with KM strategies and practices, is vital for sustaining KM efforts and achieving long-term success.

2.3 Hybrid Work (HW)

In the aftermath of the COVID-19 pandemic, most organizations have adopted a hybrid work model, characterized by a flexible arrangement where employees divide their time between traditional office settings and remote working environments. Hybrid workplaces are designed to harness the benefits of both in-person collaboration and the flexibility of remote work, allowing employees to work from various locations, including their homes or "third places" such as coworking spaces, libraries, or cafes, offering greater autonomy over their work schedules (Felstead & Reuschke, 2020; Waizenegger et al., 2020).

The research conducted by Hopkins and Bardoel (2023) further discovered that hybrid work has become a strategic response to the changing demands of the modern workforce, balancing the traditional office environment with remote work to enhance productivity, employee satisfaction, and organizational resilience. Figure 2 shows the positioning of hybrid work as a flexible work model that combines both office-based work and remote work. Remote work includes various arrangements such as working from home (WFH), working from anywhere (WFA), and working from third places. Work From Home (WFH) refers to a work arrangement where employees perform their job responsibilities remotely from their personal residences. In contrast, Work From Anywhere (WFA) provides employees with the flexibility to work from various locations beyond their home or office, such as coworking spaces, libraries, or cafes. This positioning of hybrid work within academic literature underscores its significance as a flexible working arrangement in the evolving nature of work (Hopkins & Bardoel, 2023; Waizenegger et al., 2020).



Source: Hopkins & Bardoel (2023)

Figure 2: The positioning of hybrid work within the existing academic literature

Recent studies have highlighted the growing preference for hybrid work models among knowledge workers worldwide. Knowledge workers are defined as professionals whose primary role involves handling, analyzing, and generating knowledge-based outputs, often using specialized expertise, creativity, and technology. Examples include researchers, analysts, IT specialists, consultants, and professionals in education and finance. In June 2022, Gallup surveyed a nationally representative sample of 8,090 remote-capable employees in the US, finding that 60% now prefer hybrid work options (Wigert & Agrawal, 2022). Similarly, a pulse survey from Future Forum in July 2022, which included 10,646 knowledge workers globally, revealed that hybrid work is already the dominant business model for 49% of these workers (Forum, 2022) and an April 2022 study of 1,421 Australian knowledge workers shows a majority (54%) following a hybrid work model, with 23% still working remotely full-time and 22.9% back in the office full-time (Hopkins & Bardoel, 2022). Consistent with these findings, hybrid work is expected to persist in the post-pandemic era (Tran, 2022).

3. Methodology

3.1 Research Setting

The study was conducted as an inductive, qualitative research, focusing on five hybrid workplaces across different industries. The aim was to explore the CSFs of KMPs within these organizations. Case studies were employed, which is particularly effective in providing an in-depth, contextualized understanding of complex phenomena within real-world settings (Yin, 2018). Each organization was treated as a distinct case, allowing for a comparative analysis across cases to identify patterns and unique insights (Eisenhardt, 1989).

3.2 Data Collection

Data was collected from November 2023 to April 2024 via in-depth interviews with employees across various functions and levels, including directors, specialists, managers, and engineers. The selection of participants from different organizational levels was intentional, aiming to capture a wide range of experiences and perspectives related to KMPs. This diversity enriched the study's findings by offering varied insights into KM practices across different operational environments.

Participants were drawn from five hybrid workplaces that have been practicing hybrid work for a minimum of three years, with most having adopted this arrangement since 2020, providing a robust foundation for assessing the long-term impact and sustainability of hybrid work models. Moreover, these organizations were also recognized for their best practices in KM, which become a cornerstone in hybrid environments for maintaining effective collaboration, fostering innovation, and ensuring organizational productivity. The strategic selection of these organizations allowed for a comprehensive exploration of the relationship between well-established KM practices and the successful implementation of hybrid work.

The data for this study was gathered through semi-structured interviews, which is a popular method within the qualitative research framework. The interviews were carried out online via Google Meet or Microsoft Teams and lasted between 20 and 30 minutes. Such a method allowed the participants to manage the interview schedule, which was particularly relevant in the hybrid working environment. Data collection continued until theoretical saturation was reached, meaning that no new categories relevant to the research questions emerged, ensuring informational redundancy (Saunders, Lewi & Thornhill, 2009). Additionally, all personally identifiable information was removed, and companies were referred to only by their industry type (see Table 2) to ensure confidentiality and anonymity.

Table 2: Participants of the Study

Participant	Position	Company	Industry/Sector
Participant 1	Deputy Director of Research	Company A	Financial Services
Participant 2	T&E Specialist	Company B	Oil and Gas
Participant 3	Senior Manager HRM	Company C	Oil and Gas
Participant 4	Software Engineer	Company D	IT Company
Participant 5	Senior Sales Manager	Company E	OEM power generation equipment

3.3 Data Analysis

The qualitative data obtained from interviews were analyzed using thematic analysis, facilitated by the software ATLAS.ti. This method involves coding the data in several phases to identify key themes and patterns related to

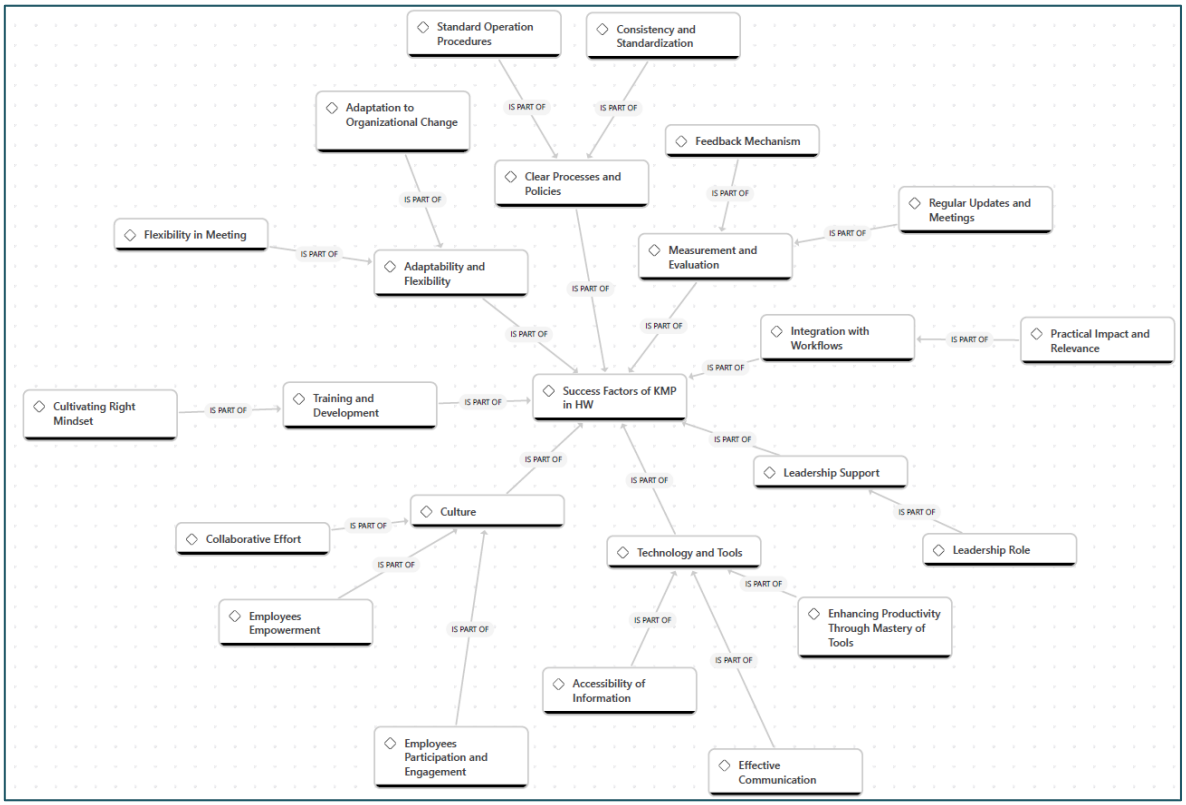
the CSFs of KMPs in hybrid workplaces. The use of ATLAS.ti enables a systematic approach to managing and organizing large datasets, ensuring a thorough exploration of the data while maintaining methodological rigor (Muhr & Friese, n.d.). Thematic analysis is particularly appropriate for studies like this, where textual data are interpreted following a detailed and nuanced assessment to facilitate the understanding of complex phenomena (Braun & Clarke, 2006).

3.4 Verification of Interview Questions and Coding Scheme

To ensure research quality and reliability, a systematic approach was followed. The interview questions were reviewed and verified by experts from the academic area and the industry. The experts, with substantial academic and practical experience in the field, provided critical insights that helped refine the questions to better address the research objectives (Creswell et al., 2010). This verification process helped align the questions with current KM practices and ensured that they were capable of eliciting relevant and meaningful responses from the participants (Patton, 2002). Similarly, the coding scheme used in the thematic analysis was also reviewed and verified by the same experts. This step was especially important to validate the appropriateness of the codes and to ensure that they accurately represented the data (Braun & Clarke, 2006). Expert verification contributes significantly to the credibility of the research findings, providing an additional layer of scrutiny to the analytical processes used (Morse, Olson & Spiers, 2002). It also ensures that the interpretations are grounded in established KM theory and practices, including Nonaka and Takeuchi's (1995) SECI model of knowledge conversion and Alavi and Leidner's (2001) framework on KM systems, thus enhancing the academic integrity of the study.

4. Findings

Our empirical findings demonstrate that the critical success factors of knowledge management practices encompass several key areas that contribute to the effective management and dissemination of knowledge within organizations. As shown in Figure 3, these factors include clear processes and policies, training and development, technology and tools, leadership support, culture, integration with workflows, adaptability and flexibility, and measurement and evaluation.



Source: Authors own work

Figure 3: Theoretical Framework of CSFs of KMPs in hybrid workplaces

4.1 Clear Policies and Processes

Policies and processes play a fundamental role, as they ensure that there are established Standard Operating Procedures (SOPs) for employees to refer to when needed. This facilitates smooth operations but also empowers employees to perform their tasks professionally and properly, as highlighted by Participant 2: *"We need to have a perfect… a proper SOP… If we have available SOP that they can refer to, then they can just carry out their work professionally and properly."* Policies and processes must be supported by well-defined strategies to ensure systematic management of knowledge. SOPs serve as detailed work instructions that guide employees through each step of the process (Dalkir, 2011). These SOPs must be strictly adhered to, rather than being 'referred to when needed,' to ensure consistency, efficiency, and compliance with established knowledge management protocols.

Furthermore, the importance of having a formal policy that encourages information sharing and storage is emphasized by Participant 1, who states, *"Obviously, at the top level, policy is the key. If you have a formal policy of encouraging people to share information and storing information so that people can access it freely."* Consistence in how knowledge is stored and presented is another critical element. As Participant 1 adds, *"You need to be consistent in your application of how that knowledge is stored and how that knowledge is presented."* This ensures that the knowledge management practices are standardized across the organization, reducing ambiguity and enhancing the reliability of the stored information.

On top of this, an effective quality management system is essential to ensure consistency and accountability in knowledge management practices (Ashok Jashapara, 2004). This includes well-documented policies, standardization of processes, and the use of quality assurance mechanisms such as internal audits and feedback loops to maintain knowledge integrity.

4.2 Training and Development

Training and Development also play a pivotal role, particularly in cultivating the right mindset among employees. Participant 4 highlighted the need for a culture where knowledge sharing and management are valued: *"Everybody has to have that good mindset,"*. Continuous training initiatives ensure that employees remain adaptable and proficient in utilizing KM tools and practices. Moreover, fostering a culture of learning and development helps embed knowledge management as a core organizational value, driving sustained engagement and participation across all levels of the organization. Martelo-Landroguez and Cepeda-Carrión (2016) stated that effective knowledge management requires a culture of stewardship, where employees actively take responsibility for maintaining and transferring organizational knowledge. Training should focus not only on technical skills but also on knowledge and training strategies, including Continuous Professional Development (CPD), to ensure long-term knowledge sustainability.

4.3 Technology and Tools

The role of technology and tools is crucial in ensuring the accessibility of information, as emphasized by Participant 5: "*Regardless of where your location, you should be able to access [information].*" The use of technology, particularly cloud-based solutions, facilitates this accessibility, ensuring that employees can access the information they need from anywhere, thus supporting remote and hybrid work environments. Additionally, mastering these tools enhances productivity, as noted by Participant 5: *"If you did not master into that, how you gonna… expedite of the works based on that."* Effective communication is another critical factor, with Participant 2 highlighting the importance of clear and efficient communication channels: *"The communication factor… where the person who highlighting the importance of clear and efficient communication channels: presents it must use a good presentation, material, tools, and at the same time, the person who wants to accept the information also needs to be ready."*

4.4 Leadership Support

Leadership support is a vital component of successful knowledge management practices. Leaders must actively drive the adoption of knowledge management practices and set an example for others. As Participant 3 notes, *"Leaders… have to rally the team to use it, to use whatever system that we have in place."* Leadership's role in fostering a culture that values knowledge management is crucial to ensuring its success across the organization.

4.5 Culture

Culture within the organization, particularly in terms of Employee Participation and Engagement, is also essential. Participant 1 highlights this by stating, *"The key factor would be… participation. Whether people*

actually have the interest in." This indicates that fostering a culture where employees are actively engaged and motivated to contribute to knowledge management is critical for its success. Additionally, Collaborative Effort and Employee Empowerment are necessary to create an environment where all members show stewardship and contribute to the process, ensuring that knowledge is actively maintained and disseminated throughout the organization.

4.6 Integration with Workflows

Integration with workflows ensures that knowledge management practices are not seen as separate from daily work but are embedded within it. As Participant 1 points out, *"Most people… are not really that much concerned with knowledge management unless it affects them on a day-to-day basis."* This indicates the need for knowledge management to be closely aligned with everyday tasks to be relevant and effective.

4.7 Adaptability and Flexibility

Adaptation to organizational change is a crucial factor, as it reflects how organizations evolve their knowledge management practices in response to shifting internal and external environments. Participant 1 highlights the significance of this adaptability by noting, *"…Since then, I've seen a rapid shift in how we do our work and how the company actually promotes sharing information across businesses and sharing knowledge."* This statement underscores the importance of being responsive to change, particularly in how knowledge is shared and managed across different areas of the business. Furthermore, Participant 1 mentions the impact of the COVID-19 pandemic, stating, *"Over the last few years, particularly after COVID, that allowed us to get more in touch with other teams."* This illustrates how significant events can drive organizations to enhance their knowledge-sharing practices, leading to better communication and collaboration across teams.

4.8 Measurement and Evaluation

Finally, measurement and evaluation also play a critical role in the success of knowledge management practices. One of the key aspects of this is the implementation of effective Feedback Mechanisms. Participant 2 emphasizes the importance of gathering feedback, stating, *"You can get feedback from every one of us."* This practice ensures that employees can share their challenges and expectations, allowing the organization to provide the necessary support. Additionally, Participant 2 highlights how feedback mechanisms contribute to continuous improvement: *"If they have any challenges in their work, they can share… what they need help with, so we can assist further from that."* This approach not only helps in addressing immediate concerns but also fosters a culture of continuous learning and development including structured Continuous Professional Development (CPD) programs, to ensure that employees remain competent and adaptable.

Regular updates and meetings are components of effective measurement and evaluation. Participant 2 explains, *"My company has this practice where every month, or every week if there are changes, they will send an email to us, and then we have this team meeting every once every two weeks with the team leader, with everyone for knowledge sharing."* Regular updates ensure that employees are kept informed about any changes or developments, while periodic meetings provide a platform for knowledge sharing and collective learning. These practices are vital in fostering knowledge sharing, collaboration, and continuous learning across teams and departments, which is essential for the success of knowledge management initiatives.

5. Discussion

The findings from this study suggest that several critical success factors (CSFs) are pivotal for the successful implementation of Knowledge Management Practices (KMPs) in hybrid workplaces. These factors include clear processes and policies, training and development, technology and tools, leadership support, organizational culture, integration with workflows, adaptability, and continuous evaluation through feedback mechanisms. The presence of well-defined Standard Operating Procedures (SOPs) ensures that employees have access to the necessary guidelines to execute their roles effectively, thereby enhancing operational efficiency and professionalism within the organization. This corroborates the findings of Nonaka (1994) and Alavi and Leidner (2001) that highlight the importance of structured processes for converting tacit knowledge into explicit knowledge, ultimately fostering better knowledge utilization within organizations.

The integration of training and development into KMPs plays a significant role in ensuring that employees possess the requisite skills and mindset to contribute to knowledge sharing and management effectively. The study participants emphasized that continuous training initiatives not only enhance employees' proficiency in using KM tools but also embed a culture of learning and knowledge sharing as a core organizational value. This aligns with Donate and Guadamillas (2011) assertion that continuous learning and adaptation are fundamental

to leveraging collective knowledge. Moreover, the emphasis on training aligns with the broader perspective of KMPs as a set of interconnected processes aimed at fostering a learning-oriented organizational culture (Lai & Lin, 2012).

Technology and tools emerge as another critical enabler of KMPs in hybrid workplaces, especially in the context of remote and hybrid work environments. The study reveals that cloud-based solutions and advanced communication tools facilitate seamless access to information regardless of employees' locations, enhancing productivity and collaboration. These findings are consistent with Alcoforado et al. (2019), who emphasized the role of technology in improving knowledge accessibility and usability across organizations. The implementation of such technology-driven KM systems supports the transformation of knowledge into actionable insights, promoting innovation and organizational agility, as noted by Xie, Zou, and Qi (2018).

Leadership support is also found to be a decisive factor in the success of KMPs. The results highlight that strong leadership is necessary to drive the adoption of knowledge management systems and foster a supportive environment for knowledge sharing. Leaders must serve as role models, advocating for the use of KM practices and encouraging employees to actively engage in these initiatives. This is in line with research by Detjen and Webber, (2023) and Herlina et al. (2024), which indicates that transformational leadership can significantly impact the dissemination and utilization of knowledge within organizations. Such leadership creates a knowledge-rich environment that supports continuous learning and innovation, making it an essential component of effective KM strategies.

A positive organizational culture is crucial for the success of KMPs, particularly in fostering an environment that encourages trust, collaboration, and knowledge sharing among employees. The study participants emphasized the role of culture in enhancing participation and engagement in KM activities. This view is supported by Septari and Latief (2020), who argued that organizational culture acts as a moderator, influencing the effectiveness of strategic planning, processes, and technology in knowledge management systems. A supportive culture not only motivates employees to share knowledge but also ensures the alignment of KM practices with broader organizational goals.

Lastly, the integration of KM practices into daily workflows and the adaptability of these practices to organizational changes are critical for sustaining KM initiatives over time. The findings indicate that KM practices must be closely linked to employees' everyday tasks to be effective and relevant. This approach ensures that knowledge management is not perceived as an additional burden but as an integral part of the workflow. Moreover, the adaptability of KM practices to respond to shifts in internal and external environments, as highlighted by the participants, is essential for maintaining the relevance and effectiveness of KM systems. This is consistent with the findings of (Abu-Alsondos, 2023), who highlighted the need for KM practices to be flexible and responsive to changing organizational contexts.

In summary, the study's findings demonstrate that successful implementation of KMPs in hybrid workplaces requires a holistic approach that incorporates clear processes and policies, continuous training and development, appropriate technology and tools, strong leadership support, a positive organizational culture, integration with workflows, and adaptability to organizational changes. The integration of Knowledge Management (KM) and Quality Management (QM) is essential for improving organizational processes and efficiency. KM plays a critical role in quality systems by facilitating the structured capture, sharing, and application of knowledge within an organization (Baltus, 2001). The findings offer new perspectives that enable organizations to create a knowledge-rich environment that fosters innovation, enhances decision-making, and ensures sustainable performance in hybrid work settings. Unlike prior studies focused on either traditional or remote work settings, this study sheds light on how hybrid work environments necessitate distinct approaches to processes, leadership, and technology. For instance, the findings reveal the importance of integrating KM practices directly into hybrid workflows, a factor previously overlooked in the literature.

6. Conclusion and Recommendations

6.1 Conclusion

The success of knowledge management (KM) in organizations is deeply rooted in the involvement of people and the quality of communication within the organization. The literature emphasizes that effective communication between internal and external stakeholders is crucial for the open sharing, retrieval, and organization of knowledge, which is often facilitated by social networks (Lewis-Pryde & Evans, 2016). Trust and collaboration among employees are vital, as they foster an environment where knowledge is freely exchanged, ultimately leading to improved organizational performance (Abu-Alsondos, 2023). This is echoed in the findings, where the

importance of policies, process descriptions, and Standard Operating Procedures is highlighted as essential for ensuring knowledge standardization and compliance (Participant 2).

Moreover, having formal policies that promote information sharing and standardized practices ensure that knowledge management is reliable and consistent across the organization, reducing ambiguity (Participant 1). Technology and tools also play a pivotal role in KM by providing the necessary platforms and systems to support knowledge-sharing processes. The adoption of advanced technologies like cloud-based solutions enhances accessibility, enabling employees to access information regardless of their location, which is especially important in remote and hybrid work environments (Participant 5). This technological support is aligned with the literature, which argues that such tools are crucial for leveraging existing knowledge and creating new knowledge, thus providing a competitive advantage (Abu-Alsondos, 2023; Kulkarni, Ravindran & Freeze, 2007). Additionally, the findings underscore the importance of leadership in driving KM practices, as leaders must champion these initiatives and ensure that knowledge management systems are effectively utilized across the organization (Participant 3). This aligns with the literature that highlights the need for strong leadership to provide strategic direction and create a supportive environment for knowledge management (Detjen & Webber, 2023).

Finally, the findings emphasize the significance of organizational culture, adaptability, and continuous evaluation in the success of KM practices. A culture that encourages participation and collaboration is crucial, as it motivates employees to engage in knowledge-sharing activities and take ownership of their roles in KM (Participant 1). This is supported by the literature, which identifies organizational culture as a critical factor in the effectiveness of KM systems (Abu-Alsondos, 2023). Moreover, the ability to adapt to organizational changes, as seen during the COVID-19 pandemic, is essential for maintaining effective knowledge management practices (Participant 1). Continuous measurement and evaluation, through feedback mechanisms and regular updates, ensure that KM practices are constantly improving and remain relevant to the organization's needs (Participant 2). The organizations must conduct continuous assessments, evaluating the effectiveness of their knowledge-sharing strategies, technology integration, and compliance with quality management standards to ensure the sustainability and adaptability of knowledge management practices, as highlighted in the literature (Mostofa, Othman & Zulkifli, 2023).

This research highlights the framework of essential factors that contribute to the success of knowledge management (KM) practices within organizations. Effective KM relies heavily on a quality system and management approach, which includes policies and strategies, process descriptions, and operational instructions like standard operating procedures, which ensure consistency and professionalism in knowledge sharing and utilization. The role of technology is also crucial, as it provides the necessary tools to facilitate accessibility and enhance productivity across remote and hybrid work environments. Leadership support emerges as a vital driver in fostering a culture of knowledge sharing, collaboration, and engagement, while a supportive organizational culture further motivates employees to actively participate in KM activities. Moreover, the ability to adapt to organizational changes and the implementation of continuous measurement and evaluation mechanisms are key to sustaining KM practices and ensuring their long-term effectiveness. These factors collectively enable organizations to manage and leverage knowledge effectively, ensuring that knowledge is effectively shared and utilized across the organization, ultimately leading to improved organizational performance and competitiveness. In summary, this study provides a novel contribution by developing a comprehensive framework of CSFs for KM in hybrid workplaces. These findings not only address the gaps in KM research but also equip organizations with actionable strategies for fostering knowledge sharing, innovation, and adaptability in hybrid work settings.

6.2 Recommendations

To enhance the generalizability and applicability of findings, future research should consider expanding the sample size and including a wider range of industries and organizational sizes. This would provide a more comprehensive understanding of knowledge management practices (KMPs) across diverse contexts, including sectors not represented in the current study, such as healthcare, education, and manufacturing. Additionally, incorporating longitudinal studies would offer insights into how KMPs evolve over time, especially in response to changes in work environments like the increasing adoption of hybrid work models. Such an approach could help explore the long-term impact of critical success factors (CSFs) on organizational performance and innovation.

Researchers are also encouraged to explore the specific challenges associated with knowledge management in hybrid workplaces. Investigating issues such as maintaining a cohesive organizational culture, ensuring effective communication, and managing technology adoption could yield targeted strategies for improving KMPs.

Addressing these challenges would be particularly beneficial for organizations seeking to optimize their knowledge management systems within the context of hybrid work arrangements.

As hybrid work environments continue to expand globally, future studies should focus on understanding how cultural differences influence knowledge management practices. Examining how organizational and national cultures interact to shape KMPs in multinational or cross-cultural hybrid workplaces could provide valuable insights. This would enable organizations to tailor their KM strategies to suit diverse cultural contexts and foster better collaboration across geographically dispersed teams.

Furthermore, future research should consider employing a mixed-methods approach that combines quantitative and qualitative data collection techniques. This would enable a deeper exploration of KMPs while providing a broader perspective on the effectiveness of these practices. Using multiple methods, such as surveys, interviews, and case studies, would allow for more robust data triangulation and increase the reliability of the findings. Finally, researchers could investigate the role of emerging technologies, such as artificial intelligence (AI) and machine learning, in enhancing KMPs in hybrid work settings. Exploring how these technologies can support knowledge creation, sharing, and storage would provide organizations with cutting-edge solutions to manage knowledge more effectively. This would also address the evolving demands of hybrid work environments, enabling organizations to stay competitive and agile in the face of ongoing digital transformation.

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Utilising Manager's Competency, Employee's Awareness and Motivation for Promoting Cybersecurity Protective Behaviour

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Abstract: Technological developments have seen a rapid evolution in the last decade. The complexity and cyber-attacks increase within the advancement of technology and artificial intelligence, this creates pressures for corporations to adopt the necessary methods to ensure they function in a safe environment. This study attempts to assess the role of managers' informational security intelligence (MISI) along with procedural information security countermeasure awareness (PCM) and cybersecurity protection motivation in promoting cybersecurity protective behaviour among employees in the public sector within the context of UAE. The study employs quantitative cross-sectional design with primary data collected from 520 employees in nine listed organisations in the public sector of Abu Dhabi, UAE. The data is analysed using Partial Least Square Structural Equation Modelling (PLS-SEM). The findings indicated that perceived threat susceptibility, self-efficacy, information security problem-solving, and social competence significantly affect cybersecurity protective behaviour. Additionally, MISI positively influences PCM, which in turn affects cybersecurity protection motivation. Finally, attitude moderates the relationship between self-efficacy and cybersecurity protective behaviour. The study extended the protection motivation theory by investigating the capabilities and competences of managers related to information security in addition to adding the attitude as a moderating variable. The findings offer valuable insights for policy makers in the aspect of ensuring the implementation of cyber security national strategies; for managers in organisations in the aspect of promoting awareness and capabilities among themselves and among their employees through educational and training programs to enhance their cybersecurity practices and mitigate risks.

Keywords: Cybersecurity protective behaviour, Information security, Cybersecurity, Public sector, Information security intelligence, Information security competency

1. Introduction

Technological developments have seen a rapid evolution in the last decade. As technology evolves, business practices and methods have also drastically changed. In this direction, organisations now carry out their online transaction in a manner that achieves better performance, customer satisfaction and safety and security assurance. For this, they store their data digitally (Shaban, Farhan and Ahmed, 2022). Along with the efficiency of storing such data to be accessible anytime and anywhere, their vulnerability remains as a key issue in information security (Mohammed, 2019). In this context, organisations rely on clouds to store their data (Jang-Jaccard and Nepal, 2014) which implies that cybersecurity is the need of the hour.

The complexity and cyber-attacks increase within the advancement of technology and artificial intelligence (Siponen, Adam Mahmood and Pahnila, 2014; Li *et al.*, 2019). It is evident in the literature that the lack of attention to security measures and underestimating cybersecurity threats significantly influence the effect of security policies (Han, Kim and Kim, 2017; Li *et al.*, 2019). Further, exposure to cybersecurity training and knowledge does not necessarily result in higher extent of cybersecurity behaviour (Zwilling *et al.*, 2022).

Security behaviour have been studied in research from different perspectives such as behaviour of management leadership on employee's security behaviour (Guhr, Lebek and Breitner, 2019), employees' resilience in dealing with Information Technology (IT) security threats (Liang *et al.*, 2019) and cybersecurity policy awareness on employee's cybersecurity behaviour (Li *et al.*, 2019).

As more and more organisations become increasingly concerned about the cybersecurity threats in the workplace and have invested huge resources to tackle such issues, especially in the new environment after the pandemic where adopting technology became more essential (Vahdat, 2022).

In the UAE context, there is a remarkable growth in adopting technology among organisation due to the focus of the government and organisations in the United Arab Emirates (UAE) on innovation and technology investments

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to improve firm performance and achieve growth (Almehairbi, Jano and Mosali, 2022). Further, the establishment of smart government was one of the significant steps to support adopting technology in UAE business environment (Haddad *et al.*, 2020). When it comes to technological innovation in the public sector, UAE leads the Arab world globally in the aspect of open government, big data, mobile government and cloud computing as emerging tools to promote the performance of the public sector (Ahmat *et al.*, 2024). Further, Al Sayegh et al. (2023) indicate that in the UAE, smart government is an outcome of e-government initiative led by the government. In this context, the services of e-government include government to citizen, employee, business and to government to government (G2G). For instance, residents obtain smart pass ID number that can used to access all the portals of government to avail the available services. In the aspect of G2G services, better utilization of public resources is aimed by connecting all the public institutions and grouping all the services together under a single e-government portal (Eid, Selim and El-Kassrawy, 2021; Al Sayegh *et al.*, 2023).Under the current circumstances, more than 82% of organisations in the UAE's public sector have faced one or more cyber-attacks in the year of 2019 alone (Younies and Al-Tawil, 2020). Research also reveals that common cybersecurity such as password hacking, falling prey to phishing attacks, accessing malicious links on company systems, and mishandling of sensitive information are responsible for these cybersecurity breaches (Ocasio and Joseph, 2018).

The UAE has become a major target for cyberattacks due to its strong economy and widespread internet use, with 85% of the population active online (Al-Kumaim and Alshamsi, 2023). Cyberattacks in the UAE surged by 71% in 2021 compared to 2020, with organisations facing an average of 925 attacks per week in the fourth quarter of 2021, up from 408 in 2020. Phishing attempts reached 1.1 million, and ransomware incidents affected 59% of organisations, with an encryption rate of 46% (Adam, 2022; SOCRadar, 2022; Alalawi, 2024).

Several high-profile cyberattacks have targeted UAE industries over the years, employing tactics like ransomware, data encryption, and phishing. In 2023, LockBit ransomware used double extortion to encrypt and threaten to leak sensitive data (SOCRadar, 2022). Similarly, the Conti ransomware attack in 2022 encrypted files and threatened to release stolen information unless a ransom was paid (SOCRadar, 2022). Due to this, the importance is geared towards the competences, skills and capacities of managers in respect to information security intelligence (Y. Connolly and Wall, 2019). Managers' information security intelligence (MISI) competencies make them exhibit familiarity with wide range of information security skills such as security and network architectures, systems and frameworks, and compliance related skills. Intelligence skills necessary for the security of information and the protection motivation for cybersecurity behaviour become an essential competency (Campbell, 2017). In this aspect, questions are raised regarding the role of such skills related to information security possessed by managers in addition to protection motivation and countermeasures awareness in promoting employees' cybersecurity protective behaviour. More particularly, the following questions are stated: (1) What is the role of cyber security protection motivation, countermeasures awareness and MISI competencies in promoting employee's cyber security protective behaviour, (2) How does the employees' attitude moderate the role of motivation in embracing protective behaviour?

Research show that UAE had the highest number of phishing attacks in the Middle East, with over 38% of attacks aimed at stealing money (Al Neaimi, Ranginya and Lutaaya, 2015a; Al-Kumaim and Alshamsi, 2023). While the government entities in Abu Dhabi have invested in various types of software and hardware technologies to mitigate cybersecurity risks, there has been an increase in ransomware attacks in Abu Dhabi, with 33% of the targeted companies being based in the UAE, according to a report by Group-IB (Ahmed Hassan and Ismail, 2022). The report by the Telecommunications Regulatory Authority (TRA) in the UAE also highlights a 250% increase in cyber-attacks in the country in the first five months of 2021 compared to the same period in the previous year (Tubaishat and AlAleeli, 2024). These statistics emphasise the need for both government and private sectors to invest heavily in cybersecurity technology and upgrade it periodically to match the onslaughts of cybercrime.

Public and private sectors in the UAE are actively engaged in cybersecurity. However, the public sector tends to have stricter regulations and a more centralised approach due to national security concerns, but in the private sector challenges my face smaller companies having weaker security practices. This variance between the two sectors, highlights the level of compliance to cybersecurity practices regulated by the government. The National Electronic Security Authority (NESA) focuses on maintaining effective rules and regulations data protection measures for critical infrastructure and government systems (UAE, 2022; Alalawi, 2024). This creates an untapped area for this study in the aspect of investigating the protection behaviour among employees towards cybersecurity within the public sector in the UAE context.

Furthermore, with the rapid advancements in technology and the growing reliance on digital platforms for business operations necessitated storing data in digital forms. This transformation contributed to business and

performance development and also exposed organisations to cyberattacks threats. Cybersecurity threats escalated in the UAE during the last five years (Younies and Al-Tawil, 2020; SOCRadar, 2022). Research indicates that regardless of investments in cybersecurity infrastructure, persistent cyber threats such as phishing, ransomware, and data breaches continue to challenge organisations. In this context, traditional cybersecurity training and awareness programs do not always lead to effective protective behaviours among employees (Zwilling *et al.*, 2022).

Prior research has explored various determinants of CPB, including cybersecurity policy awareness and protection motivation in promoting protective behaviour while dealing with cyber threats. However, limited research is observed in investigating the role of information security intelligence skills among managers and how they lead protection motivation towards embracing protective behaviour among employees.

Given the UAE's rapid digital transformation and the increasing cyber threats faced by its public sector, there is a need to explore how managers' information security intelligence, protection motivation, and countermeasure awareness shape employees' cybersecurity protective behaviour. Further, understanding the role of cybersecurity attitude in moderating the role of motivation can provide sufficient insights into how employees' perceptions and willingness to comply with security measures influence their actual behaviour. Investigating this area will offer sufficient insights into the strategic role of managerial competencies in fostering a security-conscious organisational culture, ultimately improving cybersecurity resilience in public organisation in the UAE context.

Due to the aforementioned issues, this study aims to evaluate how do manager's information security intelligence (MISI) competencies affect organisations' management of information security programs and how these MISI competencies influence CPB alongside dimensions of cybersecurity protection motivation. Additionally, the study examines how does employees' attitude toward practicing cybersecurity can enhance the relationship between their cybersecurity protection motivation and CPB as their awareness of this subject increases.

2. Literature Review and Hypothesis Development

The study is based on the Protection Motivation Theory (PMT) which explains employees' motivation in responding to warnings about threats. It is the most relevant theory in assessing the attention of engaging in protective cybersecurity actions (Li *et al.*, 2019).

PMT is based on five factors that are believed to motivate employees to protect themselves, and these factors are severity, vulnerability, response cost, and response efficacy. These factors are divided into two categories: threat appraisal (perceived threat severity and perceived threat susceptibility) and coping appraisal (self-efficacy and response efficacy). The PMT theory is selected due to its relevance in assessing behavioural change through persuasive messages and explaining how compelling communication might be constructed successfully (Rogers, 1975).

PMT has been used in the literature pertaining to examining employees' understandings on cybersecurity threats and develop coping responses (Vance, Siponen and Pahnila, 2012). Using the PMT paradigm, compelling communication, often known as emotional appeals, may forecast behavioural change (Renaud and Dupuis, 2019).

Within the application of PMT, Li, Xu and He (2022) extended it by incorporating organisational efforts such as information security efforts and employee awareness as antecedent factors for employee cybersecurity behaviour. Based on this, the study extends by extending PMT by including MISI as a key factor influencing the awareness as well as the behaviour of employees towards cybersecurity protective behaviour.

2.1 Cybersecurity Protection Motivation and Cybersecurity Protective Behaviour

Threat appraisal along with coping appraisal of PMT components are essential for organisations, especially in the public sector in order to ensure the adherence of employees to guidelines pertaining to cybersecurity protective behaviours (CPB) (Li, Xu and He, 2022). It also involves making sensitive data inaccessible for employees through unverified and unauthorised devices to ensure such protection. In addition to that, excluding access to unsafe websites from the devices used to access the data stored in the organisation is considered one of the measures adopted by organisations to promote the importance of good cybersecurity protective behaviour (Mashiane & Kritzinger, 2018).

Rogers (1975) opine that both affective and psychological reactions to threats play a substantial role in perceived behavioural control. It is evident that people are motivated by fear arousal (Ruiter, Abraham and Kok, 2001) which led to more investigation on the role of fear on behaviour intention (Cooper, Goldenberg and Arndt, 2014). Since motives are directly affected by fear, this study hypothesises that:

H1a: *Perceived Severity positively influences CPB.*

H1b: *Perceived Susceptibility positively influences CPB.*

In coping appraisal, a person's self-efficacy and response efficacy are influenced by their judgment of the proposed actions' efficiency and capacity to carry them out. Response efficacy and self-efficacy have improved behavioural intentions (Zajdel and Helgeson, 2020).

The individual's belief that their protective measures are effective is the definition of response efficacy (Alkhazi *et al.*, 2022), the absence of such belief results in abandoning such protective behaviours (Shillair, 2018). Fears and motives form the efficacy cognition when considering cybersecurity protective behaviour (Johnston and Warkentin, 2010). Therefore, the response efficacy is the individuals' belief in their ability in facing cybersecurity risks (Vance, Siponen and Pahnila, 2012). An optimization is required to promote response efficiency when it comes to cybersecurity (Zhang, Zhang and Jiang, 2023). Qiu et al. (2023) argue that response efficacy positively affects the preparedness for crisis and disasters.

The possibility that response efficacy leads the protective behaviour is evident in previous research, yet self-efficacy plays as a key factor in utilizing such capability to respond towards certain concerns (Thrasher *et al.*, 2016). The same is applicable when considering accepting technology (Zhang *et al.*, 2017). This indicates their effect on behavioural intentions (Rainear and Christensen, 2022).

Self-efficacy act as a key factor in promoting cybersecurity behaviour (Zainal, Puad and Sani, 2021), as it is evident that security self-efficacy leads to adopting security behaviour (Verkijika, 2020).

Further, the associated cost must be considered while ensuring protection. According to Bax, McGill and Hobbs (2021), the response cost is considered a significant influential factor on maladaptive and protective behaviours pertaining to cybersecurity while Bolívar and Dallery (2020) argue that the resurgence of human behaviour is affected by the response cost punishment.

H1c: *Response efficacy positively influences CPB.*

H1d: *Self-efficacy positively influences CPB.*

H1e: *Response cost negatively influences CPB.*

2.2 Procedural Information Security Countermeasure Awareness and Cybersecurity Protection Motivation of the Employees

Awareness about cybersecurity protection is the first and most integral motivator for promoting cybersecurity protection motivation. The employees working in an organisation must understand the threats they face when accessing the data and information present in the company's database.

High procedural information security countermeasure awareness is an essential factor that organisations must focus on including their employees (Zwilling *et al.*, 2022). This is primarily a critical necessity for organisations operating in the public sector. Mabitle and Kritzinger (2021) state the necessity for proper education and awareness as a contributing factor towards ensuring enhanced and greater procedural information security countermeasure awareness. Further, cybersecurity behaviour can be enhanced by the effort of educational institutions in their curricula (Deraman *et al.*, 2021).

It Is evident that PCM significantly and positively affects CPB In terms of attitude and intentions (Bulgurcu, Cavusoglu and Benbasat, 2009; Kim, Hovav and Han, 2019). Further, perceiving PCM as a negative tool result in exhibiting less protective behaviour (Kim, et al., 2019). Li et al. (2019) argue that awareness about cybersecurity protection can greatly enable organisations to be more cautious towards ensuring that their behaviour in cyberspace is responsible. Hence, for employees, responsible organisations are being exposed (Hadlington and Murphy, 2018). Therefore, greater awareness is considered a greater motivation for organisations towards adopting CPB. Hence, the study hypothesises:

H2a*: PCM positively influences Perceived Threat severity among employees.*

H2b*: PCM positively influences Perceived Threat susceptibility.*

H2c*: PCM positively influence response efficacy.*

H2d*: PCM positively influence self-efficacy.*

H2e*: PCM positively influence response cost.*

2.3 Managers' Information Security Intelligence (MISI) in an Organisation

The Managers' Information Security Intelligence (MISI) is responsible for ensuring that all the dependencies that have been defined above are correctly followed (Kim, Hovav and Han, 2019). MISI is relevant to all the activities of employees in respect to cyber security. MISI ensures that employees have a high sense of cybersecurity protective awareness which requires certain steps and procedures to be followed in the organisation (Humaidi and Abdallah Alghazo, 2022).

Safety Intelligence is the extent to which employees believe their managers are committed to safety, it is associated positively with organisational success (Clarke, 1999). This is affected by the perception of employees towards supervisory behaviours (Christian *et al.*, 2009).

Fruhen et al. (2014b) argue that safety intelligence of managers can have subcomponents such as safety knowledge, personality, regulatory commitment, social competence, and problem-solving abilities. Moreover, security managers are required to constantly develop skills such as problem-solving skills in order to be able to appropriately analyse and appraise the risks involved correctly. Cultivating such abilities among employees would reflect on their cybersecurity protective behaviour (Yoon, Arik and Pfister, 2020).

Further, knowledge of safety and cybersecurity of managers is essential especially for organisations in the public sector (Kim, Hovav and Han, 2019). Possessing such knowledge enable them to ensures systems and strategies adopted in the organisation are protected and functioning effectively along with ensuring cybersecurity is maintained.

Competency in safety knowledge among managers plays a crucial role in effectively utilizing strategy appraisals to enhance cybersecurity protective awareness among employees (Van Niekerk, 2018). This is particularly important in the public sector, where managers are pivotal in raising and enhancing cybersecurity awareness in the organisation (Prabhu and Thompson, 2022). Implementing effective safety management measures is essential for organisations to ensure their contribution to maintaining information security and managing security incidents effectively (Line and Albrechtsen, 2016).

Perceived information security knowledge is defined as the degree to which employees believe senior managers comprehend information security risks (Finkelstein, 1992). Embracing knowledge mechanisms among employees and managers is essential to promote cybersecurity in the organisation (Mady, Gupta and Warkentin, 2023). Information security knowledge is promoted by education and experience (An *et al.*, 2023). Therefore, possessing awareness positively leads to increasing information security knowledge among employees and managers (Alkhazi *et al.*, 2022). Organisation adopt certain approaches to promote their information security knowledge and awareness such as theoretical models, gamification and constructivist approaches (Khando *et al.*, 2021). Utilising data and resources promotes information knowledge in the organisation (Żywiołek and Schiavone, 2021). Hence, having the necessary knowledge acts as a motivation towards promoting cybersecurity in the organisation (Herbert, Schmidbauer-Wolf and Reuter, 2020; Alhogail, 2021).

Perceived information security problem solving skill is described as an employee's impression of the capacity of senior management to recognise information security concerns, suggest solutions, and develop action plans to overcome these difficulties (Kim, Hovav and Han, 2019). Following certain procedures allows managing predictable dangers (Spagnoletti and Resca, 2008). When considering cybersecurity protection motivation, problem-solving abilities contribute to senior managers commitment to safety (Fruhen *et al.*, 2014a). This supports the regular improvement in the organisation (Abdul Hamid *et al.*, 2015). Further, manager safety problem-solving abilities is a key factor in training employees in the organisation for information security (Fruhen *et al.*, 2014a) and safety-related regulations (Hamid et al., 2015). This implies that utilising information security problem solving acts as a motive to contribute towards maintaining cybersecurity in the organisation (Hu *et al.*, 2012).

Managers' competencies in managing information security programs within organisations have a positive influence on improving their employees' motivation toward information security (Taufan and Basalamah, 2021). Managers' connections with their employees motivates information security in the organisation (Liu, Wang and Liang, 2020). Furthermore, managers competencies are crucial for ensuring organisational performance (Szczepańska-Woszczyna and Gatnar, 2022). The enhancement of managers' social competencies leads to improved work and increased motivation among employees to practice cybersecurity behaviour (Oppong and Zhau, 2020).

According to Fruhen et al. (2014a), the role of the senior management is indispensable in encouraging the employees about the need for good cybersecurity protective behaviours. Hence, these employees can be led by

example, and the cybersecurity protective awareness of the senior management reflects directly upon the cybersecurity behaviours and attitudes of the employees. Based on these reviews, the following hypotheses were constructed:

H3a: *Perceived information security knowledge positively influences PCM.*

H3b: *Perceived social competence positively influences PCM.*

H3c: *Perceived information security problem-solving skills positively influence PCM.*

2.4 The Relationship Between MISI and CPB

In addition to this, MISI has three main components, Perceived Information Security Knowledge (PISK) which explains the extent to which senior managers are understand information security issues in the organisation; Perceived Information Security Problem Solving (PISP) which explains the extent of mitigating the issues faced in relevance to information security in the organisation; and perceived social competencies (PSC) which implies the capabilities utilised by senior managers to establish strong relationship with employees through communication to improve their performance and competitive advantage (Han and Ryu, 2016; Kim, Hovav and Han, 2019; Alghazo, Humaidi and Noranee, 2023).

The growth in the dependence of technology and Internet creates the need for sufficient knowledge, skills and capabilities to be utilised for better performance and information security. According to Zwilling et al. (2022), the increase of cybersecurity knowledge and awareness contributes to the increase of cybersecurity protective behaviour. Similarly lacking such knowledge and capabilities will negatively affect adopting the appropriate behaviour related to information technology. The literature provide evidence that the three dimensions of MISI are influential on the intention and behaviour related to information security (Kim, Hovav and Han, 2019; Alghazo, Humaidi and Noranee, 2023).

Security leaders are required to be participative in the organisation when it comes to cybersecurity management. Research shows that organisation should strategically invest in human capital and technology to promote cybersecurity management (Abraham, Chatterjee and Sims, 2019).

Mashiane and Kritzinger (2021) argue that even if organisations provide the necessary support for information security knowledge and competencies of employees and managers remain essential for its success. It is evident that employees' information security compliance intention behaviour can be promoted through information security knowledge and problem-solving skills (Chen *et al.*, 2021). This implies that managers remain the key player in promoting information security behaviour among employees (Hong and Furnell, 2021). Further, weak cybersecurity knowledge and skills among the security leaders would impact security decision-making quality and lead to decreased information security management performance.

Previous studies support this and found a positive effect of top management participation on information security awareness programs (Hasan *et al.*, 2021). Khando et al. (2021) also argued that the shared understanding amongst employees is influenced by how they perceive the role of management and the persuasiveness of communication by the security managers.

According to Whitman and Mattord (2019), the MISI's are also responsible for determining what constitutes good cybersecurity behaviour for the employees working at the organisation. The most important role of the MISI's is to promote a positive cybersecurity protective attitude amongst the employees. They achieve this by educating the employees, training them, and organizing workshops. In addition to that, they are responsible for ensuring that the necessity for information security intelligence and the protection motivation for cybersecurity behaviour are instilled amongst the organisation's employees. The role of the MISI's is even more crucial for organisations operating in the public sector since the data they deal with concerns the public welfare at large.

H4a: *Perceived information security knowledge positively influences CPB.*

H4b: *Perceived social competence positively influences CPB.*

H4c: *Perceived information security problem-solving skills positively influence CPB.*

2.5 The Moderating Role of Cybersecurity Attitude

Safa et al. (2015) and Parsons et al. (2017) stated that a person's (or an employee) views and feelings are directly influenced by what they know about information security countermeasures. Therefore, attitude is related to what a person believes and feels. The way a person practises security can be influenced both directly and indirectly by

their attitude and expertise. Attitude has explicit and implicit dimensions: a) explicit attitude, refers to that the employees are aware of the effect of their behaviour; and b) implicit attitude, refers to that the employees are not conscious of the effect of their behaviour (Yeng, Fauzi and Yang, 2022).

Previous studies on information security suggest that manger's support significantly influences employees' attitude and intentions toward security (Kankanhalli *et al.*, 2003; Chan, Woon and Kankanhalli, 2005; Knapp *et al.*, 2006). Managers can provide legitimacy to employees' information security policies and standards compliant behaviour by shaping their beliefs, norms, and attitudes toward new programs, initiatives or policies (Hu *et al.*, 2012). According to Bulgurcu, Cavusoglu and Benbasat (2010), the attitude and intentions of employees toward information security compliance are positively impacted by their perceptions of PCM. Based on this, the current study hypothesises that

> ***H5:*** *Employee's cybersecurity attitude moderates the effect of the dimensions of protection motivation on CPB.*

Although Protection Motivation Theory (PMT) has been extensively explored in terms of evaluating responses to cybersecurity threats (Vance, Siponen, & Pahnila, 2012; Li et al., 2019), there is a notable gap in the investigation of the role of managers' intelligence in the realm of information security (Fruhen et al., 2014a; Kim, Hovav, & Han, 2019). Additionally, research has highlighted the role of procedural countermeasure awareness in motivating employees to adopt cybersecurity protective behavior (Mabitle & Kritzinger, 2021; Zwilling et al., 2022), but the role of managers' skills in promoting this awareness remains underexplored. Furthermore, while previous research has examined the moderating role of attitude in similar contexts related to employee behavior (Safa et al., 2015; Parsons et al., 2017), there is a lack of investigation into how employees' attitudes influence the effect of motivation on adopting CPB. Moreover, while studies have explored cybersecurity and employee protective behavior in the private sector (Johnston & Warkentin, 2010; Li, Xu, & He, 2022), there is limited research on these aspects within the public sector. This gap provides an opportunity for this study to explore how managers' information security intelligence, cybersecurity protection motivation, and cybersecurity procedural countermeasure awareness influence the practice of adopting cybersecurity protective behavior among employees in the public sector within the context of the UAE.

3. Research Method

3.1 Research Design

This study employed quantitative cross-sectional design with an exploratory approach. It relies on a research questionnaire as the main instrument to process the collected data in numerical form for analysis.

3.2 Measurement and Survey Instrument

This section provides a brief description about the measurement of the study variables while a complete list of the variables with their measurement items can be found in Appendix (1).

Managers' Information Security Intelligence Skills (MISI) is measured with 14 items adopted from (Kim, Hovav and Han, 2019) and divided into three dimensions Perceived Information Security Knowledge (5 items) a sample item of it is "senior managers of my company know about information security", Perceived Information Security Problem-Solving (4 items) a sample item of it is "senior managers of my company maintain a balance between information security management and its costs", and Perceived Social Competence (5 items) a sample item of it is "senior managers of my company operate an open-door policy".

Cybersecurity Protection Motivation (CPM) was measured with 18 items based on (Mousavi *et al.*, 2020; Li, Xu and He, 2022), they are divided into five dimensions, which are Threat Severity (4 items) with a sample item "if my information released to unauthorised people, it would be very bad for me", Threat Susceptibility (5 items) with a sample item "my information is at risk for being released to unauthorised people", Self-efficacy (3 items) with a sample item "it is easy for me to use privacy assurance mechanisms", Response Efficacy (3 items) with a sample item "complying with the information security policies in my organisation will keep security breaches down" and Response Cost (3 items) with a sample item "".

Five items were adapted from (Simonet and Teufel, 2019) to measure Procedural Information Security Countermeasure Awareness (PCM) with a sample item "i recognise that safe security practices are needed to deal with cybersecurity threats and risks". Finally, five items adopted from (Li *et al.*, 2019) to measure Cybersecurity Protective Behaviour (CPB) with a sample item "I keep the anti-virus software on my computer up-to-date", and

another five items adopted from (Hadlington, 2017) were used to measure Cybersecurity Protective Attitude (CTA) with a sample item "it is inconvenient to check the security of an email with attachments".

3.3 Sampling and Data Collection Procedures

Three categories of respondents are targeted: IT staff, administrative staff and management/leadership as explained in Table 1. The sampling frame indicates that the total number of units in nine listed corporations in the public sector in Abu Dhabi is 3415. Based on the total the three categories are identified and the sample calculation is conducted based on their weight against the total population.

Stratification is followed to draw the sample from the study population based on the size of the population. In the listed organisations, three strata of respondents are highlighted, IT staff, administrative staff and management staff. Out of these strata, the targeted sample size is determined where management and leadership staff account for 40% of the population, while IT staff and administrative staff accounted for 30% each. Several resources are consulted in respect of the sufficient sample size which yielded that 400 to 500 responses are considered sufficient for such population (Hair *et al.*, 2010). In the case of power analysis, 189 was recommended as the minimum sample size for 13 predictors and effect size of 0.15.

The research questionnaire was distributed in print to minimise the potential for bias. However, in cases where delivering a hard copy was difficult (211 cases), email communication was used. A Google Forms link was sent to respondents after obtaining their consent to participate in the study. The distribution was carried out through random selection from the sampling frame, and respondents were given 30 days to complete the questionnaire. Approximately 27% of respondents received two reminders to ensure timely submission. The questionnaire was available in both English and Arabic to ensure better clarity. The translation was supervised by professors from the UAE and India, and validated through back translation. Out of 600 distributed forms, 520 were completed, resulting in a response rate of 86.6%.

Table 1: Demographic characteristics of respondents

Variable	Category	Frequency	Percent
Gender	Male	184	35.4
	Female	336	64.6
Age	18-24 Years	6	1.2
	25-34 Years	52	10.0
	35-44 Years	294	56.5
	45-54 Years	152	29.2
	55 or above	16	3.1
Qualification	Master Degree	191	36.7
	Bachelor Degree	233	44.8
	High School	82	15.8
	PhD or Higher	14	2.7
Experience	1-3 years	83	16.0
	4-6 years	154	29.6
	7-10 years	245	47.1
	More than 10 years	22	4.2
	Less than 1 year	16	3.1
Position	Entry-level employee	85	16.3
	Mid-level employee	141	27.1
	Senior-level employee	163	31.3
	Managerial/Supervisory position	131	25.2
Institution	Department of Digital Authority	108	20.8
	Abu Dhabi Judicial Department	118	22.7

Variable	Category	Frequency	Percent
	Abu Dhabi Security Exchange	64	12.3
	Abu Dhabi Chamber	74	14.2
	Abu Dhabi Investment	53	10.2
	Department of Finance	29	5.6
	Federal Authority for Identity and Citizenship	41	7.9
	Statistics Center Abu Dhabi	33	6.3
Cybersecurity attacked before	Yes	101	19.4
	No	419	80.6
Using mobile phone for work	No	136	26.2
	Yes	384	73.8
Allowed to work remotely	No	287	55.2
	Yes	233	44.8
Total		520	100.0

3.4 Data Analysis

Partial least square structural equation modelling (PLS-SEM) approach by using SmartPLS software version 4 was used to analyse the final data. In this analysis the measurement model is assessed for reliability and validity of the research model, then the structure model is assessed for path coefficient assessment and moderation analysis. PLS-SEM has become a significant tool in management and information system research. It differs from covariance-based SEM (CB-SEM) by being a non-parametric test for multivariate factor analysis. According to Rouse and Corbitt (2008), applying PLS-SEM in information system research requires careful attention due to misuse, lack of training and reliability and validity concerns. However, in recent research, PLS-SEM has developed to become more acceptable in information system research along with the awareness of research applying advanced tools (Cepeda *et al.*, 2024). Further, PLS-SEM is more adopted among researchers in Industrial Management and Data Systems (IMDS) due to the ability to handle model complexity and improving prediction assessment along with other advanced features (Sabol *et al.*, 2023). Research articles present methodological guidance for researchers in information system (Al-Emran, Mezhuyev and Kamaludin, 2019). Finally, Hair et al. (2017) argue that PLS-SEM increased maturity in information system research due to model complexity and formative, measurement rather than just focusing on small sample data and non-normal data. Hence, PLS-SEM is selected to analyse the data for the current study.

4. Results

4.1 Data Coding and Screening

Data was screened and managed to ensure its appropriateness for analysis. In this process, incomplete responses were excluded; valid responses were coded to ease the analysis. In addition, normality assessment was conducted to ensure the homogeneity of the responses through ensuring Skewness and Kurtosis are within 2 and -2 (Kim, 2013).

4.2 Common Method Variance

Common method bias was assessed to ensure there is no bias that can compromise the responses accuracy and negatively impact the research outcome (MacKenzie and Podsakoff, 2012; Kock, 2017). Harman's single-factor which yielded a cumulative variance explained of 41.2% which is below 50%. Further, marker variable was conducted (Miller and Simmering, 2023) where the coefficients are compared before and after adding the marker variables and the results indicates that there are no remarkable differences between both set of coefficients.

Multicollinearity is assessed to ensure data is free from multicollinearity issues. Variance Inflation Factor (VIF) is followed to do so and the results indicated that VIF values range between 1 and 2.906 which is below the limit (3.33) (Hair *et al.*, 2019).

Non-response bias (de Winter *et al.*, 2005) which assesses the difference between the first and last 20 responses using variance analysis which indicated that there is no significant difference between the first and last 20 responses ($p > 0.05$)

4.3 Assessment of the Measurement Model

In the process of establishing the research model reliability and validity, the PLS-SEM approach is used to identify the measures of reliability and discriminant validity (Hair, Ringle and Sarstedt, 2011).

Factor loading values are assessed to ensure the contribution of the items in each latent variable in the research model. The results indicates that they range from 0.715 to 0.918 which is considered sufficient according to the threshold of 0.708 recommended in scholarly research (Hulland, 1999; Hair *et al.*, 2016).

The reliability measures assessed are Cronbach's Alpha (a) and composite reliability (CR), where are the values were found to exceed 0.70 (Hair *et al.*, 2019). Further, the values of average variance extracted (AVE) have to exceed 0.50 which was also evident in the study results by exceeding 0.50 (Hair *et al.*, 2021). The details of the results are presented in Table 2.

Table 2: Reliability assessment

	Mean	Std. Deviation	Loading
Perceived information security knowledge a = 0.835, CR = 0.839 and AVE = 0.604			
PISK1	3.92	1.368	0.715
PISK2	3.96	1.352	0.818
PISK3	4.07	1.325	0.814
PISK4	4.16	1.177	0.799
PISK5	4.23	1.131	0.734
Overall	4.0685	0.98853	
Perceived social competence a = 0.872, CR = 0.873 and AVE = 0.664			
PSC1	4.16	1.353	0.821
PSC2	4.26	1.226	0.866
PSC3	4.30	1.206	0.835
PSC4	4.19	1.239	0.822
PSC5	4.32	1.134	0.725
Overall	4.2454	1.00585	
Perceived information security problem-solving a = 0.849, CR = 0.849 and AVE = 0.689			
PISP1	4.06	1.245	0.819
PISP2	4.18	1.157	0.846
PISP3	4.14	1.252	0.862
PISP4	3.99	1.309	0.791
Overall	4.0913	1.01093	
Procedural Information Security Countermeasure Awareness (PCM) a = 0.855, CR = 0.859 and AVE = 0.635			
PCM1	4.15	1.149	0.739
PCM2	4.19	1.203	0.772
PCM3	4.26	1.126	0.830
PCM4	4.17	1.193	0.850
PCM5	4.10	1.218	0.789
Overall	4.1758	0.93756	
Cybersecurity Protective Attitude (CTA) a = 0.866, CR = 0.867 and AVE = 0.653			
CTA1	4.03	1.245	0.772
CTA2	3.94	1.312	0.839

	Mean	Std. Deviation	Loading
CTA3	4.06	1.218	0.839
CTA4	4.05	1.282	0.847
CTA5	4.20	1.175	0.736
Overall	4.0542	1.00713	
Threat Severity a = 0.868, CR = 0.869 and AVE = 0.718			
SEV1	4.22	1.086	0.816
SEV2	4.20	1.201	0.877
SEV3	4.14	1.187	0.877
SEV4	4.16	1.128	0.817
Overall	4.1774	0.97557	
Threat Susceptibility a = 0.877, CR = 0.878 and AVE = 0.671			
SUSC1	4.21	1.115	0.789
SUSC2	4.20	1.106	0.813
SUSC3	4.27	1.121	0.871
SUSC4	4.25	1.117	0.848
SUSC5	4.15	1.216	0.771
Overall	4.2162	0.92786	
Self-efficacy a = 0.859, CR = 0.86 and AVE = 0.781			
SE1	3.96	1.303	0.885
SE2	3.94	1.342	0.896
SE3	3.85	1.327	0.869
Overall	3.9135	1.16980	
Response Efficacy a = 0.844, CR = 0.847 and AVE = 0.764			
RE1	3.825	1.326	0.894
RE2	3.844	1.326	0.907
RE3	3.775	1.372	0.818
Overall	3.814	1.17	
Response Cost a = 0.856, CR = 0.863 and AVE = 0.776			
RC1	3.838	1.292	0.918
RC2	3.969	1.279	0.838
RC3	3.775	1.23	0.885
Overall	3.861	1.116	
Cybersecurity Protective Behaviour (CPB) a = 0.904, CR = 0.906 and AVE = 0.723			
CPB1	3.86	1.333	0.824
CPB2	3.84	1.323	0.838
CPB3	3.83	1.330	0.886
CPB4	3.87	1.281	0.883
CPB5	3.89	1.309	0.817
Overall	3.8608	1.11759	

For discriminant validity, Fornell and Larcker (1981) yielded satisfactory outcome where the correlation values of each variable are found below the square root values of the average variance extracted of the same variable (Table 3). Similarly, Heterotrait Monotrait criteria (HTMT) yielded acceptable outcome by having the similarity values across all variables below 0.85. This implies the establishment of discriminant validity. No violations were detected when observing cross loading values as well (Table 4).

Table 3: Discriminant validity of reflective constructs (F&L).

Constructs	CPB	CTA	PCM	PISK	PISP	PSC	RC	RE	SE	SEV	SUSC
CPB	***0.850***										
CTA	0.550	***0.808***									
PCM	0.529	0.731	***0.797***								
PISK	0.529	0.623	0.669	***0.777***							
PISP	0.571	0.617	0.577	0.680	***0.830***						
PSC	0.513	0.613	0.606	0.654	0.662	***0.815***					
RC	0.403	0.479	0.565	0.479	0.459	0.493	***0.881***				
RE	0.536	0.491	0.493	0.545	0.529	0.422	0.594	***0.874***			
SE	0.423	0.485	0.460	0.482	0.500	0.516	0.375	0.427	***0.883***		
SEV	0.464	0.680	0.634	0.573	0.525	0.602	0.450	0.431	0.367	***0.847***	
SUSC	0.567	0.662	0.709	0.594	0.563	0.571	0.51	0.517	0.392	0.711	***0.819***

Resource: Responses analysis.

Table 4: Discriminant validity of reflective constructs (HTMT).

Constructs	CPB	CTA	PCM	PISK	PISP	PSC	RC	RE	SE	SEV	SUSC
CPB											
CTA	0.619										
PCM	0.604	0.846									
PISK	0.607	0.733	0.790								
PISP	0.650	0.717	0.674	0.808							
PSC	0.577	0.704	0.700	0.767	0.770						
RC	0.449	0.549	0.651	0.564	0.529	0.563					
RE	0.613	0.576	0.581	0.651	0.624	0.493	0.705				
SE	0.479	0.561	0.535	0.571	0.583	0.594	0.436	0.501			
SEV	0.521	0.784	0.734	0.67	0.610	0.692	0.516	0.504	0.423		
SUSC	0.634	0.761	0.816	0.692	0.652	0.653	0.580	0.601	0.452	0.815	

Resource: Responses analysis

4.4 Assessment of the Structural Model

The research outcome related to assessing the significance of the relationships across the research model are depicted in Table 5 and Figure 1. As illustrated in Table 5, the R^2 values of 0.479 explains the variance in CPB that is influenced by managers' information security intelligence Procedural Information Security Countermeasure Awareness, protection motivation dimensions were above the 0.26 value as suggested by Cohen (1988) indicating a solid model.

As for the effect of protection motivation dimensions on CPB, the results indicate that protective behaviour (CPB) is significantly influenced by perceived threat severity (β = -0.093, f^2 = 0.006, p = 0.120), perceived threat susceptibility (β = 0.237, f^2 = 0.037, p = 0.001) and response efficacy (β = 0.241, f^2 = 0.048, p = 0.001), while no significant effect on self-efficacy (β = 0.079, f^2 = 0.007, p = 0.130) and response cost (β = -0.076, f^2 = 0.003, p = 0.167) (Table 5).

As for the effect of PCM on protection motivation dimensions, the results indicates that PCM is found to be a significant factor in influencing perceived threat severity (β = 0.634, f^2 = 0.672, p = 0.001), perceived threat susceptibility (β = 0.709, f^2 = 1.010, p = 0.001), self-efficacy (β = 0.460, f^2 = 0.269, p = 0.001), response efficacy (β = 0.493, f^2 = 0.322, p = 0.001), and response cost (β = 0.565, f^2 = 0.468, p = 0.001).

When investigating the effect of MISI on PCM, the result unveiled that PCM is significantly and positively affected by perceived information security knowledge (β = 0.421, f^2 = 0.166, p = 0.001), perceived information security

problem-solving (β = 0.127, f^2 = 0.015, p = 0.009), and perceived social competence (β = 0.247, f^2 = 0.060, p = 0.001).

Similarly, investigating the effect of MISI on CPB revealed that CPB is not significantly influenced by perceived information security knowledge (β = 0.024, f^2 = 0.001, p = 0.695), while it is found to be significantly influenced by perceived information security problem-solving (β = 0.187, f^2 = 0.029, p = 0.002) and perceived social competence (β = 0.109, f^2 = 0.009, p = 0.045).

When assessing the moderating role of employee's cybersecurity attitude in moderating the effect of protection motivation on their cybersecurity protective behaviour. The results unveiled that the role of CAT on all the concerned relationships is found insignificant except one association involving employees' self-efficacy and its effect on their behaviour which was insignificant. This implies that the attitude does not play any moderating role over these relationships.

Table 5: Assessment of paths significance

Path	β1	B2	t	P	2.50%	97.50%
R^2	(0.479)					
Effect of MISI on CPB						
PISK -> CPB	0.024	0.028	0.392	0.695	-0.099	0.144
PISP -> CPB	0.187	0.184	3.048	0.002	0.065	0.304
PSC -> CPB	0.109	0.105	2.003	0.045	0.008	0.220
Effect of MISI on PCM						
PISK -> PCM	0.421	0.421	6.81	0.001	0.300	0.541
PISP -> PCM	0.127	0.127	2.155	0.031	0.011	0.243
PSC -> PCM	0.247	0.247	3.738	0.001	0.117	0.377
Effect of PCM on Protection motivation dimensions						
PCM -> SEV	0.634	0.633	14.659	0.001	0.539	0.710
PCM -> SUSC	0.709	0.709	19.696	0.001	0.630	0.771
PCM -> SE	0.46	0.459	10.011	0.001	0.365	0.545
PCM -> RE	0.493	0.493	11.002	0.001	0.400	0.576
PCM -> RC	0.565	0.564	13.517	0.001	0.476	0.639
The effect of Protection motivation dimensions on CPB						
SEV -> CPB	-0.093	-0.09	1.554	0.12	-0.211	0.026
SUSC -> CPB	0.237	0.233	3.868	0.001	0.116	0.356
SE -> CPB	0.079	0.083	1.514	0.13	-0.024	0.179
RE -> CPB	0.241	0.242	4.089	0.001	0.127	0.357
RC -> CPB	-0.076	-0.074	1.382	0.167	-0.181	0.032
The moderating role of CTA on the effect of Protection motivation dimensions on CPB						
CTA x SEV -> CPB	-0.048	-0.038	0.958	0.338	-0.151	0.046
CTA x SUSC -> CPB	0.046	0.038	0.853	0.394	-0.068	0.142
CTA x RE -> CPB	0.01	0.019	0.17	0.865	-0.105	0.115
CTA x SE -> CPB	0.081	0.076	2.036	0.042	0.006	0.163
CTA x RC -> CPB	-0.06	-0.063	1.123	0.261	-0.178	0.033

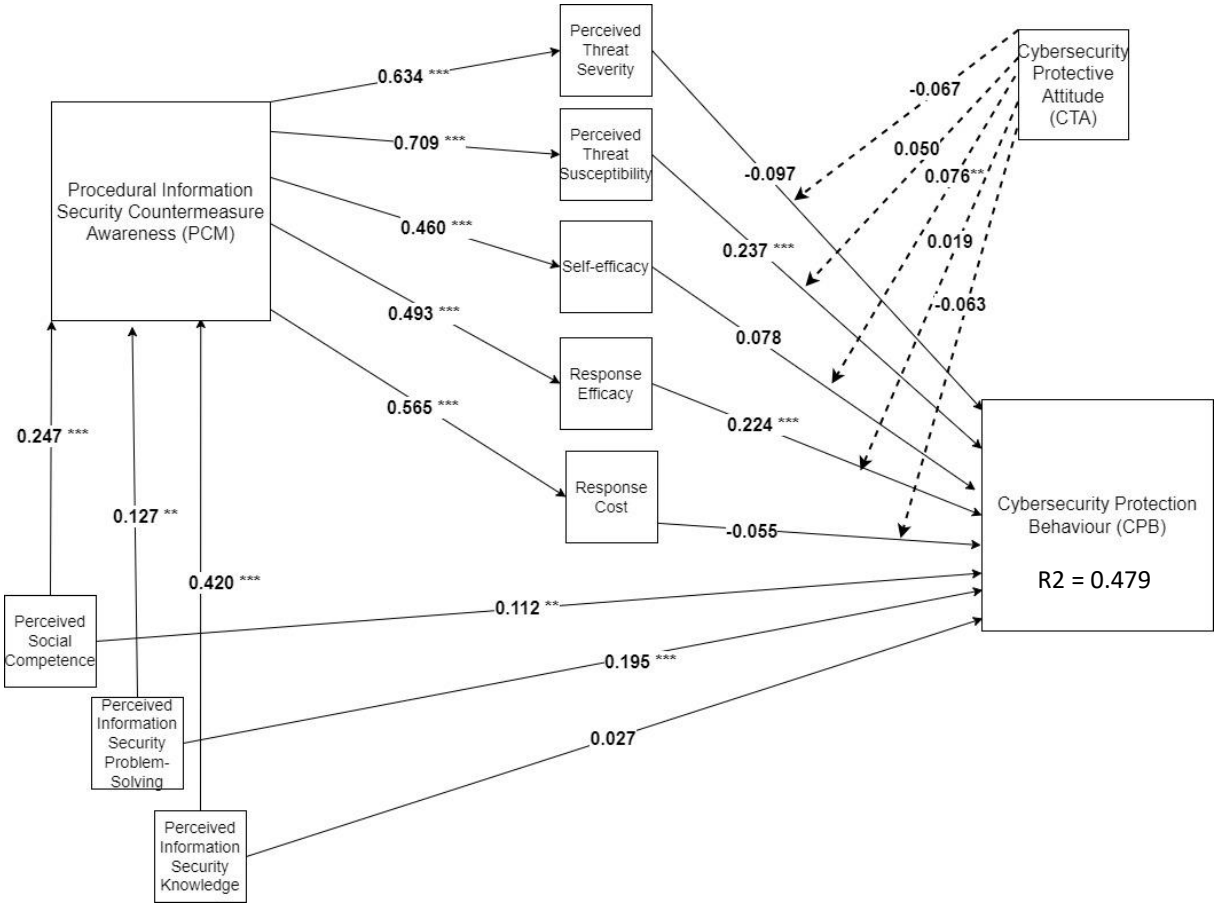

Figure 1: Research model with hypothesis assessment

When considering the explanatory power of the research model, the value of R^2 is assessed for the main dependent variable which is CPB, the value of R^2 is found to be 0.479, which is considered substantial (Cohen, 1988; Chin, 1998; Hair *et al.*, 2010). Further, Applying PLS predict technique to compare the prediction errors between the PLS model and the LM model unveiled that the mean absolute errors (MAE) are less in three of the five indicators of CPB which indicates that the research model has a medium predictive power

5. Discussion

In the current study, the presence of females in the public sector is highlighted (64.6% of respondents), this indicates a high extent of women's participation in the job market and economic development in the UAE context which is a growth supported by the government policies regarding the importance of women's inclusion and empowerment through the public sector (Othman *et al.*, 2025). Furthermore, when it comes to the qualification, only 15.8% of respondents have diplomas lower than a university degree, while 44.8% possess Batchelor's degree and 39.4% possess Masters or PhD qualifications. Similarly, when it comes to work experience, 16% of the respondents indicated having work experience lower than three years. This implies the need to focus on low qualified employees and less experienced employees to ensure they possess the necessary knowledge and awareness of cybersecurity. This highlights the need for publicizing the initiatives such as Salim, Cyber-Pulse which are launched by the government to spread knowledge and awareness about cybersecurity and promoting knowledge-based economy along with supporting the investments in the digital economy and aiming to improve resilience in both the private and public sectors. Additionally, the strategies established for promoting cybersecurity in the country such as the UAE's National Cyber Security Strategy and Dubai Cyber Security Strategy (UAE, 2022).

In the position category, the majority are of higher levels of managerial hierarchy, while 16% of the respondents are entry level employees and 27.1% are mid-level employees. Considering the extent of awareness and adoption of best practice regarding cybersecurity protective behaviour, the improvement of knowledge and experience among this category of employees is considered essential as it is evident that cybersecurity attacks are associated

with the lack of sufficient knowledge and experience in dealing with the digital work environment (Aliebrahimi and Miller, 2023).

When assessing the nature of work environment, the results indicated that 19.4% of respondents already experienced cybersecurity attacks such as losing access to data stored digitally. Further, the majority of respondents (73.8%) indicate that they use mobile systems to perform their work tasks and responsibilities. In this context, almost half of respondents (44.8%) conduct such activities remotely from home. This highlights the importance of maintaining cybersecurity awareness and protective behaviour to promote safety and productivity in the public sector. This can be improved by referring to the relevant policies, strategies and initiatives sponsored in the UAE to ensure employees in such categories are well equipped with the necessary awareness and knowledge allowing them to perform their tasks and responsibilities effectively and safely in such digital work environment (UAE, 2022).

The results indicate that three dimensions of protection motivation (threat severity, self-efficacy and response cost) are not influential on CPB. Previous literature presents that perceived threat severity as an influential factor on behaviour where individuals seek help, take protective actions or choosing to ignore (Chen and Zahedi, 2016). Furthermore, De Kimpe et al. (2022) report that perceived severity is a significant key factor leading the creation of the intention to take protective action. The difference in these results could be attributed to the lack of experiencing the actual threats when it comes to information security and protection. It is expected that the actual knowledge of the security would results in a significantly planned behaviour towards information protection and the opposite occurs when such language is lacked. Regardless of the reported facts that the UAE is ranked the fifth globally when it comes to cyber safety and digital security (UAE, 2022), in addition to that, having good and effective laws and regulation related to maintaining and developing cybersecurity in the country (Othman *et al.*, 2025), efforts are needed to promote the extent of embracing cybersecurity among individuals in corporations to ensure individual and organisational compliance is achieved.

On top of that, self-efficacy significantly influences the behaviour of individuals when it comes to cybersecurity (Edwards, 2015). It affects information security and the behaviour relevant to it (Pizam *et al.*, 2024). Further, self-efficacy is presented as an optimum factor that builds and changes the individual behaviour (Kamboj, Matharu and Shukla, 2024). The inconsistency of this results in the aspect of the current study could be attributed to the status of lacking the sufficient level of training and awareness of the effect of the threats on their personal and organisational performance. Hence, believing that the organisation is the first protector of their information regarding cybersecurity may make them expressing low level of self- efficacy when it comes to protecting their personal information at workplace. The availability of the strategies, initiatives and regulations related to promoting cybersecurity in the public sector in the UAE does not necessarily imply that all employees possess the determination related to utilizing cybersecurity to avoid any relevant threat while working digitally. This also highlights the need of corporation authority to maintain a closer look in monitoring the extent of capabilities and determination among their employees across different categories to ensure that the level of their skills, capabilities and determination is compatible with unpredicted nature of digital work environment.

Response cost is a proven negative contributor to the intention and behaviour regarding information security (Zhang, Zhang and Jiang, 2023). According to Mills, Todorova and Zhang (2024), the high level of response cost triggers the action to use specific tools in the domain of information technology. Gillam and Foster (2020) concluded that perceived response cost is a significant predictor of risky cybersecurity behaviours among employees. Further, the perceived response cost leads to changing the individual behaviour and actions with respect to cybersecurity protection (Woon, Tan and Low, 2005). The absence of its significance in this study could be attributed to the lack of occurrence of the threat as well as the awareness relating the measures to be taken to conquer potential threats in cybersecurity and information protection. Therefore, when the response cost is high or low, it would certainly affect the tendency or behaviour in the organisation towards information protection.

In the same vein, perceived threat susceptibility and response efficacy are found influential on CPB. Fan et al. (2024) stated that the individual threat susceptibility is associated with appropriate online security habits. Safaei and Head (2024) argue that improving the human computer interaction can help in mitigating the threat susceptibility which could contribute towards enhancing the adopted protection behaviour. Further, Ribeiro, Guedes and Cardoso (2024) indicate that the more ability of the individuals with respect to cybersecurity threats, the threat susceptibility gets reduced which implies improving the personal abilities in this aspect.

Mwakatage and Golyama (2024) reported that perceived response efficacy significantly shapes the attitude of the individuals towards action or prevention. According to Mills, Todorova and Zhang (2024), the perception of coping

and response efficacy helps in understanding how to cope effectively towards the threats. Further, Choi et al. (2024) argued that response efficacy is associated with the uptake of actions when it comes to using technology in response to emergencies. According to the theory of protection motivation, appraisal is necessary for threats as well as for the coping abilities and strategies. The UAE public sector has a significant infrastructure with technology and information system which is considered effective in facilitating such evaluation related to the threats and coping strategies (UAE, 2022). Compliance to the national strategies promoting cyber security is considered an essential step towards nurturing protection motivation among employees in the public sector (Al-Kumaim and Alshamsi, 2023). What promotes this motivation among employees is the focus on training and regular monitoring within the organisation to ensure best practices regarding cybersecurity are embraced by them (Al Neaimi and Lutaaya, 2018).

PCM is significantly associated with all the dimensions of cybersecurity protection motivation. This is confirmed in previous research as the literature presents evidence that procedural security countermeasure awareness positively influences protection motivation components, except for self-efficacy (Humaidi and Abdallah Alghazo, 2022). Further, Hassandoust and Techatassanasoontorn (2020) argue that procedural security countermeasure awareness positively affects response efficacy, response efficacy and response cost. This is also confirmed by Oruc, Chowdhury and Gkioulos (2024) who concluded that the lack of awareness leads to the occurrence of many cybersecurity attacks. However, along with lacking the awareness, the lack of policies and practices are also associated with the protection motivation (Sultan, Laias and El Saiti, 2024). In addition to this, Alyami et al. (2024) confirm that gaining education and awareness with respect to information security is considered effective in promoting the tendency in organisation towards cybersecurity protection. This requires regular improvement in the awareness process Shakti and Hidayanto (2024) in order to ensure that the awareness remains at a good level to promote the activities of individuals in organisations towards information security development Indrakusuma and Hidayanto (2024).

In the context of UAE, education and training are considered the major factor to promote encounter measure awareness among individuals regarding cyber security threats and attacks. In the aspect of education, educational institutions in the UAE can play a significant role in shaping the extent of knowledge and awareness among graduates about cybersecurity and the challenges associated with working in a digital work environment. This role can be guided by the national strategies launched to promote cyber security in the country (AlDaajeh *et al.*, 2022). Based on this, graduates could be prepared to be equipped with the necessary knowledge and capabilities that positively contribute to the motivation of employees to adhere to the best practices related to maintaining cyber security and preventing its attacks and managing its challenges (AlDaajeh *et al.*, 2022; UAE, 2022; Aliebrahimi and Miller, 2023).

When it comes to the role of knowledge and awareness in triggering the motive for information protection, knowledge sharing promotes self-efficacy among employees (Islam and Asad, 2024; Islam *et al.*, 2024). Further, knowledge and awareness improve the threat undesirability which is proven to be influential on protection motivation (Mady, Gupta and Warkentin, 2023). Finally, training and education can promote the protection motivation among individuals (Khan *et al.*, 2023).

The three dimensions of Managers' Information Security Intelligence (MISI) have significant and positive effect on the Procedural Information Security Countermeasure Awareness (PCM) of employees. This is consistent with previous literature. The support of management with respect to policy and problem solving can play a significant role towards building information security culture which in turns form the intention and behaviour of individuals towards cybersecurity protection (Tenzin, McGill and Dixon, 2024). Further, the activities of managers with respect to monitoring are helpful regarding solving the challenges that hinder the activities of cybersecurity protection (Ahmadi, 2024).

Alghazo, Humaidi and Noranee (2023) demonstrate that the dimensions of information security competences significantly influence the PCM among individual. The study done by Kim, Hovav and Han, 2019 has reported that perceived information security knowledge (PISK) and perceived information security problem (PISP) solving significantly influences PCM.

Similarly, Kirwan (2008) report that MISI is a significant factor in promoting PCM. However, the literature presents a different point of view when it comes to perceived social competence (PSC) which was found insignificant in affecting PCM (Alghazo, Humaidi and Noranee, 2023).

Therefore, the competencies possessed by managers can play a significant role in their awareness and knowledge related to information security. This implies that the development of the abilities and skills of the managers can

lead to developing their knowledge and awareness measured dedicated for information security. The cybersecurity protective behaviour is not found significantly influenced by perceived information security knowledge which is inconsistent with previous literature due to the lack of the sufficient knowledge and awareness that could have an effect on the protection motivation. The literature presents evidence that the managers abilities regarding knowledge and problem solving are considered influential when it comes to taking actions and behaviour (Korzynski and Protsiuk, 2024; Nguyen *et al.*, 2024).

Improving the capabilities of managers in the digital aspect in the UAE context is essential to avoid the negative effects of cybersecurity threat. When considering the aspect of the organisational that have already experienced cybersecurity attacks, the role of managers skills and capabilities should be considered in a more serious extent due to the role that can be played by utilizing the skills and capabilities among managers in implementing the guidelines and recommendations highlighted in the national strategies and initiatives targeting the promotion of cyber security awareness and best practices associated with maintaining safety and productivity in the public sector (AlDaajeh *et al.*, 2022; UAE, 2022; Aliebrahimi and Miller, 2023).

In addition, the results showed that cybersecurity protective behaviour is found to be significantly and positively influenced by PISP and PSC. The result is in line with previous research (Zwilling *et al.*, 2022; Butera, Dompnier and Darnon, 2024). Previous research indicates that the increase of the PSC leads to increasing the adoption of CPB (Carroll *et al.*, 2020; Özerk, Özerk and Silveira-Zaldivara, 2021; Zwilling *et al.*, 2022). Social competences and social support are significant in promoting the behaviour of individuals (Sinha and Sarkar, 2024). Further, the social competence and social influence are significant in improving the achievement of goals (Butera, Dompnier and Darnon, 2024) which can be applicable in the aspect of information security. According to Zwilling et al. (2022), even though individual possess the knowledge related to cybersecurity, they are found to apply only minimum protection measures which are considered common and simple to use. Furthermore, when employees possess the required knowledge, awareness and competences, their behaviour towards applying the procedures improves (Li *et al.*, 2019).

The moderating effect is unsupported in this study which is inconsistent with previous research. The literature presents evidence that the positive attitude towards cybersecurity leads to less perception of risky behaviour (Hadlington, 2017), which is also associated with adopting certain protective behaviours. This iterates that the change in cybersecurity attitude among the employees does not have an effect in the role played by protection motivation in the behaviour of induvial regarding cybersecurity protection. Expressing attitude towards information security influences the decision of students to protect their privacy on social media (Sales *et al.*, 2024), this is also confirmed by the argument of Baltuttis, Teubner and Adam (2024) that higher attitude affects the decisions towards information security protection is more common with the experience of working with information security domain. When the cybersecurity attitude is low, the association between protection motivation and protection behaviour could be rendered to a low effect association (Lechuga Sancho, Martín-Navarro and Ramos-Rodríguez, 2020; Sun *et al.*, 2022; Koloba and Surtie, 2023).

The enhancement of attitude towards cybersecurity among public sector employees in the UAE context is closely linked to raising awareness and education, particularly within educational institutions. Implementing managerial development programs for the public sector employees can significantly improve their understanding of the country's cybersecurity strategies and policies, encouraging better compliance with practices related to CPB. Additionally, on the job training plays a crucial role in fostering positive attitude among public employees, emphasizing the importance of cybersecurity in maintaining a safe and productive work environment. Research by Al Neaimi, Ranginya and Lutaaya (2015b), Al Shamsi (2019) and Ismail and Alrabaee (2024) supports the view that continuous training and education are essential for promoting strong cybersecurity practices among the employees.

5.1 Research Implication

The study implication is summarised by providing significant evidence for managers and authorities in corporations within the Emirati context by setting strategies and policies that are dedicated to ensuring the protection practices that contribute to the performance improvement among individuals as well as corporations; identifying the chances for improvement when it comes to information security protection; and utilising digital assets of the organisation for better protection. Policymakers can utilise the research outcome to address organisational and individual cybersecurity concerns by incorporating cyber threat severity awareness into a wider and national campaigns to promote security protection. The main rule that can be played by policy makers is to ensure the implementation of the established strategies targeting safer work environment in the public sector through

ensuring the compliance of individuals as well as organisations in the public sector towards having safer and effective work environment in the UAE.

Managers and executive should utilise the research outcome in fostering a culture of continuous learning and improving personal abilities for the purpose of mitigating susceptibility and protective behaviour improvement. Managers can support the development of knowledge and awareness about cybersecurity among themselves and among their employees. The first necessary aspect that can be embraced by public sector managers is to engage in managerial development programs to ensure they are aware of the best practices to maintain security measures to ensure a safe work environment in their administrations. Furthermore, managers can enhance cybersecurity knowledge and awareness among their employees by supervising on-the-job training sessions and programs, particularly for those who lack experience or understanding in dealing with cybersecurity threats.

Finally, policymakers should address organisational and individual cybersecurity concerns by incorporating cyber threat severity awareness into a wider and national campaigns to promote security protection.

When considering knowledge and awareness, educational institutions can play a key role in promoting the knowledge and awareness of the public towards cybersecurity and its importance in maintaining a safe work environment. Universities can utilise the outcome of this research in initiating managerial development programs for the employees in the public sector with the coordination of the relevant public institutions to ensure that the level of knowledge and awareness about cyber security and its threats is well maintained among students, graduates and employees. This is considered effective in improving the caution level among employees in dealing with responsibilities and tasks conducted in digital platforms in the public sector.

Theoretically, this research extends the theoretical understanding of the role played by the skills and abilities of managers in driving both the awareness as well as the behaviour of employees in respect to cyber security. The contribution of this research towards knowledge and theory is summarised by highlighting the role of support, awareness, managers' capabilities and resources in promoting cybersecurity in the public sector within the UAE context. Similarly, the individual' attitude and perception does not emerge as a key contributor towards promoting cybersecurity within the UAE context.

6. Conclusion

The study assessed how protection motivation promotes cybersecurity protective behaviour through measuring the aspect of employees in the public sector in the UAE. The study highlighted that perceived threat severity and perceived threat susceptibility should be improved through actual knowledge and experience to shape individual skills towards enhancing cybersecurity protective behaviour. Moreover, the importance of cybersecurity awareness in promoting protection motivation is highlighted, such awareness can be fostered through utilizing managerial competencies in the organisations. The study highlighted that cybersecurity protective behaviour is dependent on enhancing the managerial capabilities, awareness and motivation among employees towards embracing cybersecurity best practices. Finally, the attitude of employees towards cybersecurity may not be a fundamental driver for employing their motivation towards adopting cybersecurity best practices.

It is concluded that the attention should be focused towards enhancing the knowledge and awareness about information security, along with competences and skills of managers promoting the protection motivation factors and that leads to improving the cybersecurity protective behaviour among employees. The study recommends conducting educational sessions and awareness programs with respect to information security and protection; setting clear strategies as well as objectives related to employee information protection through using optimum tools; and coordinating the effort between the organisations with their employees with the governmental institutions in order to ensure that cybersecurity policies and practices are established.

Regardless of the effort made by the researchers, the study is still limited due to focusing on the listed corporation in Abu Dhabi, hence generalizing the results should take into consideration the shared characteristics; targeting managers and administrative members in such companies which creates a gap for further research to be widened in respect of sample and population. Further research can include organisations beyond the listed companies, further, comparative studies between the public and private sector can bring different insight contributing policy and practice. In addition to this, qualitative research method can be employed to investigate the perspective of managerial experts in organisations about managing cybersecurity attacks.

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AI Statement: The authors declare that this work is original content prepared by them and no technology (e.g. AI) was used to generate all or part of its content. Further, the authors declare that this work is not under publication or presentation considerations elsewhere.

Ethics Statement: This study was approved by the Institutional Research Ethics Committee (REC). Informed consent was obtained from all participants.

Conflict of Interest: The authors declare that they have no competing interests.

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Appendix 1: Table

Managers' Information Security Intelligence Skills (MISI) - Adapted from (Kim et al., 2019).		
Perceived Information Security Knowledge		
PISK	PISK1	Senior managers of my company know about information security.
	PISK2	Senior managers of my company understand information security issues.
	PISK3	Senior managers of my company are trained in information security.
	PISK4	Senior managers of my company understand information security management.
	PISK5	Senior managers of my company understand information security impacts.
Perceived Social Competence		
PSC	PSC1	Senior managers of my company operate an open-door policy.
	PSC2	Senior managers of my company ask their employees questions.
	PSC3	Senior managers of my company have good communication skills.
	PSC4	Senior managers of my company capture all views.
	PSC5	Senior managers of my company engage people at the floor level.
Perceived Information Security Problem-Solving		
PISP	PISP1	Senior managers of my company maintain a balance between information security management and its costs.
	PISP2	Senior managers of my company make decisions regarding the company's information security after consultation.
	PISP3	Senior managers of my company are ready to understand information security problems.
	PISP4	Senior managers of my company make informed decisions about information security problems.
Global	GI	Overall, senior managers of my company have a good information security skills
Procedural Information Security Countermeasure Awareness (PCM) - Adapted from (Simonet & Teufel, 2019)		
PCM	PCM1	I recognize that safe security practices are needed to deal with cybersecurity threats and risks.
	PCM2	I understand that following safe security practices are essential to protect my firm against cyberattacks.

	PCM3	I have the knowledge and capability to recognize and respond to cybersecurity threats and risks.
	PCM4	I am mindful of the cybersecurity threats and risks I face when doing my job.
	PCM5	I recognize that I have to take security protection measures to protect my firm's information assets against cyberattacks.
Cybersecurity Protective Attitude (CTA) – Adapted from (Hadlington, 2017)		
CTA	CTA1	I think that management have the responsibility to ensure a company is protected from cyber crime.
	CTA2	I am aware of my role in keeping the company protected from potential cyber criminals.
	CTA3	I believe everyone in the company has a role to play in protecting against threats from cyber criminals.
	CTA4	I can help protect the organisation from cyber crime.
	CTA5	I have the right skills to be able to protect the organisation from cyber crime.
Cybersecurity Protection Motivation (CPM) – Adapted from (Mousavia et al, 2020)		
Threat Severity		
SEV	SEV1	If my information released to unauthorized people, it would be very bad for me.
	SEV2	If my information released to unauthorized people, it would be a serious danger.
	SEV3	If my information released to unauthorized people, it would be significant danger.
	SEV4	If my information be available to unauthorized users, it would be risky.
Threat Susceptibility		
SUSC	SUSC1	My information is at risk for being released to unauthorized people.
	SUSC2	It is likely that my information will become available to unauthorized people.
	SUSC3	It is possible that my Information will become available to unauthorized people.
	SUSC4	It is likely that others get access to my information without my permission.
	SUSC5	It is probable that others get access to my information without my permission.
Self-efficacy		
SE	SE1	It is easy for me to use privacy assurance mechanisms.
	SE2	It is convenient for me to use privacy assurance mechanisms.
	SE3	I am able to use privacy assurance mechanisms without much effort.
Response Efficacy		
RE	RE1	Complying with the information security policies in my organisation will keep security breaches down.
	RE2	If I comply with information security policies, the chance of information security breaches occurring will be reduced.
	RE3	Careful compliance with information security policies helps to avoid security problems.
Response Cost		
RC	RC1	It is inconvenient to check the security of an email with attachments.
	RC2	Changing the privacy setting on social media sites is inconvenient.
	RC3	Backing up a computer regularly is inconvenient.

Cybersecurity Protective Behaviour (CPB) – Adapted from (Li et al, 2019)		
CPB	CPB1	I keep the anti-virus software on my computer up-to-date.
	CPB2	I watch for unusual computer behaviours/responses (e.g., computer slowing down or freezing up, pop-up windows, etc).
	CPB3	I always act on any malware alerts that I receive.
	CPB4	It is inconvenient to check the security of an email with attachments.
	CPB5	Changing the privacy setting on social media sites is inconvenient.

Investigating Knowledge Transfer Practices: Insights from Software Development Project Managers

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Abstract: Software Development Projects (SDPs) in developing economies often experience high failure rates, with the knowledge transfer (KT) behavior of SDP managers being a key challenge. While research on KT behavior is extensive in developed nations, limited studies focus on emerging economies, particularly Nigeria. This study aims to examine the factors influencing KT behavior among SDP managers in Nigeria based of insights from Social Cognitive Theory (SCT) and the SECI model. This study employs a quantitative research approach with multiple regression analysis in SPSS to test the research hypothesis and analyze the relationships among the variables in the proposed model. Data was collected from 160 SDP managers in Nigeria using a structured survey questionnaire. The results indicate that Work Motivation, Trust to Share, Social Interaction, IT Infrastructure, and Security and Privacy significantly influence KT behavior among SDP managers. However, Reciprocity, Social Identity, and Shared Language were found to have no significant impact. These findings suggest that both psychological and technological factors play a vital role in fostering KT behavior, however SDP managers in Nigeria do not regard reciprocal benefit social identity and shared languages as critical factors that influences their KT behaviors. This study provides insights for SDP managers, policymakers, and knowledge management practitioners on the factors that can improve KT behaviors of SDP managers. It emphasizes the need for targeted interventions, such as fostering trust-based collaboration, strengthening IT infrastructure, and ensuring secure knowledge-sharing platforms to enhance KT practices.

Keywords: Knowledge transfer behavior, Software development project manager, Social cognitive theory, SECI theory

1. Introduction

The Fourth Industrial Revolution (4IR) has significantly increased reliance on Information, Communications, and Technology (ICT), with software development projects (SDPs) emerging as critical components in this landscape (Ayentimi and Burgess, 2019). SDPs play a vital role in enabling organizations across various sectors such as healthcare, education, and finance to remain competitive in this era. The primary goal of these projects is to develop software solutions that streamline and enhance organizational processes, thereby contributing to overall efficiency and productivity (Khan and Keung, 2016). Despite their importance, there has been a high failure rate of SDPs which has become a global concern for both researchers and industry experts alike (Lehtinen et al., 2014; Niazi et al., 2016). The failure of SDPs is not a recent phenomenon, it dates back to the 1960s when the issue was first recognized as an international crisis affecting both developed and developing nations (Mtsweni and Gorejena, 2023).

The Standish Group's (CHAOS Report, 2020), which analysed 50,000 projects worldwide, revealed that 66% of SDPs either fail partially or completely. In developed nations like the United States, 31% of SDPs are outrightly cancelled, while 53% are so problematic that they are considered "challenged" (Faeth, 2022). This trend is not limited to developed countries; SDPs in developing nations, including Nigeria, face similar challenges (Ardo, Bass and Gaber, 2023; Mtsweni and Gorejena, 2023; Srisuksa, Wiriyapinit and Bhattarakosol, 2022). Despite these challenges, the number of SDPs has increased significantly in developing countries, attracting substantial investments. For instance, South African enterprises are projected to invest R150 billion in SDPs, with potential losses of R18 billion due to the high failure rate of these projects (Marnewick, 2016; Niazi et al., 2016). This highlights the severity of SDP failures, particularly in developing nations.

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Nigeria ranks 122nd out of 140 countries in digital skills development, which has significantly impacted SDP organizations. The shortage of experienced professionals, driven by uncompetitive salaries and limited career advancement opportunities compared to more developed regions, has contributed to the high failure rate of Nigerian SDP organizations (Kazeem, 2018). For instance, Ramachandran et al. (2019) reported that most Nigerian SDP firms employ only a small number of full-time project managers, with 11% of these organizations urgently needing additional expertise. Additionally, local tech entrepreneurs struggle to attract and retain skilled personnel, as they compete with larger, well-established companies offering higher salaries and better working conditions (OC&C Consulting, 2018). This persistent talent shortage remains a major barrier to the growth and sustainability of Nigeria's tech sector (Ramachandran, Obado-Joel, and Dempster, 2019).

SDPs are essentially knowledge-intensive, requiring a combination of explicit and tacit knowledge to carry out socio-technical activities that are focused on human needs (Mtsweni and Gorejena, 2023). While access to documented explicit knowledge is generally not an issue, SDP teams often struggle with limited access to tacit knowledge held by SDP managers (Smith, 2001). This limited access becomes a significant barrier when teams are unable to perform tasks to the requisite standard, leading to delays and project failures. The difficulty in transmitting tacit knowledge suggests the presence of unexplained barriers, with SDP managers potentially contributing to these challenges by restricting the flow of their expertise.

In each project a SDP manager takes the lead and oversees the coordination of activities, ensuring adherence to schedule, scope, budget limitations and manage the employees involved concurrently in order to achieve the expected project outcome (Chai and Lebeaux, 2020; Kaleshovska and Pulevska-Ivanovska, 2019). The role of a SDP manager is not limited communication, planning, leading, coordinating, task delegation, and executing SDP activities but also navigate more complex challenges than their team members, requiring a profound understanding of both managerial and technical aspects (Jennex, 2019). These skills can be honed and enhanced through training, on- the-job experience, and knowledge transfer (KT) by more experienced project managers Given that SDP is knowledge-intensive in nature and the knowledge of the SDP manager is crucial to the project success, effective KT of SDP manager to his team members is therefore important to achieve project success. Thus, businesses must prioritize the transfer of this knowledge and skills.

Additionally, having an effective KT process provides firms with a competitive edge (Osterloh and Frey, 2000) but the majority of project managers continue to lack adequate transfer of project management expertise which affects their KT behavior. While there is numerous definitions of KT in the past, all of which are consistently stating that KT is the transfer of experience and expertise from a sender (i.e.., SDP manager) to a receiver (i.e. SDP team members) within a particular environment until the receiver acquires new expertise in that environment. However, KT behavior of SDP manager refers to the intentional actions and processes through which they share, disseminate, and communicate both tacit and explicit knowledge with their teams to enhance project efficiency and success (Nonaka, 1994; Polanyi, 1966). This behavior is critical in SDP, where knowledge is highly specialized, dynamic, and context-dependent (Dalkir, 2011). SDP managers engage in KT behavior through various mechanisms, including documentation, mentoring, meetings, informal discussions, and the use of collaboration tools (Stampfl, Prodinger and Palkovits-Rauter, 2024). Therefore, effective KT fosters knowledge continuity, minimizes project delays, and enhances team performance.

KT in developing countries like Nigeria differs significantly from that in developed economies where they benefit from well-established knowledge management (KM) systems, robust IT infrastructure, and institutionalized knowledge-sharing cultures (Nonaka and Takeuchi, 1995; Dalkir, 2011). For instance, Nigerian SDP organizations face substantial challenges that impede efficient KT practices. The lack of skilled manpower and knowledge incubation facilities results in frequent talent migration, making it difficult for indigenous tech firms to retain experienced professionals (Ajayi, 2020; Ramachandran et al., 2019). Unlike developed countries where formal KM strategies are widely implemented, knowledge-sharing in Nigerian tech firms is often informal and ad hoc, increasing the risk of knowledge loss when the experienced employees leave the organization (Ibitowa and Akinola, 2020). Furthermore, vulnerability of IT tools in Nigeria exacerbate KT challenges and undermine trust in project management platforms (Binuyo, 2020).

Unlike developed economies where secure and integrated digital platforms facilitate seamless KT, Nigerian organizations often lack the necessary measures, leading to frequent breaches that deter professionals from openly sharing knowledge (Ajayi, 2020). While Nigerian SDP organization battles with shortage of skilled SDP professionals there is a pressing need for these organizations to mitigate strategies for implementing KT practices from experienced SDP managers to less experienced team members so that when the project manager leave the organization their knowledge still remains within the organization. SDP managers play a crucial role in

the success of SDP initiatives in Nigeria. However, a review of the literature reveals that while extensive research has been conducted on SDP and KT practices, little to no focus has been placed on Nigeria or the specific KT behaviors of Nigerian SDP managers. Despite the growing number of SDP initiatives, the Nigerian software industry continues to face a shortage of skilled SDP managers, and many indigenous companies remain underdeveloped. This talent gap, coupled with organizational and structural challenges, has contributed to a reluctance among SDP managers to actively engage in KT practices.

Given the critical role of KT in enhancing project success and fostering industry growth, this study aims to examine the factors that may influencing KT behavior among SDP managers in Nigeria. Grounded in Social Cognitive Theory (SCT) and the SECI model, this research will provide empirical insights into the determinants of KT participation, offering practical recommendations for strengthening KT practices and improving the sustainability of SDP initiatives in Nigeria.

2. Literature Review

In this study, a preliminary literature review was conducted to establish a foundational understanding of KT and its relationship with SDP failure. Following this, significant elements and theories related to the study were identified and hypothesized to examine the relationships and provide a comprehensive framework. This approach aligns with other research in the field of SDP (Babalola and Omotayo, 2017; Buthelezi and Mkhize, 2015; Khoza and Bwalya, 2021). This section provides an overview of the existing literature on KT in SDP organizations, with a particular focus on its relevance to developing countries. It also identifies the factors associated with ensuring the implementation of KT practices for SDP managers, particularly in Nigeria.

2.1 Knowledge Transfer and Software Development Project Organizations

The transfer of knowledge also known as KT has been defined in various ways over time (Argote and Ingram, 2000; Carlile and Rebentisch, 2003; Liyanage et al., 2009), but these definitions consistently emphasize the core idea that KT involves the movement of experience and expertise from a source to a recipient within a specific context, enabling the recipient to acquire new skills and knowledge in that environment. KT is a process that involves disseminating knowledge, talents, skills, and experience among individuals within an organization, and it is an essential component for enhancing performance, fostering sustainability, and an edge over competitors (Lartey et al., 2022). Later research expanded on this by emphasizing that effective KT requires not only the transmission of knowledge from a source to potential recipients but also the recipients' ability to fully understand and apply the knowledge to guide their actions (Davenport and Prusak, 1998; Srisuksa, Wiriyapinit and Bhattarakosol, 2022).

SDP organization is a structured entity that manages the planning, execution, and delivery of software projects by integrating technical expertise, managerial coordination, and knowledge management practices (Niazi et al., 2016). These organizations often operate in knowledge-intensive environments, requiring effective collaboration and KT practices such as documentation, mentoring to ensure project success (Ghobadi and Mathiassen, 2016). The primary goal of SDP organization is to successfully design, develop, and deploy high-quality software solutions that meet user requirements, business objectives, and industry standards. These projects often function independently and are sometimes geographically dispersed. This setup leads to communication barriers among project teams, which in turn impede KT and hinder the learning process (Wiewiora et al., 2009). Such barriers contribute to learning closure, where cross-project learning and communication are limited, ultimately resulting in project failures (Hobday, 2020). The transfer and application of knowledge from one project to another are not effectively realized instead, there is a tendency to repeat past mistakes, often starting new projects without leveraging lessons learned from previous ones (Prusak, 1997).

SDP organizations are characterized by their dynamic nature, relying on diverse design teams to deliver constantly evolving software solutions (Aghimien et al., 2019). The selection of project teams is based on their existing knowledge and expertise relevant to the tasks at hand. However, despite this, many software projects face significant challenges in their early stages due to ineffective KT practices (Srisuksa, Wiriyapinit and Bhattarakosol, 2022). This issue is particularly pronounced in SDP organizations in developing countries like Nigeria, where such projects are critical drivers of economic development (Omotayo and Babalola, 2016). Yet, these organizations face obstacles such as inadequate project planning, poor management, and a shortage of skilled software developers (Kazeem, 2018; Obado-Joel and Helen, 2021). The ineffective management of acquired knowledge and the scarcity of proficient software developers are key factors that need urgent attention.

Many organizations overseeing SDPs are owned by individuals with limited industry expertise, who rely heavily on their staff, regardless of their experience level, to bridge this knowledge gap (Srisuksa, Wiriyapinit and Bhattarakosol, 2022). Unfortunately, stakeholders often struggle to communicate their expertise throughout the SDP lifecycle within these organizations. When key personnel leave, they typically take their knowledge with them, leaving little to no institutional knowledge for future projects (Anwar et al., 2017). Given the highly competitive nature of the SDP industry, it is crucial for these organizations to develop effective strategies for managing and disseminating knowledge among team members. Efficient KT is therefore essential for the success, growth, and sustainability of SDP organizations.

2.2 Theoretical Foundation

2.2.1 Factors that influence knowledge transfer behaviour

Understanding KT behavior requires examining the influence of human behavior on such activities. Behavioral factors can either facilitate or hinder KT, making it essential to explore the underlying drivers of KT behavior. Numerous studies have investigated factors influencing KT intention and behavior through various theoretical perspectives. While conceptual studies (de Castro et al., 2022), content analyses (Stampfl, Prodinger and Palkovits-Rauter, 2024), and literature reviews (Anwar et al., 2019) have provided valuable insights, survey-based studies have employed diverse theoretical frameworks. Some widely used models include the Theory of Reasoned Action (TRA) (Khoza , 2018; Rese, Kopplin and Nielebock, 2020), Organizational Behavior and Organizational Learning Theory (Biloslavo and Lombardi, 2021), Social Exchange Theory (Jiang and Xu, 2020; Razzak and Ahmed, 2014), Polanyi's Tacit Knowledge Theory, and the Knowledge-Based View (Nurye, Molla and Temtim Assefa Desta, 2019). However, despite the extensive body of research, Social Cognitive Theory (SCT) and the SECI model have been underutilized in explaining KT behavior, presenting an opportunity for further theoretical exploration. This research primarily adapts insights from SCT and SECI Theory due to their suitability for understanding KT behavior.

Empirical research has consistently highlighted individual factors such as trust, reciprocity, social identity, and perceived self-efficacy as critical determinants of KT behavior. For instance, (Rese, Kopplin and Nielebock, 2020) demonstrated that trust and reciprocity significantly influence KT among German software teams, with self-efficacy acting as a mediator. Similarly, (Karagoz, Whiteside and Korthaus, 2020) found that reciprocity is essential in software project environments, although its impact varies based on organizational context. However, conflicting evidence exists. da Silva, Mosquera and Soares (2022) in their research reported that trust and reciprocal benefits had no significant effect on KT, suggesting that contextual factors may shape KT differently across organizations.

The role of shared language in KT has also been widely debated. Omotayo and Babalola (2016) found that shared language positively affects KT, whereas social identity demonstrated a negative correlation, highlighting the intricate interplay between individual and group-level factors. Contrarily, (Davidavičienė, Al Majzoub and Meidute-Kavaliauskiene, 2020) found no strong empirical support for shared language as a determinant of KT in virtual teams, underscoring the need for further investigation into its influence in diverse organizational settings.

Social interactions play a pivotal role in facilitating KT by enabling the exchange of both tacit and explicit knowledge. Mtsweni and Gorejena, (2023) suggested that social interaction among software teams enhances KT by reducing cohesion-related barriers. This aligns with (de Castro et al., 2021) research about the SECI model which emphasizes the role of socialization in KT. However, Jiang and Xu (2020) paper pointed out that reward systems have produced mixed results in knowledge-sharing effectiveness. While Khoza (2018) found that employees in South African SDP firms prioritize compensation when engaging in KT, others argue that intrinsic motivators, such as commitment and self-efficacy, may be more significant.

Security and privacy concerns have been recognized as major obstacles to KT in SDP environments. Akgün et al. (2017) found that perceived risks related to information confidentiality limit KT willingness among software professionals. Similarly, Jiang and Xu (2020) reported that concerns about knowledge misuse negatively impact tacit KT. These findings suggest that organizations must address security and privacy risks to create a conducive KT environment.

IT infrastructure is another critical enabler of KT behavior. Studies have identified IT systems as instrumental in facilitating seamless KT within organizations (Khoza and Bwalya, 2021; Kukko and Helander, 2012; Stampfl, Prodinger and Palkovits-Rauter, 2024). Recent research (Davidavičienė, Al Majzoub and Meidute-Kavaliauskiene, 2020; Islam, Jasimuddin and Hasan, 2015; Stampfl, Prodinger and Palkovits-Rauter, 2024) emphasized IT infrastructure as a key driver of KT among IT professionals in the United Arab Emirates. Anwar et al. (2019)

further proposed a framework highlighting IT infrastructure's role in SDPs, though empirical validation remains necessary. Given the diverse and sometimes contradictory findings in the literature, this study aims to examine key determinants of KT behavior among SDP managers in Nigeria using insight from SCT and SECI model.

2.2.2 Social cognitive theory

The SCT provides a framework that assists in the understanding, predicting, and modifying human behaviour. In essence, SCT provides the theoretical foundations that facilitate a dynamic interplay between personal factors, organizational factors, and their influences on an individual's behaviour, in which each factor has a bidirectional impact on each other (Hsu et al., 2007; Shehu Malami, Alawiyah and Ibrahim, 2022). During the mid nineties research by Bandura (1986) and Wood (1988) suggested that human behaviour is a dynamic interaction between personal factors, ethics, and the environment. SCT posits that an individual's knowledge acquisition is intricately linked to observing others (Anwar et al., 2017). Therefore, SCT can be applied this study to understand the factors that effects SDP mangers to participate in KT practices. Bandura argues that if individuals lack confidence in their capacity to effectively share knowledge, they are unlikely to engage in such behaviour, particularly when KT is optional.

Based on SCT, SDP manager's behaviour towards KT practices can be influenced by personal factors and environmental factors, such as those within the project organization (Wood and Bandura, 1989). Previous studies utilizing SCT have identified several factors influencing KT practices, including motivation, trust, social identity, shared language, social interaction, and reciprocity (Babalola and Omotayo, 2017; Buthelezi and Mkhize, 2014; Chiu et al., 2006). For instance, Chiu, Hsu and Wang (2006) found that social interaction ties, reciprocity, and identification significantly enhanced individuals' KT behaviour. However, contrary to expectations, trust and shared language did not significantly impact KT, while a shared vision had a strong, albeit negative, influence on KT practices. This study adopts the variables of work motivation, trust in sharing, social identity, shared language, social interaction, and reciprocity from the SCT framework.

While SCT has been extensively applied to explore factors influencing KT, prior studies have largely overlooked the impact of technological factors. Similarly, research within the SDP literature has paid insufficient attention to the role of technological infrastructure. SCT primarily addresses the question of why individuals engage in KT practices from the perspectives of personal and organizational factors. However, it does not account for the organizational resources that may influence an individual's behaviour. To address this limitation, the SECI model is introduced to complement SCT and provide more understanding of the factors influencing KT behavior of SDP managers.

2.2.3 Socialization externalization combination and internalization (SECI) model

The SECI model provides a framework for understanding how knowledge can be converted and shared within an organization. It emphasizes the importance of social interactions, communication, and the creation of shared understanding in the process of knowledge conversion (Nonaka and Takeuchi, 1995). Socialization refers to the process by which individuals interact and learn from one another through methods like observation, imitation, or apprenticeships (Nonaka, 2023). Combination involves merging explicit knowledge through meetings, conversations, or information systems. Internalization converts explicit knowledge into tacit knowledge, while externalization transforms tacit knowledge into explicit knowledge (Nonaka, 2023; Nonaka and Takeuchi, 1995). SECI model has been mostly applied in computer science and information technology (Adesina and Ocholla, 2019) and has usually been adopted in KT studies. Previous studies, including those by Abdelwhab Ali et al. (2019), Adesina and Ocholla (2020), and that of Zhou et al. (2020) have used insights from the SECI model to explain certain factors that influence KT behaviors. This study adopted this strategy in explaining how knowledge is created and transfer among SDP managers in Nigeria.

2.3 Development of Hypothesis

2.3.1 Work motivation

Work motivation refers to the internal or external factors that drive individuals to engage actively in their work-related tasks, goals, and responsibilities. It can include intrinsic motivation (personal interest, enjoyment), extrinsic motivation (rewards, recognition). Prior research has viewed "work motivation" as a personal factor (Anwar et al., 2017; Nidhra et al., 2013). According to one study, work motivation is the encouraging force behind an individual's behavior (Hung et al., 2011). SDP managers are more likely to engage in KT behaviours if their organization encourages them (Chedid, Alvelos and Teixeira, 2020; Noor Aziela, Nasir Ismail and Rahimi Mohamad, 2022). In developing countries like Nigeria, resource constraints, such as limited access to technology

and training facilities, may impact work motivation and the ability to engage in effective KT behavior (Babalola and Omotayo, 2017; Olatokun and Nwafor, 2012). In Nigeria issues such as the value given to SDP manager's work, cultural norms, and pattern of communication influences how work motivation is perceived and expressed by SDP managers in the workplace. Limitations on the SDP managers in terms of low income and perceived lack of benefit from sharing knowledge make overall knowledge transfer complicated (Khoza and Bwalya, 2021). This study incorporates "work motivation" as a personal factor, resulting in a positive relationship between work motivation and the KT behavior of SDP managers. Therefore, the following hypothesis is formulated:

H1. There is a significant relationship between SDP manager's work motivation and KT behavior.

2.3.2 Trust to share

Trust can be defined as the belief in the reliability, integrity, and competence of others in the work environment. Mayer, Davis and Schoorman (1995), argued that trust involves three key components: competence, integrity, and benevolence, and it influences KT and cooperation. Individuals are inclined to impart their expertise to others when they perceive the imparter to be trustworthy and sincere. According to Blau (1964, p.14) trust is a fundamental component of the social exchange process. Similarly, Nonaka (1994) asserts that interpersonal trust is critical for fostering an environment conducive to knowledge transmission within organizations and teams. The presence of trust among individuals increases their propensity to participate in cooperative behaviours, including KT practices (Nahapiet and Ghoshal, 1998).

Likewise, Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín (2011) in their research assert that trust is a critical component of social transactions; thus, trust can facilitate the transmission of knowledge, since transferring one's knowledge voluntarily with others constitutes a social transaction. Literature indicates that personal relationships, socialization, and constant interactions contribute to the development of trust between individuals (Kotlarsky and Oshri, 2005). The investigation of trust holds particular significance within the framework of developing nations such as Nigeria, where the number of proficient SDP managers is limited (Ramachandran et al., 2019) and there is a perception that they suppress their expertise out of a sense of job security and ownership.

Many studies (Akosile and Olatokun, 2019; Ali, Musawir and Ali, 2018; Babalola and Omotayo, 2017; Jhamba and Steyn, 2021) have reported a positive relationship between trust and KT behavior. Trust in this study is the extent to which SDP managers have confidence in the capabilities and abilities of their team members. Prior research has shown that individuals with a higher level of credibility can share a greater amount of knowledge within their trusted networks (Srisuksa, Wiriyapinit and Bhattarakosol, 2022). This study incorporates trust to share to the proposed model. Thus, it is hypothesized that:

H2. There is a significant relationship between trust to share and SDP manager's KT behavior.

2.3.3 Social identity

Identification, as defined by Bagozzi and Dholakia (2002) pertains to an individual's perception of themselves based on the distinctive characteristics of a social category that includes themselves. In this particular context, the SDP organisation is being referred to. According to Nahapiet and Ghoshal, (1998 p. 259) the concept of identification refers to the cognitive process through which individuals perceive themselves as being interconnected with another individual or a collective group. In the present investigation, the term "social identity" pertains to an individual's perception of affiliation and favourable sentiment towards the SDP organisation, akin to the concept of emotional identification as posited by Ellemers, Kortekaas and Ouwerkerk (1999).

Bagozzi and Dholakia (2002), in their research argued that social identification has a crucial role in promoting loyalty and citizenship behaviours within a group context. Additionally, they suggested that social identification can provide insights into individuals' inclination to sustain committed relationships with their team members. Social identity functions as a metric for assessing the degree of an individual's association with a certain collective. Social identity serves as a valuable resource that impacts the incentive to engage in the combination and sharing of knowledge (Nahapiet and Ghoshal, 1998). On the other hand, the presence of different and conflicting identities within groups poses major obstacles to the transmission of knowledge, learning, and the development of knowledge (Chiu, Hsu and Wang, 2006). Within SDP organizations, SDP managers' self-perception and their perception of fellow team members significantly influences their KT behavior (Buthelezi and Mkhize, 2015; Ellemers, Kortekaas and Ouwerkerk, 1999).

SDP organizations in Nigeria do not have full time SDP managers (Ramachandran et al., 2019). This issue adds to their behavior regarding sharing their expertise with the SDP team members and their sense of belonging. Individual self-perception is constructed based on his past experiences, whether they have been positively acknowledged or criticized for sharing knowledge (Buthelezi and Mkhize, 2015). Given that valuable knowledge is embedded in individuals and people usually tend to hoard the knowledge (Mubarak, Khan and Atasya Osmadi, 2022), one would not contribute his knowledge unless another person is recognized as his group-mate and the contribution is conducive to his welfare. A team-centric perspective may lead members to prioritize collective benefits over individual concerns, exemplified by a willingness to undertake risks for the team's perceived well-being, especially when a strong social identity with the team is established (Ellemers, Kortekaas and Ouwerkerk, 1999). In a nutshell, social identification has been included in this study and is assumed to have a significant impact on the KT behavior of SDP managers. Therefore, another hypothesis is formulated:

H3. There is a significant relationship between social identity and SDP manager's KT behavior.

2.3.4 Shared language

Shared language is the degree in which participants believe others share their language, goals and values. It is viewed as a bonding mechanism that helps different parts of an organization to integrate or combine resources (Tsai and Ghoshal, 2017). SDP managers who share a common vision with their team members are more likely to form partnerships and exchange ideas and resources. Lesser and Storck (2001) clarify that shared language encompasses more than just the language itself; it also delves into the acronyms, subtleties, and underlying assumptions that are essential components of daily communication. Shared codes and language enable a common understanding of collective objectives and suitable behaviours in SDP organizations (Tsai and Ghoshal, 2017).

Nigerian organizations is characterized by rich diversity of languages, ethnic groups, and cultural norms, shared language represents a critical factor that can significantly influence the KT behaviour of SDP managers. It provides an avenue in which SDP manager and his team understand each other and build common vocabulary in their domains (Chiu, Hsu and Wang, 2006). The diverse linguistic and ethnic landscape in Nigeria can pose communication barriers, hindering the seamless transfer of knowledge. Hence, the presence of a shared language, or the lack thereof, can either facilitate or impede KT practices (Omotayo and Babalola, 2016). When a shared language exists, it can bridge linguistic and cultural divides, enhancing mutual understanding and trust among individuals, ultimately fostering more effective KT practices (Khoza and Bwalya, 2021).

In the absence of a shared language, efforts to transfer knowledge may be hampered by misunderstandings and communication challenges, potentially limiting the effectiveness of KT behavior. Accordingly, having a common language not only facilitates the exchange of ideas but also improves the effectiveness of communication between individuals with comparable experiences or backgrounds (Omotayo and Babalola, 2016). Therefore, using the same language will encourage participants to actively participate in KT activities and improve the calibre of knowledge that is conveyed. Based on this the next hypothesis is postulated:

H4. There is a significant relationship between shared language and SDP manager's KT behavior.

2.3.5 Social interaction

Social interaction is defined as any relationship between two or more individuals. Chiu, Hsu and Wang (2006) stated that social interaction encompasses various aspects such as the intensity of relationships, the duration of engagement, and the regularity of communication within a community. It refers to the extent to which individuals within a community possess pre-existing social connections. Empirical evidence from many studies (Liu and Liu, 2008; Omotayo and Babalola, 2016; Wasko and Faraj, 2005) substantiates the impact of social interaction on the process of KT among individuals. Social interaction provides the opportunity to integrate and transfer knowledge, impact the availability and exchange of expertise, and predict the value that will arise from these interactions (Hall, 2003). Social interaction ties is described by Tsai and Ghoshal (2017) as portals for the sharing of resources and knowledge. On the other hand, clarify that social interaction ties among community members offer an affordable way to acquire a wider range of knowledge sources (Liang, Liu and Wu, 2008).

In Nigeria, resource limitations may affect the ability of SDP managers to engage in social interactions and KT practices effectively. Unsuitable outdated technological infrastructure, and the reluctance to use the available collaboration tools are some of the obstacles that reduces social interaction which has an impact on KT behavior of SDP mangers in Nigeria (Babalola and Omotayo, 2017). In previous research strong social interactions have been found to positively affect KT practices. Therefore, stronger social interaction enables quicker exchange of

knowledge leading to the conclusion that social interaction correlates with KT behaviour of SDP managers. Thus, it is hypothesized that:

H5. There is a significant relationship between social interaction and SDP manager's KT behavior.

2.3.6 Reciprocity

The concept of reciprocity, according to Nowak (2000), relates to "the evolutionary basis for cooperation in society." In the words of Molm, (2010), one of the vital components of social exchange is reciprocity. SDP teams frequently collaborate on the same project, ensuring that their subsections of work may be merged into the required system (Jennings and Finkelstein, 2010). In Nigeria's software development landscape, SDP managers often view their knowledge as a means of job security and tend to operate in silos, reciprocity emerges as a critical factor influencing KT behaviour. In this situation, in order to collaborate effectively, each would need to know what the other is doing and how they are going about it (Buthelezi and Mkhize, 2015). As a result, for members of the team to effectively engage in the knowledge sharing process as part of their everyday job responsibilities, a bilateral agreement of exchange is required (Molm, 2010).

Reciprocity entails to the give-and-take dynamic in knowledge sharing, where individuals are more willing to transfer their expertise when they perceive a fair exchange of knowledge or anticipate benefits in return (Cropanzano and Mitchell, 2005). This interaction should be mutual (Molm, 2010). In Nigeria, SDP managers may not prioritize KT practices as it is not part of their job description and therefore due to the work overload, shortage of skilled team members (Ramachandran et al., 2019) there is a tendency to work independently. Fostering a reciprocal environment becomes essential. Thus, a culture of mutual knowledge exchange, where SDP managers understand the benefits of collaborative information sharing, can counteract siloed practices. The reciprocity of the interaction is emphasized by several authors (Biloslavo and Lombardi, 2021; Jhamba and Steyn, 2021; Rese, Kopplin and Nielebock, 2020) as a factor that influences KT behavior of an individual. This leads to the following hypothesis:

H6. There is a significant relationship between reciprocity and SDP manager's KT behavior.

2.3.7 Security and privacy

A security breach refers to an occurrence in which an organization or company experiences the loss of critical information, personal records, or other forms of sensitive data (Bishop, 2003). The integration of storage and computing within a shared multi-user project environment has heightened security concerns (Shin, 2010). Security encompasses the protection of services, datacentres, and associated resources, while also addressing the privacy and confidentiality of a company's data (Ilvonen , 2013). It also entails effectively managing potential information losses and the associated costs (Winkler, 2007). In contrast, privacy pertains to an individual's ability to exercise control over the flow and exchange of personal data (Shin, 2010). This concept can be understood as individuals, groups, or institutions asserting their rights to determine how information about them is communicated to others. In SDP environments, where privacy concerns loom large, SDP managers are less inclined to disclose personal information due to perceived threats and a lack of control over their data (Gupta and Xu, 2010).

In Nigeria, where online crimes and cyberattacks are common, security and privacy concerns can affect socialization and KT behaviours (Ardo, Bass and Gaber, 2023; Benjamin and Foye, 2022; Njenga et al., 2020). Security directly influences user behaviour affecting KT practices (Shin, 2010). User awareness regarding information security and privacy plays a pivotal role in shaping the way individuals use the KT system. Dinev and Hu (2007), found that heightened technology awareness leads to a more favourable user behavioural inclination to adopt protective technologies against information security threats. Therefore, security and privacy concerns are included in the framework as a factor that affects socialization which influences the transfer of SDP managers' knowledge. Thus, our hypothesis is as follows:

H7. There is a significant relationship between security and privacy and SDP manager's KT behaviour.

2.3.8 IT infrastructure

Alavi and Leidner (2001) stated that IT infrastructure encompasses machinery, systems, and ITs that facilitate three fundamental functions: encoding and disseminating best practices, establishing corporate knowledge repositories, and establishing knowledge networks. IT infrastructure serves as an essential facilitator, holding a central role in an organization's knowledge management system (Islam, Jasimuddin and Hasan, 2015). It plays a critical part in both sharing existing knowledge and fostering the creation of new knowledge by integrating

various technological platforms. Accordingly, SDP organizations should have IT infrastructures such as repositories that allow managers to store their tacit knowledge. Consequently, managers should allow team access to project organizational databases. Since knowledge may be implicit or explicit. Explicit knowledge is merely the type of knowledge that is documented. Access to databases and repositories enables personnel to investigate explicit knowledge that has been stored and transmitted, thereby facilitating externalization through the use of information technology (Dei, 2017; Nold, 2009).

Implementing technological innovations is difficult and expensive for SDP organizations in developing countries such as Nigeria (OC&C Consulting, 2018), where reoccurring issues related to disparities in internet access, deficit IT infrastructure, scarcity of hardware and software, little technical support, and a lack of technological resources (Adeleke, 2020; Ramachandran et al., 2019) is a big challenge for SDP managers. Technological entrepreneurs in Nigeria find it difficult to maintain this IT infrastructure for a long period of time (Adeleke, 2021; OC&C Consulting, 2018). Hence it is evidence that IT infrastructure affects the KT behavior of SDP manager in Nigeria. Other studies in different contexts have also supported this argument (Dei, 2017; Frost, 2012; Mikulecky and Lodhi, 2009; Rice and Rice, 2005). Therefore, this study includes IT infrastructure as a factor that is critical for implementing KT practices for SDP managers in Nigeria. Therefore, the following hypothesis was proposed:

H8. There is a significant relationship between IT infrastructure and SDP manager's KT behaviour.

2.3.9 Knowledge transfer behaviour

The literature frequently employs the terms "KT behaviour" and "KT" interchangeably, without establishing a clear distinction between the two ideas. KT involves the transmission of knowledge from a source to potential recipients, with the critical requirement that the recipients fully grasp and utilize the knowledge to guide their actions (Srisuksa, Wiriyapinit and Bhattarakosol, 2022). KT behavior refers to the extent to which individuals, groups, or organizations actively impart their expertise and exchange task-related ideas, information, and suggestions (Liang, Liu and Wu, 2008). The concept of KT behavior, which encompasses both cognitive and psychological components, is defined as "the degree to which one has positive feelings concerning sharing one's knowledge" (Bock et al., 2005, p. 91). The psychological aspect considers motivational and emotional factors, suggesting that interactions between SDP managers and their colleagues can be highly stimulating, enjoyable, or rewarding (Hsu et al., 2007).

Empirical evidence suggests that positive past interactions can create affective memory traces, which enhance future collaborative experiences (Khoza, 2018; Rese, Kopplin, & Nielebock, 2020). Effective KT helps avoid repeating mistakes or reinventing existing systems, ultimately saving time and improving the efficiency of SDPs (Wiewiora et al., 2009). The role of SDP managers is particularly critical, as their behavior significantly influences how well knowledge is shared and applied (Argote & Ingram, 2000; Ko, Kirsch, & King, 2005; Matthew & Dhillon, 2020). While each project brings its own innovations, leveraging lessons from previous work can offer valuable advantages. Without structured KT practices, teams often start from scratch, missing out on insights that could streamline project execution (Wiewiora et al., 2009). Encouraging proactive KT behaviors among SDP managers is therefore key to enhancing project outcomes.

3. Research Method

This work used a survey research design and specifically targeted the demographic of SDP managers in the Federal Capital Territory (FCT) Abuja and Lagos state, Nigeria. Abuja and Lagos are Nigeria's primary hubs for software development, hosting numerous IT companies and startups. Focusing on software development project managers in these cities provides insights into the country's tech industry. Given the absence of a sample frame for the population of SDP managers in these cities, convenience expert sampling and snowball methods were employed to choose respondents. An appropriate sample size was determined using G*Power software based on established statistical guidelines. The input parameters included an effect size of 0.35, an alpha error probability of 0.05, a statistical power (1-β error probability) of 0.95, and eight predictors. These parameters align with the recommendations of Faul et al. (2007) for determining the minimum sample size required for behavioral research. The analysis yielded a required sample size of 74 responses, ensuring sufficient statistical power to detect meaningful effects and minimize the risk of Type II errors. In all, 160 completed responses were collected, surpassing the pre-established sample size. An 80% response rate was achieved by distributing 200 copies of a structured questionnaire to the respondents, of which 160 copies were collected and deemed suitable for data collection and analysis.

The survey was carefully designed, integrating adjustments to questions derived from prior research on SCT and SECI framework. The questionnaire was divided into two separate sections. The first part gathers demographic data about the participants, whereas the second part collects information on the main variables of the research. The data collection measures for work motivation, trust to share, reciprocity, and KT behaviour in this section were derived from the works of Ko, Kirsch and King (2005) and Rese, Kopplin and Nielebock (2020). Measurements for social identity, shared language, and social interaction were obtained from the work of Chiu, Hsu and Wang, (2006). The security and privacy measurements were taken from Gupta, Fernandez-Crehuet and Gupta, (2022); Gupta and Xu, (2010), while the IT infrastructure measures were derived from the work of Islam, Jasimuddin and Hasan (2015). Each variable was measured using a five-point Likert interval scale. The questionnaire's validity was established by distributing the instruments to experts in the field of study, who provided feedback and suggestions for refinement. Specific components were then revised and restructured based on their recommendations (see Appendix). Construct validity was assessed through factor analysis technique (principal component analysis). Additionally, internal consistency and reliability were evaluated using Cronbach's alpha. Constructs with higher alpha values, indicating greater reliability for measuring variables, were selected. Each item included in the study exhibited a scale loading exceeding 0.70, meeting the criteria for acceptable alpha values (Table 1).

The study was carried out in accordance with rigorous ethical standards that regulate the appropriate activities in social research. Consideration was given to the respondents' entitlement to confidentiality and privacy during the development and administration of the questionnaire. Appropriate measures were taken to safeguard the respondents from any circumstances that may constitute a risk to their well-being, and they were granted the autonomy to decide whether or not to take part in the study. Coding and analysis of the data obtained from the questionnaire were conducted using the Statistical Package for Social Sciences (SPSS) software, Version 20. Summaries of the socio-demographic characteristics of the respondents were obtained using descriptive statistics. To assess the relationship between the independent and dependent variables, multiple regression analysis was conducted, a method previously utilized in KT studies within SDP (Khoza and Bwalya, 2021).

Table 1: Alpha value for adopted and modified scales

Constructs	Number of items	Alpha value
Knowledge transfer (KT)	4	0.882
Work motivation (WM)	5	0.743
Trust to share (TS)	5	0.866
Social identity (SID)	4	0.724
Shared language (SL)	3	0.724
Social interaction (SI)	4	0.840
Reciprocity (RE)	3	0.830
Security and privacy (SP)	4	0.741
IT Infrastructure (ITF)	4	0.882

4. Data Analysis

4.1 Descriptive Analysis

This section presents descriptive statistics derived from the data collected through the questionnaire. Table 2 displays the demographic characteristics of the respondents. Out of all the participants, 61.9% were males and 38.1% were females. The survey shows that the majority of the participants work with diverse SDP organizations. The participants work with the following project organizations: Custom software development firm (24.4%); Open-source software development company (21.3%); Mobile application development company (19.4%); Health care IT company (16.2%); E-commerce/Fintech software company (15.6%); and (3.1%) which accounts for others.

Table 2: Demographic characteristics of participants

Gender	Category	Frequency	Percentage
	Male	99	61.9%
	Female	61	38.1%

	Total	160	100%
Educational qualification	Diploma	24	15%
	Bachelor's degree	71	44.4%
	Postgraduate's degree	51	31.9%
	Others	14	8.8%
	Total	160	100%
Type of SDP organization	Custom based	39	24.4%
	Open source	34	21.3%
	Mobile application	31	19.4%
	Healthcare based	26	16.2%
	E-commerce/Fintech	25	15.6%
	Others	5	3.1%
	Total	160	100%
Years of experience	1-5 years	51	31.9%
	6-10 years	60	37.5%
	11-20 years	28	17.5%
	Above 20 years	21	13.1%
	Total	100	100%

4.2 Hypothesis Test

To address this research objective, multiple regression analysis was used to test the hypothesis. The regression analysis was to examine the relationship between the independent variable (predictor variables) and the dependent variable of significant relationships between the dependent and independent variables. The findings are outlined in Table 3. The dependent variable being measured was KT behavior. The following are the independent variables that are shown in the table: Work Motivation (WM), Trust to Share (TS), Social Identity (SID), Shared Language (SL), Social Interaction (SL), Reciprocity (REC), Security and Privacy (SP), and Information Technology Infrastructure (ITF). The predetermined threshold of significance was set at 5 percent (%); if the acquired p-value was < 0.05, the hypothesis is significant. Conversely, if the obtained p-value was > 0.05, the hypothesis is not significant.

The hypothesis test if work motivation carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable WM to test the hypothesis H_1. WM significantly predicts KT, $F(8, 359) = 318.331$, $p < 0.001$, which indicates that WM can play a significant role in shaping KT behavior ($\beta = 0.344$, $p < .001$). The hypothesis test if trust to share carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable TS to test the hypothesis H_2. TS significantly predicts KT, $F(8, 359) = 318.331$, $p < 0.001$, which indicates that TS can play a significant role in shaping KT behavior ($\beta = 1.014$, $p < .001$). The hypothesis test if social identity carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable SID to test the hypothesis H_3. SID did not significantly predict KT, $F(8, 359) = 318.331$, $p > 0.001$, which indicates that SID did not play a significant role in shaping KT behavior ($\beta = 0.070$, $p < .256$).

The hypothesis test if shared language carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable SL to test the hypothesis H_4. SL did not significant predict KT, $F(8, 359) = 318.331$, $p > 0.001$, which indicates that SL did not play a significant role in shaping KT behavior ($\beta = -0.009$, $p < .818$). The hypothesis test if social interaction carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable SI to test the hypothesis H_5. SI significantly predicts KT, $F(8, 359) = 318.331$, $p < 0.001$, which indicates that SI can play a significant role in shaping KT behavior ($\beta = 0.233$, $p < .001$). The hypothesis test if reciprocity carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable RE to test the hypothesis H_6. RE did not significantly predict KT, $F(8, 359) = 318.331$, $p > 0.001$, which indicates that RE did not play a significant role in shaping KT behavior ($\beta = -0.469$, $p < .818$).

The hypothesis test if security and privacy carry a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable SP to test the hypothesis H_7. SP significantly predicts KT, F (8, 359) = 318.331, p < 0.001, which indicates that SP can play a significant role in shaping KT behavior (β = 0.383, p < .001). The hypothesis test if IT infrastructure carries a significant impact on KT behavior. The dependent variable KT was regressed on predicting variable ITF to test the hypothesis H_8. ITF significantly predicts KT, F (8, 359) = 318.331, p < 0.001, which indicates that ITF can play a significant role in shaping KT behavior (β = 0.260, p < .001). These results clearly direct the positive effect of the ITF.

The R^2 value measures the extent to which the predictor variables account for the variation in the endogenous variable. Cohen (1988) categorized R^2 value of 0.02 as weak, 0.13 as moderate, and 0.26 as strong respectively. Moreover, the R^2 values from the present study is 0.859, which indicates that the research model explains 85.9% of the overall variance in KT behavior. Therefore, this study's R^2 value of 85.9% is considered strong, indicating a good predictive accuracy in accordance with Cohen's (1988) criterion. Table 3. shows the summary of the findings.

Table 3: Test for hypothesis and findings

Hypothesis	Regression Weights	Beta (β)	t-value	p-value	Hypotheses Supported
H1	WM→KT	1. 0.344	2. 7.021	3. 0.000	Yes
H2	TS→KT	4. 1.014	5. 12.992	6. 0.000	Yes
H3	SID→KT	7. 0.070	8. 1.147	9. 0.252	No
H4	SL→KT	10. -0.009	11. -0.230	12. 0.818	No
H5	SI→KT	13. 0.233	14. 7.292	15. 0.000	Yes
H6	RE→KT	16. -0.036	17. -0.725	18. 0.469	No
H7	SP→KT	19. 0.383	20. 6.187	21. 0.000	Yes
H8	ITF→KT	22. 0.260	23. 6.877	24. 0.000	Yes

Note * p < 0.05. WM: Work Motivation, TS: Trust to Share, SID: Social Identity, SL: Shared Language, SI: Social Interaction, RE: Reciprocity, SP: Security & Privacy, ITF: IT Infrastructure, KT: Knowledge Transfer.

5. Discussion

The findings of this study provide important insights into the factors influencing KT behavior among SDP managers in Nigeria. The demographic analysis reveals that most respondents hold bachelor's degrees (44.4%), followed by postgraduate degrees (31.9%), diplomas (15%), and other qualifications (8.8%). Additionally, participants had varying levels of experience, with 37.5% having 6–10 years, 31.9% with 1–5 years, 17.5% with 11–20 years, and 13.9% possessing more than 20 years of experience. This diversity in expertise highlights the potential for experienced SDP managers to facilitate KT within project teams.

The study found that work motivation, trust to share, social interaction, security and privacy, and IT infrastructure significantly influence KT behavior among SDP managers. However, social identity, shared language, and reciprocity did not have a significant impact. Work motivation was positively associated with KT behavior, aligning with previous studies that suggest motivated employees are more willing to transfer knowledge when they perceive tangible or intrinsic benefits (Davidavičienė, Al Majzoub and Meidute-Kavaliauskiene, 2020; Riaz, Buriro and Mahboob, 2019). The findings support the idea that the presence of incentives, recognition, and career advancement opportunities enhances SDP managers' willingness to transfer knowledge. This is consistent with research in South Africa, which found that managers are hesitant to share knowledge without appropriate rewards (Khoza, 2018). Without structured motivation mechanisms, knowledge hoarding may persist, limiting organizational learning and innovation.

Trust to share also exhibited a strong and statistically significant correlation with KT behavior, reinforcing the notion that trust fosters a conducive knowledge-sharing environment (Omotayo and Babalola, 2016; Ren et al., 2019). This result aligns with Srisuksa, Wiriyapinit and Bhattarakosol (2022) argument that trust is foundational to effective KT, particularly in knowledge-intensive industries such as SDP. The findings further confirm the relevance of SCT, which suggests that individuals are more likely to engage in KT practices when they trust that their shared knowledge will not be misused or exploited (Bandura, 1986). In the Nigerian context, where concerns over job security and competitive advantage are prevalent, SDP managers may be reluctant to share knowledge without confidence in their team members' integrity and reliability (Omotayo and Babalola, 2016).

Contrary to expectations, social identity did not significantly influence KT behavior. Previous studies suggested that individuals who strongly identify with their teams are more likely to share knowledge (Chiu, Hsu and Wang, 2006; Yu, Lu and Liu, 2010). However, the lack of significance in this study may stem from the nature of project-based employment in Nigeria, where many SDP managers work across multiple projects and do not form deep affiliations with a single organization. Additionally, Nigerian SDP managers may prioritize professional competence and project outcomes over social identification, unlike team members who rely more on group cohesion for knowledge exchange (Buthelezi and Mkhize, 2015).

Similarly, shared language did not significantly impact KT behavior, diverging from previous studies that identified a strong link between common language and knowledge-sharing efficiency (Alam et al., 2009; van den Hooff and Huysman, 2009). A possible explanation is Nigeria's linguistic diversity, where English serves as the primary business language, reducing the importance of a shared mother tongue in SDP organizations. Furthermore, SDP managers may prioritize technical accuracy and structured documentation over verbal communication, reducing reliance on shared language for KT practices.

Social interaction was positively correlated with KT behavior, supporting the view that frequent interaction enhances knowledge exchange (Babalola and Omotayo, 2017; Chiu et al., 2006). Regular engagement with team members fosters trust, facilitates mentorship, and encourages informal KT, which aligns with the SECI model's emphasis on socialization as a key component of knowledge creation (Nonaka and Takeuchi, 1995). In Nigeria, where informal mentorship often plays a crucial role in professional development, fostering social interactions through team-building activities and collaborative platforms can enhance KT effectiveness (Stampfl, Prodinger and Palkovits-Rauter, 2024).

Unexpectedly, reciprocity did not significantly influence KT behavior. While past research posited that individuals share knowledge in anticipation of reciprocal benefits (da Silva, Mosquera and Soares, 2022; Wasko and Faraj, 2005), the findings suggest that SDP managers do not perceive reciprocity as a necessary condition for KT practice. This may be attributed to the hierarchical structure of Nigerian organizations, where managers are expected to transfer knowledge without necessarily receiving equal knowledge in return (Li, Shankar and Stallaert, 2020). Additionally, SDP managers may share knowledge as part of their professional responsibilities rather than based on mutual exchange expectations (Sharma and Stol, 2020).

Security and privacy were found to have a significant impact on KT behavior, corroborating previous studies that highlighted concerns over information protection as a barrier to knowledge-sharing (Gifford, 2009; Gordon and Loeb, 2006). Nigerian SDP managers may be particularly cautious due to the high prevalence of cyber threats and data breaches, making them reluctant to share knowledge without adequate security measures in place (Govindarajan and Gupta, 2002). This underscores the need for organizations to invest in secure digital platforms to foster trust in KT processes (Shin, 2010).

Finally, IT infrastructure was positively associated with KT behavior, reinforcing the importance of technological tools in facilitating efficient knowledge exchange (Dei, 2017; Frost, 2012). The findings align with previous research in the UAE and other developing economies, where IT infrastructure significantly enhanced KT practices (Davidavičienė, Al Majzoub and Meidute-Kavaliauskiene, 2020). However, Nigerian SDP organizations face challenges in adopting advanced IT solutions due to infrastructural deficiencies and high implementation costs (OC&C Consulting, 2018). Government support and strategic investment in IT infrastructure could mitigate these challenges and promote seamless knowledge-sharing among SDP managers. The study's findings contribute to KT and SDP research by confirming the influence of work motivation, trust, social interaction, security, and IT infrastructure while challenging the assumed significance of social identity, shared language, and reciprocity.

6. Conclusion

This research makes a significant contribution to KT literature by providing empirical insights into the factors influencing KT behavior among SDP managers, particularly within the context of a developing nation like Nigeria. Given the critical role of SDPs in driving technological and economic advancements, understanding KT practices is essential for enhancing project efficiency, knowledge retention, and innovation. The study offers practical implications for SDP managers by identifying key enablers to KT, highlighting the need for cultivating trust, fostering social interaction, and ensuring robust IT infrastructure to facilitate effective KT practices.

From a practical standpoint, the findings can inform SDP managers in implementing targeted strategies to enhance KT. For instance, organizations should foster reciprocal knowledge-sharing cultures by integrating structured mentorship programs and incentivizing knowledge exchange through performance-based rewards. Additionally, the study underscores the importance of informal social interactions such as team-building

exercises and collaborative workshops as a means to build trust and encourage open knowledge exchange. While shared language did not exhibit a direct effect on KT, promoting common terminologies and standardized communication frameworks within SDP teams can enhance clarity and reduce misunderstandings. Similarly, IT infrastructure investments, including secure digital collaboration platforms, can mitigate security and privacy concerns, ensuring knowledge is transferred in a protected environment.

Beyond organizational applications, this study holds relevance for policymakers and stakeholders involved in SDP initiatives. Policymakers should consider providing regulatory frameworks that incentivize KT behaviors, including tax reliefs for companies that invest in structured KT programs. Furthermore, the study suggests that government intervention could play a moderating role in strengthening IT infrastructure, an area that future research could explore empirically. In terms of broader contributions, the study's insights extend beyond Nigeria particularly to other developing economies facing similar SDP challenges. Comparative studies with countries in regions such as South Asia, Latin America, and Africa could validate and refine the proposed KT model, making it a globally adaptable model. Furthermore, investigating KT behaviors across different SDP structures such as agile development teams could provide more nuanced findings applicable to diverse organizational settings.

Despite its contributions, the study acknowledges certain limitations, including a relatively small sample size and the use of convenience expert sampling, which may restrict the generalizability of the findings to only SDP managers. Future research should address these constraints by employing larger, more diverse samples, including entire SDP teams, and exploring alternative methodological approaches such as longitudinal studies or experimental validation of the proposed KT model. Additionally, incorporating the moderating effects of top management support and exploring sector-specific variations in KT behavior would provide a deeper understanding of how knowledge flows within SDP environments. In conclusion, while this study offers valuable contributions to KT literature and SDP management practices, further research is essential to refine and expand its applicability. By addressing the identified limitations and exploring new dimensions of KT behavior, future studies can enhance the theoretical and practical understanding of knowledge transfer in software development projects worldwide.

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Appendix: Table

Construct	Items	Sources
Knowledge transfer behaviour	In my organization	Rese, Kopplin and Nielebock (2020)
	1. I frequently share my knowledge with others	
	2. I regularly tell others what I am doing.	
	3. I know what the others are doing.	
	4. I immediately tell others about it, when I learn something new.	
Work motivation	1. I am willing to share my knowledge because it can enhance my reputation	Ko, Kirsch and King (2005)
	2. I think that sharing my knowledge makes my colleagues better aware of my skills.	
	3. I consider that my organization recognizes/values those who share knowledge.	
	4. I consider that my organization provides its members with a fair evaluation/reward system for sharing knowledge	
	5. I think that sharing knowledge has a direct impact on the progression of my career.	
Trust to share	in my organization	Rese, Kopplin and Nielebock (2020)
	1. All team members are honest and sincere dealing with me about knowledge.	
	2. Nobody takes advantage of my knowledge of my knowledge.	
	3. All members deal constructively and carefully with my information.	
	4. The information I receive is accurate at all times.	
	5. All members always keep their promises to me.	
Social identity	1. I feel a sense of belonging with the team members in my organization.	(Chiu, Hsu and Wang, 2006)
	2. I have the feeling of togetherness or closeness with my team members.	
	3. I have a strong positive feeling toward the team members in my organization.	
	4. I am proud to be a team member in my organization.	
Shared language	1. Team members in my organization use common terms.	(Chiu, Hsu and Wang, 2006)
	2. Team members in my organization use understandable communication pattern during discussion.	
	3. Team members in my organization use understandable narrative forms to share information.	
Social interaction	1. I maintain close social relationships with some team members of my organization.	
	2. I spend a lot of time interacting with some team members in my organization.	
	3. I know some team members in my organization on a personal level.	
	4. I have frequent communication with some team members in my organization.	
Reciprocity	1. When I receive help from my team members, it is only right to help the others as well.	Rese, Kopplin and Nielebock (2020)
	2. Team members in my organization would help me if I needed it.	
	3. Solidarity between team members is a high priority in my organization.	

Construct	Items	Sources
Security and privacy	My organization provides facilities that:	(Gupta, Fernandez-Crehuet and Gupta, 2022; Gupta and Xu, 2010)
	1. Helps in the secure storage of my data.	
	2. Ensures data protection so that it can not be manipulated by hackers outside the organization.	
	3. Ensures protection of usage of official data by team members for their personal benefit.	
	4. Makes me feel comfortable sharing my knowledge with my team members.	
IT Infrastructure	My organization uses technology that allows:	Islam, Jasimuddin and Hasan (2015)
	1. Employees to collaborate with team members inside the organization.	
	2. Employees to collaborate with team members outside the organization.	
	3. Employees from multiple loactions to learn as a group from a single source.	
	4. Employees to retreive and use knowledge about software development project.	

Unlocking Potential: The Effects of Knowledge Databases on Work Performance and Job Satisfaction in SMES

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Abstract: This qualitative study investigates the impact of implementing a Wiki-based knowledge management system on job satisfaction and performance in a medium-sized enterprise (SME) operating in the pool construction industry in Western Europe. This study aims to address the conflicting findings in the literature regarding the relationship between knowledge management, job satisfaction, and employee performance as well as the lack of research in the context of Western European SMEs. Using a qualitative methodology, the study provides nuanced insights into the effects of specific knowledge management processes, such as knowledge acquisition, sharing, generation, codification, and preservation, at different organisational levels. The results showed that the implementation of the Wiki-based knowledge database led to significant improvements in job satisfaction, mainly because of the ease of finding information and streamlining work processes. However, the system's ability to fully meet employees' specific knowledge needs influences their satisfaction levels. This study also highlights the differential impact of knowledge management processes at different organisational levels, with middle management and professionals benefiting more than top management and administrative staff. The findings are consistent with previous research indicating a positive relationship between knowledge management practices and job satisfaction and support the notion that well-structured and accessible knowledge resources can lead to better job performance. This study contributes to the field by offering a rich, qualitative perspective on the implementation of Wiki-based knowledge systems in the specific context of the pool construction industry in Western Europe, providing valuable insights for both researchers and practitioners in the fields of knowledge management and organisational behaviour.

Keywords: Knowledge management, Wiki-based systems, Job satisfaction, Work performance, Case study, Pool construction industry

1. Introduction

In modern companies, regardless of the industry, value is increasingly determined by existing knowledge capital, which creates new opportunities for customers and businesses (Pawlowsky, 2019). Small- and medium-sized manufacturing enterprises (SMEs) face several challenges, including the reduction of total product costs and the recognition of knowledge as a critical success factor (Fuchs-Kittowski & Voigt, 2010). Increasing decentralisation and internationalisation, coupled with frequent changes in employers for employees, influences the exchange of knowledge and work processes (Voigt et al., 2016). While the importance of knowledge management in SMEs is widely recognised, its specific impact on job satisfaction and performance remains a subject of debate.

Studies show a positive correlation between knowledge management and job satisfaction and work performance (Almahamid, Mcadams & Mahmoud Al Kalaldeh, 2010; Singh & Sharma, 2011; Kianto, Vanhala & Heilmann, 2016; Kucharska & Erickson, 2019; Meher & Mishra, 2021; Ćurčić & Matejić, 2021). However, conflicting results have been reported (Köseoglu et al., 2008; Singgih et al., 2020). While some studies have found no direct influence of knowledge management on employee performance (Singgih et al., 2021), others have confirmed the role of job satisfaction (Alyoubi et al., 2018).

Given these conflicting findings, this study aims to investigate how the implementation of a Wiki-based knowledge management system affects job satisfaction and job performance in Western European SMEs, specifically in the pool construction industry. By investigating the effects of specific knowledge management processes at different organisational levels, this study employs a qualitative methodology to capture nuanced insights that may have been overlooked in previous quantitative studies. This approach allows for context-specific insights into the underexplored area of Western European SMEs, potentially explaining conflicting

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findings in broader studies and shedding light on the differential impact of knowledge management at different organisational levels.

As studies on job satisfaction and work performance have not been conducted in Western Europe, with two exceptions, and there are possible cultural differences in corporate cultures, it is necessary to investigate this area of research more closely in the context of Western European SMEs. Furthermore, the limitations of Kianto, Vanhala and Heilmann´s (2016) study highlight the need for a more in-depth investigation into the relationship between knowledge management processes, job satisfaction, and employee work performance.

By addressing these gaps and conflicts in the literature, this study aims to provide a comprehensive understanding of how knowledge management affects SMEs' job satisfaction and performance. This study provides valuable insights into both academic research and practical applications in the field of knowledge management by offering a nuanced perspective on the implementation and effects of Wiki-based knowledge systems in the specific context of Western European SMEs in the pool construction industry.

2. Theoretical Background

The implementation of Wiki-based knowledge databases in SMEs, especially in specialised industries such as pool construction, requires a thorough understanding of job satisfaction, job performance, and the unique characteristics of SMEs. This section explores these concepts and their interrelationships in the context of SME knowledge management.

Job satisfaction is defined in many ways in the academic literature. Locke (1976) described it as a pleasant or positive emotional state resulting from the evaluation of one's work or work experience. This definition emphasises the cognitive evaluation process and employees' affective feelings. Similarly, Spector (1997) described job satisfaction as the extent to which people like or dislike their jobs and the different aspects of these jobs. Robbins and Judge (2013) characterise job satisfaction as 'a positive feeling about a job that results from an evaluation of its characteristics' (p. 74), highlighting the subjective nature of the evaluation. This interplay between ability and motivation is particularly relevant in SMEs that implement knowledge databases, in which the effectiveness of the system depends on both the quality of the information it contains and the willingness of employees to use and contribute to it.

Drabe (2015) defined employee satisfaction as the employee's attitude towards their own work, with the employee as the evaluative actor at the centre. The terms employee satisfaction and job satisfaction are considered to be interchangeable (Drabe, 2015). This perspective is particularly relevant in SMEs, where employees often wear multiple hats, which has a more direct impact on business success. Job satisfaction is defined as an attitude towards various aspects of work such as work content, conditions, supervisors, colleagues, training opportunities, and compensation (Rosenstiel, 2015, p. 73). This satisfaction results from the comparison between a subjectively perceived actual state and an individual target state (Rosenstiel, 2015, p. 73). The intensity and type of job satisfaction depend on whether individual demands are maintained or reduced in the face of reality (Bruggemann, Groskurth & Ulich, 1975). Different forms of dissatisfaction lead to different behaviours and have different effects on employees' willingness to perform. Fixed job dissatisfaction can lead to resignation, whereas constructive dissatisfaction motivates improvement (Rosenstiel, 2015). In the pool construction industry, where project-based work and technical knowledge are crucial, job satisfaction may be closely linked to an employee's ability to access and use specialised knowledge efficiently. A well-implemented knowledge database can potentially address these needs and positively affect job satisfaction.

Work performance and job satisfaction were closely related. However, job satisfaction alone does not necessarily result in a high workplace performance. Schanz and Strack (2019) defined work performance as the product of performance and willingness to perform, whereby a lack of performance cannot be compensated by a high willingness to perform, and vice versa. This interplay between ability and motivation is particularly relevant in SMEs implementing knowledge databases, where the effectiveness of the system depends both on the quality of the information it contains and on the willingness of employees to use and contribute to it.

In addition to these main factors, work organisation and ergonomic conditions, as well as the incentive system in the company, also influence work performance. Work performance is also influenced by individual parameters such as excessive demands, insufficient demands, physical and psychological factors, current and potential performance, and individual learning and social/professional skills. Dessler (2020) defines performance in organisations as the process and work performance of individuals and groups over a period of time. Employee performance, also referred to as work performance, is assessed based on an employee's actual performance compared to expected performance. In the context of SMEs in the pool construction industry, this could

translate into metrics such as project completion times, customer satisfaction rates, and efficiency of resource utilisation, all of which could be influenced by the effective use of a knowledge database. Mlekus, Ötting and Maier (2020) showed a correlative relationship between conducive work design, support, learning opportunities, increased work performance, job satisfaction, commitment to the organisation, and increased work motivation. In this context, digital technologies can help enhance the potential to increase motivation.

The definition of SMEs varies depending on their source. The European Commission defines SMEs based on the number of employees (less than 250) or annual turnover (up to €50 million), whereas IfM Bonn sets an upper limit of 500 employees and a turnover of up to €50 million (Levering, May-Strobl & Norkina, 2016). The company in this study, which operates in the pool construction industry, falls within these definitions, allowing for the application of SME-specific theories and findings.

Small and medium-sized enterprises (SMEs) recognise the importance of knowledge management for business success, similar to large companies. However, the implementation of knowledge management as a process primarily occurs in large companies. SMEs identify knowledge barriers due to a lack of awareness of knowledge as a resource (Pfau & Mangliers, 2009). The key challenge for SMEs is to identify, structure, and communicate critical knowledge among key personnel (Schiedermair et al., 2009). In the pool construction industry, where specialised technical knowledge is critical, these challenges can be particularly pronounced, making the implementation of an effective Wiki-based knowledge base even more critical. Small firms can benefit from more efficient knowledge dissemination through personalised and regular communication. To avoid competitive disadvantages for decentralised subsidiaries, care must be taken to ensure that they do not generate redundant knowledge if they are not integrated into the parent company (Döring, 2016).

Organisational structures in SMEs include both primary and secondary structures. The primary organisational structure refers to the hierarchical organisation of departments and positions, while the secondary structure provides complementary mechanisms, such as cross-functions and project teams, to enable more flexible collaboration (Jager, 2009). In the pool industry, where project-based work is common, a flexible structure that allows knowledge to be easily shared easily across projects and teams can be particularly beneficial. Hybrid organisational structures may emerge by combining the formal organisational structure and flexible structures, as described by Nonaka and Takeuchi (1995). This hypertext organisation allows a balance between stability and adaptability.

The importance of knowledge management processes for job satisfaction varies by occupational group. Middle managers showed a strong correlation between internal knowledge sharing and job satisfaction, whereas different knowledge management processes influenced the job satisfaction of experts and specialists. Knowledge retention plays a key role for managers, whereas other processes are less influential (Kianto, Vanhala & Heilmann, 2016). In the context of an SME in the pool construction industry, this could lead to different effects from the knowledge database on the job satisfaction of design teams, construction crews, and customer service representatives. By exploring these theoretical concepts in the specific context of knowledge database implementation in an SME in the pool construction industry, this study aims to bridge the gap between general theories of job satisfaction and job performance and their practical application in a specialised SME setting.

3. Literature Review

Kianto, Vanhala and Heilmann (2016) hypothesised that knowledge acquisition has a positive influence on job satisfaction. However, the study found that knowledge acquisition in an urban organisation in Finland had no significant link to job satisfaction. The authors speculate that the nature of the work may not require the acquisition or generation of knowledge, and that these activities are neither supported nor rewarded within the organisation. Consequently, they have no impact on job satisfaction. This was also true for employees in strictly controlled and routine tasks as well as for experts, middle management, and top management. While this study used a quantitative approach with a large sample size, which provides statistical reliability, it may have missed nuanced insights that a qualitative approach might have uncovered, particularly regarding the reasons for the lack of an impact on job satisfaction.

The importance of knowledge sharing for employee job satisfaction and performance has been analysed in several studies. In their study of manufacturing companies in Jordan, Almahamid, Mcadams and Mahmoud Al Kalaldeh (2010) showed that knowledge sharing is positively associated with job satisfaction and can therefore improve organisational performance. Kianto, Vanhala and Heilmann (2016) confirm a positive relationship between knowledge sharing and job satisfaction, particularly among experts, employees, and middle managers. In their study of the Indian IT industry, Meher and Mishra (2021) emphasised the importance of effective

knowledge sharing to increase job satisfaction. Ćurčić and Matejić (2021) found that knowledge sharing needs to be motivated by the organisation, especially for employees with critical knowledge. In a comprehensive analysis, Rafique and Mahmood (2018) found a clear positive correlation between knowledge sharing and job satisfaction. These studies have predominantly used quantitative methods that, while providing broad trends, may not capture the full complexity of how knowledge sharing affects job satisfaction in different organisational contexts. A qualitative approach, as used in this study, could provide deeper insights into the mechanisms through which knowledge sharing affects job satisfaction.

Meher and Mishra (2021) analysed the impact of knowledge management on job satisfaction in the Indian IT industry. The results showed that effective knowledge management was positively correlated with job satisfaction. By contrast, Kianto, Vanhala and Heilmann (2016) were unable to prove a corresponding correlation in the public sector. Knowledge generation was not encouraged in local government occupational groups, which could lead to a lack of impact on job satisfaction. The contrasting findings of these studies highlight the potential influence of industry-specific factors on the relationship between knowledge management and job satisfaction. The focus of this study on a specific industry (pool construction) and its qualitative approach may help to elucidate sector-specific nuances.

Kianto, Vanhala and Heilmann (2016) investigated the relationship between knowledge codification and job satisfaction. The questions on knowledge codification were related to the extent of knowledge storage and documentation, as well as the extent of knowledge repositories. The results showed a proven influence on job satisfaction among white-collar workers, but this relationship was not found among experts, middle management, and top management. According to the case study by Ćurčić and Matejić (2021), the codification of knowledge takes place through the introduction of rules, procedures and instructions that regulate business activities in detail. Written procedures facilitate access to necessary knowledge for new employees. This study found a demonstrable link between knowledge codification and job satisfaction. Although these studies provide valuable insights, their quantitative nature may not fully capture the complexity of how different groups of employees interact with codified knowledge. The qualitative approach used in this study allowed for a more in-depth exploration of these interactions.

Kianto, Vanhala and Heilmann (2016) analysed the relationship between knowledge retention and job satisfaction. Knowledge retention is defined as the continuity and preservation of knowledge within an organisation. The results show that knowledge retention is the most important factor in top management job satisfaction. Knowledge retention is an important determinant for experts and middle management. This seems plausible, as management needs a comprehensive understanding of the organisation in order to make strategic decisions. It is also important for professionals and middle managers to understand the external environment of the organisation in order to act effectively. Meher and Mishra (2021) confirmed in their study that knowledge retention has a positive impact on job satisfaction and ensures the security and future use of well-structured knowledge. The consistent findings across these studies suggest a robust relationship between knowledge retention and job satisfaction. However, the mechanisms through which this relationship operates may benefit from the deeper exploration that qualitative methods can provide.

Singgih et al. (2020) find that knowledge management does not have a significant impact on employee performance. Instead, this study shows that the work environment has a significant impact on employee performance, both directly and indirectly, through job satisfaction. Job satisfaction has a positive effect on employees´ performance. However, job satisfaction did not mediate the relationship between transformational leadership and employee performance, or between knowledge management and employee performance. Instead, job satisfaction mediates the relationship between the work environment and employee performance. Therefore, management should promote employees' job satisfaction by creating a positive work environment that improves employee performance. Meher and Mishra (2021) confirm that knowledge management has a positive and significant impact on employee performance. The effective use of shared knowledge improves work performance, because job satisfaction depends on the successful completion of tasks. Zhang (2017) conducted a comprehensive study on the use of knowledge management systems (KMS) in the Chinese financial sector. The results show that the use of a deep structure, which is a specific feature of knowledge management systems, has a positive impact on employees' work performance. Various contingency factors moderated the relationship between the use of rich KMS and workplace performance, with employees likely to perform better when they used KMS functions for specific tasks. The conflicting results of these studies highlight the complexity of the relationship between knowledge management, job satisfaction, and job performance. Although the quantitative methods used in these studies provide valuable insights, they may not fully capture the contextual factors

influencing these relationships. A qualitative approach, as used in this study, can help unpack this complexity and provide a more nuanced understanding of how these factors interact in specific organizational contexts.

This literature review highlights gaps in our understanding of the impact of knowledge management on job satisfaction and performance in SMEs with conflicting findings in different contexts. This study addresses these gaps by investigating the implementation of a Wiki-based knowledge-management system in SME using a qualitative approach. This methodology allows for a deeper exploration of the contextual factors that may influence the relationships between knowledge management, job satisfaction, and job performance and may explain some of the conflicting results found in previous quantitative studies. By focusing on a specific industry (pool construction) and employing a qualitative approach, this study aims to uncover the unique challenges and opportunities in this under-researched setting and provide a more nuanced understanding of the impact of knowledge management systems on SMEs.

4. Current Study – Aim and Research Question

The central question of this study concerns the influence of knowledge management on job satisfaction, work performance, and organisational success in light of the changing environment and increasing importance of knowledge in SMEs. This question directly addresses the conflicting findings identified in the literature review regarding the impact of knowledge management on job satisfaction and performance in different organisational contexts. The main objective of this study is to investigate the extent to which the introduction of a knowledge management system based on Mediawiki in an SME can have an impact on subjective work performance and job satisfaction. The aim was to analyse the effects of specific knowledge management processes on job satisfaction.

A qualitative research methodology was selected to identify previously unknown opportunities and challenges in the implementation of knowledge management systems in SMEs. This approach allows for a more nuanced exploration of how knowledge management processes operate within the specific context of an SME, potentially filling gaps in the understanding left by previous quantitative studies. This study aimed to generate findings that are not only scientifically but also economically useful. The results should provide practical recommendations for the design of knowledge management processes in SMEs and contribute to further development of knowledge transfer programs. By focusing on SME in the pool construction industry, this study addresses a significant gap in the literature, as much of the existing research focuses on large organisations or other specific sectors. This study did not evaluate the knowledge management software and did not consider the detailed organisation of knowledge management.

5. Methodology

This case study examines the influence of knowledge databases on job satisfaction and work performance in international SME. This research approach was chosen to understand and describe the complex phenomena in its natural environment. For this purpose, individual cases were analysed intensively and in detail (cf. Yin, 2018). The decision to focus on a single company was taken to allow an in-depth exploration of the complex interplay between knowledge management, job satisfaction, and work performance within a specific organisational context. Although this approach limits the generalisability of the findings, it provides rich contextual insights that can inform future research and practice in similar settings.

This study focuses on a little-researched area of knowledge management and the knowledge base of a medium-sized company in the pool-construction industry. The company is active in four main business areas and operates in eleven countries. The implementation of a knowledge database was considered the top priority for a successful growth. A knowledge base is used to document products, standards, and guidelines for project implementation and execution. Knowledge-based statistics show a significant increase in content pages, resources, and page views since their launch in December 2021. The company in which the study takes place included 150 employees, of which 18.7% were female and 81.3% were male. Employee structures are widespread across several countries, with the majority employed in Austria. This international aspect of the company provides an opportunity to explore how knowledge management practices affect job satisfaction and performance in different cultural contexts within a single organisation.

5.1 Participants

The selection of interviewees for this study was carried out according to Yin´s (2018) criteria to ensure that the research questions were relevant and answerable to guarantee the richness of information and cover a variety

of perspectives. The diversity of interviewees was ensured through targeted selection from different departments of the company, considering both international orientation and gender distribution (Table 1).

Table 1: Information on the participants

Person	Gender	Age	Company affiliation	Expert	Position
B1	female	20-35	1-5		Administrative / Worker
B2	male	36-50	1-5		Administrative / Worker
B3	male	20-35	1-5	Expert	Administrative / Worker
B4	male	36-50	<1		Administrative / Worker
B5	female	36-50	1-5		Middle management (team leader)
B6	male	36-50	1-5		Middle management (team leader)
B7	male	51-65	16-30	Expert	Administrative / Worker
B8	male	20-35	1-5		Administrative / Worker
B9	male	36-50	1-5		Top-Management
B10	male	20-35	1-5		Administrative / Worker
B11	male	36-50	1-5	Expert	Administrative / Worker
B12	male	51-65	16-30		Middle management (team leader)
B13	male	36-50	6-15	Expert	Adminstrative /Worker
B14	female	51-65	6-15		Top-Management
#14	**11 male** **3 female**	**Æ 42,43**	**Æ 8,02**	**4 Experts**	**2 Top-Management** **3 Middle management (team leader)** **9 Administrative / Worker**

5.2 Instrument and Data Collection

An interview guide was developed to collect information on job satisfaction, work performance, and work experience, using a knowledge database. To develop the guide, both main and detailed questions were created to guide the interviewer during the interviews. Various aspects have been explored, including knowledge generation, codification, retention, and their influence on workplace performance. Finally, participants were asked about their experience with the knowledge base and open questions.

Semi-structured interviews were conducted using an interview guide consisting of a catalogue of open-ended questions to be answered by the interviewees in their own words (Döring, 2022). According to Misoch (2019), this structure is based on four phases. As part of the organisational preparation according to Döring (2022), the interview guide was checked for comprehensibility and practicability by means of a test interview with a colleague. This approach allowed for a balance between consistency across interviews and flexibility to explore each participant's unique insights, in line with the study's aim of uncovering nuanced experiences in the knowledge management system. During the development of the guide, both the main and detailed questions (Table 2) were created to guide the interviewer during the interviews (Döring 2022):

Table 2: Interview guide

1. Information phase
Welcome and thank you for your participation
Information on the research topic
Obtaining authorisation for the audio recording and use in the study
Information on the anonymous processing of the data material
2. Demographic data and warm-up
Demographic survey
Query of the position and work area in the company
Use of the knowledge database

3. Main part
Job Satisfaction
Are you satisfied with the work?
What makes you happy at work?
Would you say that Mediawiki and the measures behind it make you happier?
What makes you happy about it?
Knowledge acquisition - does the acquisition of knowledge make you satisfied or only dissatisfied if it is not available?
Knowledge exchange and transfer - Do you like to share your knowledge with colleagues? Does the Mediawiki support you in this?
Knowledge generation - Do you enjoy generating/creating new knowledge?
Knowledge codification - Do you like to write down new knowledge and do you like to prepare it?
Knowledge retention or knowledge storage - is it important to you that knowledge is retained in the company?
Work performance
Does the Mediawiki affect your work performance?
4. Closing
Final questions: Question about experiences with the Mediawiki and the question about open topics.

The interviews for data collection were conducted in July 2023. The interviews were conducted in German and one case in English. The total amount of interview material was 11:56 hours, with interviews lasting an average 51.10 minutes. The interviews were digitally recorded using Microsoft Teams and then transcribed. Transcription was carried out using the Amberscript web platform, which uses artificial intelligence (AI) for support, according to the rules of Kuckartz and Rädiker (2022).

5.3 Data Analysis

Qualitative content analysis was used to analyse the transcripts. MAXQDA Standard 2022 software was used for content analysis, as recommended by Kuckartz and Rädiker (2022). The analysis process followed a systematic approach to ensure rigor and reliability of the findings.

- Initial coding: The material was analysed using predefined categories derived from the research questions and a literature review. These categories include job satisfaction, job performance, and various knowledge-management processes.
- Inductive subcategory development: Within these main categories, subcategories were inductively derived from the data. This allowed themes and patterns specific to the participants' experience of the knowledge management system to emerge.
- Second round of coding: The materials were coded according to these refined subcategories to ensure a comprehensive analysis of the data.

The content analysis of the interview transcripts combined quantitative and qualitative elements such as frequency counts and verbatim quotations. This mixed approach allowed for both a broad overview of the data trends and a deep dive into the nuanced experiences of individual participants. Coding was performed by only one person, which, while ensuring consistency, may introduce potential bias. Regular peer debriefing sessions were held to discuss and validate the emerging codes and themes. The categories and subcategories (Table 3) were derived directly from the research questions and refined based on interview data. They were designed to capture the multifaceted nature of job satisfaction and work performance in relation to the different aspects of the knowledge management system. This categorisation allows for a structured analysis of how different knowledge management processes contribute to job satisfaction and work performance, thus addressing the core objectives of the study.

Table 3: Categories and Subcategories

Main categories	Subcategories
Job satisfaction	General job satisfaction Influence of job satisfaction on employee satisfaction Satisfaction through knowledge acquisition Satisfaction through knowledge exchange Satisfaction through knowledge generation Satisfaction through knowledge codification Satisfaction through knowledge retention
Work performance	Time Quality Knowledge exchange Knowledge acquisition
Experience	No subcategories

Although the findings of this single case study may not be widely generalisable, they provide valuable insights into the complex dynamics of knowledge management in SMEs. These insights can inform hypothesis generation for future larger studies and offer practical considerations for similar organisations implementing knowledge management systems.

6. Results

To allow for comparison, the survey asked about general job satisfaction independent of the knowledge database. Five participants said that they were generally satisfied with their job. However, limitations were also mentioned, with six people citing lack of time as the main reason for not being fully satisfied. Other reasons included too many projects, which were also linked to a lack of time and problems with personal development and induction. In summary, three people expressed complete satisfaction, whereas nine expressed limited satisfaction, mainly because of time constraints and workload. The analysis at the organisational level showed that middle management and professionals felt that some aspects were imperfect, while administrators were satisfied, but only half of them were fully satisfied.

6.1 Job Satisfaction

A study on job satisfaction one and a half years after the introduction of the knowledge base showed that 11 of 14 participants reported a positive impact. They experienced increased satisfaction owing to the quick retrieval of information and the simplification of their work processes. However, some participants indicated that their specific knowledge needs had not yet been fully covered, which affected their satisfaction. Employees with complex tasks and mobile working conditions particularly appreciated the use of the knowledge base. The analysis at the organisational level shows that both middle management and experts benefit from the measure, while administrators show an improvement, and top management shows no change in job satisfaction. These results support the hypothesis that knowledge management promotes job satisfaction and shows differences depending on the organisational structure and employees' area of responsibility.

Although the knowledge base is the primary source of external knowledge, only about half of the respondents indicated that knowledge acquisition influences their job satisfaction. Reasons for satisfaction vary and include increased competence, personal relevance of knowledge content, improved understanding of interrelationships, and increased efficiency of knowledge acquisition. The results did not clearly confirm or disprove the contribution of knowledge acquisition on job satisfaction. The distribution of knowledge acquisition at the organisational level shows no significant differences between the hierarchical levels. Experts may show less interest in external knowledge acquisition, which could be due to their specialised roles and existing management knowledge.

This study showed that knowledge sharing has an important impact on job satisfaction for most respondents. Knowledge sharing helps clarify technical issues and creates a common knowledge base. In addition to exchanges with colleagues, dialogue with superiors is also seen as an important dimension of satisfaction with knowledge sharing. Only one person rated the influence as low, while for two people, the exchange had no

influence on satisfaction because the necessary content support was not yet available in the knowledge database. Overall, the theory that knowledge sharing has a positive impact on job satisfaction is confirmed. The analysis at the organisational level shows that top and middle management see the greatest impact of knowledge sharing on job satisfaction, followed by administrative staff. On the other hand, experts do not perceive knowledge sharing as a decisive factor.

Knowledge generation played an important role along with knowledge sharing as a factor influencing job satisfaction, as highlighted by 11 respondents. The enjoyment of knowledge generation can be attributed to curiosity and the ability to communicate with the older generations. Personal exchange during knowledge generation is considered important, as it provides additional information and enriches the process. Some participants also stressed the importance of contributing their results to the knowledge base to help others and share knowledge. A knowledge base is used to obtain inspiration and new information. However, not all participants experienced satisfaction when generating knowledge, mainly because of time pressure at work. Overall, knowledge generation was seen as a driving force for job satisfaction, with 12 people perceiving varying degrees of impact. The analysis at the organisational level showed a strong and even presence of knowledge generation at all hierarchical levels.

The respondents addressed the issue of knowledge codification less intensively. Eight participants expressed satisfaction, particularly those who were actively involved in content creation. One person said that he would like to be more involved but that he did not have enough time due to other responsibilities. Some respondents document their knowledge and pass it to the knowledge management unit, which processes and distributes information. One person found the codification of knowledge time-consuming and did not feel satisfied with the process. In summary, knowledge acquisition contributes to job satisfaction but not as much as knowledge generation or knowledge sharing. The distribution at the organisational level shows different assessments, with top management seeing only a small influence and one person among the clerk seeing no influence. Overall, there was an even distribution of agreement, with only one respondent at each hierarchical level, indicating that it had little impact.

Knowledge retention, also known as knowledge preservation, proved to be an important factor influencing job satisfaction, as emphasised by all participants. However, no specific questions were asked on this topic in the two interviews, so only 12 participants made statements on this topic. However, all patients were positive. The reasons for its outstanding importance are manifold. The ease of use, particularly quick and easy access, proved to be a crucial aspect. Four responses emphasised the importance of knowledge retention, particularly in the context of a centrally organised and curated unit that allows knowledge to be collected and made centrally available. Two participants also highlighted issues of demographic change and staff retirement in the coming years as important factors in relation to knowledge retention. One participant highlighted the importance of induction in the context of knowledge retention. In summary, knowledge retention was confirmed by almost all participants, with two exceptions, and therefore, had an impact on job satisfaction. The breakdown at the organisational level shows that knowledge retention is particularly important for top management and experts, while it seems less important for clerks and middle management.

6.2 Work Performance

Employees perceive the influence of knowledge management, in the form of a knowledge database, to be more intensive than their influence on job satisfaction. In principle, 11 of the 14 participants considered that their work performance would improve. The main reason for the increase in work performance is the time advantage of information procurement. The ease with which information can be obtained saves time and makes it possible to respond more quickly to customer enquiries or find the materials needed. The ease of acquiring knowledge through the use of a knowledge base is also highlighted. Some respondents also highlighted the ease of sharing knowledge with colleagues and the improvement in work through the availability of relevant information. Although the majority of respondents noticed an increase in their work performance, some noticed only a slight increase. This may be because the impact of the knowledge base is limited to their specific jobs or because their jobs require less knowledge.

The analysis at the organisational level shows that the proportion of those who perceive an increase in work performance is lower among the top management and administrative staff. This can be attributed to the limited number of contact points at the top and the less relevant knowledge base for routine activities. This discrepancy in perceived performance improvement across organisational levels raises important questions regarding the design and implementation of knowledge management systems. This suggests that a one-size-fits-all approach

may not be optimal, and that tailoring the system to different roles and levels within the organisation could potentially increase its effectiveness.

6.3 Experience

As with work performance and job satisfaction, employees particularly appreciate the ease of searching for and accessing information, which increases work performance and satisfaction and reduces error rates. According to some employees, the knowledge base also contributes to the improved retention and faster integration of new employees. In the long term, some expect that the centralisation of knowledge and data storage will make personal files obsolete. The attractiveness and user-friendliness of the system are emphasised, as is the importance of a structured and well-maintained database for employee acceptance and skills development. Overall, there is broad support for a knowledge database as a valuable tool to increase efficiency and knowledge networking within a company.

6.4 Summary of Results

These results suggest that knowledge-management processes contribute differently to job satisfaction and performance. Knowledge-sharing and generation emerged as the strongest contributors to job satisfaction, with most participants reporting positive effects. Knowledge retention is generally recognised as important, particularly by top management and experts. Knowledge codification and acquisition showed mixed results, with moderate positive impacts on job satisfaction. In terms of work performance, the implementation of a wiki-based knowledge base was perceived as having a more intense impact than job satisfaction. Most participants reported increased work performance, mainly because of time savings in information retrieval and improved knowledge-sharing. However, the impact varied across organizational levels, with top management and administrative staff reporting less pronounced effects. These findings suggest that while all knowledge management processes contribute to job satisfaction and work performance to some extent, their impact varies depending on the specific process and employee's position within the organisation.

7. Discussion

Looking at the underlying theoretical findings and the empirically analysed and discussed results of the study, some conclusions can be drawn regarding the effects of implementing a knowledge database on job satisfaction and work performance. This study identified knowledge generation as a positive aspect of job satisfaction. While knowledge acquisition is seen as an influencing factor for job satisfaction by half of the respondents, the study by Kianto, Vanhala and Heilmann (2016) shows that this factor, like knowledge generation, is not significant across all organisational levels. However, this study shows that the number of mentions of knowledge generation has the second-highest impact on job satisfaction.

The findings are consistent with and diverge from previous research in interesting ways. For example, while Kianto, Vanhala and Heilmann (2016) found that knowledge sharing was the most important process, followed by knowledge retention, our study found an inverse relationship. Knowledge retention was mentioned most often, followed by knowledge sharing and knowledge generation, with equal importance. This can also be seen in studies by Kucharska and Erickson (2019) and Ćurčić and Matejić (2021). This discrepancy may be due to the specific context of the pool construction industry, where the retention of specialised technical knowledge is critical to project success.

The differential impact across organisational levels in our study also provides new insights. Unlike Kianto, Vanhala and Heilmann (2016), who found that knowledge processes have a limited impact on top management satisfaction, our study found that top management highly valued knowledge retention, generation, and sharing. This may be due to the more hands-on nature of top management roles in SMEs compared to larger organisations studied in previous research.

In general, knowledge management processes have a strong effect on job satisfaction, which could indicate increased efforts to improve knowledge in the organisation.

In comparison with the studies cited in this paper, the knowledge processes that have an impact show the following responses according to Table 4.

Table 4: Comparison of the studies in this paper on the influence of knowledge processes on job satisfaction

	Case study	Kianto, Vanhala and Heilmann (2016)	Kucharska und Erickson (2019)	Ćurčić und Matejić (2021)
	KMU	Municipal	IT & Construction	Military
Knowledge acquisition	partly supported	no	-	-
Knowledge exchange	supported	yes	yes	yes
Knowledge generation	supported	no	-	-
Knowledge codification	supported	yes	-	yes
Knowledge preservation	supported	yes	-	-

The contrasting findings between our study and previous research, particularly regarding the impact on different organisational levels, highlight the importance of context in the effectiveness of knowledge management. For example, the finding that middle managers benefit significantly from the knowledge base contrasts with previous studies (e.g. Singgih et al., 2020) that found a limited impact of knowledge management on middle management performance. This discrepancy highlights the need for tailored knowledge management approaches that take into account the specific roles and responsibilities within an organisation.

In the context of middle management, which in this research case represents the team leaders of specialist departments, the following overall picture emerges: the knowledge base contributed to job satisfaction for all team leaders surveyed, whereas knowledge generation emerged as the dominant factor in the knowledge processes. Knowledge acquisition comes second, on par with knowledge sharing, knowledge codification, and knowledge retention. Compared to the study by Kianto, Vanhala and Heilmann (2016), in which middle managers consider knowledge sharing to be the most important factor influencing job satisfaction, a different dynamic is evident.

The experts in this study generally attributed a high level of influence to the knowledge database. Regarding knowledge processes, knowledge retention had the greatest influence on job satisfaction, followed by knowledge acquisition. This observation is in line with the findings of Kianto, Vanhala and Heilmann (2016), in which experts attributed the greatest influence to knowledge sharing and knowledge retention. Kianto, Vanhala and Heilmann (2016) speculate that experts may derive satisfaction from the fact that the solutions they develop are shared, thus adding value to the organisation. Although problem-solving is central to experts, knowledge generation does not seem to increase job satisfaction to the same extent as the two preferred factors of knowledge retention and knowledge sharing.

Although the findings regarding experts are consistent with those of previous research, the reasons for this inconsistency may differ. In this study, the high value placed on knowledge retention by experts is likely due to the project-based nature of the pool construction industry, in which lessons learned from past projects are critical to future success. This suggests that the nature of the industry plays an important role in determining which knowledge-management processes are the most valued.

The knowledge base also has a clear impact on clerks' job satisfaction, although not to the same extent as for middle managers and experts. The interviews show that this is due to the lack of specific knowledge and the highly routinised way of working. Knowledge exchange and generation were considered to have the greatest influence on this group, followed by knowledge acquisition. This observation correlates with the findings of Kianto, Vanhala and Heilmann (2016), who saw knowledge exchange as the most important influencing factor, followed by knowledge codification. In this case study, the survey responses suggest that because of the project-based nature of administrative and workers business, there is an increased need to develop solutions to contribute to the success of the business, which may result in less focus on documentation.

This research finding is consistent with studies that found a positive impact of knowledge management on work performance, such as that of Meher and Mishra (2021) and Zhang (2017). However, this contradicts studies, such as those by Singgih et al. (2020), which found no significant impact of knowledge management on work performance. This study fills the knowledge gap identified by Kianto, Vanhala and Heilmann (2016) regarding the relationship between knowledge management, job satisfaction, and workplace performance.

The implications of these findings extend beyond the pool-construction industry. For SMEs in other sectors, these results suggest the following.

- The effectiveness of knowledge management systems can vary significantly across organisational levels. SMEs should consider tailoring their knowledge-management approaches to the specific needs of different employee groups.
- The nature of the industry and type of work (e.g. project-based vs. routine) can significantly influence which knowledge management processes are most valued. SMEs should assess their specific industry context when designing knowledge management strategies.
- The implementation of a Wiki-based knowledge database can have considerable positive effects on both job satisfaction and work performance, even in industries not traditionally associated with intensive knowledge work.
- The strong emphasis on knowledge retention found in this study may be particularly relevant for SMEs in industries with high employee turnover or those facing demographic challenges (e.g. an aging workforce).
- The different impacts of knowledge codification on different employee groups suggest that SMEs should carefully consider how they structure and present information in their knowledge-management systems to ensure the relevance and usability of all employees.

These implications provide valuable insights for SMEs in different industries for implementing or improving their knowledge management systems. However, further research is needed to validate these findings in different industry contexts and to explore how the unique characteristics of different SMEs may influence the effectiveness of knowledge management practices.

8. Conclusion

This study showed that the introduction of a wiki-based knowledge base improved job satisfaction. In particular, in industries with complex products and extensive standards, wiki enables quick access to relevant information, increasing satisfaction. All respondents who noted a positive impact emphasised their ability to find information quickly. This is a crucial factor, as many employees cited lack of time as a barrier to satisfaction. Thus, this study confirms the positive impact of knowledge management on job satisfaction even in manufacturing companies. It also encourages the introduction of simple knowledge management using Wiki in small and medium-sized companies.

This study identifies knowledge generation as a positive aspect of job satisfaction. While knowledge acquisition is seen as an influencing factor for job satisfaction by half of the respondents, the study by Kianto, Vanhala and Heilmann (2016) shows that this factor, like knowledge generation, is not recognised across all organisational levels. However, this study shows that the number of mentions of knowledge generation has the second highest impact on job satisfaction. It is worth noting that in the study by Kianto, Vanhala and Heilmann (2016), knowledge sharing was seen as the most important process, followed by knowledge retention. In contrast, the current study shows an inverse picture based on the mentions: Knowledge retention was mentioned most often, followed by knowledge sharing and knowledge generation with equal importance. In general, knowledge management processes have a strong effect on job satisfaction, which could indicate increased efforts to improve knowledge in the organisation.

The impact on work performance was very positive. Of the 14 respondents, 11 noted an improvement in work performance and three noted a minor impact on work performance. The time saved by being able to easily finding curated information is a key factor. Ease of acquiring and sharing knowledge has also been cited as an important factor. However, it can be deduced from the statements that, on the one hand, there was a considerable need for knowledge in the work processes and, on the other hand, existing knowledge was not effectively curated and documented.

This study shows that the introduction of a knowledge database has a positive effect on job satisfaction and work performance in SME after one and a half years of operation. However, it remains unclear whether the positive results are due to the wiki database itself or to the careful curation of the data by employees. However, this can have a significantly positive effect on companies. This underlines the importance of targeted knowledge management for business success, especially during times of increasing knowledge intensity and global competitive pressure. Therefore, this study provides valuable insights into the potential for knowledge management in SMEs and the strategic orientation of such companies.

9. Recommendations for practice

The following practical recommendations for the implementation of knowledge bases are based on the results of this study and employees' experiences:

- Introduction of a knowledge management system: Based on the positive effects of the knowledge management system in the present study, a wiki-based system should be implemented to improve knowledge management and sharing, as it is well-suited for knowledge management and can lead to higher job satisfaction and improved work performance. In addition, this can lead to an increase in employees' personal skills.
- Pre-implementation survey: A pre-implementation survey of employees' needs will help address these needs and better document changes in job satisfaction.
- Communicating the benefits: To promote the acceptance and use of a knowledge management system, it is advisable to communicate the benefits, such as time savings and improved information retrievability transparently, and to provide regular training.
- Employee education and training: Based on the findings of the positive effects of knowledge acquisition and sharing, employees can be trained to use a knowledge management system to increase its effectiveness and acceptance.
- Encouraging knowledge creation: As knowledge creation has a positive influence on job satisfaction, an incentive system can be created to motivate employees to actively participate in knowledge creation.
- Regular updating and maintenance of the knowledge base: Regular updates and maintenance of the knowledge database should be implemented to ensure the long-term effectiveness of the knowledge management system.
- Embedding knowledge management in corporate culture: Knowledge management can be embedded as an integral part of corporate culture to establish a sustainable knowledge culture in the long term.
- Feedback and evaluation: An ongoing process of evaluation and feedback from employees helps continually improve the knowledge management system and adapt it to changing needs.
- Consider the organisational context: When implementing these recommendations, organisations should consider their specific context, including industry, size, and existing organisational culture. The effectiveness of these practices varies among SME.

10. Limitations and Future Directions

Respondents were limited to employees who used a knowledge base. This provided a detailed insight into the experiences of this group but may lead to bias in the results. As not all employees regularly access the knowledge base, the overall picture of the organisation may be incomplete, leading to some ambiguity in the results.

The interviews were conducted with the company's knowledge manager, which may have influenced the objective view. Although the researcher tried to maintain a neutral position, internal actors may have consciously or unconsciously influenced the interviewees' responses. This could have led to potentially biased results, as highlighted by Misoch (2019).

This case study illustrates only one perspective of a specific international manufacturing company in the pool-construction industry. The generalisability of these findings to other industries or even to other SMEs within the same industry may be limited. In particular, SMEs are often characterised by complex organisational structures that are influenced by many variables. These variables include access to the knowledge base, timeliness of the data provided, and the way in which the organisation is shaped by its culture. Studies such as Lund's (2003) on organisational culture or Singh and Sharma's (2011) on an organisation's learning culture have shown that these factors can have a significant impact on the success of knowledge management. Studies such as that by Kucharska and Erickson (2019) on the role of IT infrastructure and IT skills as factors influencing knowledge sharing and job satisfaction also show that the influence of infrastructure is overestimated, whereas that of IT skills is underestimated. Particularly in small- and medium-sized enterprises, these factors can diverge significantly, thus influencing the perception of knowledge management.

The limitations of the present study provide grounds for further research to deepen and extend the findings, and the impact of knowledge management on job satisfaction and work performance may be influenced by various factors such as access to the knowledge base, timeliness of data, organisational culture, or learning

culture of an organisation. Future studies should explore these parameters in greater detail to obtain a more complete picture.

A comparative analysis of similar SMEs with different approaches to knowledge management could provide valuable insights into best practices. Such benchmarking can help to identify successful strategies and derive recommendations for action. This study represents a snapshot that does not consider the long-term effects of an implemented knowledge management system. Future research could focus on how the implementation and use of the system affects job satisfaction and work performance over time.

In conclusion, while this study provides valuable insights into the implementation of a Wiki-based knowledge management system for SME in the pool construction industry, it also highlights avenues for future research. A comparative analysis of similar SMEs using different knowledge management approaches could provide best practices and actionable recommendations. Furthermore, as this study provides a snapshot of the system's impact, longitudinal research is needed to understand the long-term effects on job satisfaction and work performance. By addressing these areas, future studies can build on the current findings to develop a more comprehensive understanding of's role of knowledge management in different SME contexts. This expanded research agenda will not only contribute to the theoretical advancement of the field, but also provide practical guidelines for SMEs seeking to implement effective knowledge management systems, ultimately enhancing their competitive edge in an increasingly knowledge-driven business landscape.

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Ethics statement: The study was conducted in full compliance with all applicable laws and institutional regulations. Informed consent was obtained from all participants prior to their involvement. The privacy rights of all individuals were diligently respected and safeguarded. The research adhered to the ethical principles set out in the World Medical Association's Code of Ethics (Declaration of Helsinki) concerning research involving human subjects. Ethical committee review and approval were not required, as the data collection was solely based on non-invasive methods and addressed everyday topics without particular ethical sensitivity. No sensitive personal data, as defined by the European General Data Protection Regulation (GDPR), was collected. Special care was taken to protect the participants. Participation was entirely voluntary, and informed consent was secured in advance. Participants were free to withdraw from the survey at any time without providing reasons. It is also noteworthy that no dependency relationship existed between the researchers and the participants. All necessary data protection measures were meticulously implemented. All data were collected and processed exclusively in an anonymised form, making it impossible to trace the information back to individual persons. Data storage was carried out in accordance with current data protection standards. Methodologically, only standardised and well-established research techniques were applied, fully complying with recognised scientific standards. Experimental or innovative methods were entirely avoided.

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The Impact of Knowledge Management on Performance Through Intellectual Capital in Yemen's Telecom

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Abstract: In the contemporary knowledge-driven economy, organisations are increasingly dependent on knowledge management and intellectual capital as key drivers for enhancing organisational performance. Despite the growing academic interest in these domains, research examining their combined impact remains limited, particularly within the context of the telecommunications sector in developing economies. This study aims to address this gap by identifying the impact of knowledge management on organisational performance through intellectual capital in the Yemeni telecommunications sector. To achieve this objective, the present study employed the quantitative research methodology, incorporating descriptive and analytical approaches. SPSS was utilised for descriptive and preliminary statistical analysis, while PLS-SEM was employed to examine the effects among the variables. The questionnaire was the principal instrument used to collect the necessary data for this study. A structural model has been proposed for the study variables, illustrating the relationship between knowledge management, intellectual capital, and their subsequent impact on organisational performance. The non-proportional stratified random sampling method was employed to select the study sample individuals. The model was evaluated using data obtained from 289 individuals employed in the Yemeni telecommunications sector. The study's findings indicated that knowledge management positively impacts organisational performance (B=0.776; $p < 0.05$), suggesting that knowledge management plays a significant role in enhancing organisational performance. In addition, intellectual capital was found to have a statistically significant direct impact on organisational performance (B=0.557; $p < 0.05$), highlighting its contribution to enhancing organisational performance. Furthermore, the results revealed a significant effect of knowledge management on IC (B=0.852; $p < 0.05$), suggesting that knowledge management enhances intellectual capital, which in turn strengthens its impact on organisational performance. Moreover, the mediation analysis confirmed that intellectual capital mediated the relationship between knowledge management and organisational performance, demonstrating that knowledge management influences organisational performance both directly and indirectly through intellectual capital. The findings contribute to the development of the resource-based view (RBV) and the knowledge-based view (KBV) by demonstrating how knowledge management and intellectual capital interact and jointly influence organisational performance. Furthermore, this study contributes to the extant literature by presenting a model that connects these variables in the telecommunications sector, a field that has not been sufficiently studied in previous research. In light of the aforementioned findings, the study recommended an increased focus on organisational performance and the establishment of organisational units within the organisational structures of the Yemeni telecommunications sector concerned with knowledge management, due to its significant impact on enhancing organisational performance in the Yemeni telecommunications sector.

Keywords: Knowledge management, Intellectual capital, Organisational performance, Yemeni telecommunications sector

1. Introduction

Organisations strive for success, particularly in an era marked by rapid cognitive and technological advancements. To achieve their strategic objectives, they continuously seek to enhance performance by optimising the utilisation of both tangible and intangible resources. Organisational success is fundamentally tied to the effectiveness of their performance (Obeidat, 2016). In this context, knowledge management (KM) has emerged as a critical contemporary management concept. KM enables organisations to generate, obtain, select, organise, use, and disseminate knowledge essential for administrative activities such as decision-making, problem-solving, and strategic planning (Taher, 2018, p. 45). Consequently, many organisations have adopted KM practices, focusing on processes such as diagnosing, acquiring, generating, storing, sharing, applying, and protecting knowledge. A key resource in the knowledge economy is intellectual capital (IC), which comprises human capital, structural capital, and relational capital. IC represents a core aspect of KM, enabling organisations to leverage and invest in knowledge to enhance performance and drive development. Studies on the relationship between KM and IC highlight a shift from financial performance measures to IC management.

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Financial indicators, while useful, often focus on short-term results and lack strategic dimensions such as internal operations, learning and growth, and customer satisfaction (Babakr, 2019). Both KM and IC are vital sources of competitive advantage and organisational performance (OP) (Chowdhury, Rana, and Azim, 2019). The effective development and utilisation of IC depend on organisational members possessing the requisite knowledge and demonstrating a willingness to apply and share it (Alvino et al., 2021). Therefore, identifying ways to enhance the application of IC is imperative for impacting organisational outcomes (Weqar et al., 2020). As Grant (1996) notes, "differences in performance are due to different stocks of knowledge and different capabilities in using and developing them". In other words, resources (IC assets) and capabilities (KM practices) have the potential to create a sustainable competitive advantage and enhance organisational performance (Grant, 1996). The relationship between KM and IC has been a focal point of research, with studies consistently showing a significant positive relationship between these variables and their collective impact on enhancing organisational performance (Piri, Jasemi, and Abdi, 2013). From a theoretical perspective, scholars such as Silva and Fain (2024), Ethelmary, Udodiugwu and Nnanyelugo (2023) and Adhikari (2020), have explored the connection between KM and OP. Similarly, researchers such as Cahyono and Ardianto (2024), Muftiasa et al. (2023), Sigdel and Amponstira (2023), and Alvino et al. (2021) have investigated the link between IC and OP. Despite the widespread recognition of the importance of KM, IC, and OP in literature, few studies have jointly examined these factors, particularly in developing economies. This gap is especially pronounced in the context of Yemen, where research on the interrelationships between these factors remains scarce. The necessity of this empirical investigation is further emphasised by the limited attention given to this topic in the Yemeni context. Bridging this gap is imperative for advancing theoretical understanding and offering practical recommendations to enhance OP, particularly in the Yemeni telecommunications sector. While previous research has extensively examined the individual relationships between KM, IC, and OP (e.g., Al-Hasani, 2019; Hussini, 2019; Kharboush, 2019), fewer studies have explored their combined effects, especially in developing economies. This study builds on prior findings by integrating these three variables within a unified framework and empirically testing their interrelationships using structural equation modelling (SEM). This approach allows for a more nuanced understanding of direct and indirect effects. Moreover, by focusing on the telecommunications sector in Yemen, this study addresses a notable gap in the literature, as most existing research has been conducted in different industrial and geographical contexts. Practically, the telecommunications sector in Yemen plays a pivotal role in the national economy, serving as a primary catalyst for connectivity and business operations. However, it faces persistent challenges, including inadequate technological infrastructure, limited knowledge-sharing mechanisms, regulatory constraints, and insufficient investment in IC. The aforementioned issues have contributed to a decline in OP, as demonstrated by various reports. For example, Al-Bashiri (2021) noted a deterioration in the sector's overall performance. According to the GSM Association (GSMA), mobile phone penetration rates in Yemen decreased from 46% in 2015 (GSMA, 2015, p. 8) to 42% by the end of 2018. This figure is notably lower than both the regional average in the Middle East and North Africa (64%) and the global average (66%) for the same period (GSMA, 2019, p. 2). Academic studies have confirmed these challenges. Al-Feel (2021) found a significant decline in the overall performance of the Public Telecommunications Corporation, while Al-Soswa (2019) found that the institutional performance of mobile telecom companies in Yemen—Yemen Mobile, MTN, and Sabafon—remains below the desired level. These challenges underscore the necessity for a more profound investigation into the factors that influence OP within the Yemeni telecommunications sector. In this context, the role of KM and IC in enhancing OP becomes increasingly critical. Therefore, the objective of the present study is to address this research gap by analysing the relationship between these factors and their impact on OP in the Yemeni telecommunications sector. Specifically, the research seeks to answer the following central question: How does KM impact OP in the Yemeni telecommunications sector, and what is the mediating role of IC in this relationship?

To address this research question, the study develops a theoretical model based on the resource-based view (RBV) and the knowledge-based view (KBV). The model posits that KM exerts a direct influence on OP, with IC serving as a mediating variable in this relationship. The proposed model is empirically evaluated using survey data collected from employees working in the Yemeni telecommunications sector. Structural equation modelling (SEM) was utilised to assess and validate the hypothesised impacts among the variables. The unit of analysis for this study encompasses all organisations operating within the Yemeni telecommunications sector. The target participants include all employees based at the headquarters of these organisations in the capital city of Sana'a. The rationale for this selection lies in the relevance of the study variables to all employees, regardless of their administrative level. In the subsequent sections, we present a review of the relevant literature on KM processes, IC, and OP. This is followed by the conceptual model, which captures the relationship between KM and OP through IC. The study concludes with a discussion of the key findings and an acknowledgement of its limitations.

2. Theoretical Background

The present study utilises the theoretical underpinnings of the Resource-Based View Theory (Barney, 1991), Knowledge-Based View (KBV) Theory (Grant, 1996), and Intellectual Capital Theory (Stewart, 1997). Moreover, a review of extant literature on this subject is undertaken to ascertain the dimensions of the variables incorporated within the conceptual model, a topic that is elaborated upon in the ensuing sections.

2.1 Resource-Based View (RBV) Theory

The origins of the resource-based theory can be traced to Wernerfelt (1984), who shifted the analytical focus from products to the internal resources of organisations and introduced the term "Resource-Based View" (RBV). Subsequently, Barney (1991) then "presented and developed the basic principles of the Resource-Based View, providing a detailed definition of resources and clarifying the full set of characteristics that make a resource a potential source of competitive advantage (i.e., valuable, rare, unique, and non-substitutable)" (Barney, Ketchen and Wright, 2011, p.1301). The resource-based theory posits that internal organisational resources are more significant than external environmental factors in enhancing organisational performance and securing a sustainable competitive advantage. And that these internal resources primarily determine organisational performance. By clarifying the relationship between resource theory and the study's structural model, the Yemeni telecommunications sector (YTS) can leverage KM and IC to address persistent challenges, respond to environmental changes, and enhance OP.

2.2 Knowledge-Based View (KBV) Theory

This theory was mainly developed by researcher William Grant in 1996, in his famous paper "Toward a Knowledge-Based Theory of the Firm", in which he explained that knowledge is the basic resource that can give organisations a sustainable competitive advantage. This theory posits that effective KM fosters a sustainable competitive advantage and enhances organisational performance (Grant, 1996). Moreover, in the knowledge-based theory of the firm, knowledge is regarded as a firm's most valuable strategic asset. This theory explains the characteristics of knowledge: that it is the most strategic resource in the organisation, that the production activities and processes in the organisation include the application of knowledge, and that individuals in the organisation form the basis for creating, retaining, and sharing knowledge (Irawan, Bastian and Hanifah, 2019). The knowledge-based theory establishes knowledge as the foundation for all organisational activities. This knowledge necessitates the implementation of KM, which facilitates the transformation of both individual and collective knowledge into IC to enhance OP in the YTS .The conceptualisation of KM in this study is based on an extensive review of previous research. A matrix analysis was conducted to identify the most frequently examined KM dimensions across previous studies, ensuring a comprehensive and empirically supported framework. The analysis revealed that core KM processes in the literature include knowledge diagnosis, acquisition, generation, storage, sharing, and application. However, this study also incorporates knowledge protection, a dimension that, while less frequently examined in previous research, is particularly critical in the telecommunications sector. Given the sector's dependence on intellectual assets and data security, knowledge protection is vital for safeguarding proprietary information and sustaining competitive advantage. The integration of these dimensions ensures a comprehensive assessment of KM and its impact on OP in this study.

2.3 Intellectual Capital Theory

Intellectual capital theory emerged in response to the growing recognition of the importance of information and knowledge (Williams, 2001). Research based on IC theory has shown a relationship between IC and OP. Stewart (1997, 75) stated that IC consists of three dimensions: human capital, structural capital, and relational capital. This theory holds that the tangible assets (land, buildings, equipment, and money) of today's leading companies around the world have less value than intangible assets. The conceptualisation of IC in this study is based on an extensive review of previous research. A matrix analysis was conducted to identify the most frequently examined IC dimensions across previous studies, ensuring a comprehensive and empirically supported framework. The analysis revealed that the core components of IC in the literature include human capital, structural capital, and relational capital, as they provide a comprehensive framework for understanding and managing IC within organisations. These are the exact dimensions highlighted by Stewart (1997).

2.4 Knowledge Management

Sultana (2023) defined KM as a structured, institutionally defined process for acquiring, organising, keeping, deploying, exchanging, and reinvigorating both explicit and implicit staff knowledge. Wagh (2023) defined it as

the process of capturing, developing, sharing, retaining, and effectively utilising organisational knowledge. Furthermore, KM includes a variety of processes. “These processes can be defined as the activities associated with the creation, capture, storage, organisation, dissemination, and application of knowledge that enhance organisational competitiveness” (Obeidat, 2016).

2.5 Intellectual Capital

Intellectual capital refers to the intangible assets of an organisation, such as knowledge, skills, and expertise possessed by its employees (Halim, 2024). Roos and Röös (1997) defined it as a set of intangible assets–comprising competencies, resources, and capabilities–that enhance organisational performance and create value for the firm. Despite the differences in the definition of IC, scholars largely concur on a framework comprising three key components: human capital, structural capital, and relational capital (Alhamoudi, 2023; Muhammad and Salma, 2021; Wang et al., 2016). It should be mentioned that John K. Galbraith is credited with coining this phrase, which first appeared in 1969. "Researchers frequently use the term "intellectual capital" to refer to intangible assets" (Alzenknh, 2023).

2.6 Organisational Performance

Organisational performance can be broadly defined as the extent to which an organisation achieves its objectives (Mobolade and Ibojo, 2024). This "can be measured using various key performance indicators (KPIs) such as profitability, productivity, innovation, customer satisfaction, and market share" (Chidiadi, 2024). Obtaining and sustaining excellent performance is the objective of all organisations, including those whose ultimate objective is not always to generate profit (Mukaro, Deka and Rukani, 2023). Historically, the assessment of OP was predominantly confined to financial metrics, such as revenue, profit, net operating income, return on assets (ROA), return on equity (ROE), and return on sales (ROS), along with other indicators primarily linked to revenue and profitability (Mobolade and Ibojo, 2024). It is worth noting that most institutions assess their performance primarily through traditional financial reports, which do not adequately capture the true dynamics of competitive variables within the business environment, which led to the need to use non-financial indicators alongside financial ones when assessing performance, including aspects such as clients’ satisfaction, internal operations efficiency, and learning and growth, has become essential. This is precisely what the Balanced Scorecard achieves, as it serves as a measurement tool that enables organisations to translate their vision and strategy into actionable objectives while offering a clear and comprehensive view of organisational performance (Mehralian, Nazari and Ghasemzadeh, 2018). The Balanced Scorecard (BSC) framework has been widely adopted as a strategic management tool. Since it was proposed in the 1990s, it has been utilised as a tool for measuring and managing four key dimensions of organisational performance: Financial, Customers, Internal Business Processes, and Learning and Growth (Sadic, de Sousa and Crispim, 2020) .Based on the Balanced Scorecard framework developed by Kaplan and Norton (1992), this study adopts four key dimensions to measure OP: customer, internal processes, learning and growth, and financial performance. These dimensions were selected for their ability to provide a comprehensive and balanced view of OP, encompassing both financial and non-financial aspects, and ensuring that performance is measured from multiple perspectives that reflect the organisation’s strategic objectives. In addition, these dimensions have been widely used in previous studies, which enhances their credibility and ability to deliver accurate and reliable results.

2.7 Theoretical and Methodological Classification

To provide a more rigorous theoretical foundation, the reviewed studies were grouped and synthesised according to their methodological approaches and theoretical frameworks. From a theoretical perspective, several studies drew upon the resource-based view (RBV) and knowledge-based view (KBV) to explain how intangible resources such as KM and IC contribute to sustained OP (e.g., Alvino et al., 2021; Gold et al., 2001; Babakr, 2019). Other studies adopted capability-based frameworks, focusing on KM as a dynamic organisational capability that facilitates innovation and performance (e.g., Hussinki et al., 2017; Adhikari, 2020). Methodologically, previous research varies in its approach to testing these relationships. Some studies utilised traditional regression analysis to examine direct effects between variables (e.g., Setyawan, 2021; Kharboush, 2019), while others adopted structural equation modelling (SEM) to explore both direct and indirect paths–particularly those involving mediating roles such as that of IC (e.g., Babakr, 2019; Al-Gburi & Mohsin, 2025). These nuanced theoretical debates and methodological differences underscore the need for a unified model that captures the multidimensional interplay between KM, IC, and OP.

2.8 Conceptualising the Role of Intellectual Capital in the KM–OP Relationship

Previous research has conceptualised IC in diverse roles within the KM and OP nexus. While some studies have positioned IC as a mediator that channels the effects of KM towards improved performance outcomes (e.g., Babakr, 2019), other studies have treated IC as an independent variable, directly impacting OP (e.g., Kharboush, 2019; Dhiban, 2020). In addition, there is emerging literature suggesting that IC can function as a moderating variable, influencing the strength or direction of the KM–OP relationship, particularly under specific contextual conditions such as industry type or organisational maturity. This conceptual diversity reflects the evolving understanding of IC's strategic role in organisational success. In this study, IC is modelled as a mediator, consistent with the assumptions of the resource-based view (RBV) and knowledge-based view (KBV), which emphasise the transformation of knowledge resources into performance outcomes through intangible assets as IC.

3. Hypotheses Development

The present study proposes four main hypotheses, each of which is further subdivided into sub-hypotheses. These four hypotheses were formulated on the extant literature on this topic, thereby providing a foundation for examining and testing the relationships among the study's variables. The following sections elaborate on each hypothesis with reference to relevant previous studies.

3.1 First Hypothesis: Impact of KM on Organisational Performance

Effective KM plays a pivotal role in enhancing decision-making processes and enhancing organisational performance (Silva and Fain, 2024; Adhikari, 2020). By aligning KM practices with organisational objectives and strategies, organisations can ensure that knowledge is effectively managed to create value. This involves identifying the sources and nature of knowledge, fostering a culture conducive to continuous learning, knowledge sharing, and creation, and ensuring that knowledge is delivered to the right individuals at the right time. In addition, KM facilitates the generation of new and relevant knowledge, which enhances organisational performance in line with strategic objectives while addressing potential threats and opportunities (Ethelmary, Udodiugwu, and Nnanyelugo, 2023). Furthermore, KM enables organisations to coordinate and optimise their knowledge resources, leveraging collective expertise to drive innovation and enhance decision-making processes. This, in turn, "enhances organisational performance and provides a competitive advantage" (Rehman et al., 2021; Bailey et al., 2018, p. 280). However, measuring the effectiveness of KM and its contribution to organisational performance remains a significant challenge for many organisations (Tubigi and Alshawi, 2015). "In addition to potentially impacting people, products, and processes, KM may also affect the overall performance of the organisation, either directly or indirectly." (Becerra-Fernandez, Sabherwal, and Kumi, 2024, p. 82). Recent studies highlight KM's vital role in enhancing organisational performance, particularly within knowledge-intensive sectors such as telecommunications. For example, Al-Adwan (2019) found that KM systems–including knowledge acquisition, storage, sharing, and application–significantly impacted the performance of Jordanian telecommunications companies. Similarly, Al-Hasani (2019) emphasised the importance of KM processes, such as knowledge generation, acquisition, storage, transfer, and application, in enhancing OP from the perspective of employees in Jordan's telecommunications sector. The positive impact of KM extends beyond the telecommunications sector, as demonstrated by recent studies across various industries. Megha and Sushan (2024) explored the effects of KM practices–such as knowledge creation, transfer, storage, and application–on operational efficiency, financial performance, and employee satisfaction. Their findings revealed that organisations with structured KM strategies consistently outperformed those without, demonstrating improvements in productivity and collaboration. Similarly, Yang and Nuruly (2024) demonstrated that KM enhances decision-making, innovation, and workforce capabilities in educational institutions, highlighting its broad applicability. In the manufacturing context, Onikoyi et al. (2024) found that KM technologies, training, strategic approaches, and knowledge application significantly enhanced workforce effectiveness and productivity in Nigerian firms. Building on these findings, this study hypothesises that KM positively influences OP within the telecommunications sector. However, not all studies have reached consistent conclusions. For example, Setyawan (2021) investigated the impact of KM on OP in the Indonesian coal mining sector and found no significant direct effect. This discrepancy may be attributed to industry-specific characteristics, as KM tends to play a more central role in knowledge-intensive sectors like telecommunications, where innovation and IC are critical competitive assets. In contrast, asset-intensive industries such as mining may not rely as heavily on KM for performance improvement. In addition, Setyawan's study utilised regression analysis instead of SEM, which may have limited its ability to capture the complex, interconnected relationships

between KM and OP. SEM, as applied in this study, allows for a more comprehensive examination of both direct and indirect effects, particularly through mediating variables such as IC. Given these inconsistencies, further research is needed to explore the interconnected role of KM and IC in shaping OP. This study aims to address this gap by examining the hypothesis that KM positively influences OP, particularly within the telecommunications sector, while considering the mediating role of IC. By doing so, it seeks to provide a deeper understanding of how KM can be leveraged to drive performance and competitive advantage in knowledge-intensive industries.

H1: KM has a significant impact on OP.

3.2 Second Hypothesis: Impact of Knowledge Management on Intellectual Capital

KM plays a vital role in enhancing IC, which is widely recognised as a critical intangible asset for organisations (Simalango, Isnurhadi, and Andriana, 2023). KM and IC are closely interrelated concepts (Kianto et al., 2014; Hussinki et al., 2017; Mehralian, Nazari, and Ghasemzadeh, 2018), with each reinforcing the other (Simalango, Isnurhadi, and Andriana, 2023; Jordão and Novas, 2017). This mutual reinforcement contributes significantly to value creation within firms (Abeysekera, 2021). The academic discourse on knowledge in organisations primarily revolves around two key areas: IC and KM. While the IC literature focuses on identifying and categorising the intangible resources available to firms, the KM literature explores the mechanisms through which these resources can be effectively controlled and managed (Kianto et al., 2014). From a static perspective, IC represents a stock of knowledge predominantly shaped by cognitive activities within the organisation and serves as a foundation for value creation (Vaz, Selig, and Viegas, 2019; Mehralian, Nazari, and Ghasemzadeh, 2018). "To facilitate the creation and management of intellectual capital, organisations should work to establish knowledge management systems" (Kioko and Muriuki, 2024). The effective and continuous application of KM enables organisations to maximise their IC, generate value, and achieve a competitive edge in the market. Recent studies highlight the critical role of KM in fostering IC development. For example, Hussini (2019) study within Algeria's telecommunications sector (Biskra region) demonstrated that KM significantly enhances IC within this sector. These findings highlight the importance of KM as a strategic tool for enhancing IC and driving organisational success. Therefore, the authors develop the second hypothesis of this study as follows:

H2: KM has a significant impact on IC.

3.3 Third Hypothesis: Impact of Intellectual Capital on Organisational Performance

"The Resource-Based View underscores the importance of effectively leveraging a company's strategic resources, particularly intangible assets like IC, to secure competitive advantage and superior performance" (Cahyono and Ardianto, 2024). According to resource-based theory, intangible assets are the primary drivers of organisational performance (Forte et al., 2017). "These intangible assets—such as employee experience, intellectual property, patents, trademarks, brand name, and human resources—have a significant impact on a company's overall worth" (Achmad, 2022). Efficient utilisation of intellectual capital can enhance non-financial performance metrics, such as customer and employee satisfaction, internal business processes, effective operational management, and the expansion of social and financial networks (Sigdel and Amponstira, 2023). Furthermore, an organisation's success in today's rapidly changing and unpredictable global business environment depends heavily on its ability to create and utilise IC effectively (Irawan, Bastian, and Hanifah, 2019). IC management focuses on recognising the IC's potential to create new opportunities and add value to organisations, thereby positively influencing organisational performance (Todericiu, 2021; Lee and Wong, 2019). As highlighted by Alvino et al. (2021), IC not only ensures current OP, but also aligns with long-term strategic objectives, positioning it as a central pillar of sustained success. Recent studies demonstrate the significant impact of IC on OP, particularly within the telecommunications sector. For example, Kharboush (2019) conducted a study on Algeria Telecom (Biskra branch) and found a statistically significant effect of IC on OP. Similarly, Dhiban (2020) investigated the role of IC in enhancing performance at Yemen Mobile, revealing that even with limited availability of IC components, its impact on OP–measured through the Balanced Scorecard–remained positive. More recent research has further reinforced this relationship. Al-Gburi and Mohsin (2025) examined the role of IC in sustainable performance among Iraqi telecommunications firms and demonstrated that various components of IC–including human, structural, and relational capital–significantly contribute to corporate performance and long-term sustainability. Their findings are consistent with earlier research highlighting the critical role of IC efficiency in enhancing OP. Therefore, the authors develop the third hypothesis of this study as follows:

H3: IC has a significant impact on OP.

3.4 Fourth Hypothesis: The Mediating Role of Intellectual Capital in the Relationship Between Knowledge Management and Organisational Performance

To the authors' knowledge, only one study—Babakr (2019)—has integrated KM, IC, and OP within a single research framework. Examining the mediating role of IC in the relationship between KM and OP at the Sudanese PetroEnergy Oil and Gas Company. The results revealed a direct effect of KM on OP and an indirect effect through IC, highlighting a positive relationship between KM and IC that ultimately enhanced OP. These findings underscore the critical role of IC as a mediator in the relationship between KM and OP, a dimension this study aims to further investigate within the context of the Yemeni telecommunications sector. Therefore, the authors develop the fourth hypothesis of this study as follows:

H4: IC mediates the impact of KM on OP.

After grounding the hypotheses in established theoretical foundations (as discussed above), we present the proposed structural model in Figure 1.

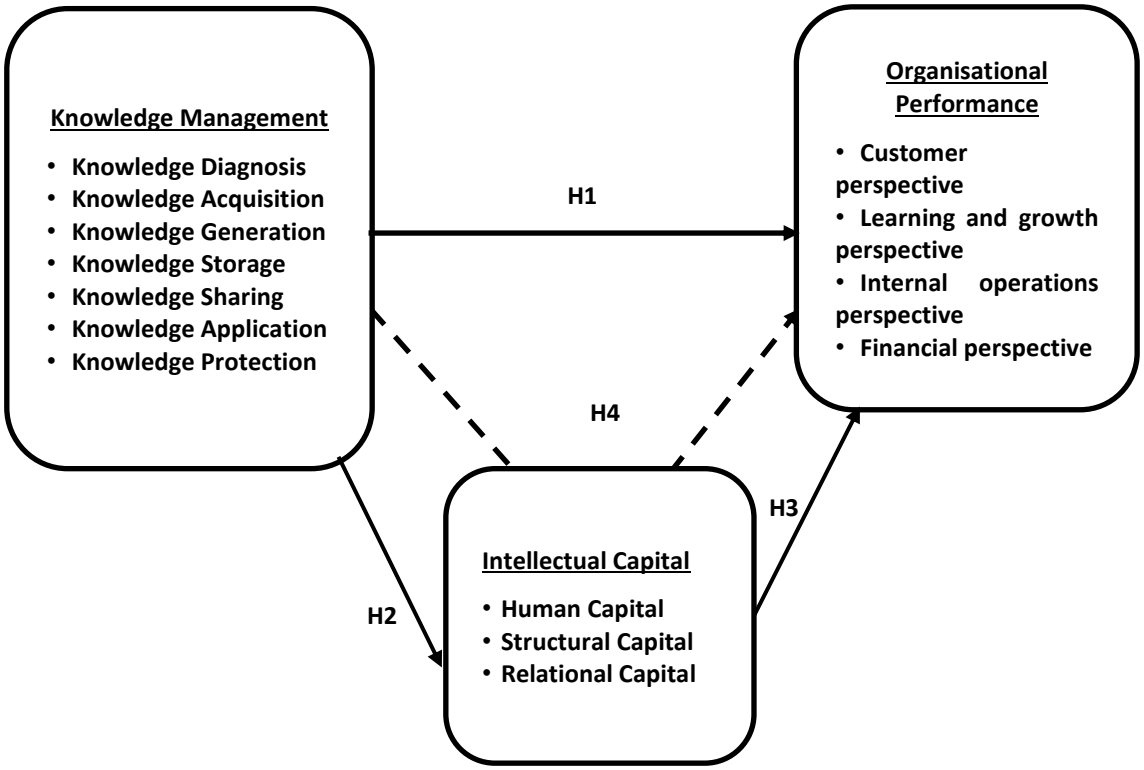

Figure 1: Proposed structural model. Source: Authors own work

This conceptual model illustrates the hypothesised relationships among the study's three core constructs: KM, IC, and OP, as articulated in hypotheses H1 to H4. Specifically, the model posits that:

H1: KM has a significant impact on OP.

H2: KM has a significant impact on IC.

H3: IC has a significant impact on OP.

H4: IC mediates the impact of KM on OP.

In the visual representation of the model, solid arrows indicate direct effects (H1–H3), while the dashed arrow indicates the mediating effect of IC (H4).

4. Research Method

This study adopted a quantitative research methodology, selected for its suitability in empirically examining the relationships between KM, IC, and OP. This approach enables statistical validation of hypotheses, ensuring generalisability and replicability (Creswell, 2018). This study employs both descriptive and analytical methods, enabling a theoretical understanding of the phenomenon through secondary data while also enabling an

empirical examination via fieldwork and unbiased data collection and analysis (Al-Ariqi, 2020). Unlike qualitative methods, which offer in-depth exploration through subjective insights, the quantitative approach enables a structured and objective assessment of variables, rendering it particularly appropriate given the nature and objectives of this study. Although a mixed-methods approach was considered, the primary objective of this research is to test an established conceptual model rather than generate new theoretical insights. Therefore, a survey-based quantitative method was considered the most suitable approach for this study. We used a questionnaire to collect data for this study to obtain information on KM, IC, and OP. Several statistical methods were employed, consistent with the nature of this study. The collected data were coded and analysed using the Statistical Package for the Social Sciences (SPSS, **v**ersion 28) and Partial Least Squares (Smart PLS). The collected data were screened for missing values and data entry errors. Subsequently, the data were rigorously analysed using scientific methods, and the results were interpreted to address the study's objectives and used to test its hypotheses.

4.1 Sample and Data Collection

The study population comprised five Yemeni telecommunications organisations operating in Yemen: Public Telecommunications Corporation (PTC), Yemen Mobile Company, TeleYemen Company, SabaFon Mobile Company, and YOU Mobile Company. The job titles that were the focus of the study included the following: Chief Executive Officer, Deputy Chief Executive Officer, Director General of Administration, Deputy Director General of Administration, Department Managers, Deputy Department Managers, Section Heads, Supervisors, and Specialists. The population consisted of 4,171 employees at the organisations' headquarters in Sana'a. Due to the variation in the number of individuals across different layers of the study population, a non-proportional stratified random sampling method was utilised to select the sample members. Following Thompson's (2012) sampling methodology, a representative sample size of 352 participants was determined to be statistically appropriate for this study. Data were collected by distributing 352 questionnaires to participants in the YTS. We received 289 valid responses, yielding a response rate of 82%. The majority of the respondents were male (75%). Participants held various positions, with 62% occupying supervisory roles and 38% serving in specialist positions.

4.2 Measures

The survey instrument was composed of several questions related to the KM processes, IC, and OP. Specifically, 35 items addressing the seven KM processes (knowledge diagnosis, acquisition, generating, storage, sharing, application, and protection); 15 items addressing the dimensions of IC (human capital, structural capital, and relational capital); and 20 items addressing the dimensions of OP (customer perspective, learning and growth perspective, internal operations perspective, and financial perspective). Each item was rated on a seven-point Likert-type scale, ranging from strongly disagree (1) to strongly agree (7). To ensure the face validity of the study instrument, it was initially presented to 8 academics specialising in relevant disciplines. They assessed the questionnaire in terms of structure, clarity, and relevance, as well as its alignment with the study's research questions, objectives, and hypotheses. Based on their feedback, modifications were made, including rearranging, adding, deleting, merging, and separating certain items. The final version of the questionnaire is presented in Appendix A.

4.3 Common Method Variance

Initial steps in the study's design prioritised procedural rigour, firstly through careful attention to the scale items to avoid ambiguous and vague terms in the questionnaire and by keeping the questions simple. Next, participants' anonymity was ensured by stating that clearly at the beginning of the questionnaire. During the data collection process, sufficient time was also provided to complete and return the survey, thus minimising assessment apprehension, all of which have the potential to cause method bias in the data (Podsakoff et al., 2003). As an ex-post measure, we evaluate the extent of common method variance. Harman's single-factor test was conducted. This involved performing a principal component factor analysis that included all items. (Podsakoff and Organ, 1986). The first factor accounted for 48.01% of the variance, which is below the 50% threshold commonly cited as indicative of potential common method variance issues.

5. Results

5.1 Statistical Analysis

The analysis of the study data was conducted using SPSS version 28 and the Hayes and Preacher Process Macro version 4. The study employed a range of statistical tests to examine the relationships among KM, IC, and OP. Partial Least Squares Structural Equation Modelling (PLS-SEM) was utilised to analyse the hypothesised

relationships, as it is well-suited for research involving latent constructs and exploratory models. PLS-SEM offers advantages over traditional regression analysis by enabling the simultaneous estimation of both measurement and structural models. Furthermore, compared to covariance-based SEM (CB-SEM), PLS-SEM is more appropriate for studies with complex models and relatively small sample sizes (Hair et al., 2021). Given the study's emphasis on theory development and prediction, rather than strict theory confirmation, PLS-SEM was the most appropriate analytical approach.

5.2 Descriptive Statistics of the Study Variables

Table 1 presents the descriptive statistics for the main study variables: KM, IC, and OP, including their mean, standard deviation, and Relative Importance Index (RII).

Table 1: Descriptive statistics results related to the study variables

	Mean	SD	RII
Knowledge Management (KM)	4.711	1.039	67.3%
Intellectual Capital (IC)	4.828	0.981	69.0%
Organisational Performance (OP)	5.050	0.927	72.1%

As shown in Table 1, the significance of KM was apparent in its aggregate mean of 4.711 (SD = 1.039) and a Relative Importance Index (RII) of 67.3%, thereby underscoring its perceived importance. A comparable level of significance was observed in IC, which attained an aggregate mean of 4.828 (SD = 0.981) and an RII of 69.0%. OP demonstrates an even higher level of perceived importance, with an aggregate mean of 5.050 (SD = 0.927) and an RII of 72.1%, thus highlighting the strong emphasis placed on OP across the study sample.

5.3 Correlational Analysis

The correlational analysis revealed significant relationships among KM, IC, and OP. The Pearson correlation coefficient between KM and IC is 0.866, indicating a strong positive correlation, which is statistically significant at the 0.01 level. Similarly, KM demonstrated a significant positive correlation with OP (r = 0.787), suggesting that improvements in KM are associated with enhanced OP. Furthermore, IC demonstrates a robust positive correlation with OP (r = 0.889), which is also significant at the 0.01 level. Table 2 presents the correlational analysis. Table 3 shows the Heterotrait-Monotrait (HTMT) ratio of correlations.

Table 2: Correlational analysis

	KM	IC	OP
KM	1		
IC	.866**	1	
OP	.787**	.889**	1

Table 3: Heterotrait-Monotrait (HTMT) Ratio of Correlations

	Customer perspective	Learning and growth perspective	Internal operations perspective	Financial perspective	Knowledge Diagnosis	Knowledge Acquisition	Knowledge Generation	Knowledge Storing	Knowledge Sharing	Knowledge Application	Knowledge Protection	Human Capital	Structural Capital	Relational Capital
Customer perspective														
Learning and growth Perspective	0.745													
Internal operations perspective	0.841	0.801												
Financial perspective	0.836	0.797	0.869											
Knowledge Diagnosis	0.584	0.478	0.669	0.581										
Knowledge Acquisition	0.828	0.808	0.855	0.815	0.863									
Knowledge Generating	0.638	0.665	0.711	0.712	0.839	0.853								
Knowledge Storage	0.566	0.582	0.669	0.596	0.758	0.794	0.863							
Knowledge Sharing	0.714	0.637	0.769	0.672	0.786	0.811	0.866	0.833						
Knowledge Application	0.690	0.657	0.803	0.720	0.835	0.883	0.870	0.859	0.898					
Knowledge Protection	0.616	0.498	0.689	0.605	0.766	0.737	0.729	0.788	0.748	0.778				
Human Capital	0.821	0.625	0.800	0.761	0.733	0.849	0.833	0.697	0.851	0.850	0.742			
Structural Capital	0.780	0.753	0.897	0.785	0.706	0.851	0.723	0.720	0.811	0.802	0.718	0.800		
Relational Capital	0.914	0.719	0.847	0.849	0.710	0.793	0.790	0.682	0.775	0.748	0.687	0.846	0.836	

5.4 Measurement Model Assessment (External Model)

Hair et al.(2021) stated that the assessment of results in PLS-SEM follows a two-step approach: first, assessing the measurement model, and then assessing the structural model. The assessment procedures differ depending on whether the constructs are specified as reflective or formative. According to Hair et al.(2019), the measurement model indicators can be divided into two main levels: the first degree is related to the relationship between items and dimensions, and the second degree is concerned with the relationship between dimensions and main variables. The first-order standard model is an important tool in mathematical logic to represent relationships between elements in an organised manner. In PLS-SEM, items may be removed from the measurement model when they fail to demonstrate sufficient discriminant validity or exhibit cross-loadings. This purification process enhances model parsimony and analytical efficiency. Table 4 shows the items excluded from the first-order measurement model, and Figure 2 shows the final structure of the measurement model after these modifications.

Table 4: Items deleted from the first-order measurement model

Item No.	Dimension	Variable	Reason
1, 3	Human Capital	Intellectual Capital	There is an overlap, resulting in a lack of clear differentiation
2, 4	Relational Capital	Intellectual Capital	There is an overlap, resulting in a lack of clear differentiation
1, 3	Customer Perspective	Organisational Performance	There is an overlap, resulting in a lack of clear differentiation

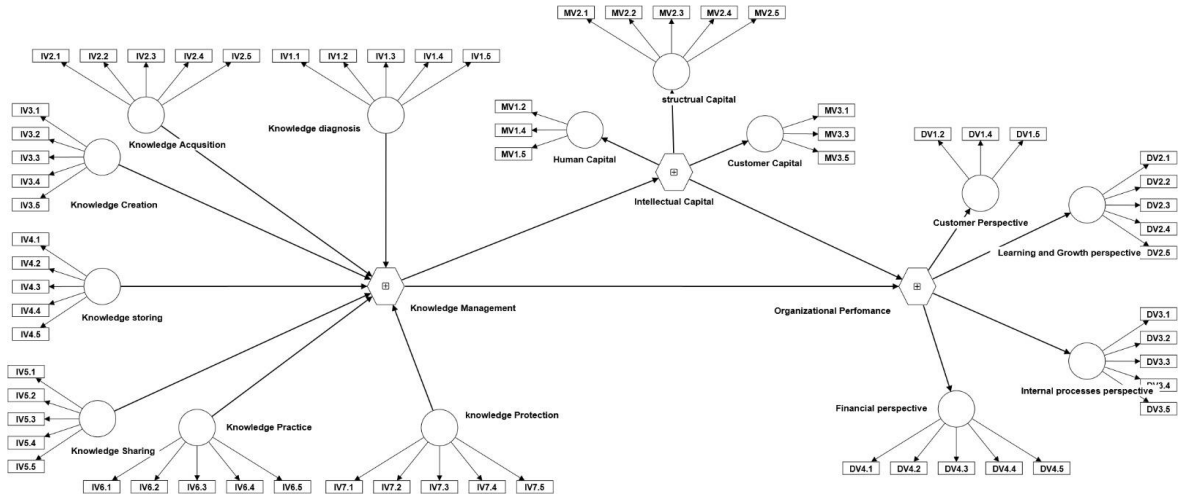

Figure 2: Measurement model

5.4.1 First-Order measurement model assessment

First-Order Measurement Model Assessment: Dependent Variable Dimensions:

Table 5 shows the convergent validity results for the dimensions of organisational performance, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 5: Convergence validity indicators for the dimensions of the dependent variable (organisational performance)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Customer Dimension	DV1.2	0.859	0.847	0.848	0.766
	DV1.4	0.881			
	DV1.5	0.885			

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Learning & Growth Dimension	DV2.1	0.828	0.834	0.870	0.601
	DV2.2	0.610			
	DV2.3	0.859			
	DV2.4	0.733			
	DV2.5	0.819			
Internal Processes Dimension	DV3.1	0.770	0.897	0.902	0.708
	DV3.2	0.876			
	DV3.3	0.880			
	DV3.4	0.826			
	DV3.5	0.852			
Financial Dimension	DV4.1	0.828	0.833	0.849	0.607
	DV4.2	0.874			
	DV4.3	0.817			
	DV4.4	0.740			
	DV4.5	0.606			

As shown in Table 5, the first-order measurement model for organisational performance demonstrates strong psychometric properties that meet the required reliability and validity standards. External saturation analysis confirmed high indicator reliability, with most outer loadings exceeding the 0.708 threshold, except for two indicators, which remained within acceptable limits due to sufficient AVE values. Internal consistency analysis (Cronbach's alpha) showed that all dimensions exceeded 0.700, confirming the scale's reliability. Composite reliability (CR) results also exceeded the required threshold, ensuring internal consistency. Convergent validity analysis confirmed that all dimensions met the AVE criterion (≥0.5), demonstrating adequate explained variance. Despite minor deviations, the model remains statistically robust for measuring organisational performance.

Second: First-Order Measurement Model Assessment: Independent Variable Dimensions:

Table 6 shows the convergent validity results for the dimensions of knowledge management, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 6: Convergent Validity Indicators for the Dimensions of the Independent Variable (knowledge management)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Knowledge Diagnosis	IV1.1	0.783	0.880	0.885	0.677
	IV1.2	0.819			
	IV1.3	0.770			
	IV1.4	0.842			
	IV1.5	0.895			
Knowledge Acquisition	IV2.1	0.788	0.829	0.836	0.595
	IV2.2	0.812			
	IV2.3	0.807			
	IV2.4	0.673			
	IV2.5	0.768			
Knowledge Generation	IV3.1	0.829	0.921	0.921	0.760
	IV3.2	0.889			

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	IV3.3	0.848			
	IV3.4	0.907			
	IV3.5	0.884			
Knowledge Storage	IV4.1	0.878	0.947	0.949	0.826
	IV4.2	0.924			
	IV4.3	0.910			
	IV4.4	0.902			
	IV4.5	0.929			
Knowledge Sharing	IV5.1	0.819	0.890	0.892	0.695
	IV5.2	0.848			
	IV5.3	0.853			
	IV5.4	0.799			
	IV5.5	0.848			
Knowledge Applying	IV6.1	0.885	0.905	0.913	0.728
	IV6.2	0.728			
	IV6.3	0.877			
	IV6.4	0.903			
	IV6.5	0.860			
Knowledge protection	IV7.1	0.736	0.860	0.867	0.645
	IV7.2	0.719			
	IV7.3	0.867			
	IV7.4	0.884			
	IV7.5	0.795			

As shown in Table 6, the first-order measurement model for knowledge management demonstrates strong psychometric properties. Most outer loadings exceeded 0.708, with the highest in knowledge storage (0.878–0.929) and knowledge generation (0.829–0.907), while one acquisition indicator (0.673) remained acceptable due to sufficient AVE. Cronbach's alpha (0.829–0.947) and composite reliability (0.836–0.949) exceeded 0.700, ensuring internal consistency. Convergent validity (AVE) values ranged from 0.595 to 0.826, confirming adequate variance explanation. Overall, the model demonstrates high reliability and validity, particularly in knowledge storage and generation. However, periodic review of lower-performing indicators, especially in knowledge acquisition, is recommended.

Third: First-Order Measurement Model Assessment: Mediating variable Dimensions:

Table 7 shows the convergent validity results for the dimensions of intellectual capital, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 7: Convergence validity indicators for the dimensions of the mediating variable (intellectual capital)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Human Capital	MV1.2	0.832	0.738	0.759	0.654
	MV1.4	0.854			
	MV1.5	0.736			
Structural Capital	MV2.1	0.756	0.885	0.891	0.687

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	MV2.2	0.848			
	MV2.3	0.860			
	MV2.4	0.878			
	MV2.5	0.798			
Relational Capital	MV3.1	0.888	0.800	0.808	0.715
	MV3.3	0.849			
	MV3.5	0.798			

As shown in Table 7, the first-order measurement model for intellectual capital demonstrates strong psychometric properties. Most outer loadings exceeded 0.708, with the highest in relational (0.888) and structural capital (0.878), while one human capital indicator (0.736) remained acceptable. Internal consistency was high, with Cronbach's alpha values ranging from 0.738 to 0.885 and composite reliability (CR) values from 0.759 to 0.891, all above the 0.700 threshold. Convergent validity (AVE) exceeded 0.500 across all dimensions, confirming adequate variance explanation. Overall, the model meets reliability and validity standards, with structural and relational capital performing best, making it a reliable tool for assessing IC.

Table 8 presents the discriminant validity assessment using the single ratio criterion and the Heterotrait-Monotrait (HTMT) ratio.

Table 8: Heterotrait-Monotrait (HTMT) Ratio of Correlations

	Customer Dimension	Learning & Growth Dimension	internal processes Dimension	Financial Dimension	Knowledge Diagnosis	knowledge acquisition	Knowledge generation	Knowledge Storing	Knowledge sharing	Knowledge Applying	knowledge protection	Human Capital	Structural capital	Relational capital
Customer Dimension														
Learning & Growth Dimension	0.745													
Internal processes Dimension	0.841	0.801												
Financial Dimension	0.836	0.797	0.869											
Knowledge Diagnosis	0.584	0.478	0.669	0.581										
knowledge acquisition	0.828	0.808	0.855	0.815	0.863									
Knowledge generation	0.638	0.665	0.711	0.712	0.839	0.853								
Knowledge Storing	0.566	0.582	0.669	0.596	0.758	0.794	0.863							
Knowledge sharing	0.714	0.637	0.769	0.672	0.786	0.811	0.866	0.833						
Knowledge Applying	0.690	0.657	0.803	0.720	0.835	0.883	0.870	0.859	0.898					
knowledge protection	0.616	0.498	0.689	0.605	0.766	0.737	0.729	0.788	0.748	0.778				
Human Capital	0.821	0.625	0.800	0.761	0.733	0.849	0.833	0.697	0.851	0.850	0.742			
Structural capital	0.780	0.753	0.897	0.785	0.706	0.851	0.723	0.720	0.811	0.802	0.718	0.800		
Relational capital	0.914	0.719	0.847	0.849	0.710	0.793	0.790	0.682	0.775	0.748	0.687	0.846	0.836	

As shown in Table 8, the results indicate that most variable relationships fall within the acceptable threshold (<0.900), confirming a good level of discriminant validity. However, one instance exceeded this threshold, requiring further review of indicators MV3 and DV1 to enhance differentiation. While high HTMT values may be theoretically justified for interrelated variables, clear documentation remains essential. Furthermore, additional analyses and validation across different contexts are recommended to ensure the robustness of these findings.

5.4.2 Second-Order Measurement Model Assessment

First: Dependent variable and mediating variable (reflective)

Table 9 presents the results of reliability, convergent validity, and discriminant validity tests for the second-order dimensions of the dependent and mediating variables.

Table 9: Test of Reliability, Convergent Validity, and Discriminant Validity for Second-Order Dimensions

Variable	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Organisational performance	Customer Dimension	0.875	0.909	0.912	0.786

Variable	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	Learning & Growth Dimension	0.868			
	Internal Processes Dimension	0.914			
	Financial Dimension	0.889			
Intellectual Capital	Human Capital	0.870	0.864	0.865	0.786
	Structural Capital	0.898			
	Relational Capital	0.891			

As shown in Table 9, discriminant validity between the mediating and dependent variables is confirmed, as the Heterotrait-Monotrait (HTMT) ratio value was below 0.900, which is considered the threshold for conceptual closeness between the variables.

Based on these results, it can be concluded that the second-order structural model demonstrates high reliability and validity, rendering it suitable for hypothesis testing and subsequent statistical analyses.

Second: Convergent Validity of the Independent Variable (Formative Variable)

Table 10 presents the assessment of the second-order formative model for the independent variable, Knowledge Management (KM), based on outer weights and variance inflation factors (VIF).

Table 10: Assessment of the Second-Order Structural Model for the Independent Variable (Formative)

Variable	Indicator	Outer Weight	Variance Inflation Factor
Knowledge Management	Knowledge Diagnosis	-0.175	3.124
	Knowledge Acquisition	0.521	3.132
	Knowledge Generation	0.212	4.415
	Knowledge Storage	-0.161	4.072
	Knowledge Sharing	0.304	3.655
	Knowledge Applying	0.219	4.658
	Knowledge Protection	0.169	2.416

As shown in Table 10, outer weights varied across KM dimensions, with Knowledge Acquisition being the highest (0.521), while two indicators —Knowledge Diagnosis and Storage—exhibited negative values. Nevertheless, all indicators were retained due to the formative nature of the construct. VIF values ranged from 2.416 to 4.658, remaining below the threshold of 5, thus indicating no multicollinearity issues. Overall, the construct demonstrates acceptable convergent validity, with all indicators contributing theoretically to its formation.

5.5 Structural Model Assessment (Inner Model): Examining the Relationship among the Key Variables of the Study

The structural model, also known as the inner model, plays a pivotal role in quantitative research by elucidating relationships among key variables. Its assessment relies on several statistical metrics to ensure robustness. Path significance is first assessed to confirm that hypothesised relationships are statistically meaningful, thereby validating the model. Subsequently, the coefficient of determination (R^2) is examined to determine the model's explanatory power, with values exceeding 0.10 indicating that it accounts for at least 10% of the variance in the dependent variable. The effect size (f^2) was then analysed to quantify the influence of independent variables, with values above 0.02 indicating a substantive impact. Finally, predictive relevance (Q^2) was assessed to gauge the model's ability to predict new data, with values greater than zero signifying positive predictive capability. Together, these indicators ensure the model's reliability in both explaining and forecasting outcomes.

Structural Model Measurement Indicators

First: Coefficient of determination value (R^2)

Shmueli and Koppius (2011) stated that the coefficient of determination is a measure of the explanatory power of the model within the sample. The coefficient of determination represents the proportion of variance explained by the independent variable in the dependent variable. According to Hair et al. (2019), the values are compared against the following: (0.25 - weak), (0.50 - moderate), and (0.75 - strong), with the acceptable value being 0.10.

Table 11 presents the coefficient of determination (R^2) values for assessing the explanatory power of the structural model in relation to the dependent, mediating, and independent variables.

Table 11: Measuring the coefficient of determination (R^2)

Type of variable	Variable	Coefficient of determination value (R^2)
Dependent variable	Organisational performance	0.779
The mediating variable	Intellectual Capital	0.737
Independent variable: Knowledge management		

As shown in Table 11, the independent variable (KM) and mediator (IC) collectively explain 77.9% of the variance in the dependent variable (OP), highlighting the model's effectiveness. In addition, KM alone accounts for 73.7% of the variance in IC, highlighting its significant role in shaping and enhancing IC. These results demonstrate the model's robustness in explaining the relationships among the variables.

Second: Effect size (f^2)

The effect size (f2) is an important indicator for assessing the contribution of each independent variable in explaining the variance in the dependent variable. According to commonly accepted standards for assessing effect size, values of 0.35, 0.15, and 0.02 are classified as indicators of large, medium, and small effect sizes, respectively.

Table 12 presents the effect size (f^2) values, which assess the individual contribution of both the independent and mediating variables in explaining the variance in the dependent variable.

Table 12: Measuring the effect size coefficient (f^2)

Type of variable	Variable	f^2
The independent variable	Knowledge Management	0.153
The mediating variable	Intellectual Capital	0.368
A. Dependent Variable: Organisational Performance		

As shown in Table 12, the results of the effect size (f^2) analysis indicate that the mediator variable (IC) exerts a substantial effect on OP (f^2 = 0.368), exceeding the high-effect threshold of 0.35. This underscores its pivotal role in enhancing performance. The independent variable (KM) demonstrates a medium effect (f^2 = 0.153), thereby confirming its relative importance. These findings highlight that IC has a more substantial impact on OP compared to the direct influence of KM, emphasising its critical mediating role. This suggests organisations should prioritise developing IC to strengthen the link between KM and OP.

Third: Predictive and Explanatory Accuracy of the Model Within and Beyond the Study Sample (Q^2)

The explanatory and predictive accuracy of the study model was assessed using Geisser's (1974) and Stone's (1974) blindfolding procedure, which systematically omits parts of the data matrix to compare out-of-sample (deleted) and in-sample (remaining) values. (Q^2) measures prediction accuracy, with values >0 indicating validity: 0–0.25 (weak), 0.25–0.50 (moderate), and >0.50 (strong). Smaller differences between deleted and remaining values confirm higher predictive accuracy.

Table 13 presents the (Q^2) values assessing the model's predictive accuracy for the dependent and mediating variables.

Table 13: Predictive Relevance of the Model (Q^2)

Type of variable	Variable	Q^2 (=1-SSE/SSO)
Dependent variable	Organisational Performance	0.602
The mediating variable	Intellectual Capital	0.570
Independent variable: Knowledge management		

As shown in Table 13, the results corroborate the model's robust predictive capacity for both the dependent and mediator variables. OP recorded a high Q^2 value (0.602), exceeding the 0.35 threshold, indicating strong predictive accuracy. Similarly, Intellectual Capital achieved a Q^2 of 0.570, reinforcing the model's reliability in forecasting both variables. These results validate the theoretical model's predictive power, supporting its applicability in similar contexts.

5.6 Hypotheses Testing

To test the hypotheses of the study, the Hayes and Preacher Process was utilised to examine the mediation role of IC in the relationship between KM and OP (Preacher and Hayes, 2004). Table 14 shows the direct, indirect, and total effects of all significant effects in the structural model

Table 14: Direct, indirect, and total effects of all significant effects in the structural model

Hypotheses	Effect Type	Path		B	SE	T	p	Result
H1: KM has a significant impact on OP	Total Effect	Path c	KM -> OP	0.776	0.057	13.715	0.000	Supported
H2: KM has a significant impact on IC		Path a	KM -> IC	0.852	0.048	17.763	0.000	Supported
H3: IC has a significant impact on OP		path b	IC -> OP	0.736	0.077	9.572	0.000	Supported
H4: IC mediates the impact of KM on OP	Indirect Effect	Path a*b	KM -> IC -> OP	0.627	0.069	9.061	0.000	Supported
	Direct Effect	Path c'	KM -> OP	0.149	0.087	1.720	0.043	Supported

The results confirm a statistically significant relationship between KM and OP, with IC as a mediator.

- Hypothesis 1: KM has a significant positive impact on OP (B = 0.776, SE = 0.057, T = 13.715, $p < 0.001$), confirming a strong effect.
- Hypothesis 2: KM has a significant positive impact on IC (B = 0.852, T = 17.763, $p < 0.001$), highlighting its role in the development of IC.
- Hypothesis 3: IC has a significant positive impact on OP (B = 0.736, T = 9.572, $p < 0.001$), highlighting its role as a key driver of OP.
- Hypothesis 4: IC mediates the KM‑OP relationship, as evidenced by a significant indirect effect (B = 0.627, T = 9.061, $p < 0.001$). The direct effect of KM on OP diminishes when IC is included (B = 0.149, T = 1.720, p = 0.043), confirming partial mediation.

These findings validate the model, demonstrating that KM enhances OP both directly and indirectly through IC.

6. Discussion

A summary of direct, indirect, and total effects of all significant effects in the structural model is presented in Table 14. The results indicate that KM exerts the strongest effect on OP, supporting acceptance of the first hypothesis (H1). The findings of this study are consistent with organisational theories, particularly the Knowledge-Based View (Grant, 1996), and are congruent with previous empirical studies, such as Abu-Hatab (2021), which found a statistically significant effect of KM processes on the OP of agricultural and development civil society organisations in the Gaza Strip, and with the findings of Al-Adwan (2019), which found a statistically significant positive effect of KM processes on OP in Jordanian telecommunications companies. These findings are further supported by recent studies conducted in developing economies (Onikoyi et al., 2024) and more recent research (Megha and Sushan, 2024; Yang and Nuruly, 2024), particularly in knowledge-intensive sectors

such as telecommunications and education. However, these findings contradict those of Setyawan (2021), who reported no significant direct effect in the Indonesian coal mining sector. This discrepancy may stem from sector-specific characteristics, particularly in knowledge-intensive industries where reliance on IC and knowledge-sharing mechanisms is more pronounced. These differences underscore the need for further empirical validation across diverse economic and industrial contexts to better understand the varying impacts of KM on OP. The findings of this study highlight the urgent need for organisations to implement KM to ensure the ongoing success of their OP. Furthermore, the findings of this study reaffirm the positive impact of KM on OP. Regarding the second hypothesis (H2), the results confirm that KM significantly impacts IC, consistent with those of previous studies, such as Fani and Saduq (2020) in the context of Sonelgaz Electricity and Gas Distribution Company in Adrar, Algeria, and Hussini (2019) within the telecommunications sector in Biskra, Algeria. Regarding the third hypothesis (H3), the results confirm that IC impacts OP, aligning with those of previous studies, such as Kharboush (2019), which concluded that there is an effect of IC on OP in the Algerian telecommunications corporation. Similarly, Dhiban (2020) investigated the role of IC in enhancing performance at Yemen Mobile, revealing that despite the limited availability of IC components, its impact on OP—as measured by the Balanced Scorecard—nevertheless remained positive. Similarly, Al-Gburi and Mohsin (2025) examined the role of IC in sustainable performance among Iraqi telecommunications companies and demonstrated that various components of IC significantly contribute to corporate performance and long-term sustainability. Regarding the fourth hypothesis (H4), which focuses on the mediating role of IC, it is clear that IC mediates the relationship between KM and OP according to the results of the testing of H4. In other words, the implementation of KM can be made more efficient when organisations possess the IC necessary to support OP. These findings are consistent with those reported by Babakr's study (2019), which concluded that there is an indirect effect of KM on OP with the presence of IC. Hence, the results of this study not only confirm the relationships among the three constructs, as suggested by previous research, but also highlight the mediating role of IC, making a significant contribution to the literature. In addition, the consistency of these findings with studies in various economic and industrial contexts reinforces the broader applicability of the theoretical framework. However, the observed discrepancies underline the importance of sectoral dynamics, pointing to the need for further research to determine whether these findings hold across different industries and geographical settings.

Practical Implications

The findings of this study offer valuable insights for practitioners within the telecommunications sector and beyond. To enhance OP through KM and IC, organisations should:

- Establish KM Units—Create dedicated units to acquire, store, and share knowledge, ensuring continuity despite employee turnover.
- Invest in IC Development—Strengthen human (training, knowledge platforms), structural (IT infrastructure), and relational capital (partnerships, customer management).
- Leverage Technology—Utilise AI, digital platforms, and cloud-based KM systems to enhance decision-making and innovation.
- Foster a Knowledge-Sharing Culture—Incentivise collaboration through rewards, performance assessments, and internal knowledge communities.

Implementing these strategies can optimise knowledge resources, enhance IC, and drive OP.

Policy Implications:

At the policy level, governments and regulatory bodies should:

- Provide Funding and Incentives: Support KM and IC initiatives within the telecommunications sector through grants, tax incentives, or subsidies.
- Develop National Policies: Create policies that promote knowledge sharing, innovation, and the adoption of advanced technologies.
- Facilitate Industry Collaboration: Establish industry-wide knowledge networks to encourage collaboration among telecom companies and other stakeholders.

Limitations and Future Research

Limitations

Despite its contributions, this study has several limitations. First, it focuses exclusively on the Yemeni telecommunications sector, which may limit the generalisability of the findings to other industries or regions.

Second, the study adopts a cross-sectional research design, capturing data at a single point in time, which does not account for dynamic changes over time. Third, the reliance on self-reported survey data may introduce response biases, including social desirability bias and common method variance. Fourth, while the focus on second-order constructs ensures model parsimony and theoretical coherence, it limits the ability to explore the individual dimensions of KM and IC in greater depth. This approach precludes a nuanced understanding of how specific dimensions influence OP.

Future Research

To address these limitations, future studies could expand the investigation to different industries, such as manufacturing or financial services, to assess whether the proposed model holds across varying knowledge-intensive environments. In addition, employing a longitudinal research design would provide deeper insights into how KM and IC evolve over time and influence OP. Finally, integrating objective performance indicators alongside self-reported data or adopting multi-source data collection methods could enhance the robustness and validity of findings.

Future Research Directions

Beyond addressing the study's limitations, several promising research avenues emerge. Comparative studies between developing and developed economies could shed light on contextual factors influencing the KM–IC–OP relationship. Moreover, case studies and expert interviews could elucidate the underlying mechanisms of these relationships. Future research could also explore the role of emerging technologies—such as artificial intelligence and big data analytics—in strengthening KM and IC practices. In addition, future studies could investigate the individual dimensions of KM and IC, particularly within the context of Yemen's unique cultural and industry-specific dynamics, to provide a more granular understanding of their impact on OP.

7. Conclusion

This study presented empirical evidence on the effect of KM on OP, which was mediated by IC. Building on the study's results, it was found that KM and IC exert both direct and indirect effects on OP, as well as its various dimensions measured by the BSC. The results demonstrate that KM processes result in improved OP. The results also indicate that human, structural, and relational capital dimensions in IC enhance OP. In addition, IC also mediates the relationship between KM and OP. Based on the research results, the implication of this research was that the top management in the Yemeni telecommunications sector should establish organisational units in the organisational structures of the YTS that are concerned with KM, due to its significant impact on enhancing OP in the sector.

This study presented empirical evidence that KM, mediated by IC, positively impacts OP. The findings show that KM and IC directly and indirectly enhance OP across various dimensions measured by the BSC. Specifically, KM processes enhance performance, while IC further strengthens this effect. In addition, IC serves as a mediator in the relationship between KM and OP.

The study recommends that Yemeni telecommunications companies establish dedicated KM units to leverage these benefits and improve sector-wide performance.

Broader Implications:

The findings of this study extend beyond the Yemeni telecommunications sector, offering valuable insights for other developing economies and global industries facing similar challenges, such as resource constraints and the need for innovation. For example, the proposed framework could be applied in sectors like healthcare, education, and manufacturing, where KM and IC play a critical role in driving performance. By adopting similar strategies, organisations in these sectors can enhance their efficiency and competitiveness. This global relevance underscores the study's contribution to both academic research and practical applications across diverse contexts.

7.1.1 Abbreviations

Abbreviations	Meaning
B	A coefficient
H1	Main Hypothesis No. 1
H2	Main Hypothesis No. 2

H3	Main Hypothesis No. 3
H4	Main Hypothesis No. 4
IC	Intellectual Capital
KBV	Knowledge-Based View
KM	Knowledge Management
OP	Organisational Performance
p	P-value
PLS	Partial Least Squares
RBV	Resource-Based View
SE	Standard Error
SPSS	Statistical Package for the Social Sciences
T	T- value
YTS	Yemeni Telecommunications Sector

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Authors' Contributions

FR addressed the research gaps, performed the literature review, designed the study methodology, collected the data, and wrote and revised the manuscript accordingly. ZS made substantial contributions to this research, including project leadership and critical revisions to the final manuscript.

All authors have read and approved the manuscript.

AI Statement: The authors declare that this work is original content prepared by them and no technology (e.g. AI) was used to generate all or part of its content.

Ethics declarations: Ethics Approval and Consent to Participate. Although this study did not require formal ethical clearance, all procedures adhered to ethical guidelines, including informed consent and compliance with the 1964 Helsinki Declaration and its later amendments. The research involved anonymous surveys with no sensitive data.

Consent for Publication: All participants involved in this study gave their informed consent for the use of their data in academic research and for publication in research papers.

Availability of Data and Materials: The raw data collected during the study are available from the corresponding author upon reasonable request.

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Appendix A: Questionnaire

Section One: Demographic and Job Information

Please mark (√) in the box that best represents your response.

1. Gender:

☐ Male

☐ Female

2. Age:

☐ 30 years or less

☐ 31 to 39 years

☐ 40 to 49 years

☐ 50 years and above

3. Educational Qualification:

☐ High school or less

☐ Diploma after high school

☐ Bachelor's degree

☐ Master's degree

☐ Doctorate (Ph.D.)

4. Job title:

☐ Specialist

☐ Supervisor

☐ Section Head

☐ Deputy Department Manager

☐ Department Manager

☐ Deputy Director General of Administration

☐ Director General of Administration

☐ Deputy Chief Executive Officer

☐ Chief Executive Officer

5. Nature of Work:

☐ Technical

☐ Administrative

6. Years of service in the telecommunications sector:

☐ Less than 6 years

☐ From 6 to less than 10 years

☐ From 10 to less than 15 years

☐ 15 years and above

7. Organisation you work for:

☐ PTC

☐ Yemen Mobile

☐ Sabafon

☐ Yemen Oman United Telecommunication Company (YOU)

☐ Y

☐ Telyemen

Section Two / Measurement of Variables:

Note: All items were measured using a seven-point Likert scale, ranging from 1 = Strongly Disagree to 7 = Strongly Agree.

Please indicate your level of agreement with the following statements by marking (✓) in the box provided for your response.

Knowledge Management:

It refers to the organised management of knowledge assets within an organisation aimed at creating added value that contributes to fulfilling strategic needs and enhancing organisational performance. It includes all initiatives, processes, and systems involved in diagnosing, acquiring, generating, storing, sharing, applying, and protecting knowledge.

No	Item Statement	Item Source
Dimension One: Knowledge Diagnosis Identify the topics of knowledge and experience that the organisation currently possesses and the topics of critical knowledge that it wants in the future, as well as determining where that knowledge is located, whether it is in the heads of employees, in systems, or procedures, and how important it is to the organisation.		
1	Employees in the organisation can easily identify the knowledge needed to perform the job.	Adopted from Awtayef (2019)
2	The organisation utilises employee performance assessment reports to evaluate the cognitive abilities of its employees.	Adapted from Ahmed (2018)
3	The person with the knowledge required by the organisation can be easily identified.	Adopted from Awtayef (2019)
4	The organisation assesses its knowledge base in comparison to that of competing organisations.	Adopted from Hussini (2019)
5	The organisation regularly identifies the knowledge it requires to maintain its competitive edge.	Adopted from Hussini (2019)
Dimension Two: Knowledge Acquisition The process by which an organisation can obtain knowledge from its original sources, whether internal or external.		
1	The organisation actively seeks to acquire new knowledge from the various entities it interacts with, such as suppliers, competitors, partners, customers, and others.	Adopted from Al-Shalabi (2018)
2	The organisation encourages its employees to continually learn to gain new knowledge.	Adopted from Ahmed (2018)
3	The organisation provides technological means that help employees acquire knowledge.	Adopted from

No	Item Statement	Item Source
		Al-Shaer (2021)
4	Employees in the organisation are required to attend training courses, workshops, or scientific conferences to gain new knowledge.	Adapted from Abdelkader (2014)
5	The organisation is keen to attract and recruit individuals with distinguished competencies and benefit from their knowledge.	Adopted from Sharifa (2019)
Dimension Three: Knowledge Generation The process of meeting with specialists and using modern methods and techniques, such as brainstorming technology, to generate new knowledge that is used in the organisation.		
1	The organisation is constantly interested in knowledge generation.	Adopted from Ben Maatouk (2019)
2	The organisation uses dialogues or brainstorming sessions to enable employees to generate new knowledge.	Adopted from Abu Hila (2019)
3	The organisation rewards employees for their contributions to generating new knowledge.	Adopted from Awtayef (2019)
4	The organisation establishes specialised teams for knowledge generation.	Adopted from Barhama (2017)
5	The organisation supports areas of research and development initiatives to generate knowledge.	Adopted from Shaabna and Boujaâtat (2020)
Dimension Four: Knowledge Storage The process of retaining, maintaining, and organising knowledge to facilitate its search, access, and retrieval within the organisational memory of the organisation.		
1	The organisation utilises electronic systems to store its available knowledge.	Adopted from Sokar (2021)
2	The knowledge within the organisation is classified in a way that facilitates its retrieval and use.	Adopted from Al-Hasani (2019)
3	The organisation encourages employees to preserve and document their knowledge.	Adopted from Abu Hila (2019)
4	The organisation prioritises documenting lessons learned from past experiences.	Adapted from Cumari (2018)
5	The organisation is keen to continuously update its stored knowledge.	Adapted from Al-Mustafa (2021)
Dimension Five: Knowledge Sharing The processes and activities undertaken by the organisation to facilitate the sharing of knowledge among employees and ensure its availability to all who need it.		
1	An atmosphere of trust and mutual cooperation prevails among employees within the organisation.	Adopted from Al-Ammar (2017)
2	The culture of the organisation supports the sharing of information and knowledge.	Adapted from Hussini (2019)
3	Employees who possess valuable knowledge are keen to share their knowledge with others.	Authors Developed
4	The organisation releases periodic publications to facilitate the dissemination of knowledge among its employees.	Adapted from Al-Ammar (2017)
5	The organisation adopts knowledge sharing as a criterion in employee performance assessments.	Authors Developed
Dimension Six: Knowledge Application The process of effectively and timely utilising knowledge, leveraging its presence within the organisation, and employing it to address the challenges faced by the organisation.		
1	The organisation encourages the application of new knowledge to enhance its performance.	Adapted from Haffadh (2018)

No	Item Statement	Item Source
2	Employees are fully aware of the knowledge and expertise they possess.	Authors Developed
3	The organisation leverages the outcomes of employee training programmes by translating them into practical applications.	Adopted from Ajjan (2017)
4	The organisation is keen to overcome the difficulties that hinder employees from effectively applying their knowledge.	Adopted from Al-Shaer (2021)
5	Employees who effectively apply their knowledge to benefit the organisation are recognised and motivated.	Adapted from Al-Ali (2013)
Dimension Seven: Knowledge Protection The process by which knowledge is preserved within the organisation through the implementation of appropriate technological tools, policies, and procedures.		
1	Employees are well-informed and sufficiently aware of the importance of knowledge protection.	Adopted from Mtawali (2018)
2	The organisation maintains secure databases to store all information about its internal operations.	Adopted from Abdelkader (2014)
3	The management of the organisation implements security systems to protect knowledge against potential risks.	Adopted from Al-Mustafa (2021)
4	The organisation adopts both legal and technological measures to ensure the protection of its knowledge resources.	Adopted from Hussini (2019)
5	The organisation communicates with suppliers and customers continuously to remind them of the importance of protecting the organisation's knowledge and information.	Adopted from Al-Ali (2013)

Intellectual Capital

It refers to the group of intangible assets, including human capital, structural capital, and relational capital, owned by the organisation that earns it the ability to perform its functions, enhance its organisational performance, and increase its competitiveness.

No	Item Statement	Item Source
Dimension One: Human Capital The capabilities and competencies possessed by the employees of the organisation, which they utilise and invest in their work.		
1	The organisation is keen to identify skills gaps among its employees.	Adopted from Haffadh (2018)
2	The organisation encourages its employees to provide creative opinions and ideas that help in business development.	Adopted from Shaabna and Boujaâtat (2020)
3	The organisation values and retains experienced individuals, implementing strategies to prevent them from transitioning to other organisations.	Adopted from Al-Shaer (2021)
4	Employees have sufficient knowledge of the services offered by the organisation.	Adopted from Hussini (2019)
5	The employees of the organisation have the ability to effectively adapt to work-related pressures.	Adopted from Al-Aloufi (2019)
Dimension Two: Structural Capital It includes all systems, laws, regulations, policies, procedures, organisational structures, and internal processes owned by the organisation, as well as the programmes and databases.		
1	The organisation's information systems enhance the efficiency and speed of task completion as needed.	Adopted from Al-Aloufi (2019)
2	The organisation is keen to continuously develop and update its information systems and databases.	Adopted from Abdelhadi (2017)

No	Item Statement	Item Source
3	The administrative processes within the organisation are sufficiently flexible to effectively achieve its objectives.	Adopted from Abdelhadi (2017)
4	The organisation is keen to continuously develop administrative processes to reduce errors in the work.	Adopted from Ben Haizia (2017)
5	The organisation continuously adapts and evolves its organisational structure in line with the changes in the competitive environment.	Adopted from Al-Aloufi (2019)
Dimension Three: Relational Capital It refers to the relationships maintained by the organisation with its customers, suppliers, partners, and even competing organisations.		
1	The organisation offers its permanent customers additional advantages to distinguish them from other customers.	Adopted from Hussini (2019)
2	The organisation grants its permanent customers additional advantages to distinguish them from other customers.	Adopted from Shaabna and Boujaâtat (2020)
3	The organisation periodically analyses the services offered by its competitors.	Adopted from Hussini (2019)
4	The organisation carefully considers the economic conditions of the community when delivering its services to beneficiaries.	Adopted from Abdelhadi (2017)
5	The organisation is keen to build distinguished relationships with external stakeholders closely related to its work.	Adopted from Hussini (2019)
Organisational Performance It refers to the integrated system of outcomes achieved by the Yemeni telecommunications sector, measured across the dimensions of the Balanced Scorecard: customer perspective, internal processes perspective, learning and growth perspective, and financial perspective. It is assessed within the context of its interaction with both internal and external environments.		
No	Item Statement	Item Source
Dimension One: Customer Perspective Through this dimension, the organisation focuses on meeting customer needs by enhancing service quality, reducing service delivery time, increasing customer satisfaction, and thus increasing market share.		
1	Information flows seamlessly between the organisation and its customers, ensuring effective communication.	Adapted from Kharboush (2019)
2	The organisation is keen to achieve customer satisfaction to retain them.	Adopted from Kharboush (2019)
3	The organisation implements an effective assessment and follow-up system to monitor and improve the services delivered to customers.	
4	The organisation prioritises the continuous improvement of service quality to meet customer expectations.	
5	The organisation seeks to minimise the rate of customer complaints.	Adapted from Al-Aloufi (2019)
Dimension Two: Learning and Growth Perspective Through this dimension, the organisation focuses on enhancing employee capabilities, developing their skills, and providing the necessary infrastructure to support their growth.		
1	The organisation encourages its employees to continually enhance their skills and abilities.	Adopted from Al-Maamari (2018)
2	The organisation offers grants to its employees to complete their postgraduate studies.	Authors Developed
3	The organisation offers a variety of training programmes designed to help employees enhance their performance levels.	Adopted from Al-Maamari (2018)
4	The organisation dedicates an annual budget for the training of its employees.	Adopted from Kharboush (2019)

No	Item Statement	Item Source
5	The organisation has an organisational climate that encourages new and creative practices.	Adopted from Ahmed (2019)
Dimension Three: Internal Processes Perspective Through this dimension, the organisation focuses on all critical internal activities and processes that are essential for meeting customer needs and achieving organisational objectives.		
1	The organisation utilises appropriate technology and equipment.	Adopted from Kharboush (2019)
2	The organisation is keen to utilise a variety of methods and approaches to efficiently complete tasks.	Adapted from Sharifa (2019)
3	Coordination among the various administrative units is aligned with the vision, mission, and objectives of the organisation.	Adopted from Barhama (2017)
4	The organisation is keen to deliver its services with high quality.	Adapted from Sharifa (2019)
5	The key processes within the organisation are clear.	Adopted from Abdelhadi (2017)
Dimension Four: Financial Perspective Through this dimension, the organisation focuses on managing the financial aspects of its organisational performance.		
1	The organisation establishes its financial objectives in advance to ensure clear targets are set.	Adopted from Sharifa (2019)
2	The organisation effectively utilises its available financial resources to enhance and develop its performance.	Adopted from Kharboush (2019)
3	Financial reports are regularly and consistently prepared to achieve effective financial performance.	
4	The organisation prioritises introducing new services to increase revenue.	
5	The organisation strives to minimise costs as much as possible without compromising quality.	

Cultural Dynamics and Knowledge-Sharing in Philippine Higher Education: A Multilevel Analysis

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Abstract: This study examines the cultural dynamics that influence knowledge-sharing in Philippine higher education institutions (HEIs). It addresses the gap in understanding the impact of national, organizational, and local (institutional) cultural factors on educators' intentions to share knowledge. The research employs a mixed-methods approach, integrating quantitative analysis via multiple regression and ANOVA with qualitative insights from follow-up interviews. This comprehensive methodology suggests that cultural dimensions, such as power distance and collectivism, have a significant influence on knowledge-sharing intentions. The findings indicate that diminishing power distance and formalizing knowledge-sharing processes enhance the knowledge ecosystem within HEIs. These insights are valuable for educational practitioners, administrators, and policymakers who aspire to cultivate a collaborative and knowledge-rich environment. By customizing strategies to align with local cultural contexts, institutions can enhance teaching, research, and application, thereby advancing the domains of learning and organizational competitiveness.

Keywords: Knowledge-Sharing, Knowledge-Sharing intention, Higher educational institutions, Cultural values, Multilevel culture, Organizational culture

1. Introduction

In the global academic environment, higher education institutions (HEIs) face challenges in developing intercultural competence among their educators. Effective handling of cultural differences has become increasingly important with the rise of academic collaboration, educator mobility, and international research partnerships. Institutions are now endeavoring to integrate intercultural learning into their curricula, promote inclusive teaching practices, and cultivate cultures that embrace diversity and foster mutual understanding. Effective communication and collaboration across cultures are critical to academic performance, institutional unity, and inclusivity (Sabet and Chapman, 2023). Consequently, HEIs emphasize the need for educators to excel in multicultural environments and encourage knowledge-sharing for continuous improvement and innovation (Sabet and Chapman, 2023). Thus, HEIs emphasize the importance of developing educators' abilities to thrive in multicultural settings and facilitate knowledge-sharing for continuous improvement and innovation (Sabet and Chapman, 2023).

In the Philippines, the Commission on Higher Education (CHED) has undertaken programs to enhance institutional collaboration and fortify quality assurance frameworks (Commission on Higher Education and Professional Regulation Commission, 2025). These initiatives apply Knowledge Management (KM) practices to enhance organizational learning, facilitate knowledge transfer, and mitigate potential knowledge loss in academic environments. Despite the abundance of expertise in educational institutions, challenges persist in effectively transferring knowledge, particularly when cultural and organizational barriers remain unaddressed.

Encouraging educators to share insights, experiences, and pedagogical approaches fosters innovation and professional growth within HEIs (Tsoi and Strønen, 2024). However, underlying cultural dimensions and structural constraints frequently shape these knowledge-sharing behaviors. Institutions foster collaborative knowledge environments by leveraging key enablers such as communities of practice, organizational trust, communication infrastructures, and incentive mechanisms, ensuring their effectiveness aligns with the specific institutional context (Ng, 2022; Mohillo, Jalandoon and Marcial, 2024). An essential yet under-researched aspect of this issue concerns how multi-level cultural influences affect educators' willingness and capacity (intentions) to participate in knowledge-sharing. Educators are considered primary knowledge workers who navigate complex social norms, organizational frameworks, and institutional expectations that influence their dissemination and application of knowledge (de Carvalho-Filho, Tio and Steinert, 2020). Understanding the social

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and structural elements that drive these behaviors is critical because they significantly impact the development of long-term knowledge practices in education (de Guzman, de Castro and Adamos, 2022). remains the key to actively sharing insights with their peers.

At the national level, Hofstede's cultural dimensions provide a valuable framework for investigating the cultural values held by Filipino educators. Values such as Respect for Authority ("Paggalang") or Power Distance, Social Acceptance ("Pakikisama") or Collectivism, Adaptability to Uncertainty ("Bahala Na") or Uncertainty Avoidance, and Commitment to Tradition ("Pagpapahalaga") or Short-term Orientation significantly influence interpersonal dynamics, pedagogical choices, and the willingness to engage in knowledge-sharing (Cruz et al., 2020; de Guzman, de Castro and Adamos, 2022). For instance, collectivist characteristics may significantly improve group cohesiveness and cooperative learning; however, high power distance can hinder candid communication and crucial debates (Bonetto, Pichot and Adam-troïan, 2022).

In addition to national culture, the organizational culture significantly influences how teachers share their knowledge. Factors such as trust between colleagues, communication styles, information systems, workplace environments, and reward structures all contribute to the organizational climate regarding knowledge-sharing and retention (Chedid et al., 2020; Ng, 2020; Hosen et al., 2022). For instance, in-group cultures prioritizing shared values and collegiality foster collaboration, while hierarchical or individualistic environments may impede open knowledge exchanges (Rao, Abdul and Kamel, 2021).

Nevertheless, institutional and local contexts—including university branches with unique administrative cultures, leadership approaches, and policy practices—add another level of impact (Rao, Abdul and Kamel, 2021). Differences in institutional support structures, resource access, and leadership responsiveness shape knowledge across geographically and academically diverse settings.

This study investigates the influence of national, organizational, institutional, and local cultural factors on educators' intentions and behaviors regarding knowledge sharing in higher education institutions in the Philippines. Recognizing the cultural and structural components that influence these behaviors is essential because they significantly impact the development of long-term knowledge practices in education.

2. Research Problem and Questions

This research analyzes the multi-level cultural influences on educators' knowledge-sharing intentions in higher educational institutions in the Philippines. It assesses the impact of distinct cultural traits by integrating Hofstede's cultural framework with Filipino indigenous values.—specifically, Respect for Authority ("Paggalang")/Power Distance, Social Acceptance ("Pakikisama")/Collectivism, Fatalism ("Bahala Na")/Uncertainty Avoidance, and Value for Tradition ("Pagpapahalaga")/Short-term Orientation. Additionally, it examines how organizational culture impacts knowledge-sharing intentions, including trust, communication, information systems, and reward systems. Finally, the study considers whether regional and institutional contexts, including differences among university branches, affect variations in knowledge-sharing practices.

2.1 Research Hypotheses

- National cultural values significantly influence educators' knowledge-sharing intentions, particularly Respect for Authority ("Paggalang")/Power Distance, Social Acceptance ("Pakikisama")/Collectivism, Fatalism ("Bahala Na")/Uncertainty Avoidance, and Value for Tradition ("Pagpapahalaga")/Short-term Orientation.
- Organizational culture influences educators' knowledge-sharing intentions through interpersonal trust, inter-organizational communication, organizational information systems, and reward systems.
- There are significant differences in knowledge-sharing practices among educators from various university branches, shaped by institutional policies, leadership approaches, and cultural dynamics.

3. Literature Review

This study explores the phenomena arising from interactions, circumstances, conditions, and consequences of actions that influence knowledge-sharing. It provides practical insights into managing these factors in real-world organizational settings, emphasizing a pragmatic view of human behavior shaped by cultural values and the work environment.

3.1 Knowledge-Sharing in HEIs

knowledge-sharing in Higher Educational Institutions (HEIs) refers to the dissemination of information, expertise, and insights among educators (Odularu and Bokwe, 2025). It plays a critical role in enhancing organizational performance, fostering professional development among teachers, contributing to the knowledge economy, optimizing knowledge diversity through practitioner-led programs, and utilizing social media for knowledge management (Alghamdi, Pileggi and Sohaib, 2023; Starcevic and Sher, 2021; Veer Ramjeawon and Rowley, 2020; Hasan, Aparisi-Torrijo, González-Ladrón-de-Guevara, 2025; Moumin, 2025). Knowledge-sharing also drives collaboration, innovation, and the creation of sustainable business practices, influencing both academic performance and societal advancement (Odularu and Bokwe, 2025; Santos, Carvalho and Martins, 2024; Do and Do, 2025). By encouraging knowledge exchange through seminars, workshops, and digital platforms, HEIs cultivate a culture of continuous learning and institutional growth (Mazorodze and Mkhize, 2022). Moreover, a culture that fosters knowledge-sharing enhances decision-making, improves access to information, and promotes collaboration – factors essential for institutional innovation and sustainability (Mazorodze and Mkhize, 2022).

3.2 National Culture-Cultural Dimensions

Hofstede's cultural dimension framework remains a foundational model for examining how national culture influences knowledge-sharing practices (Castaneda and Ramirez, 2021). This model systematically categorizes cultural values across various regions, facilitating cross-cultural behavioral analysis (Castaneda and Ramirez, 2021; Escandon-Barbosa, Ramírez and Salas-Paramo, 2022; Leonavičienė and Burinskienė, 2022). The framework offers structured insights into how cultural values shape organizational and individual behaviors, including those relevant to innovation, sustainability, and digital communities (Bonetto, Pichot and Adam-troïan, 2022; Escandon-Barbosa, Ramírez and Salas-Paramo, 2022).

Cultural dimensions shape behaviors in HEIs, influencing strategic planning and instructional methods (Xu et al., 2021). These dimensions reflect geographic, social, and institutional factors that impact educator interactions and learning styles. For instance, collectivism fosters trust and knowledge-sharing, emphasizing group objectives and promoting harmonious relationships. Conversely, cultures characterized by competition and individualism may inhibit sharing due to perceived threats to personal status (Hosen et al., 2022; Fan and Beh, 2024). Institutions that foster trust and reduce uncertainty promote effective knowledge-sharing (Castaneda and Ramirez, 2021). High power distance cultures may discourage sharing due to hierarchical constraints and authority-based interactions (Dai, Li, Xie and Deng, 2022). Furthermore, long-term orientation (LTO), which prioritizes future outcomes, supports stronger knowledge-sharing practices than short-term orientation (STO), which focuses on tradition and frugality (Kucharska and Bedford, 2019).

3.3 Organizational Culture

Although cultural values influence knowledge-sharing, their effects are inconsistent across different contexts. Organizational context plays a crucial role in reinforcing or inhibiting sharing behaviors. Key organizational factors in HEIs are interpersonal trust, organizational communication, information systems, and reward structures.

Interpersonal trust, encompassing both trust in leaders and trust in peers, is crucial for mitigating the perceived risks associated with knowledge-sharing (Kmieciak, 2021). Trust enhances social cohesion and fosters positive attitudes toward collaborative behaviors (Ng, 2020). Trust-based incentives, such as recognition, further motivate sharing (Haesebrouck, Van den Abbeele, Williamson, 2021). Effective organizational communication facilitates knowledge-sharing among faculty, while collaboration strategies promote engagement (Chedid et al., 2020). The organizational climate influences attitudes and perceived control over knowledge-sharing intentions (Hosen et al., 2022). Information systems facilitate knowledge-sharing by providing platforms for storing, retrieving, and disseminating information. They should ensure easy access while promoting user engagement (Quarchioni, Paternostro and Trovarelli, 2020). However, privacy concerns can hinder knowledge-sharing if individuals doubt the data management responsibility (Jones, Rubel and LeClere, 2020). Reward systems motivate knowledge-sharing through explicit incentives, such as bonuses, or implicit ones, like recognition and advancement opportunities. Trust is crucial in designing these systems, as sharing is more effective when individuals expect rewards from peers rather than external supervisors (Haesebrouck, Van den Abbeele, Williamson, 2021). Aligning reward structures with diverse employee motivations enhances knowledge-sharing.

3.4 Knowledge-Sharing Intentions

The Theory of Planned Behavior (TPB) suggests that an individual's actions are primarily driven by their intention to perform a behavior. This intention, in turn, is shaped by three key factors: attitudes (one's evaluation of the behavior), subjective norms (social pressures and expectations), and perceived behavioral control (the perceived ease or difficulty of performing the behavior) (Dodaj et al., 2023). TPB has been widely applied across various fields to predict and explain human behavior (Dodaj et al., 2023; Maulana and Marsasi, 2024; Prasetya, Darmayanti and Setyorini, 2024).

In the context of academic institutions, TPB provides a valuable framework for understanding why and how academics engage in knowledge-sharing. Their attitudes toward the act influence their willingness to share knowledge, the expectations of peers and institutions, and their perceived ability to do so effectively. Research further supports this perspective, emphasizing the role of trust, perceived costs and benefits, and organizational climate in shaping knowledge-sharing intentions (Fan and Beh, 2024). Understanding the interaction of factors in knowledge-sharing provides insight into why individuals share or withhold knowledge. Examining attitudes, subjective norms, and perceived ease of sharing, TPB predicts and enhances knowledge-sharing behaviors in higher education institutions. Recognizing these factors in Philippine HEIs is essential for developing a framework to improve knowledge-sharing practices. By addressing cultural and organizational influences, HEIs can promote continuous learning and innovation, benefiting the academic community and society.

3.5 Philippine HEIs' Culture and Knowledge-Sharing

The interaction between traditional beliefs and modern educational practices influences Philippine cultural values and knowledge-sharing in institutions. Cultural values prioritize social harmony and affect knowledge exchange among educators, either facilitating or hindering these efforts. Culture is integral to Philippine education, especially culture-based education, which merges local traditions with academic curricula. HEIs play a vital role in promoting this method by generating, transmitting, and disseminating knowledge. However, few studies focus on knowledge-sharing within HEIs in the Philippine context (Muya and Calupitan, 2019). Moreover, understanding the factors affecting individual knowledge-sharing behavior in relation to cultural values is limited. To evolve universities into professional learning communities, fostering knowledge-sharing practices is essential for effective knowledge conversion across disciplines. This transformation requires insight into teachers' sharing behaviors, work environments, and organizational strategies that support knowledge-sharing.

The Philippine culture is deeply rooted in collectivism, prioritizing group goals over individual achievements. This perspective promotes collaborative learning and encourages knowledge-sharing within educational settings, as individuals are more likely to contribute to the collective success of their group or community (Huda, Che Mustafa and Mohamed, 2021). Likewise, the cultural emphasis on maintaining social harmony fosters trust and openness, essential for effective knowledge exchange (Hosen et al., 2022). Respect for authority is another dominant cultural value in the country, influencing how knowledge is shared within educational institutions. This can create a top-down dynamic, potentially limiting peer-to-peer interactions and collaborative learning (Hosen et al., 2022). While a structured sharing environment can be beneficial, it may discourage innovation and critical thinking if students hesitate to question or challenge established ideas (Moser and Deichmann, 2021). Likewise, trust is a fundamental component of the knowledge-sharing process, often developed through personal relationships and social networks. Strong interpersonal connections increase the willingness to share knowledge among peers (Hosen et al., 2022). Additionally, the cultural expectation of reciprocity motivates knowledge-sharing, as individuals anticipate mutual benefits and support in return (Moser and Deichmann, 2021). Furthermore, a tight culture exists where strong social norms dictate behavior. These norms influence knowledge-sharing by reinforcing conformity and discouraging deviations from established practices (Elster, Elster and Gelfand, 2021). While such norms help maintain consistency in educational methods, they may also restrict the diversity of ideas and approaches within academic institutions (Elster, Elster and Gelfand, 2021). Considering these challenges, integrating local cultural insights with global skills is becoming increasingly vital in higher education. This approach enhances the educational experience by valuing indigenous knowledge systems alongside international perspectives (Heng, Heng and Yeh, 2021). Balancing traditional cultural values with global educational standards can improve the relevance and applicability of knowledge shared in Philippine higher education institutions (Heng, Heng and Yeh, 2021). The intricacies of the Philippine education system underscore the need for cultural sensitivity in knowledge-sharing. In its discussion paper, the Philippine Institute for Development Studies highlights how educational outcomes in the Philippines are highly context-sensitive. It stresses the importance of rigorously validated, culturally aware approaches to improve the system (Orbeta and Paqueo, 2022). This viewpoint highlights the importance of aligning educational reforms with local cultural

contexts, particularly in diverse countries like the Philippines, where systems that overlook cultural diversity often encounter challenges.

Beyond systemic obstacles, the culture within schools shapes knowledge-sharing practices. A policy discussion paper by the Philippine Institute for Development Studies discussed how school governance structures and leadership transitions contribute to systemic inefficiencies and cultural fragmentation in the Philippines (Orbeta and Paqueo, 2022). It revealed that public secondary schools continue to operate within hierarchical and bureaucratic frameworks. These are shaped by transient leadership, compartmentalized faculty roles, and rigid administrative structures, which collectively hinder systemic reform and innovation (Orbeta and Paqueo, 2022). These structural elements can either promote or impede knowledge-sharing, depending on their interaction with school culture.

Cultural sensitivity is also pivotal in influencing knowledge-sharing behaviors, as evidenced by a study of pre-service teachers in the Philippines. Enhancing multicultural sensitivity through transformative learning has improved teachers' attitudes toward knowledge-sharing (Ruales et al., 2021). It suggests that promoting cultural awareness can foster collaborative behaviors, underscoring the complex relationship between knowledge-sharing and cultural dynamics. Lastly, educators' experiences in multicultural settings shape their instructional methods and readiness to share insights. According to Ross and Chan (2023), leveraging personal experiences enables teachers to develop a richer understanding of diversity, thereby enhancing their ability to promote effective knowledge-sharing in various educational environments. It highlights the importance of a culturally responsive approach in fostering a robust culture of knowledge exchange within higher education institutions and beyond.

Building on this idea, the impact of culture on Filipino teachers' willingness to share knowledge is complex and influenced by factors such as multicultural awareness, organizational culture, and personal attitudes. Cultural aspects play a crucial role in shaping teachers' perceptions and involvement in knowledge-sharing efforts, which are essential for improving educational quality and institutional effectiveness. This study emphasizes vital elements, highlighting the need for a comprehensive strategy that considers both organizational structures and personal factors to foster a collaborative and knowledge-rich environment.

4. Methodology

This study employs a post-positivist approach to examine knowledge-sharing intentions in higher education, with an emphasis on national culture, organizational culture, and institutional knowledge-sharing practices. Employing a critical realist framework, this approach acknowledges the intricacy of social interactions.

A census approach ensured broad coverage and reduced selection bias by inviting all faculty members of the participating university to participate in the study. Participants varied in educational attainment, academic rank, position, gender, age, and service years. The university's five campuses, spread across the Philippines, represented regional cultures, allowing for a detailed analysis of local cultural dimensions. Faculty members provided valuable insights into knowledge-sharing perceptions and practices within their respective branches. When determining the final sample size, the study considered participants' availability and willingness to engage in the online survey. Despite efforts to encompass the entire population, the survey received 155 responses, yielding a 49.21% response rate. Some faculty members opted out, potentially introducing non-response bias; however, the high response rate mitigates this. Additionally, biases may arise from relying on self-reported data. Nevertheless, by targeting the entire faculty and securing strong participation, the research offers a comprehensive overview of teachers' knowledge-sharing intentions and cultural influences in higher education.

A convergent parallel mixed-methods approach was used to collect and analyze data. The study began with an online survey that assessed participants' cultural dimensions, organizational factors, and knowledge-sharing intentions, drawing on three references. The questionnaire employed for data collection was modified to incorporate a six-point Likert scale and underwent validation by three experts in the field of knowledge management. In-depth interviews followed, providing insights into cultural differences and key factors influencing knowledge-sharing intentions, which were reinforced by integrating findings from both methods.

A Multiple Regression analysis was performed to test the relationship between cultural factors (cultural dimension and organizational culture) and knowledge-sharing intentions. This approach reflected the theoretical framework by assessing how cultural variables (exogenous) influence knowledge-sharing intentions (endogenous) and the degree to which these intentions are realized in actual behaviors (endogenous). Furthermore, an Analysis of Variance (ANOVA) was utilized to evaluate faculty perceptions of knowledge-sharing techniques across various campuses. The resulting statistical F-value and p-value (below 0.05) indicated a

significant difference in perceptions across institutional contexts, highlighting the impact of local factors on knowledge-sharing practices. A thematic approach was employed to categorize the data into meaningful groups, facilitating the analysis of interview responses and the management and interpretation of qualitative data for improved credibility and reliability of the findings.

5. Results and Discussion

5.1 Influence of National Culture on Knowledge-Sharing Intentions

This study investigated the influence of national culture dimensions (at the regional level) on knowledge-sharing intentions (KSI) among teachers. Table 1 presents the results of the multiple regression analysis conducted to test the influence of power distance, uncertainty avoidance, collectivism, and short-term orientation as predictors of KSI.

Table 1: Result of the Regression Model – Cultural dimensions and KSI (N=155)

Model	df	F	Sig.	Adjusted R-squared
Regression	4	49.056	.000[b]	.567

Predictors: Power Distance, Uncertainty Avoidance, Collectivism, and Short-Term Orientation

Dependent: knowledge-sharing Intention

The multiple regression analysis of culture's influence on KSI revealed that cultural dimensions have a significant impact on KSI. Therefore, the hypothesis is accepted. The F-value that was obtained, 49.056, fell within the acceptable range. The corrected R-squared value of 0.555 indicates that other variables or unknown factors influence 45.5% of the desire to share knowledge, with 55.5% of the intention to share knowledge attributable to culture. The significant F-statistic and p-value of less than .05 indicate that the observed relationship is unlikely to be due to chance. The substantial adjusted R-squared value suggests that national culture is a powerful predictor of KSI, attributing over half of the variation in teachers' intentions to share knowledge.

5.2 Individual Cultural Dimensions and KSI

The study further examined the individual effects of each cultural dimension to understand the nuanced relationship between national culture and KSI. Table 2 presents the coefficients, p-values, and significance levels for each dimension in relation to KSI.

Table 2: Effects of each national culture dimension on KSI (N=155).

Relationships of the following cultural dimensions on KSI	Coefficient	P-value	Significance
Power Distance	-.239	.003	Significant (negative)
Uncertainty Avoidance	.455	.000	Significant
Collectivism	.354	.000	Significant
Short Term Orientation	.162	.090	Not Significant

Dependent Variable: KSI

Significant level at. o5

Figure 1 shows the diagram of the regression coefficients of the national culture dimensions and knowledge-sharing intention.

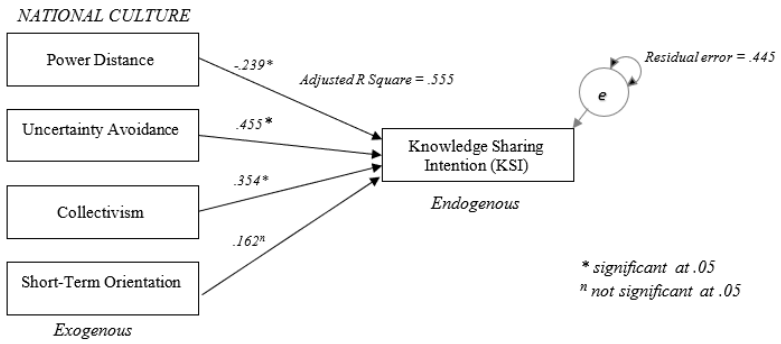

Figure 1: Regression model of the influence of national cultural dimensions on KSI

The negative coefficient (-0.239) indicates that higher power distance is associated with lower KSI. It suggests that individuals may be less inclined to share knowledge in cultures with strong hierarchies (Jia et al). A positive coefficient (0.455) indicates that higher uncertainty avoidance is linked to greater KSI. This implies that individuals in cultures that value predictability and structure may be more likely to share knowledge. The positive coefficient (0.354) indicates that higher collectivism is associated with higher KSI. This aligns with the notion that cultures emphasizing group harmony and interdependence foster knowledge-sharing. The coefficient for short-term orientation (0.162) was not statistically significant. The result suggests that this dimension does not have a strong influence on KSI in the studied context.

5.3 Influence of Organizational Culture on Knowledge-sharing Intentions

Table 3 presents the statistical analysis of the influence of organizational culture, encompassing interpersonal trust, inter-organizational communication, organizational information systems, reward systems, and KSI. The computed value (R-value) is 29.287, which falls within the acceptance region, $\alpha >$ p-value (.05 > 0).

Table 3: Summary of the Regression Model - Organizational Culture and KSI (N=155)

Model	df	F	Sig.	Adjusted R Square
Regression	4	29.287	.000[b]	.439

Predictors: Power Distance, Uncertainty Avoidance, Collectivism, and Short-Term Orientation

Dependent: KSI

The results supported the acceptance of the hypothesis, demonstrating significant effects of organizational culture on KSI. Therefore, it can be concluded that organizational culture influences teachers' knowledge-sharing intentions. Moreover, the adjusted R-squared value was .439, suggesting that 43.9% of the factors influencing knowledge-sharing intention can be attributed to organizational culture. Other unidentified factors affect 56.1% of the intentions.

5.4 Individual Organizational Factors and KSI

The coefficient was computed for each identified organizational factor and KSI to conduct a more in-depth analysis of the relationships between organizational culture and KSI. Table 4 presents the results of the computed coefficient of the relationships between organizational culture and KSI.

Table 4: Relationship between each organizational culture factor and KSI (N=155).

Organizational culture	Coefficient	P-value	Significance
Interpersonal Trust	.020	.869	Not Significant
Inter-Organizational Communication	.616	.000	Significant
Organizational Information Systems	.194	.196	Not Significant
Rewards System	-.184	.129	Not Significant

Dependent Variable: KSI

The significance level is at .o5

Figure 2 shows the portion of the Path Model that evaluates the regression coefficients of the factors related to organizational culture and knowledge-sharing intention.

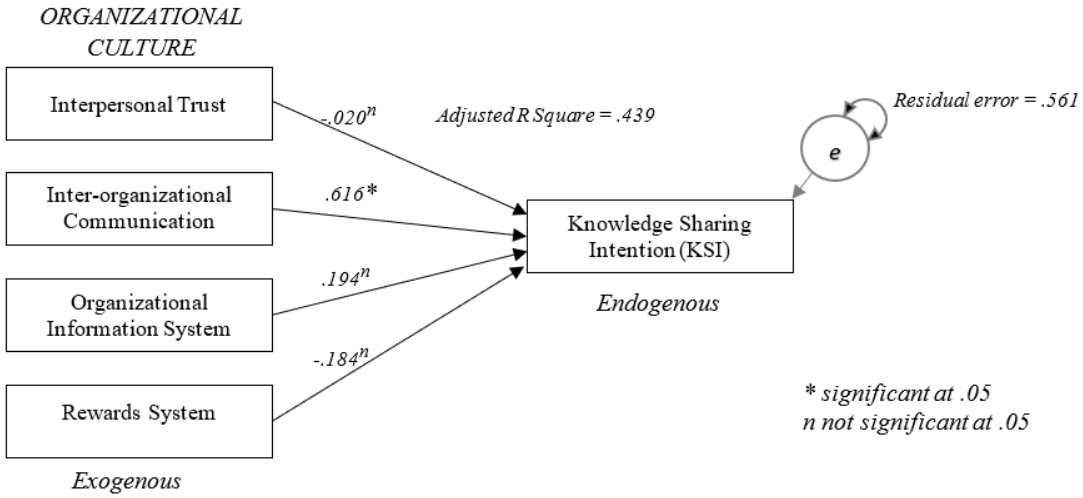

Figure 2: Regression model of the influence of organizational culture on KSI

Interpersonal trust did not significantly affect the participants' intentions to share knowledge, with a coefficient value of 0.020. The p-value was 0.869, which is higher than the significance level of 0.05. Therefore, the decision was to reject the hypothesis. The results indicate that interpersonal trust has no significant effect on knowledge-sharing intentions. The analysis of inter-organizational communication revealed that participants considered communication a crucial factor in knowledge-sharing. With a calculated coefficient of 0.616 and a p-value of 0.000, it can be concluded that inter-organizational communication has a significant effect on the participants' knowledge-sharing intentions. Hence, communication within the organization was found to be a significant factor that can influence knowledge-sharing intentions. *Organizational information systems* did not affect the knowledge-sharing intentions of the participants. The results show that organizational information systems had no significant effect on knowledge-sharing intentions, with a coefficient of 0.194 at a p-value of 0.196, which is not significant. Finally, *the rewards system* was not significantly related to knowledge-sharing intentions, with a negative coefficient of -.184 and a p-value of .129. The reward system did not significantly affect the participants' intentions to share knowledge.

5.5 Perceived Effectiveness of knowledge-sharing Techniques (KST) Between the Local Institutions (University Branches)

The perceived effectiveness of KST within the local institutions was considered evidence of experience and participation in the participants' knowledge-sharing. To examine differences in participants' perceptions of the regional institutions, an analysis of variance (ANOVA) was conducted. Table 5 provides a summary of the statistical analysis results for the variance in knowledge-sharing across branches.

Table 5: Difference in the perceptions of the participants on the effectiveness of KST between local institutions *(N=155)*

Organizational culture	F-value	P-value	Significance
Perceptions between local institutions	2.762	.03	Significant

The significance level is at .o5

The analysis aimed to determine whether the perceived effectiveness of knowledge-sharing techniques differs significantly among participants from different regional branches of the university. The results yielded an F-value of 2.762 and a p-value of .030. The hypothesis is accepted since the p-value (.030) is less than the significance

level (.05). This indicates a statistically significant difference in perception among participants from the different regional institutions on the effectiveness of KST.

5.6 Each Local Institution's KST and KSI

To further analyze participants' perceived effectiveness of KST across different local institutions, the correlation between their perceptions of these techniques and their intentions to share knowledge within each institution was examined. Table 6 presents the results of the correlation analysis.

Table 6: Each local institution's correlation between the participants' perceived effectiveness of KST and KSI

Local Institutions	Correlation Coefficient Value	Significance Level
Manila (Main)	.462**	.000
Mindanao	.321[n]	.084
North Luzon	.530**	.008
South Luzon	.398 [n]	.377
Visayas	.539*	.031

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

[n] Correlation is not significant

The analysis examined how participants' perceptions of KST's effectiveness were related to their intentions to share knowledge within their respective local institutions. Table 6 shows the correlation coefficients (R-values) and significance levels for various university branches.

- *Manila (Main):* The correlation between the perceived effectiveness of KST and knowledge-sharing intentions (KSI) is strong (R = .462) and statistically significant at the 0.01 level. This suggests that in the Manila (Main) branch, a higher perception of KST effectiveness is associated with a stronger intention to share knowledge.
- *Mindanao:* The correlation here is moderate (R = .321) but not statistically significant (p = .084). This suggests that while a relationship exists between perceived KST effectiveness and KSI, it is not strong enough to be statistically reliable in this context.
- *North Luzon:* The correlation is strong (R = .530) and significant at the 0.01 level. This implies a clear and significant association between how effectively participants perceive KST and their intention to share knowledge.
- *South Luzon:* The correlation is moderate (R = .398) but not statistically significant (p = .377). This suggests no significant relationship exists between perceived KST effectiveness and KSI in the South Luzon branch.
- *Visayas:* The correlation is strong (R = .539) and significant at the 0.05 level. This indicates a significant positive relationship between perceived KST effectiveness and knowledge-sharing intentions in the Visayas branch.

The results indicate that perceptions of KST effectiveness are positively correlated with knowledge-sharing intentions, supporting earlier research highlighting the importance of supportive environments in encouraging such behaviors (Mohillo, Jalandoon and Marcial, 2024; Lane et al., 2022). Nevertheless, the relationship varies in strength and importance across different local institutions, which demonstrates the subtle impact of organizational culture (Algheryafi, 2021). Consistent with studies emphasizing the context-dependent nature of knowledge-sharing practices (Ng, 2022; Rao, Abdul and Kamel, 2021), results indicate that local cultural dynamics in branches in Manila, North Luzon, and Visayas significantly influenced educators' willingness to share knowledge. Conversely, the knowledge-sharing intentions of the South Luzon and Mindanao branches were not significantly affected by their local knowledge-sharing cultures, which suggests that other factors, such as personal attitudes, institutional structures, or external constraints, may also be influential. These differences highlight the literature's emphasis on the complexity of knowledge sharing within diverse organizational and cultural contexts (Cruz et al., 2020; de Guzman, de Castro and Adamos, 2022).

6. Follow-up Interview

A follow-up interview was conducted with participants from South Luzon and Mindanao to gather insights into the lack of correlation between their knowledge-sharing techniques and intentions. The interview results revealed that most respondents were unaware of the rule or process for knowledge-sharing being implemented in their specific branches. Some respondents said:

> *"There is no systematic way of communication, and knowledge-sharing is done informally; no formal process or system of knowledge-sharing". – (Three participants from both South Luzon and Mindanao)*

South Luzon and Mindanao participants sought a collaborative space for knowledge-sharing to foster a culture of expertise sharing through effective policies and processes. They noted the impact of uncertainty avoidance in this knowledge-sharing effort. Communication also played a key role; some participants expressed hesitance due to the lack of rules regarding language that could potentially offend others. Acceptance and recognition of shared knowledge were essential themes. The previous analysis highlighted how inter-organizational communication influences knowledge-sharing, focusing on the system and style of communication used. An additional point highlighted in the interview was the importance of respecting authority. Participants highly value this when sharing knowledge. Here are some of the responses recorded verbatim:

> *"Hierarchy or superiority is one factor I consider most when sharing knowledge." – (participant from South Luzon/male)*
>
> *Another participant validated this when she said:*
>
> *"There are barriers between the heads/leaders and the subordinates." – (Participant from Mindanao/female)*

Moreover, they also consider the authority or expertise of the person sharing the knowledge.

> *"There is a notion of authority of the knowledge being shared." – (Participant from South Luzon/female)*

This response reflects the high power distance between people from the two branches. Group belongingness was another factor that people from the South Luzon and Mindanao branches considered in knowledge-sharing.

> *"Only people belonging to certain groups usually share." – (Participant from South Luzon/female)*
>
> *"The relationship between mentors and mentees to pass on the skills is very important" – (Participant from Mindanao/female)*

The significant responses from the interview relate to collectivism: participants expressed greater confidence in sharing their knowledge with those within their circle of acquaintances.

The interview results from South Luzon and Mindanao participants reinforce the findings regarding the significant relationship between power distance, high collectivism, and uncertainty avoidance, as well as the crucial role of communication style in facilitating knowledge-sharing. The findings confirm that these cultural factors have a strong influence on educators' intentions to share knowledge(Knoll et al., 2021). Additionally, the results highlight the cultural diversity across various regions of the Philippines, aligning with previous studies that have explored the differing cultural dimensions among Filipinos (Tabajen, Sabetzadeh and Senivongse, 2023; Rentillo, Casalan and Gustilo, 2024).

7. Discussion

This study confirms that national culture has a significant influence on teachers' knowledge-sharing intentions, based on Hofstede's cultural dimensions theory. Specifically, power distance emerges as an essential barrier: educators in hierarchical cultures often hesitate to share knowledge with superiors due to fears of judgment. This view is supported by Castaneda and Ramirez (2021), Escandon-Barbosa, Ramírez and Salas-Paramo, (2022), and Leonavičienė and Burinskienė (2022). It is further confirmed by Al Rushud (2021), who found that high power distance in higher education institutions (HEIs) restricts open communication. Kucharska and Bedford (2019) also note that strict hierarchies hinder the flow of knowledge from subordinates to superiors. In contrast, uncertainty avoidance, another Hofstede dimension, promotes knowledge-sharing. Cultures valuing predictability and structure tend to share knowledge to reduce ambiguity. This aligns with Kucharska and Bedford (2019) and Castaneda and Ramirez (2021), underscoring that knowledge-sharing stabilizes uncertain contexts. Collectivism was positively associated with KSI, supporting the findings of Nguyen, Siri and Malik,

(2021) and Al Rushud (2021). These findings underscore the significance of Hofstede's framework in evaluating the cultural influences on knowledge-sharing in education.

At the organizational level, results posit that shared values and norms influence institutional behavior. This supportive organizational culture asserts that shared values and norms influence behavior within institutions. A conducive organizational culture, characterized by trust and collaboration, enhances KSI, according to Hristova, Mileva and Bundaleska (2022), who argue that such environments foster engagement and knowledge exchange. Hosen et al. (2022) found that organizational climate has a significant influence on attitudes toward knowledge-sharing, although the effects of interpersonal trust and rewards vary by context. Effective communication is crucial. Chedid et al. (2020) note that open communication reduces misunderstandings and aids knowledge transfer. On the other hand, this study suggests that the roles of information systems and rewards in KSI are limited, indicating that cultural elements may influence these factors. This challenges previous assumptions and highlights the need for nuanced strategies.

Finally, regional variations complicate knowledge-sharing in the Philippines. Participants from South Luzon and Mindanao expressed differing views on knowledge-sharing techniques (KST), indicating that cultural contexts influence their effectiveness. These findings align with Tabajen, Sabetzadeh and Senivongse (2023), who emphasize the need for culturally tailored knowledge management strategies. Interviews revealed that power distance, collectivism, uncertainty avoidance, and communication styles influence knowledge-sharing behaviors, reflecting the country's cultural diversity.

8. Conclusion and Implications

This study emphasizes the significant impact of national and organizational cultures on teachers' knowledge-sharing intentions (KSI), highlighting the necessity for culturally responsive knowledge management strategies. Cultural elements such as power distance, uncertainty avoidance, and collectivism play a role in KSI. In hierarchical cultures with high power distance, knowledge-sharing is impeded, whereas cultures that prioritize predictability (high uncertainty avoidance) facilitate it. Collectivist cultures tend to emphasize group harmony, which may contribute to higher KSI. Moreover, organizational culture influences KSI by nurturing environments that cultivate trust and collaboration among educators. Clear communication is crucial for minimizing misunderstandings and facilitating effective information exchange. Lastly, regional variations necessitate that knowledge-sharing initiatives be adapted to local contexts, as attitudes towards knowledge-sharing techniques (KSTs) differ, particularly in South Luzon and Mindanao. HEIs should implement culturally attuned strategies that break down hierarchical barriers, bolster support, invest in communication resources, and acknowledge regional nuances when developing initiatives. Policymakers and educational leaders must incorporate culture-oriented training and locally relevant policies to enhance knowledge-sharing among educators. By tackling these cultural factors, institutions can establish more effective knowledge-sharing systems, thereby enhancing knowledge management within the higher education sector in the Philippines.

Reducing hierarchical barriers and encouraging participatory decision-making creates an inclusive culture where educators feel empowered to share knowledge. Shared leadership, peer mentoring, and recognition are key elements for maintaining this openness. Effective, culturally responsive communication is vital; institutions should invest in tools and training that improve intercultural competence and reduce misunderstandings.

Trust and collaboration depend on mutual respect and common goals. Leadership that embraces diverse perspectives fosters greater engagement in knowledge-sharing. Tailoring initiatives to local values, norms, and technological readiness—especially in South Luzon and Mindanao—ensures their relevance and sustainability.

Cultural competence among educators and leaders is crucial for navigating diverse communication styles and power dynamics. Training should increase awareness of cultural factors and prepare individuals to address potential conflicts effectively. Lastly, aligning institutional policies with local needs and involving stakeholders fosters acceptance and lasting impact.

AI statement: No artificial intelligence (AI) tools were used in the design, data collection, analysis, or interpretation of this research

Ethics statement: This study involved human participants, all of whom were adults and participated voluntarily. No sensitive personal data, vulnerable populations, or sensitive resources or environments were involved. As such, formal ethics approval was not required in accordance with applicable institutional and national guidelines.

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Appendix A

SURVEY QUESTIONNAIRE

PART I: DEMOGRAPHIC PROFILE

Instructions: Please check the answers most applicable to you in the space provided. Your honest and sincere answer will be much appreciated.

NAME (optional): _____

Age

_____ 30 years old and below

_____ 31 – 40 years old

_____ 41 – 50 years old

_____ 51 years old and above

Sex

_____ Female

_____ Male

Place of birth _____

Hometown (place you grew up):

Please specify town/city and province: _____

Ethnicity

_____ Badjao

_____ Bicolano

_____ Cebuano

_____ Ilocano

_____ Maranao

_____ Muslim

_____ Tagalog (Manila)

_____ Tagalog (Southern Luzon)

_____ Waray

Other, please specify: _____

Highest educational degree earned:

_____ Bachelor's degree

_____ Master's degree

_____ Doctor's degree

Years of teaching experience _____

Faculty/Institute: _____

Branch/Campus:

_____ Main (Manila)

_____ Mindanao

_____ North Luzon

_____ Visayas

_____ South Luzon

No. of years have you been teaching/working on the campus _____

Academic Rank _____

Position/Designation _____

PART II. KNOWLEDGE-SHARING

This section will determine what type of knowledge you are willing to share with your colleagues. Which of the following are you willing to share most? Select all that apply.

___ Books/Journals/Magazines, etc.

___ Experiential (sharing your experiences in teaching, learning, etc.)

___ Files

___ Instructional materials

___ Learning modules and other learning materials

___ Other Documents such as lesson plans, etc.

___ Research

___ Routine or Process (sharing the way you do your tasks/work)

___ Subjects Matter Content and Pedagogy

___ Talents and Skills

___ Teaching presentations

___ Teaching presentations and other resources

___ Teaching strategies and techniques

___ Technology skills/Technical issues

___ Video learning materials

Others (please specify): _____

PART III. KNOWLEDGE-SHARING TECHNIQUE

Mission and vision statements, along with strategic directions, define the features and direction of the university, which support and shape its organizational culture. How do you think the mission, vision, and strategies influence the knowledge strategies being implemented in the *university and on the campus/branch*? Please rate the (1) entire university (PNU System) and (2) your campus' current practice.

Knowledge-Sharing Technique
Community of Practice – A place/mechanism for experts' collaboration and teamwork.
Conferences, Seminars, and Workshops
Focus groups/Brainstorming
Formal and Informal Discussion
Quality circles
Research Forum
Social media networks (internet, intranet, and extranet)
Training Programs and Activities
Utilizing knowledge-sharing tools (e.g. e-mails, document management system, LMS, etc.)
Other:
Other:
Other:

Source: Adapted from Ken, Shirley, Tzu Ting, Cheah Yeh Ying, Culture Dimensions Comparison: A Study of Malaysia and South Korea. Copyright. 2013 Society of Interdisciplinary Business Research (www.sibresearch.org)

PART IV. KNOWLEDGE-SHARING INTENTION

Questions in this part refer to your intention in sharing your knowledge. This aims to measure your *willingness to share your knowledge with your colleagues within your unit or campus*.

Please share your honest and sincere answer.

Please rate how much you agree or disagree with the following statements – how much they reflect to you in your campus.
If I share knowledge and resources with my colleagues, I feel that I am doing something positive for the campus to promote learning.
My knowledge and skills are improved when participating in knowledge-sharing practices on campus.
I am willing to participate in any program our campus implements to promote a knowledge-sharing environment.
I am willing to share my knowledge and resources with my colleagues who are close to me.
I have professional growth, and my professional network is broadened when I participate in the knowledge-sharing practice conducted by my unit or by my school campus.
A good relationship with my colleagues and co-workers is promoted through sharing.
I am willing to share/I share knowledge, based on the professional expertise I have acquired through studies and training
My ownership rights and/or my intellectual property rights are protected when I share knowledge and resources.
Policies and procedures on sharing and collaboration being implemented by the school campus were effectively formulated and fostered adequately within the community I work with.

Source: Adapted from Tabajen (2020). Factors Affecting Teachers' Use of Web Portal in knowledge-sharing: A Behavioral Intention and Technology Acceptance Perspective

PART V. NATIONAL CULTURAL DIMENSION

This part refers to a distinctive set of beliefs, values, and assumptions generally held by members of a national group. Please rate your agreement or disagreement with the statements below based on your actual *observation in your unit and/or campus*.

Please share your honest and sincere answer.

Statement
Being accepted by members of your workgroup is very important.

Statement
Having a sense of shame is important in the workplace.
I consider group success more important than individual success.
I consider group welfare more important than individual rewards.
Instructions for operations are important for employees on the job.
It is frequently necessary for the management to use authority when dealing with subordinates who are challenging to handle.
It is important to have job requirements and instructions spelled out in detail so that teachers always know what they are expected to do.
It is proper that teachers should agree with the school management decisions.
Management expects teachers to follow instructions and procedures closely.
Management should be very careful when trusting or asking for opinions of their teachers.
Management should be prudent and should not delegate important tasks to their teachers.
Management usually makes the most important decisions.
Ordering relationships by status and observing this order is important in the workplace.
Persistence is important in the workplace.
Rules and regularities are important because they inform workers what the organization expects of them.
Standard operating procedures are helpful to teachers when doing their job.
Teachers should pursue their goals after considering the welfare of the group.
In the workplace, it is important to fulfill current obligations and respect traditional ways of doing things.

Source: Adapted from Ken, Shirley, Tzu Ting, Cheah Yeh Ying, Culture Dimensions Comparison: A Study of Malaysia and South Korea. Copyright. 2013 Society of Interdisciplinary Business Research (www.sibresearch.org)

PART VI. ORGANIZATIONAL CULTURE FACTORS

This section will determine how you value and adapt to your work environment, as well as how organizational factors influence your knowledge-sharing behavior. Please rate your agreement or disagreement with the statements below based on your actual *observation in your unit and/or campus*.

Please share your honest and sincere answer.

Statement
A considerable level of trust exists between coworkers in this organization
Certain rules and procedures exist to protect the person sharing his/her knowledge against the harmful intentions of others
Certain tasks are accomplished through teamwork and collaboration between employees
Certain tasks require the formation of teams with members from different departments in order to be accomplished.
Coworkers commonly exchange their knowledge and experience while working
Employees are more likely to be rewarded for teamwork and collaboration rather than merely for individual performance.
Employees are rewarded for sharing their knowledge and experience with their colleagues.
I believe coworkers should not share personal information
I believe people will not hesitate to take advantage of other's knowledge and experience for personal gains
I do not hesitate to share my feelings and perceptions with my fellow colleagues
I feel comfortable using the knowledge sharing technologies available.
I have not been previously harmed as a result of sharing my knowledge with my coworkers
Information flows easily throughout the organization regardless of employee roles or other boundaries.
Language is not a problem when communicating with other staff
Most of my colleagues are people whom I know well and thus are considered trustworthy

Teamwork, discussion, and collaboration enhance communication between colleagues
The knowledge-sharing rewards available are effective in motivating staff to spread their knowledge.
The organization provides various tools and technologies to facilitate knowledge-sharing and exchange (e. g. groupware, e-mail, intranet).
The problem of people hoarding (keeping) knowledge does not exist and most staff members are willing to share their knowledge freely
The technological tools available at the organization for sharing knowledge are effective.
There is a high level of face-to-face interaction among colleagues in the workplace
Workers actively participate in the process of decision-making.

Source: Adapted from Al-Alawi, Adel Ismail, Al-Marzoogi, Nayla Yousif & Mohammed, Yasmeen Fraidoon (2007). Organization culture and knowledge-sharing: Critical success factors. www.emeraldinsight.com/reprints

Do you have any additional comments, questions, or concerns you would like to share about this survey or your knowledge-sharing thoughts and practices?

Artificial Intelligence in Knowledge Management: Identifying Intellectual Milestones and Emerging Domains

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Abstract: Research exploring the integration of knowledge management and artificial intelligence has grown significantly over the past two decades, driven by the transformative potential of intelligent technologies in reshaping how organizations create, share, and apply knowledge. Despite this expansion, the field remains conceptually fragmented, with limited synthesis across theoretical and practical contributions. This study offers a comprehensive bibliometric analysis of 1,650 peer-reviewed publications indexed in the Web of Science from 1975 to 2024. By employing performance metrics, co-citation and keyword co-occurrence analyses, timeline visualizations, and citation burst detection; the study maps the intellectual landscape and thematic evolution of this interdisciplinary domain. The results reveal four core thematic areas: the strategic application of artificial intelligence in human resource management, hybrid decision-making frameworks, innovation-driven supply chain transformation, and the use of intelligent systems in hospitality and service delivery. These clusters illustrate the field's conceptual diversity and the convergence of technological and managerial perspectives. Burst-detection analysis pinpoints 2020–2023 as a tipping period, when landmark publications sharply accelerated theoretical diversification and research momentum across the KM–AI domain. Theoretically, the study refines the Knowledge-Based View by introducing the contingencies of algorithmic transparency and inter-organizational power asymmetry, advancing a paradox-aware lens that reconciles augmentation vs. transformation and optimization vs. resilience tensions. Practically, cluster-specific evidence is translated into adaptable principles for HR leaders, supply-chain managers, and service innovators, emphasizing phased AI deployment, transparency-driven trust, and balanced efficiency–resilience strategies, while informing sector-specific governance standards and paradox-aware curricula for policymakers and educators. By identifying key research trajectories, influential contributions, and emerging areas of inquiry, this work provides a structured overview of the field's development and lays the foundation for future investigations into the evolving relationship between knowledge management and artificial intelligence.

Keywords: Knowledge management, Artificial intelligence, Machine learning, Intelligent systems, Bibliometric analysis, Co-Citation analysis, Science mapping, CiteSpace

1. Introduction

In an era increasingly defined by data proliferation and algorithmic decision-making, organizations face mounting pressure to extract strategic value from their knowledge resources. Knowledge Management (KM), which emerged in the 1990s as a discipline focused on the creation, sharing, storage, and application of knowledge (Nonaka & Takeuchi, 1995), is undergoing a profound transformation through the integration of Artificial Intelligence (AI). Advanced AI technologies—such as machine learning, natural language processing, and intelligent agents—have introduced new paradigms in how knowledge is captured, classified, and operationalized across firms (Duan, Edwards & Dwivedi, 2019; Ma & Yu, 2010; Del Giudice & Maggioni, 2014).

This convergence has catalyzed growing academic interest in understanding how AI augments KM systems, enabling knowledge discovery from unstructured data, automating knowledge workflows, and personalizing decision support. At the same time, it introduces complex challenges that disrupt traditional KM assumptions—particularly concerning the unpredictable behavior of learning algorithms and the opacity of AI-driven reasoning processes (Cavaleri, 2004; Jarrahi, 2018).

The educational sector has emerged as a relevant test bed for AI–KM integration, with developments ranging from smart learning environments (Dmitrenko et al., 2022) and data-driven quality assessment (Bondar et al., 2022) to AI-powered speech recognition tools (Pronina & Piatykop, 2022) and IoT-based health monitoring systems (Klochko et al., 2022). These cases illustrate broader KM–AI challenges such as AI-enabled decision support, large-scale knowledge discovery, and intelligent system integration in complex organizational

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settings. Similar advancements are observed in AI-assisted human resource management, knowledge-driven supply chain optimization, and intelligent service delivery systems.

Recent contributions have explored this intersection from various angles. Some focus on the role of AI in enabling knowledge-intensive business processes and innovation (Marques & Ferreira, 2020), while others investigate how knowledge workers interact with AI-enabled systems in dynamic, data-saturated environments (Haenlein & Kaplan, 2019). Educational institutions, in particular, have served as important test beds, with studies examining how digital platforms facilitate knowledge sharing during crises (Papanikolopoulou Arco, 2022), how interactive technologies enhance knowledge transfer in specialized technical domains (Kanivets et al., 2022), how student response systems improve knowledge engagement (Holovnia et al., 2022), and how intelligent navigation systems support institutional knowledge access (Gryzun, Shcherbakov & Bida, 2022). Scholars such as Dwivedi et al. (2021) advocate for integrative models capturing the interplay between human cognition, machine intelligence, and organizational learning.

Despite these advances, the KM–AI literature remains fragmented at conceptual, theoretical, and methodological levels, with divergent definitions, foundational assumptions, and research designs (Rodríguez, Edwards and Bertone, 2020; Centobelli, Cerchione & Esposito, 2022). This lack of coherence hampers cumulative knowledge building and inhibits the development of robust, integrative frameworks. Addressing such fragmentation requires a synthesis method capable of identifying conceptual clusters, intellectual structures, and thematic trends across a diverse body of work.

Bibliometric mapping is particularly well-suited to this objective because it allows for a systematic, quantitative synthesis of large scholarly corpora, capturing both the intellectual foundations and emerging frontiers of a research field. Compared to traditional narrative or systematic reviews, bibliometric analysis can reveal the structural relationships between concepts, authors, and institutions, offering an evidence-based map of the domain's evolution.

Accordingly, this study addresses the following central research question:

What is the current state of research at the intersection of Knowledge Management and Artificial Intelligence, and what emerging trends are shaping this domain?

To provide a more precise analytical lens, this overarching question is examined through three sub-research questions:

- What are the intellectual foundations of KM–AI research?
- Which thematic clusters and research fronts have emerged over time?
- How have collaboration patterns and knowledge flows evolved across authors, institutions, and countries?

The aims of the study are therefore to: (1) consolidate dispersed research by mapping its intellectual and thematic structures, (2) identify gaps and fragmentation patterns, and (3) highlight future research frontiers. Theoretically, the study seeks to contribute to the development of an integrated conceptual framework that bridges AI and KM perspectives. Managerially, it offers actionable insights for designing AI-enabled KM systems that enhance decision quality, optimize knowledge flows, and foster organizational learning.

The remainder of the paper is structured as follows: Section 2 reviews the theoretical evolution of the KM–AI research domain. Section 3 presents the methodology, including data collection and scientometric techniques. Section 4 outlines the current state of KM–AI research based on publication trends, citation patterns, and collaboration networks. Section 5 examines thematic evolution through co-citation and keyword co-occurrence analyses. Section 6 explores the intellectual structure of the field via timeline visualizations and cluster analysis. Section 7 synthesizes the findings, identifies research frontiers, and proposes future research directions.

2. Theoretical Evolution of the KM–AI Research Domain

The integration of AI into KM has garnered increasing scholarly attention over the past two decades, prompting a reexamination of how knowledge is created, shared, and applied in data-intensive organizational environments. While KM emerged as a distinct research field in the early 1990s, grounded in foundational works such as Nonaka and Takeuchi (1995), its conceptual development was initially shaped by organizational learning theory (Argyris & Schön, 1978) and the resource-based view (RBV) of the firm (Barney, 1991; Grant,

1996). These frameworks positioned knowledge as a key strategic asset, emphasizing its role in enabling innovation and sustaining competitive advantage.

As digital transformation intensified and AI technologies became increasingly integrated into enterprise systems, scholars began to question the sufficiency of traditional KM theories. Cavaleri (2004), for example, noted that conventional KM systems were often ill-equipped to detect tacit, emergent, or non-linear knowledge patterns—dimensions that are now more accessible through AI techniques such as machine learning, natural language processing, and semantic analysis. To better reflect the complexity of AI-enhanced knowledge processes, researchers have progressively adopted diverse theoretical lenses.

Among these, sociotechnical systems theory has been influential in exploring how AI interacts with human knowledge workers and institutional contexts (Jarrahi, 2018). Simultaneously, complexity theory and systems thinking have been mobilized to conceptualize knowledge flows as dynamic, adaptive, and continuously reconfigured through feedback loops enabled by AI. In addition, paradox theory has helped frame the tensions between automation and human cognition, particularly in scenarios where AI augments rather than replaces knowledge work (Haenlein & Kaplan, 2019). When combined, these lenses provide a holistic framework: sociotechnical systems theory situates AI within human–organizational contexts; complexity theory explains the adaptive, emergent nature of AI-enabled knowledge flows; and paradox theory captures the tensions between automation and human agency. Together, they enable a richer understanding of AI not merely as a technological tool but as an active partner in organizational knowledge generation.

Despite this theoretical diversification, several recent reviews suggest that the field remains fragmented and lacks an overarching conceptual foundation (Dwivedi et al., 2021). One recurring critique is that AI is still predominantly treated as a tool or infrastructure, rather than as a partner in knowledge generation (Rodríguez, Edwards and Bertone, 2020). This ontological framing limits the development of integrative perspectives capable of capturing the co-evolution of human and machine intelligence in organizational settings.

To address this limitation, researchers have increasingly relied on systematic literature reviews and science mapping techniques to trace the evolution of KM–AI research and clarify its emerging structure. For example, Del Giudice and Maggioni (2014) examined KM dynamics in inter-organizational networks, highlighting the role of digital technologies in facilitating knowledge transfer. Later, Marques and Ferreira (2020) focused on the transformation of KM practices in higher education, while Centobelli, Cerchione & Esposito (2022) proposed a multi-dimensional framework for embedding AI into organizational knowledge systems.

In parallel, bibliometric methods have played a growing role in consolidating the intellectual architecture of the field. Early efforts by Ma and Yu (2010) identified key research paradigms within KM through citation-based analysis. Building upon this, Rodríguez, Edwards and Bertone (2020) and García-Peñalvo et al. (2021) employed co-word and co-citation techniques to map the diffusion of AI concepts—such as deep learning, recommender systems, and ontological reasoning—into KM literature. Unlike previous KM–AI bibliometric studies, which have typically focused on either technological trends or conceptual mapping in isolation, our work integrates multiple theoretical perspectives—sociotechnical systems, complexity, and paradox theories—into the science mapping process itself. This allows us to address the specific problem of conceptual fragmentation by examining how technological, organizational, and cognitive dimensions intersect, rather than treating them as separate analytical layers. Furthermore, our study extends the temporal scope to nearly five decades (1975–2024) and incorporates managerial implications, positioning it as a bridge between theoretical synthesis and practical decision-making.

Educational contexts have provided rich empirical grounds for testing these theoretical frameworks. For instance, studies on belief revision and epistemic modeling illustrate how formal logic approaches can be applied to educational knowledge systems (Kozachenko, 2022), while the implementation of STEM technologies in educational settings exemplifies how complexity theory principles manifest in knowledge-intensive learning environments (Kukharchuk et al., 2022). Additionally, the intersection of economic analysis and educational knowledge management highlights the importance of understanding market-driven knowledge requirements in educational institutions (Abuselidze & Zoidze, 2022).

These foundational studies have laid the groundwork for identifying thematic clusters and research fronts focused on AI's role in knowledge discovery, intelligent decision support, and automated classification. However, as Dwivedi et al. (2021) and Centobelli, Cerchione & Esposito (2022) emphasize, the proliferation of theories and methodologies now requires a synthesis-driven approach that bridges technical, organizational,

and cognitive perspectives. The present study contributes to this ongoing effort by offering a comprehensive bibliometric analysis of 1,650 publications indexed in the Web of Science Core Collection from 1975 to 2024, with the aim of tracing the intellectual evolution and mapping the emerging knowledge structure of the KM–AI domain.

This theoretical fragmentation underscores the need for a systematic, quantitative synthesis of the KM–AI knowledge base. Bibliometric analysis offers a unique capability to integrate these dispersed insights and systematically address the conceptual and methodological gaps identified above.

3. Methodology

3.1 Data Collection

To address the research question concerning the evolution and intellectual structure of the literature at the intersection of KM and AI, this study adopted a scientometric approach grounded in principles of transparency, reproducibility, and methodological rigor. Scientometrics enables the quantitative analysis of scientific literature based on bibliographic metadata and offers clear advantages over traditional narrative reviews—particularly in capturing the performance, collaboration networks, and thematic structures of a research domain (White & McCain, 1989; Zupic & Čater, 2015).

The Web of Science (WoS) Core Collection was selected as the data source due to its extensive coverage of peer-reviewed journals and its well-established use in bibliometric analyses. Its reliable citation indexing and multidisciplinary breadth make it a preferred database for tracing knowledge evolution across scientific fields.

To retrieve relevant documents, a topic search (TS) query was formulated to capture the overlap between KM and AI-related literature. The following search string was used:

TS = (("knowledge management" OR "KM") AND ("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "intelligent systems"))

The query was conducted across all document types and publication years from 1975 to 2024, capturing nearly five decades of scientific output. This initial search yielded 1,986 records.

To ensure dataset quality and relevance, a multi-step filtering process was applied. Non-research content such as editorials, proceedings abstracts, and non-peer-reviewed material was excluded. Duplicate entries were removed, and a manual relevance screening based on the titles and abstracts was conducted to retain only articles clearly situated within the scope of KM–AI integration. After this cleaning and validation phase, a total of 1,650 publications were retained and served as the foundation for the bibliometric analyses described in the following sections.

3.2 Data Analysis

In this study, the scientific article served as the primary unit of analysis. We employed a bibliometric methodology to investigate the intellectual structure, thematic developments, and collaboration patterns in the literature situated at the intersection of KM and AI. Bibliometric analysis provides a systematic means of examining research trends, citation dynamics, and authorial networks, making it particularly suitable for identifying both historical roots and emerging research frontiers (Zupic & Čater, 2015).

To conduct the analysis, we utilized CiteSpace (Chen, 2006), a widely adopted software tool in the field of scientometrics and science mapping. CiteSpace supports the exploration of bibliographic records and their cited references, offering capabilities such as co-citation network construction, keyword co-occurrence mapping, and timeline visualizations. These functionalities are instrumental in detecting intellectual milestones, identifying structural turning points, and highlighting temporal patterns of scholarly influence.

While other tools—such as VOSviewer, HistCite, BibExcel, and Gephi—offer comparable features, CiteSpace was selected for its robust algorithms in citation burst detection, cluster labelling (via LLR and LSI), and its focus on the temporal evolution of knowledge domains. Its algorithmic foundation, particularly the pathfinder network scaling, enhances the interpretability of complex citation structures by filtering out redundant links and highlighting the most meaningful connections.

The outputs generated through CiteSpace allowed us to construct visual representations of the KM–AI research landscape, revealing its core thematic clusters, influential authors and publications, and temporal trajectories. These knowledge maps facilitated a deeper understanding of the field's developmental trajectory,

from foundational theories to current research hotspots, while also enabling the identification of underexplored yet rapidly emerging areas of inquiry.

4. The Current Status of KM-AI field

4.1 Research Trends at a Disciplinary Level

To investigate the disciplinary evolution and knowledge diffusion patterns within the intersection of KM and AI, we conducted a dual-map overlay analysis of journals. This technique provides a macro-level visualization of citation flows across scientific domains, enabling a better understanding of how KM–AI research is intellectually positioned within the broader academic landscape.

The dual-map overlay, generated using bibliometric software, displays citing journals on the left and cited journals on the right. Each node represents a journal, and the connecting arcs indicate the directional flow of citations between disciplinary domains. These arcs are color-coded to reflect distinct citation trajectories, revealing how knowledge produced in the KM–AI domain draws from, and contributes to, various scientific fields.

Following the guidance of Lin, Chen & Fang (2023), this method captures shifts in disciplinary influence by identifying statistically significant citation paths. Table 1 reports the top domain-level associations, ranked by z-score, a statistical measure of the strength of citation linkage. The most significant citation path originates from journals in Psychology/Education/Health, which cite extensively from literature in Psychology/Education/Social Sciences (z = 5.87). This is followed by strong connections from the same citing cluster to the Systems/Computing/Computer Science domain (z = 4.78). Additionally, journals in the Mathematics/Systems/Mathematical cluster cite both Systems/Computing/Computer (z = 2.43) and Economics/Economic/Political domains (z = 2.18).

As visualized in Figure 1, the map reveals two dominant citation trajectories: one linking computational and mathematical sciences to computer and information systems, and another connecting educational and psychological research with social and organizational sciences. These dual pathways suggest that KM–AI research is inherently interdisciplinary, grounded simultaneously in technical foundations (e.g., AI methods, data processing) and human-centric disciplines (e.g., education, organizational behavior, management).

This hybrid knowledge base underscores the evolving nature of the KM–AI field, which increasingly depends on the integration of algorithmic capabilities with social, behavioral, and institutional insights. The convergence of these domains reflects both the technological sophistication and the managerial relevance of contemporary research on knowledge and intelligence systems.

Table 1: Citation trends at a domain level

Citing region	Cited region	Z-score
Psychology/Education/Health	Psychology/Education/Social	5.87
Psychology/Education/Health	system/computing/computer	4.78
Mathematics/systems/mathematical	system/computing/computer	2.43
Mathematics/systems/mathematical	economics/economic/political	2.18

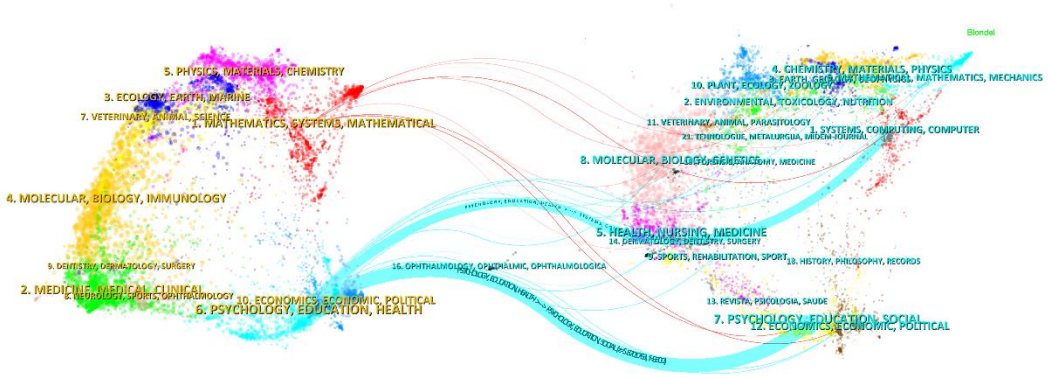

Figure 1: Dual-map overlay of cited and citing references on KM-AI field

4.2 Publication and Citation Pattern Analysis

A longitudinal examination of publication and citation trends offers valuable insight into the intellectual development and scientific consolidation of research at the intersection of KM and AI. As illustrated in Figure 2, both the volume of publications and their citation impact have increased markedly over the past five decades, with a particularly pronounced acceleration beginning in 2017.

From 1975 to the early 2000s, the field remained in its embryonic phase, characterized by low publication output—fewer than 10 articles annually—and exploratory contributions. During this period, scholarly efforts focused primarily on the conceptual foundations of KM and early applications of AI in expert and knowledge-based systems. The literature was sparse and largely fragmented.

Between 2010 and 2016, a steady development phase emerged. The number of annual publications grew consistently, reflecting the growing relevance of AI-related technologies—such as machine learning and big data analytics—to KM systems. Citation activity also increased, indicating broader academic engagement and diffusion.

The most dynamic growth occurred after 2017, marking the field's rapid expansion phase. Publication output more than doubled between 2018 and 2024, reaching a peak of over 300 articles in 2024. Citation counts followed a similar trend, culminating in more than 12,000 citations in 2023 alone. A slight decline observed in 2024 and 2025 is likely attributable to database indexing delays and the typical citation lag of recently published works.

In total, the dataset comprises 1,650 peer-reviewed articles indexed in the Web of Science Core Collection from 1975 to 2024, collectively cited 34,147 times, including 32,395 citations excluding self-citations. These articles appear in 25,212 citing documents, with an average of 22.58 citations per article and an overall H-index of 83. These metrics signal both high academic visibility and the field's consolidation as a multidisciplinary research front.

Despite its relatively recent momentum, the field's quantitative indicators underscore its maturity and impact. The growing citation base and increasing publication volume reflect a transition from theoretical groundwork to more applied and systemic research, drawing from disciplines such as computer science, information systems, organizational theory, and cognitive science.

While this analysis relies solely on WoS-indexed literature—excluding conference proceedings and grey literature—the findings nonetheless offer a robust overview of a rapidly evolving field with strong scholarly engagement and intellectual momentum.

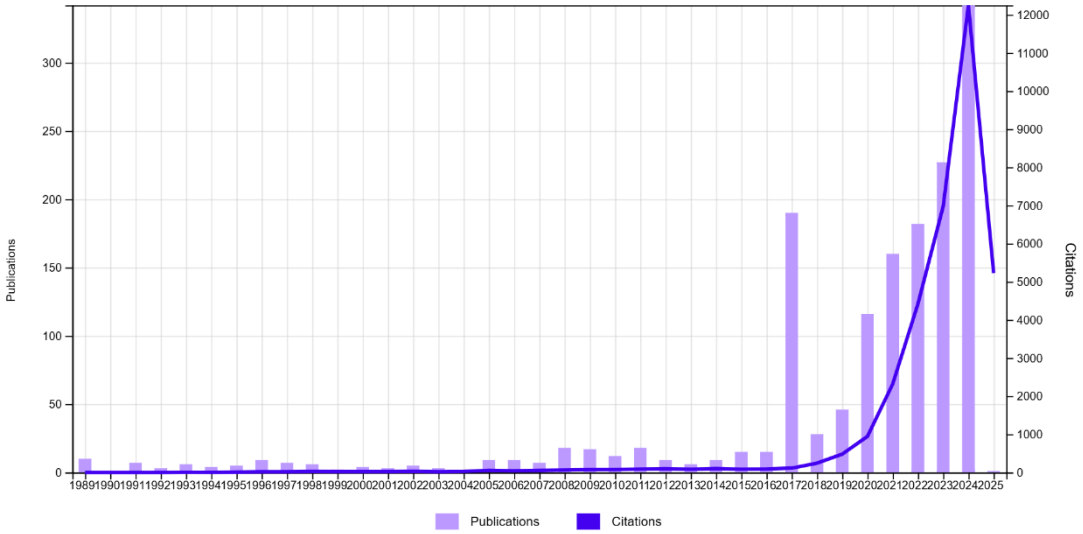

Figure 2: Times cited and publications over time

4.3 A Collaboration Analysis of Major Contributors to CS Field

As emphasized by Katz and Martin (1997), scientific collaboration refers to the process through which researchers collectively produce new knowledge. In the context of KM and AI—a field defined by its cross-disciplinary character—collaborative research is especially important, as it fosters the integration of technological, managerial, and organizational perspectives.

To examine collaboration patterns in this domain, we conducted a co-authorship network analysis using bibliographic data extracted from the Web of Science. The resulting maps illustrate three layers of collaboration: individual (author-level), institutional, and country-level. In these visualizations, node size reflects productivity (e.g., number of publications), while link thickness indicates the strength of collaborative ties. Node color captures temporal evolution, with warmer tones representing more recent activity. The overall network density (0.0025) suggests a low degree of cohesion, indicating that only a small fraction of potential collaborations have been actualized.

4.3.1 Co-authorship network

Identifying the most prolific authors is key to understanding the field's emerging intellectual core. Following Price's law, we expected a core group of approximately √1650 ≈ 40 authors to contribute roughly 50% of the field's publications. However, our data reveal that the top 40 authors account for only 14.5% of total output, suggesting that KM–AI remains a dispersed and maturing domain.

As shown in Table 2, S. Gupta leads with 14 publications, followed by S. Kumar and A. Malik with 11 each. Other key contributors include Y. Zhang, S. Bag, D. Vrontis, and P. Budhwar—scholars known for their work in digital transformation, business analytics, and intelligent knowledge systems. Their thematic alignment around AI-enabled innovation reflects the interdisciplinary nature of this research space.

Table 2: Most productive authors in CS domain

Authors	Record Count	% of 1 650
Gupta S	14	0.848
Kumar S	11	0.667
Malik A	11	0.667
Zhang Y	9	0.545
Bag S	8	0.485
Vrontis D	8	0.485
Budhwar P	7	0.424
Dwivedi YK	7	0.424

Authors	Record Count	% of 1 650
Kar AK	7	0.424
Kraus S	7	0.424

Despite the overall fragmentation of the global co-authorship network in the KM–AI research domain, two significant and thematically coherent groups of researchers have emerged. The first group (Figure 3a) is centered around Surajit Bag, S. Gupta, Arpan Kumar Kar, and M. S. Rahman, with frequent co-authorship from S. Kumar, Ajay Kumar, Maheshwari, and Leoni. Their collective body of work focuses on AI-enabled supply chains, sustainable digital transformation, and knowledge-based performance improvement, particularly in the context of emerging markets. Their contributions are regularly published in respected journals such as Technological Forecasting and Social Change, Industrial Marketing Management, Journal of Knowledge Management, and The International Journal of Logistics Management. For example, Bag et al. (2021) examined the role of AI in enhancing supply chain resilience, while Gupta and Rahman (2023) explored the dynamics of AI-driven knowledge ecosystems. The regularity of their collaborations and thematic consistency suggests a moderately cohesive and focused research agenda concerned with operational excellence through intelligent systems.

The second group (Figure 3b) includes Vijay Pereira, Shahriar Akter, Abhishek Behl, Sheshadri Chatterjee, and Samuel Fosso Wamba, with additional collaborations involving J. J. Ferreira, Mahdiraji, and Zaman. Their work appears in high-impact journals such as Human Resource Management Review, Technovation, International Marketing Review, and IEEE Transactions on Engineering Management. This group is primarily concerned with organizational AI adoption, knowledge transformation, and consumer behavior analytics, often framed through the lenses of strategic agility, digital platformization, and innovation management. Pereira, Mellahi and Collings (2023), for instance, proposed an AI-based framework for strategic HRM, while Akter et al. (2023) contributed to the literature on intelligent business model innovation. The group is marked by international, cross-disciplinary collaboration spanning information systems, marketing, and strategic management, underscoring the multidimensional nature of KM–AI research.

Despite the scholarly productivity and thematic coherence observed within the two leading research communities, the KM–AI field remains structurally fragmented. Cross-group collaboration is still limited, with many scholars publishing within institutionally or regionally siloed networks. This structural dispersion poses significant barriers to theoretical integration, knowledge transfer, and the cumulative advancement of the field.

This observation underscores an urgent need to move from parallel specialization to integrated collaboration. While the two groups each advance distinct areas of KM–AI scholarship—supply chain innovation and strategic HRM—the lack of cross-pollination prevents the field from reaching its full integrative potential.

To overcome this fragmentation, future research should prioritize the cultivation of cross-institutional and interdisciplinary linkages. Strengthening connectivity across research clusters can accelerate conceptual synthesis, promote methodological innovation, and support the co-development of actionable, practice-oriented frameworks that align technological capabilities with knowledge-based organizational strategy. These mechanisms align with broader trends in science policy, such as EU Horizon collaborative consortia and NSF-funded AI institutes, which actively promote transdisciplinary integration.

Specific, actionable mechanisms to promote such integration include:

- establishing thematic research consortiums that formally bridge the two identified author clusters through shared agendas and longitudinal collaboration;
- launching joint doctoral training programs across institutions to foster early-stage interdisciplinary knowledge exchange and methodological cross-pollination;
- designing multi-institutional grant proposals that explicitly require co-investigators from both communities; and
- convening structured workshops or symposia focused on synthesizing insights from supply chain innovation and strategic HRM to develop integrated, cross-domain research agendas.

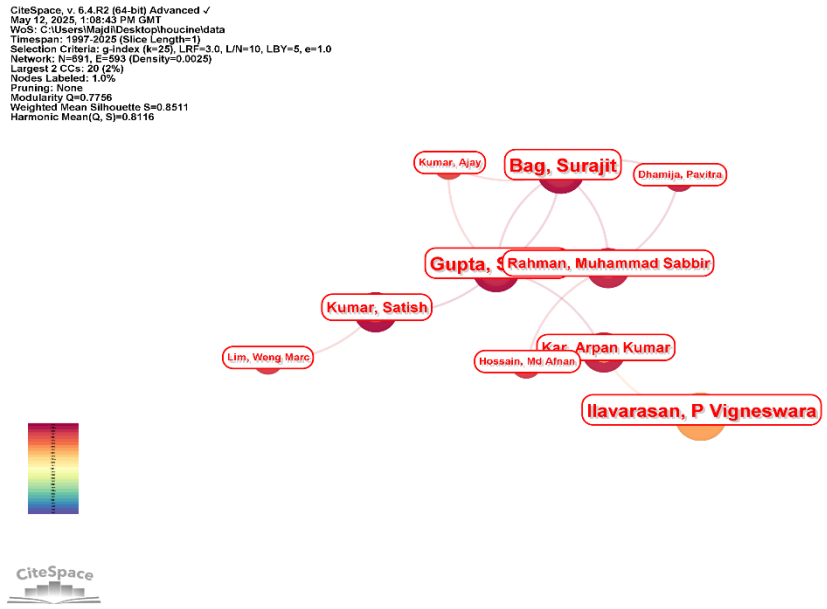

Figure 3a: Co-authorship cluster around Bag, Gupta, Kar, Rahman

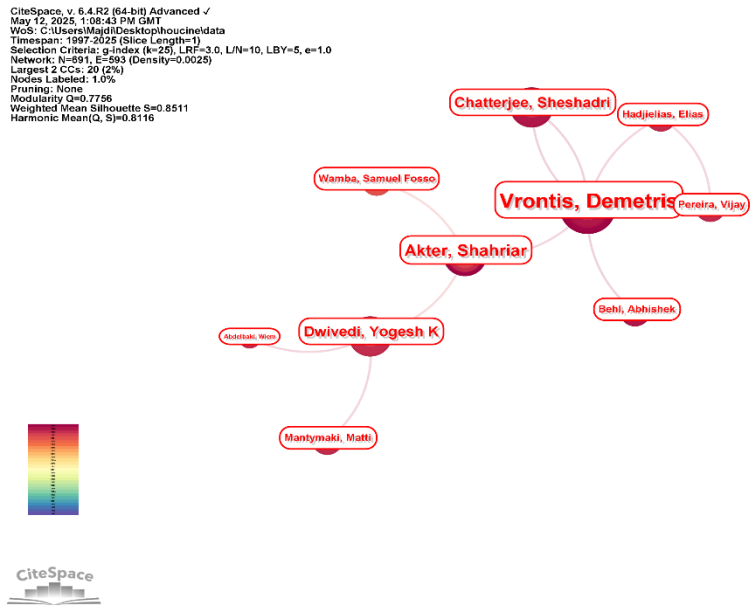

Figure 3b: Co-authorship cluster around Vrontis, Dwivedi, Akter, Wamba

4.3.2 Co-institute co-country network

Understanding collaboration patterns at both the institutional and national levels provides critical insights into the geographic concentration and organizational distribution of research at the intersection of KM and AI. The results indicate that the most active contributors to this domain are countries currently in advanced stages of digital and scientific infrastructure development. These nations are home to the majority of leading institutions that drive scholarly output in the KM–AI space.

As shown in Table 3, China stands out as the most prolific country, accounting for 18.61% of all publications in the dataset. It is followed by the United States (14.67%), India (13.46%), and England (11.64%). Other notable contributors include Italy, France, Australia, Germany, Spain, and Canada, each representing more than 3% of total publications. Collectively, these countries form the backbone of global KM–AI research, with regional clusters of activity concentrated in Asia, North America, and Western Europe.

The dominance of China, the USA, and India reflects the growing convergence between emerging innovation ecosystems and traditional academic strongholds. Researchers based in these countries have demonstrated the capacity to produce high-impact studies either independently or through domestic institutional networks. However, the landscape remains heavily inward-oriented, with collaboration often limited to national boundaries.

This trend is further illustrated in Figure 4, which visualizes the institutional collaboration network. The majority of nodes appear isolated, suggesting that most institutions operate independently, with minimal co-authorship or formal partnerships across organizations. While certain academic systems—such as India's IIM and IIT networks or China's Academy of Sciences—exhibit internal cohesion, their ties to international partners remain relatively weak and infrequent.

Table 4 lists the most productive institutions, with the Indian Institute of Management (IIM) System leading (36 publications), followed by Indian Institutes of Technology (IIT) and Jaypee Institute of Information Technology (JIIT). Other productive contributors include the Chinese Academy of Sciences, University of Johannesburg, and several institutions in Europe such as Aston University and the University of London.

Despite the presence of several high-output institutions and national research hubs, the overall structure of collaboration in KM–AI research remains fragmented. Most partnerships are domestically oriented, with limited durable connections across countries or institutional systems. This insularity restricts the global diffusion of novel insights and hampers the development of integrated theoretical models that can address the interdisciplinary nature of the field.

Promoting broader cross-institutional and international collaboration is therefore essential to accelerate theoretical convergence, foster knowledge diversity, and advance impactful innovation in KM–AI. These goals align with current global priorities in science policy, including open science, transnational funding frameworks, and inclusive digital infrastructures.

To operationalize these efforts, we propose the following collaborative mechanisms:

- Establishing international KM–AI research networks that formally link leading institutions across key regions (e.g., Chinese Academy of Sciences, IIM/IIT systems in India, top US universities, and European centers such as Aston University and the University of London);
- Creating multinational funding schemes requiring tri-continental research partnerships to stimulate broader intellectual exchange;
- Launching rotating international fellowships, enabling scholars to spend extended time at partner institutions to foster long-term collaboration and mentorship;
- Hosting an annual global KM–AI symposium, rotating across major research centers to encourage face-to-face networking and joint agenda-setting;
- Developing shared digital research infrastructures, including standardized datasets, interoperable collaboration platforms, and open-access publishing pipelines that transcend national boundaries.

These initiatives would not only bridge institutional and geographic divides but also establish a more cohesive and resilient global research ecosystem capable of driving interdisciplinary innovation in the KM–AI domain.

Table 3: Major productive countries

Countries/Regions	Record Count	% of 1 650
PEOPLES R CHINA	307	18.606
USA	242	14.667
INDIA	222	13.455
ENGLAND	192	11.636
ITALY	119	7.212
FRANCE	110	6.667
AUSTRALIA	109	6.606
GERMANY	97	5.879
SPAIN	61	3.697
CANADA	60	3.636

Table 4: Major productive institutions

Affiliations	Record Count	% of 1 650
INDIAN INSTITUTE OF MANAGEMENT IIM SYSTEM	36	2.182
INDIAN INSTITUTE OF TECHNOLOGY SYSTEM IIT SYSTEM	30	1.818
JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY JIIT	28	1.697
CHINESE ACADEMY OF SCIENCES	26	1.576
UNIVERSITY OF JOHANNESBURG	21	1.273
ASTON UNIVERSITY	18	1.091
INDIAN INSTITUTE OF TECHNOLOGY IIT DELHI	18	1.091
UNIVERSITY OF LONDON	18	1.091
HSE UNIVERSITY NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS	17	1.030
UNIVERSITY OF CHINESE ACADEMY OF SCIENCES CAS	17	1.030

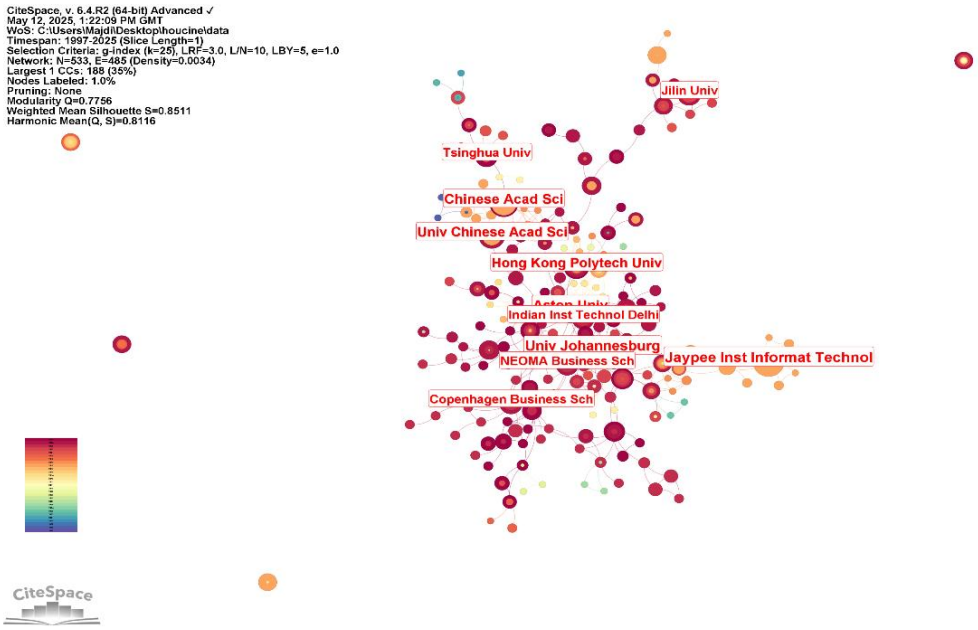

Figure 4: Most collaborative institutions

4.3.3 Keyword co-occurrence

The analysis of keyword co-occurrence provides valuable insights into the conceptual structure, research hotspots, and emerging themes of a scientific domain. Keywords serve as distilled representations of a study's focus, and their patterns of co-occurrence reveal how key topics converge, evolve, and delineate the intellectual frontiers of the field (Callon et al. 1983)

In the context of KM and AI, the co-occurrence network—visualized in Figure 5—comprises 796 nodes and 4,182 links, resulting in a network density of 0.0132. This density reflects a moderately interconnected structure, suggesting the presence of a well-formed conceptual core alongside a range of semi-autonomous thematic branches.

As shown in Table 5, the most frequently used keyword is "artificial intelligence", with 698 occurrences, underscoring its central role in the research corpus. It is followed by core terms such as "knowledge" (269), "management" (241), and "performance" (176), indicating sustained interest in the intersection of AI applications and knowledge processes—particularly as they relate to organizational effectiveness and value creation.

Other recurring keywords include "technology", "big data", and "innovation", which highlight the technological enablers driving knowledge transformations. Meanwhile, terms like "impact", "model", and "knowledge management" suggest a strong methodological and evaluative orientation within the literature.

The visual structure of the network reveals distinct topical clusters. For instance, terms such as big data, technology, and model frequently co-occur, reflecting a technically focused subdomain centered on AI architectures, data-driven modeling, and system design. In contrast, terms like performance, impact, and innovation are often grouped, pointing to research concerned with strategic, organizational, and outcome-oriented dimensions.

Overall, the keyword co-occurrence analysis reveals a robust conceptual nucleus at the intersection of AI and KM, framed by themes of performance and innovation. Around this core, the network branches out into specialized threads—ranging from big data analytics and intelligent modeling to digital transformation and knowledge-based decision-making. These findings confirm that the KM–AI domain is not only expanding in volume, but also diversifying in scope, evolving toward an increasingly interdisciplinary and application-driven frontier.

Table 5: Top 10 keyword

Frequency	keyword
698	artificial intelligence
269	knowledge
241	management
176	performance
164	technology
148	big data
147	innovation
146	impact
141	knowledge management
129	model

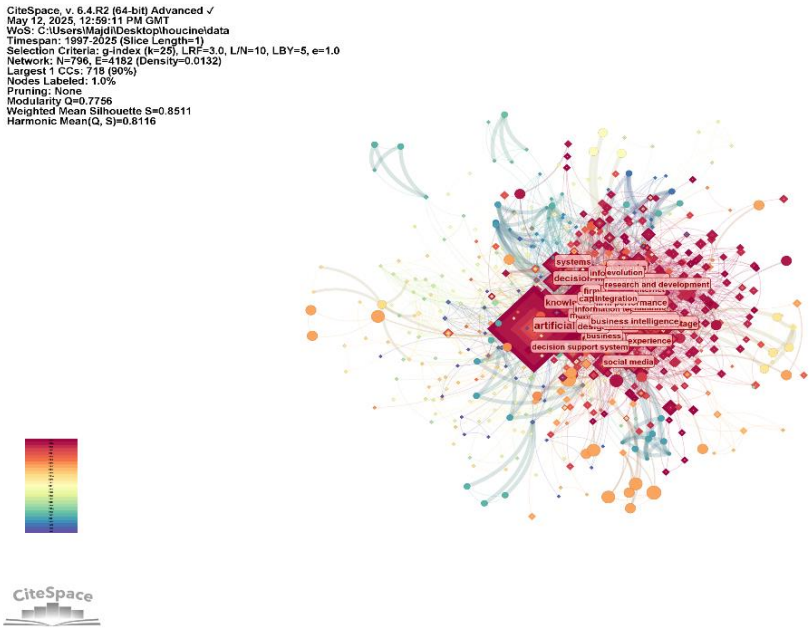

Figure 5: Keyword co-occurrence map

5. Scientometric Analysis: Research Hot Spots and Research Trend

5.1 Co-Citation Analysis

Co-citation analysis (CoA), originally developed by Small (1973), is a foundational method in scientometrics that enables the mapping of a field's intellectual structure. It operates on the premise that publications frequently cited together tend to share conceptual proximity, thus revealing core thematic domains and the evolution of scientific thought (Hjørland, 2013). This approach is particularly effective in identifying clusters of influence and research fronts within complex, interdisciplinary domains such as that of KM and AI.

In this study, we performed an author co-citation analysis to uncover the latent knowledge structure of KM–AI research. Using CiteSpace, we constructed a co-citation network based on the top 50 most cited authors per year, covering a time span from 1997 to 2025. The resulting network includes 1,086 authors, represented as nodes, with co-citation links visualized as edges. Node size reflects citation frequency, while link thickness represents the strength of co-citation between authors (Donthu et al., 2021; Zhang et al., 2021).

The temporal dynamics of the network are visualized using color-coded arcs, which indicate the year in which each co-citation relationship emerged. This temporal layer not only captures the historical progression of scholarly activity but also helps trace the intellectual evolution and the emergence of key research trajectories (Chen, 2012).

To assess the quality and structural coherence of the clusters produced, we used two key metrics:

- Modularity Q: Measures the clarity of separation between clusters. A value above 0.7 is generally considered a sign of well-delineated thematic groupings.
- Silhouette Score: Evaluates the internal consistency of each cluster, with scores approaching 1 indicating highly cohesive groupings (Argoubi & Masri, 2022).

Our analysis returned a modularity Q of 0.77, suggesting a well-structured network with clearly partitioned clusters. The top four clusters exhibited high silhouette values, indicating excellent internal consistency and thematic clarity.

As summarized in Table 6, four major co-citation clusters were identified, each reflecting a distinct subdomain of KM–AI research:

- Cluster 1 (Mean Year: 2018; Silhouette: 0.906; Size: 119): Focuses on the strategic integration of AI into human resource and organizational management, highlighting frameworks such as AI capability models and socio-technical alignment to enhance firm performance.
- Cluster 2 (Mean Year: 2009; Silhouette: 0.909; Size: 113): Concentrates on algorithmic HRM and human–AI collaboration, addressing themes such as algorithmic management, augmentation versus automation, and ethical implications in strategic decision-making.
- Cluster 3 (Mean Year: 1999; Silhouette: 0.998; Size: 86): Centers on AI adoption in supply chains, covering topics like knowledge-driven innovation, green logistics, and business model transformation through smart technologies.
- Cluster 4 (Mean Year: 2005; Silhouette: 0.965; Size: 52): Explores AI applications in hospitality and tourism, with a strong focus on service robotics, human–robot interaction, and customer experience management.

These clusters represent the thematic backbone of KM–AI research, illustrating how the field has evolved from foundational knowledge frameworks to nuanced, application-driven areas of inquiry. The co-citation network (Figure 6) provides a visual synthesis of this intellectual terrain, enabling scholars to identify influential authors, pivotal works, and emerging paths for future investigation.

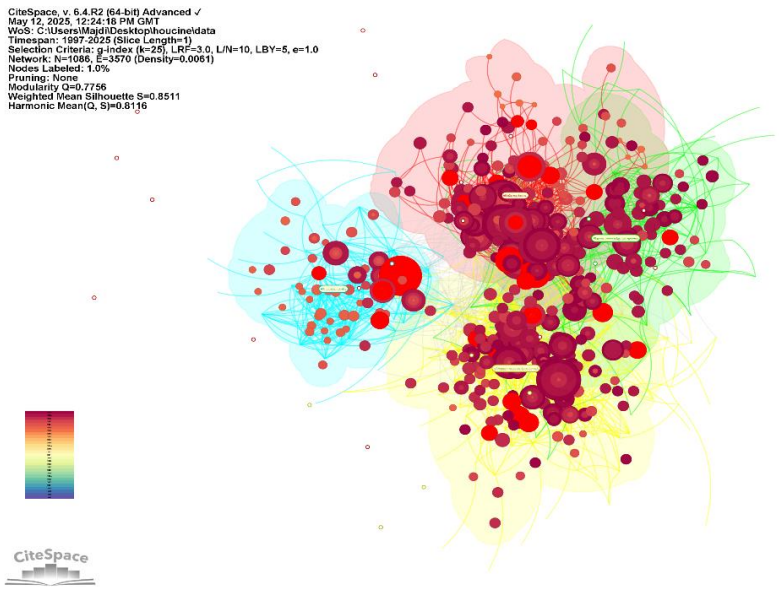

Figure 6: Co-citation map

Table 6: The 5 largest cluster

Cluster	ID	Size	Silhouette	Mean year
Strategic Integration of AI in Human Resource and Organizational Management	1	119	0.906	2018
Algorithmic HRM and Human–AI Collaboration in Strategic Management	2	113	0.909	2009
AI Adoption and Knowledge-Driven Innovation in Smart Supply Chains	3	86	0.998	1999
AI and Service Robots in Hospitality and Tourism Management	4	52	0.965	2005

5.2 Timeline-View Analysis

Figure 7 presents the timeline visualization of co-citation clusters in the KM–AI research domain. This representation offers a temporal dimension to the clusters previously identified in the co-citation network, illustrating how each thematic area has evolved over time. In this view, clusters are arranged horizontally, while their position on the vertical axis reflects their relative size—with the most substantial clusters placed at the top.

The colored lines represent the active citation period for each cluster, and the color gradient (from dark to light) denotes the chronological sequence, where darker tones indicate earlier activity and lighter colors reflect more recent citations. This format enables the identification of both enduring and short-lived research themes, offering a clear perspective on the developmental trajectory of the field.

The analysis reveals that several clusters demonstrate long lifespans exceeding 10 years, indicating sustained academic interest. These often correspond to foundational themes, such as the integration of AI in decision support systems, or theoretical discussions on knowledge creation and learning. In contrast, some clusters appear as short bursts, typically linked to emerging technologies or methodological innovations, which may reflect temporary research foci or developing subfields.

Of particular note is the observation that some clusters remain active beyond 2024, the final year included in our dataset. This signals that these areas are likely to constitute ongoing research fronts and may shape the next phase of KM–AI scholarship.

Compared to the static co-citation network, the timeline view offers a more intuitive understanding of thematic longevity and influence. It facilitates the detection of intellectual turning points, identifies periods of intensified scholarly attention, and distinguishes persistent foundational domains from transitory topics.

In the following section, we conduct a cluster-by-cluster analysis of the four most prominent thematic clusters, examining their leading authors, central documents, and conceptual contributions. These clusters form the intellectual backbone of the KM–AI research landscape and are instrumental in understanding its theoretical consolidation and future directions.

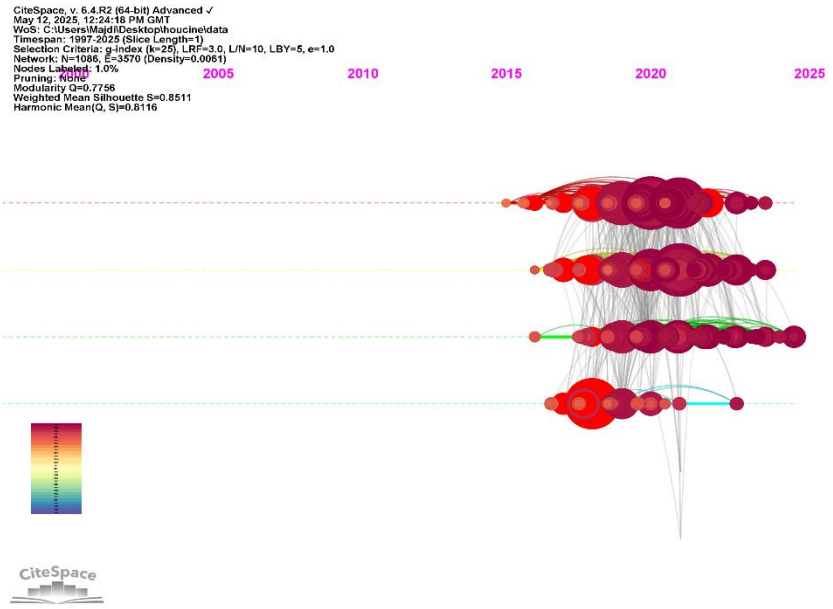

Figure 7: Network's timeline visualization

5.3 The Intellectual Base

Cluster analysis reveals hidden semantic themes and overlaps in research corpora by identifying groups of co-cited references that share conceptual foundations (Hossain, Ramakrishnan and Hecker, 2011; Waltman, van Eck & Noyons, 2010). Our analysis identifies four distinct thematic clusters (Q = 0.77, silhouette scores > 0.80) that represent the core intellectual foundations of KM–AI research over the 26-year period under investigation.

Rather than presenting these clusters by size, we discuss them in order of their theoretical significance and contribution to advancing KM–AI understanding. This ordering foregrounds the empirical patterns—both expected and unexpected—that emerge from the bibliometric mapping, including conceptual synergies within ostensibly opposed logics and unresolved theoretical tensions.

The four clusters contribute distinct but complementary theoretical insights: Cluster 2 provides the most fundamental reconceptualization by revealing paradoxes in human–AI collaboration that challenge traditional strategic management assumptions; Cluster 1 establishes the foundational capability frameworks that bridge KM and strategic HRM theories; Cluster 3 demonstrates how these theoretical advances manifest in complex operational contexts through AI-enabled supply chain innovation; and Cluster 4 offers sector-specific insights into service transformation that illustrate broader patterns of technology-mediated knowledge work.

Each cluster analysis combines quantitative evidence (citation bursts, centrality measures, temporal evolution) with qualitative interpretation, ensuring that theoretical propositions are grounded in empirical network structures. The gaps and tensions identified here directly inform the integrated theoretical contributions presented in Section 5.4. Table 7 summarises the structural characteristics of these clusters, which serve as the foundation for our theory-building discussion.

Cluster 2: Algorithmic HRM and Human–AI Collaboration in Strategic Management

Cluster 2 is the second-largest in the co-citation network, composed of 113 references, with a high silhouette value of 0.822, indicating strong thematic homogeneity. Its mean publication year is 2020, aligning with the 2020–2023 tipping period identified in our temporal analysis, and signalling a thematic area that is emergent yet rapidly consolidating. Quantitative network patterns reveal that several works in this cluster, particularly those addressing ethical governance, hold high betweenness centrality, suggesting their bridging role between HR analytics and broader KM–AI debates.

This cluster signals a strategic rethinking of HRM for the algorithmic era, emphasizing human–AI interaction, ethical issues, and the organizational fallout of automated decision-making. The citing documents—such as Kim (2025), Chowdhury (2023), Malik (2023), and Prikshat (2023)—reveal an expanding interest in multilevel theoretical frameworks that explore the capabilities, boundaries, and paradoxes of integrating AI into HR decision systems.

A distinguishing feature of this cluster is its normative and conceptual orientation. While Cluster 1 focuses more on capability development and performance impact, Cluster 2 dives deeper into critical and reflexive dimensions such as:

Algorithmic bias and fairness in HR decisions,

Redefinition of roles and identities in augmented workplaces,

Strategic ambidexterity and organizational paradoxes arising from human–AI coexistence.

Key cited references provide a rich theoretical backdrop:

- Raisch, Krakowski and Berente (2021) examine organizational ambidexterity and the challenges of managing contradictory tensions, highly relevant in AI-augmented HR contexts.
- Glikson & Woolley (2020) delve into human–AI collaboration, highlighting the social and psychological dynamics in AI-mediated team environments.
- Tambe, Cappelli and Yakubovich (2019) offer insights on AI-driven HR analytics, laying the groundwork for algorithmic decision-making.
- Jarrahi (2018) proposes a model of human–AI symbiosis, where decision power is shared between humans and intelligent agents.

The citing articles build upon these foundations to propose extended strategic frameworks. For instance, Malik (2023) conceptualizes AI-assisted HRM as a multifaceted system requiring ethical governance, data transparency, and hybrid decision-making protocols. Kim (2025) develops a research agenda for strategic HRM in algorithmic contexts, calling for new theoretical models that reconcile human judgment with machine logic.

An unexpected empirical insight emerging from this cluster is that efficiency gains—such as double-digit reductions in recruitment cycles and improved candidate–job fit (Tambe, Cappelli and Yakubovich, 2019; Kim, 2025)—often co-occur with stronger ethical safeguards like interpretability reports and applicant-facing explanations. This challenges the intuitive assumption that transparency requirements necessarily slow down performance, instead suggesting potential synergy between fairness and efficiency.

Yet, two paradoxes remain unresolved. First, Jarrahi's (2018) model of human–AI symbiosis clashes with analytics-driven frameworks that leave little room for human discretion, raising fresh questions about power sharing in hybrid decisions. Second, the call for organizational ambidexterity (Raisch, Krakowski and Berente, 2021) collides with algorithms' need for consistency, exposing a paradox between adaptive flexibility and rule-based automation.

Methodologically, many contributions rest on conceptual arguments: governance blueprints (Malik, 2023) or ethical guidelines (Kim, 2025) seldom undergo field validation or longitudinal testing. This "theory–practice gap" limits guidance for real-world transformation. Future work should combine quasi-experimental pilots, algorithm-audit protocols, and mixed-method designs to evaluate whether proposed safeguards actually mitigate bias and sustain ambidexterity.

Taken together, the network evidence and theoretical tensions in Cluster 2 form a critical input to the paradox-oriented theoretical refinements presented in Section 5.4, reinforcing the need to integrate ethical governance, performance optimisation, and human discretion in future KM–AI frameworks.

Cluster 1: Strategic Integration of AI in Human Resource and Organizational Management

Cluster 1 is the largest in the co-citation network, comprising 119 cited references, with a mean publication year of 2019 and a silhouette value of 0.815, indicating strong thematic consistency. Its works also display high betweenness centrality, suggesting a bridging role between knowledge management theory and applied strategic HRM. Spanning nearly a decade of research, this cluster represents a key intellectual foundation for understanding how AI capabilities are embedded in HRM to create organizational value.

The core themes emerging from the cluster include AI capability frameworks, AI–human collaboration, knowledge-based performance improvement, and the integration of socio-technical perspectives into strategic

HR planning and execution. The most frequently cited references—Davenport & Ronanki (2020), Dwivedi et al. (2021), Kaplan & Haenlein (2019), and Mikalef and Gupta (2021)—provide both theoretical and practical models for AI adoption, from strategic alignment and digital readiness to ethical governance and human–machine symbiosis. For example, Davenport & Ronanki (2020) demonstrate that AI can augment rather than replace HR decision-making, laying the groundwork for adaptive HRM systems.

A recurring theoretical anchor is the Knowledge-Based View (KBV), which positions AI capabilities as strategic knowledge assets. Chowdhury, Budhwar and Hammerschmidt (2022, 2023) and Malik (2023) merge KBV with socio-technical theory to examine how human–AI collaboration shapes business performance, employee experience, and strategic agility. Among citing works, Chowdhury, Budhwar and Hammerschmidt (2023) propose a robust AI capability framework for HRM, while Malik (2023) develops a strategic model emphasising organizational learning and workforce adaptability. Methodologically, the cluster shows a shift from early descriptive studies toward systematic reviews, conceptual modelling, and theory-building.

An unexpected empirical insight is that reported efficiency gains—such as 15–20 % faster decision cycles and lower administrative errors (Davenport & Ronanki, 2020; Mikalef and Gupta, 2021)—tend to materialise only in firms with strong learning climates, suggesting that technological capability alone is insufficient without cultural enablers.

Despite its foundational role, the cluster reveals two unresolved tensions. First, augmentation approaches (AI as assistant) conflict with transformation views advocating complete redesign of HR structures (Chowdhury, Budhwar and Hammerschmidt, 2023). Second, definitions of "AI capability" diverge: technology-centric perspectives (Mikalef and Gupta, 2021) emphasise infrastructure, while KBV-oriented studies (Chowdhury, Budhwar and Hammerschmidt, 2023; Kaplan & Haenlein, 2019) stress learning routines and culture. These definitional splits, compounded by differing performance metrics—intangible outcomes in KBV studies versus efficiency indicators in strategic-HRM work—complicate cumulative theory development.

Ethical considerations are frequently cited (Dwivedi et al., 2021) but rarely operationalised through concrete bias-mitigation or transparency mechanisms, leaving a gap between principle and practice. Furthermore, much of the literature remains conceptual, limiting empirical validation.

In sum, Cluster 1 establishes AI-enabled strategic HRM as a legitimate research frontier but exposes conceptual, methodological, and ethical gaps. Its bridging position in the network makes it pivotal for integrating KBV, socio-technical systems theory, and strategic HRM—connections further developed in Section 5.4, where we address the paradox of combining augmentation and transformation logics within coherent KM–AI frameworks.

Cluster 3: AI Adoption and Knowledge-Driven Innovation in Smart Supply Chains

Cluster 3 comprises 86 co-cited references, with a mean publication year of 2021 and a silhouette score of 0.803, indicating satisfactory internal consistency. Ranked third in prominence within the co-citation network, this cluster captures a rapidly expanding research front at the intersection of AI, knowledge management (KM), and supply chain innovation. Quantitative patterns — including high inter-cluster link density with strategic KM networks and strong betweenness centrality for Dubey et al. (2020) — suggest a shift from abstract capability discussions toward application-focused investigations, particularly in operations, logistics, and digital transformation contexts.

The most frequently cited works include Dubey et al. (2020) and Toorajipour, Sohrabpour and Ghasemaghaei (2021) on big data and AI in enhancing supply chain responsiveness and flexibility; Bag (2021) on resilience and performance; Di Vaio et al. (2020) on digital accountability and transparency; and Hair et al. (2019), which plays a methodological anchor role by providing partial least squares structural equation modelling (PLS-SEM) guidance widely adopted in empirical AI adoption and performance research.

The citing literature reinforces this thematic convergence. Shahzadi (2024) and Di Vaio (2024) provide systematic reviews of AI in supply chains and enterprise systems. Abdulmuhsin (2024) integrates KM and AI into a proactive green innovation model moderated by trust and sustainability imperatives, while Jorzik (2024) conceptualises how AI-driven innovation reshapes business models under digital pressure. These studies emphasise multi-level perspectives, combining firm-level capabilities with inter-organisational coordination and environmental responsiveness.

A distinctive — and somewhat non-intuitive — finding emerging from the cluster is the integration of resilience-oriented strategies within efficiency-optimisation paradigms (Bag, 2021; Dubey et al., 2020),

suggesting these approaches may function synergistically rather than competitively. This aligns with dynamic capabilities theory but remains under-theorised in the AI–supply chain domain.

Critical gaps, however, remain. The tension between resilience-driven and optimisation-driven paradigms is rarely reconciled in theory, reflecting a broader fragmentation in AI supply chain scholarship. Methodologically, the widespread reliance on PLS-SEM, while ensuring statistical reliability, risks obscuring conceptual validity issues — especially when operationalising complex constructs like "AI adoption" or "knowledge integration." Moreover, the literature's focus on positive implementation outcomes risks selection bias, limiting insights into failure factors. The predominantly firm-centric lens also neglects power asymmetries and value distribution dynamics inherent in AI-enabled supply networks.

Overall, Cluster 3 marks substantial progress in operationalising AI–KM integration in supply chains but requires more systematic theoretical synthesis, methodological diversity, and critical examination of less successful cases to evolve into a robust, generalisable research stream.

Cluster 4: AI and Service Robots in Hospitality and Tourism Management

Cluster 4 comprises 52 co-cited references, with a high silhouette score of 0.927, indicating excellent thematic homogeneity. With a mean publication year of 2018, it represents one of the more mature research fronts in the KM–AI domain, focusing on the adoption and impact of service robotics and AI in hospitality, tourism, and customer service industries. Network metrics reveal low inter-cluster connectivity but high internal cohesion, signalling a specialised but relatively siloed domain.

The citing literature — including Chi, Denton and Gursoy (2020), McCartney (2020), Zhu and Xu (2020), and Belanche et al. (2020) — examines AI deployment in frontline service contexts, with particular attention to customer experience, service design, trust formation, and organisational readiness in technology-mediated environments. Chi, Denton and Gursoy (2020) provide a systematic review of AI in hospitality service delivery; McCartney (2020) develops a conceptual framework for service robots in hospitality and tourism; Zhu and Xu (2020) investigate how anthropomorphic design in robotic chefs influences food quality perceptions; and Belanche et al. (2020) outline a theoretical agenda for service robot implementation.

Key co-cited works anchor the cluster in established service and technology adoption theories: Lemon & Verhoef (2016) on customer experience management across touchpoints, Huang & Rust (2018) on AI's strategic role in service delivery, Wirtz et al. (2018) on the future of service with intelligent automation, and Gursoy et al. (2019) on technology acceptance and innovation in tourism and hospitality. Collectively, these studies integrate service-dominant logic, technology acceptance models, and human–machine interaction theories to explain shifting service encounter dynamics in AI-augmented environments.

A distinctive — and somewhat counter-intuitive — insight from this cluster is the coexistence of anthropomorphic design strategies aimed at enhancing emotional engagement (Zhu and Xu, 2020) alongside efficiency-driven models advocating minimal human-like features (Huang & Rust, 2018). This suggests that optimal design may be highly contingent on service context and cultural expectations, a nuance often overlooked in deterministic adoption models.

Despite its thematic maturity, Cluster 4 shows notable limitations. The literature is heavily skewed toward Western, high-income contexts, limiting cross-cultural generalisability. Employee perspectives — including displacement risks, skill adaptation, and workplace power dynamics — remain under-examined, leading to a customer-centric bias. Methodologically, the strong reliance on technology acceptance models ensures coherence but restricts theoretical innovation, reinforcing linear and context-agnostic adoption narratives.

In sum, Cluster 4 defines a well-bounded, sector-specific research front that advances understanding of AI-mediated service transformation, yet its broader KM–AI contribution is constrained by cultural bias, unresolved theoretical tensions between experiential and efficiency paradigms, and a systematic neglect of labour-related implications.

5.4 Theoretical Contributions and Strategic Implications

Our bibliometric analysis (Q = 0.77; silhouette scores > 0.90) identifies two cross-cutting tensions shaping KM–AI research since the 2020–2023 tipping period: augmentation vs. transformation logics and optimisation vs. resilience–sustainability paradigms. A notable, non-intuitive finding is that resilience-oriented work increasingly emerges within optimisation-focused clusters (Clusters 1 and 3), indicating potential synergies rather than strict opposition.

Theoretical advances.

Three key empirical patterns underpin our theoretical contributions:

- Algorithmic transparency — prominent in Cluster 2 (AI-enabled decision support), where citation burst analysis highlights foundational works on auditability and explainability — directly challenges the KBV assumption that codified knowledge is universally transferable.
- Inter-organisational power asymmetry — most visible in Cluster 3 (Data governance and knowledge flows), where high betweenness centrality nodes represent dominant platform actors — constrains the diffusion of AI-enabled knowledge capabilities.
- Unexpected theory convergence — co-citation mapping reveals paradox theory connecting with optimisation-focused literature, forming a latent bridge for integrating competing logics within KM–AI frameworks.

These findings collectively support refining the KBV to incorporate context-dependent governance mechanisms and shifting from contingency-only models toward paradox-oriented perspectives, recognising that firms often sustain opposing logics simultaneously.

Strategic implications.

Stable environments: Augmentation paths with explainable decision aids can deliver efficiency gains while preserving human oversight.

Turbulent contexts: Transformation paths centred on autonomous learning systems are viable when supported by mechanisms for bias monitoring and tacit knowledge transfer.

Supply chains: Phased strategies balancing cost-efficiency with disruption-readiness are promising, especially when transparent data governance reduces power asymmetry.

Policy and education.

Sector-specific AI governance, tested in regulatory sandboxes, and curricula addressing augmentation/transformation and optimisation/resilience as complementary rather than opposing logics can accelerate responsible AI adoption.

Grounded in quantitative network evidence, these contributions move beyond descriptive mapping to offer an empirically anchored, theoretically integrated, and practice-relevant framework for advancing KM–AI research.

Table 7: Clusters analysis

Cluster Label	Size	Silhouette	Mean year	Most citing articles	Most cited authors (in the cluster)
				Reference	Reference
Cluster 1: Strategic Integration of AI in Human Resource and Organizational Management	119	0.815	2019	Chowdhury, S (2023-JAN) Unlocking the value of artificial intelligence in human resource management through ai capability framework. HUMAN RESOURCE MANAGEMENT REVIEW DOI 10.1016/j.hrmr.2022.100899 Lee, MCM (2023-JAN) The implementation of artificial intelligence in organizations: a systematic literature review. INFORMATION & MANAGEMENT DOI 10.1016/j.im.2023.103816 Chowdhury, S (2022-JAN) Ai-employee collaboration and business performance: integrating knowledge-based view, socio-technical systems and organisationalsocialisation framework. JOURNAL OF BUSINESS RESEARCH, V144, P19 DOI	Davenport T (2020) J ACAD MARKET SCI V48 P24 2.5 10.1007/s11747-019-00696-0 Dwivedi YK (2021) INT J INFORM MANAGE V57 P0 2.5 10.1016/j.ijinfomgt.2019.08.002 Kaplan A (2019) BUS HORIZONS V62 P15 3.5 10.1016/j.bushor.2018.08.004 Mikalef P (2021) INFORM MANAGE-AMSTER V58 P0 2.5 10.1016/j.im.2021.103434 Duan YQ 2019 INT J INFORM MANAGE V48 P63 3.5 10.1016/j.ijinfomgt.2019.01.021

Cluster Label	Size	Silhouette	Mean year	Most citing articles	Most cited authors (in the cluster)
				10.1016/j.jbusres.2022.01.069 Malik, A (2023-JAN) Artificial intelligence (ai)-assisted hrm: towards an extended strategic framework. HUMAN RESOURCE MANAGEMENT REVIEW DOI 10.1016/j.hrmr.2022.100940	
Cluster 2: Algorithmic HRM and Human–AI Collaboration in Strategic Management	113	0.822	2020	Kim, S (2025-JAN) Strategic human resource management in the era of algorithmic technologies: key insights and future research agenda. HUMAN RESOURCE MANAGEMENT, V64, P18 DOI 10.1002/hrm.22268 Chowdhury, S (2023-JAN) Unlocking the value of artificial intelligence in human resource management through ai capability framework. HUMAN RESOURCE MANAGEMENT REVIEW DOI 10.1016/j.hrmr.2022.100899 Malik, A (2023-JAN) Artificial intelligence (ai)-assisted hrm: towards an extended strategic framework. HUMAN RESOURCE MANAGEMENT REVIEW DOI 10.1016/j.hrmr.2022.100940 Chowdhury, S (2022-JAN) Ai-employee collaboration and business performance: integrating knowledge-based view, socio-technical systems and organisationalsocialisation framework. JOURNAL OF BUSINESS RESEARCH, V144, P19 DOI 10.1016/j.jbusres.2022.01.069 Prikshat, V (2023-JAN) Ai-augmented hrm: literature review and a proposed multilevel framework for future research. TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE DOI 10.1016/j.techfore.2023.122645	Raisch S (2021) ACAD MANAGE REV V46 P192 2.5 10.5465/amr.2018.0072 Glikson E (2020) ACAD MANAG ANN V14 P627 3.5 10.5465/annals.2018.0057 Tambe P (2019) CALIF MANAGE REV V61 P15 3.5 10.1177/0008125619867910 Vrontis D (2022) Vrontis D 2022 INT J HUM RESOUR MAN V33 P1237 1.5 10.1080/09585192.2020.1871398 Jarrahi MH (2018) BUS HORIZONS V61 P577 3.5 10.1016/j.bushor.2018.03.007

Cluster Label	Size	Silhouette	Mean year	Most citing articles	Most cited authors (in the cluster)
Cluster 3: AI Adoption and Knowledge-Driven Innovation in Smart Supply Chains	86	0.803	2021	Shahzadi, G (2024-JAN) Ai adoption in supply chain management: a systematic literature review. JOURNAL OF MANUFACTURING TECHNOLOGY MANAGEMENT, V35, P26 DOI 10.1108/JMTM-09-2023-0431 Abdulmuhsin, AA (2024-JAN) Impact of artificial intelligence and knowledge management on proactive green innovation: the moderating role of trust and sustainability. ASIA-PACIFIC JOURNAL OF BUSINESS ADMINISTRATION DOI 10.1108/APJBA-05-2024-0301 Jorzik, P (2024-JAN) Ai-driven business model innovation: a systematic review and research agenda. JOURNAL OF BUSINESS RESEARCH DOI 10.1016/j.jbusres.2024.114764 Di, vaio A (2024-JAN) Digitalization and artificial knowledge for accountability in scm: a systematic literature review. JOURNAL OF ENTERPRISE INFORMATION MANAGEMENT, V37, P67 DOI 10.1108/JEIM-08-2022-0275	Hair JF (2019) EUR BUS REV V31 P2 4.5 10.1108/EBR-11-2018-0203 Dubey R (2020) INT J PROD ECON V226 P0 3.5 10.1016/j.ijpe.2019.107599 Bag S (2021) Bag S 2021 TECHNOL FORECAST SOC V163 P0 2.5 10.1016/j.techfore.2020.120420 Toorajipour R (2021) J BUS RES V122 P502 2.5 10.1016/j.jbusres.2020.09.009 Di Vaio A (2020) Di Vaio A 2020 J BUS RES V121 P283 2.5 10.1016/j.jbusres.2020.08.019
Cluster 4: AI and Service Robots in Hospitality and Tourism Management	52	0.927	2018	Chi, OH (2020-JAN) Artificially intelligent device use in service delivery: a systematic review, synthesis, and research agenda. JOURNAL OF HOSPITALITY MARKETING & MANAGEMENT, V29, P30 DOI 10.1080/19368623.2020.1721394 Mccartney, G (2020-JAN) Rise of the machines: towards a conceptual service-robot research framework for the hospitality and tourism industry. INTERNATIONAL JOURNAL OF CONTEMPORARY HOSPITALITY MANAGEMENT, V13, P17 DOI 10.1108/IJCHM-05-2020-0450 Zhu, DH (2020-JAN) Robot with humanoid hands cooks food better? effect of robotic chef anthropomorphism on food quality prediction. INTERNATIONAL JOURNAL OF CONTEMPORARY HOSPITALITY MANAGEMENT, V32, P17 DOI 10.1108/IJCHM-10-2019-0904 Belanche, D (2020-JAN) Service robot implementation: a theoretical framework and research agenda. SERVICE INDUSTRIES JOURNAL, V40, P23	Lemon KN (2016) J MARKETING V80 P69 4.5 10.1509/jm.15.0420 Huang MH (2018) J SERV RES-US V21 P155 3.5 10.1177/1094670517752459 Wirtz J (2018) SERV MANAGE V29 P907 2.5 10.1108/JOSM-04-2018-0119 Li J (2019) Li J 2019 TOURISM MANAGE V73 P172 3.5 10.1016/j.tourman.2019.02.006 Gursoy D (2019) INT J INFORM MANAGE V49 P157 4.5 10.1016/j.ijinfomgt.2019.03.008

6. Research Frontiers and Major Milestones

In a field marked by rapid technological change and increasing cross-disciplinary integration, identifying turning points and emerging trajectories is essential to understanding the evolution of KM and AI research. To this end, we employed Kleinberg's burst detection algorithm (Kleinberg, 2003) to identify references that experienced a sudden and intense increase in citations over a defined time span. These citation bursts signal works that have catalyzed academic attention and, consequently, represent significant milestones in the field's development.

The analysis uncovered ten references with the highest burst strengths (see Table 8), which together delineate key research frontiers and help illuminate the shifting intellectual landscape of the KM–AI domain. These bursts are distributed across multiple clusters, highlighting the field's thematic diversification. Three particularly influential contributions are examined below.

The first and strongest citation burst is associated with Huang and Rust (2018), published in *Journal of Service Research* and belonging to Cluster 4 (AI in hospitality and service contexts). With a burst strength of 17.26 lasting from 2020 to 2023, this work has played a central role in conceptualizing how AI transforms service encounters. It introduces a hierarchical model of AI applications in service settings and outlines the evolution from task automation to full cognitive service delivery. Its influence is especially pronounced in studies addressing service robotics, customer experience, and automation strategies in hospitality and tourism.

The second notable burst corresponds to Syam and Sharma (2018) in Industrial Marketing Management (Cluster 1). This study discusses the integration of AI and machine learning into strategic marketing decisions and organizational design. Though rooted in marketing, its broader organizational implications have significantly influenced work on AI-enabled strategic HRM, particularly in the development of capability frameworks and workforce transformation strategies. With a burst strength of 9.33 (2019–2022), it reflects growing interest in how AI reshapes managerial decision-making and resource allocation in knowledge-driven contexts.

A third turning point is identified in Jarrahi (2018), published in *Business Horizons* and assigned to Cluster 2. The article conceptualizes human–AI symbiosis in organizational decision-making, arguing for the complementary strengths of humans and intelligent systems. With a burst period from 2020 to 2022 and a strength of 7.80, the paper has become foundational for research on algorithmic management, hybrid decision-making models, and the ethical governance of AI-infused processes.

These burst references—together with others listed in Table 8—reveal a research trajectory that is increasingly oriented toward strategic implementation, organizational redesign, and ethical oversight. Their timing also reflects key inflection points, especially between 2020 and 2023, coinciding with a broader acceleration of digital transformation in organizational and societal contexts due to external pressures such as the COVID-19 pandemic.

In sum, the citation burst analysis not only validates the thematic clusters identified through co-citation mapping but also sharpens our understanding of the temporal dynamics and research momentum within the KM–AI field. These high-impact studies continue to shape scholarly discourse and will likely inform the next generation of research addressing AI's role in knowledge-intensive, service-oriented, and digitally transformed organizational environments.

Table 8: Top 10 burst references

Authors	Cluster	Year	strength	Begin	End	1996-2022
Huang MH, 2018	4	2011	31.23	**2013**	2016	
Syam N, 2018	1	2009	17.66	**2012**	2014	
Wirtz J, 2018	4	2018	14.41	**2020**	2022	
Jarrahi MH, 2018	2	2009	13.56	**2011**	2014	
Davenport TH, 2018	1	2018	11.51	**2020**	2022	
Von Krogh G, 2018	2	2007	9.54	**2009**	2012	
Hair JF, 2017	2	2011	9.35	**2012**	2016	

Authors	Cluster	Year	strength	Begin	End	1996-2022
Dwivedi YK, 2021	1	2016	8.47	**2019**	2022	
Makridakis S, 2017	2	2006	8.36	**2007**	2011	
Kumar V, 2019	1	2012	8.21	**2014**	2016	

7. Conclusion

The intersection of Knowledge Management and Artificial Intelligence has emerged as a strategically significant research frontier, reflecting accelerated technological change, shifting organizational paradigms, and interdisciplinary convergence. This study provides a comprehensive scientometric analysis of 1,650 publications indexed in the Web of Science Core Collection between 1975 and 2024, combining performance metrics, co-authorship and co-citation mapping, and keyword co-occurrence analysis in CiteSpace. These methods allowed us to chart the intellectual evolution, current structure, and emerging trends within the KM–AI research landscape.

Our findings reveal that the field has moved beyond its formative phase, exhibiting substantial growth since 2017 with increasing scholarly impact. This growth is evidenced by high citation rates and cohesive co-authorship communities. The intellectual structure centers on four dominant thematic clusters: AI-enhanced strategic human resource management, algorithmic HRM and human–AI collaboration, AI adoption in knowledge-driven supply chains, and AI-based service delivery in hospitality and tourism. These clusters reflect both theoretical diversification and application-oriented evolution.

The burst analysis revealed recent milestone publications that catalyzed intellectual shifts between 2020 and 2023. However, despite this growing maturity, the field faces persistent challenges including fragmentation, limited international collaboration, and conceptual dispersion across disciplines. These challenges directly inform our recommendations for future research directions. For example, longitudinal multi-tier case studies could test how algorithmic transparency moderates supply chain resilience, while large-scale audit protocols might quantify power asymmetry effects in AI-driven HR analytics.

Methodological note. This study relies on a scientometric approach using CiteSpace for network mapping and bibliometric indicators to capture the structural and dynamic aspects of the field. This methodological choice enables systematic, replicable insights but also imposes boundaries shaped by database coverage and citation-based metrics.

Limitations. The analysis is based exclusively on the Web of Science Core Collection, which—while offering high-quality, peer-reviewed sources—excludes relevant work indexed in other databases such as Scopus, IEEE Xplore, and Google Scholar. Grey literature, industry reports, and non-English publications were also excluded, potentially omitting valuable practitioner-oriented insights and non-Western perspectives.

Implications for stakeholders.

- Scholars: The mapped intellectual structure and identified gaps offer a basis for theory development that integrates algorithmic capabilities with human-centered knowledge processes, encouraging cross-disciplinary and longitudinal research designs.
- Practitioners: Sector-specific insights, particularly in HRM, supply chains, and service industries, provide actionable guidance for responsible AI deployment that aligns with organizational knowledge strategies.
- Policymakers: Findings highlight the need for regulatory frameworks that promote algorithmic transparency, mitigate power asymmetries, and foster international collaboration to ensure equitable AI benefits.

Given these findings, future studies should prioritize developing integrative theoretical frameworks that transcend disciplinary boundaries and bridge the gap between algorithmic capability and human-centered knowledge processes. The observed fragmentation necessitates greater emphasis on global and institutional collaboration to support knowledge diffusion and methodological innovation, and to tailor AI applications to specific knowledge-intensive contexts.

This systematic mapping of the KM–AI research domain consolidates prior work and provides a foundation for future inquiry. The findings support scholars, practitioners, and policymakers in navigating this rapidly evolving field and contribute to designing more intelligent, adaptive, and inclusive knowledge systems. By introducing

algorithmic-transparency and power-asymmetry contingencies into the Knowledge-Based View, this study moves beyond descriptive mapping. Coupled with paradox-aware principles for practice, it sets a forward agenda for responsible, AI-enabled knowledge systems.

AI Statement: The author confirms that no generative artificial intelligence was used in the writing of this manuscript or in the creation of images, graphics, tables, or their corresponding captions.

Ethics Statement: This study does not require Institutional Review Board (IRB) approval, as it involves only the analysis of publicly available bibliometric data from the Web of Science Core Collection. No human subjects were directly involved in the research. All analyzed publications are accessible through legitimate academic databases, and no personal or sensitive information was collected or processed. The study adheres to standard practices in bibliometric and scientometric research, which typically fall outside the scope of human subjects research regulations. All data handling and analysis procedures followed established ethical guidelines for secondary data research.

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The Role of Shared Information Systems Knowledge, Information Systems Resources, and Information System Function Performance

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Abstract: Understanding the role of moderating variables is important. Researchers, academicians, and practitioners can see what is happening between two variables and find ways of addressing the changes. Promoters of the resource-based view theory assert that organizations possess heterogeneous resources with unique strategic characteristics that make them competitive. A shared understanding is required for organizations to control the resources. This paper seeks to establish the moderating role of information systems resources on the relationship between shared information systems knowledge and information system function performance. The study used interdisciplinary theories and adopted descriptive, exploratory, and cross-sectional research designs. We used data from 42 public and private universities in Kenya. Members of each university's Top management team and the IT head took part in the study. The data was modeled and analyzed using the partial least squares structural equation modeling technique. The findings of the study revealed that information system resources have a direct and significant effect on information system function performance (β= 0.820), (t=13.904), and p-value (0.000). However, shared IS knowledge has an insignificant effect on information system function performance (β= 0.025), (t = 0.336), and p-value (0.369). The findings suggest that there may be other factors influencing the relationship between shared IS knowledge and IS function performance, as IS resources do not show a moderating effect. The study had limitations. First, the study sample included only a few university strategic leaders. A higher number of strategic leaders in the sample may provide a better representative sample of university leaders. Second, other factors, like culture, can influence the level of information sharing. Finally, the study suggests future longitudinal research to test if there are other factors and mechanisms that combine with shared IS knowledge to affect IS function performance in organizations. The findings of the study provide useful information about shared IS knowledge, IS resources and how they interact to impact IS function performance. Understanding the moderating effect of IS resources towards IS function performance and how it can help university IS strategic leaders improve the overall performance of information systems is important. Also, these findings may be useful for information technology or systems service managers and industry practitioners in appreciating practices that bring positive contributions to their information systems. The research findings are useful to policymakers and practitioners in helping them to gain better insights and understanding of the factors and changes to better exploit organizational IS resources. The findings will also help them understand what structures and mechanisms to use for a better understanding of shared IS knowledge to fully exploit resources for Optimal IS function performance. The study's findings will provide organizational leaders with the opportunity to share knowledge and understanding, as well as to develop cultural change structures for better utilization of IS resources to enhance performance.

Keywords: IS function performance, IS resources, Top management team, IS executive, IS leadership, Shared IS knowledge, Moderation

1. Introduction

In the contemporary fast-moving and vibrant business environment, Information Systems (IS) and Information Technology (IT) are indispensable components for organizational development and existence (Kamariotou & Kitsios, 2019). The promoters of the resource base view (RBV) theory assert that organizations possess heterogeneous resources that they can use to conceive, choose, and implement organizational strategies. The adopted strategies contribute to and account for differences in an organization's performance. To sustain competitiveness, organizations need to gain capabilities and competencies to redesign resources that are valuable, rare, inimitable, non-substitutable, durable, appropriable, and mobile (Amit & Schoemaker, 1993). As such, organizations have continued to make enormous investments in information systems (IS) (Karahanna, 2006). However, these investments do not necessarily lead to sustained advantage (Piccoli, 2005). The way organizations manage their investments to develop unique IS resources and skill sets ultimately determines an organization's overall success performance. The literature has indicated that most upper-echelon leaders lack

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business and technology skills (Fang Ding, 2014). This has prompted universities' strategic leadership to seek good business and technology knowledge and understanding to effectively and strategically exploit IS resources. Research has also shown that Information Technology (IT) capabilities are important factors that differentiate successful organizations from their competitors (Jude, 2022). The purpose of this paper, therefore, is to establish whether IS resources have a moderation relationship between shared information systems knowledge and IS function performance.

Broadbent (2005) categorized IS resources in terms of human, technological, and relationships. Resources are existing stocks that are possessed or controlled by the organization and include physical and intangible assets like knowledge, experience, and culture, which are rooted in the organization (Anggraeni, 2014). Therefore, systems and technologies held or existing in the university are essential sets of resources, including the IT infrastructure, knowledge, and skills residing in employees. These are the resources available for exploitation by the management of organizations to plan, control, budget, prioritize, and innovatively use to have a positive IS function performance (Anggraeni, 2014). Therefore, universities can use their existing IS resources and capabilities to compete and enhance IS function performance (Bhatt, 2009). This calls for the university's management to gain a shared understanding of how to exploit and align their resources for competitiveness and sustained performance. The study argues that knowledge sharing results in a better understanding of how to exploit an organization's resources, determine their requirements, and also identify potential limitations. This could encourage executives to transfer resources to other business areas that are deficient or likely to experience change (Talion & Pinsonneault, 2011).

Despite the belief that information technology (IT) is necessary for an organization's survival and growth, scholars are still struggling to unravel the factors that connect IT with organizational performance. Anecdotal evidence and case studies have shown that effective use of IS resources significantly discriminates successful organizations from less successful ones (Jude, 2022). The study argues that having a shared understanding will enable the university's strategic team to understand, utilize, and exploit IS resources, which will eventually lead to superior IS function performance. The study found a positive and significant relationship between IS resources and IS function performance, which is consistent with prior findings. While Bharadwaj (2000) claims a positive relationship between IS resources and organizational performance, others have doubted the relationship, arguing that IS resources only affect performance when they are designed to build distinctive complementarities with other organizational resources. The perspectives outlined above call for continual debate and research. Shared IS knowledge as an intangible asset needs to be developed in universities. Such knowledge is postulated to strengthen and complement strategic team IS skills and capabilities, giving the team a strategic mindset to know how and what mechanisms to adopt to exploit IS resources productively. How IS resources and other complementaries interact to affect IS function performance still calls for further empirical work. Therefore the study highlights the importance of organizations' senior leaders having an understanding of IS resources, practices, and culture, and how they can adopt a social approach to exploit shared IS knowledge. This is deemed to give them extra intelligence on how to exploit IS resources. The study envisions that when organizations' senior leadership attains high levels of shared IS knowledge, they comprehend how to use, re-engineer, reconfigure, and remix their IS resources and systems to drive superior IS function performance (Talion & Pinsonneault, 2011).

2. Literature Review

2.1 Theories Underpinning the Study

The reinforcing theories of this study include: Resource-Based View (RBV), Dynamic Capabilities Theory (DCT), and the Social Capital Theory. Resource-based theory is an influential theory in IS stemming from the works of Edith Penrose's (1959) theory of organizational growth. The theory postulates that organizations possess resources that are heterogeneous resources that they can use to plan, select, and implement organizations' strategies. The strategies contribute to and explain why there are differences in organizational performance. Therefore, organizational performance is based on its ability to exploit internal and external resources. DCT advanced by Bourdieu (1983) posits that an organization's competitiveness is linked to its ability to demolish existing IS resources and build a fresh remix of new operational capabilities to attain high performance in volatile business environments, focusing on its capabilities (Gizawi, 2014). The study places prominence on building management IS capabilities and difficult to duplicate blends of organizational resources such as culture, functional and technological skills, among others (Helfat & Martin, 2015). Universities need to apply existing dynamic capabilities through mechanisms and structures that support collaborations, partnerships and relationships to rebuild IS resources, skills, and re-engineer processes to enhance their performance outputs. In

the same realm, SCT theory claims that social capital has existed ever since small societies existed and people intermingled with expectations to exchange and trust one another (Larsen, 2014). Therefore, social capital occurs in associations among the actors and is fruitful, just like physical and human capital in facilitating productivity. In this study, social capital exists between the university strategic team, signifying that one's connections can help them (Minh, 2020) through existing culture and the sharing of knowledge. When explicit knowledge exchange happens as a resource, knowledge integration occurs within the university's strategic teams, which strengthens understanding and exploitation of resources. Strategic leadership needs to be given a chance to interact formally or informally in events or forums, such as training, workshops, and seminars (Kwon, 2002).

2.2 Information Systems Resources

Organizations continue to make investments in information systems, which are strategic resources and deemed enablers for sustainability and performance. However, these investments do not automatically provide any sustained advantage, but how organizations control their investments to create unique IS resources and skill sets that determine an organization's overall performance. Research has also shown that Information Technology (IT) capability is an important factor that differentiates successful organizations from their competitors (Jude, 2022). However, investments in IT resources are easy to duplicate. Broadbent (2005) categorizes these resources in terms of human, technological, and relationship resources. Resources are existing stocks that are possessed or controlled by the organization and include physical and intangible assets like knowledge, experience, and culture, which are rooted in an organization (Anggraeni, 2014). Systems and technologies held or existing in the university are essential sets of resources and include the IT infrastructure and the knowledge and skills residing in employees. These are the resources available for exploitation. Further, the literature stresses the importance of intangible resources where IS human capital, IT infrastructure, and relationship aspects acknowledge a positive association between resources and IS function (Anggraeni, 2014). Therefore, universities can use their existing IS resources and capabilities to compete and enhance IS performance (Bhatt, 2009). Resource-based view theory argues the existence of a positive relationship between resource alignment and performance. Key resources in organizations must be obtained, retooled and deployed in order to implement changes in IS to employ business strategies strategically.

2.3 Shared Information Systems Knowledge

In IS, knowledge is the "awareness and understanding of a set of information and the ways it supports specific tasks or reaches a decision" (Stair & Reynolds, 2006, p.6). It involves structures that exist to facilitate the sharing and exchange of knowledge. IS literature identifies TMT meetings, team interactions, and CEO-ISE distance as key for knowledge sharing (Feeny et al., 1992, Watson 2005). High levels of business and IS knowledge in ISE and TMT foster a shared understanding that boosts organizational capabilities (Armstrong & Sambamurthy 1999). The Upper Echelon theory (UET) provides theoretical viewpoints relating to TMT and the strategic choices made in terms of business and IS strategies as a likeness of their intellectual bases.

Formal and informal meetings, seminars, workshops, and other forums facilitate knowledge integration and understanding between the strategic teams (Anggraeni, 2014). Empirical evidence by (Boynton et al., 1994) confirms that a high frequency of interactions between strategic teams positively contributes to IS integration, appreciation, and understanding. Therefore, when strategic teams attain high levels of IS strategic knowledge, they support and associate with IS initiatives and appreciate their contribution towards IS value creation and organizational performance.

2.4 Information System Function Performance

The IS function is the all individuals, groups, or departments in an organization with daily responsibility for IS-related activities (Rajesri, 2008). Performance is the result of all the organization's work processes and activities and how well the goals or capabilities are achieved to meet stakeholders' needs and continued existence (Abong'o, 2015). The importance of measuring IS performance is demonstrated by the references to various IS "issue" studies and approval by yearly popular magazines such as "ComputerWorld Premier 100", among others, that utilize proxy metrics to measure the IS function performance (Niederman, 1991). Chang, (2005) argues that though there exists ways and instruments to measure definite information aspects, such as data center, efficiency, and data quality, characteristically these measures cannot be used in any express way as a basis for determining information system function (ISF) overall performance. Initial performance evaluation models aimed at achieving efficiency and addressing operational problems. Quantitative measures such as turnaround time, and cost-saving, among others, fail to evaluate the 'soft' benefits such as service performance, and

improved decision-making among others (Chang & William, 2005). Because of its criticality and lack of pragmatic measures, multiple and diverse perspectives from stakeholders exist, making performance assessment difficult (Weiss, 2011).

Researchers have developed and used various models, such as Pitt and Watson (1995), Seddon (1997), and Heo & Han (2003) to measure IS performance (Chang & King 2005). Though the constructs used are significant, they fail to represent the overall performance of the IS function (Chang & King, 2005). To guarantee the suitability of the model at the IS functional level, this study used guidelines developed by Cameron and Whetton (Cameron, 1983). Several IS researchers have used the procedures to explain conceptual developments to examine IS functional effectiveness (Benbasat Moore, 1991). In this study, IS function performance is assessed by following Cameron's guidelines by taking the universities' top-level IS users' perceptions as the primary users and their ability to apply IS products and services.

2.5 IS Resources, Shared IS Knowledge, and IS Function Performance

IT assets of an organization are its core infrastructure and form a shared information delivery base (Bharadwaj, 2000). This defines the business functionality in terms of its reach and range (Keen, 1991). Usually, having a non-integrated IT infrastructure characterized by system incompatibilities may restrict an organization's business choices. However, creating an integrated IT infrastructure requires considerable time and expertise. As organizations create and develop IT infrastructure that links users, suppliers, and customers, expertise is required. The expertise develops skills, knowledge, and procedures that define the use, distribution, and management of IT facilities and support services (Ross et al. 1996). However, even though the infrastructure components are commodity-like, integrating them to develop and tailoring them to the organization's strategic needs is complex and poorly understood (Weill and Broadbent, 1998).

Organizations must learn how to redesign their products and services in a manner that exploits their infrastructure capabilities. The study argues that management teams with shared understanding, IT knowledge, and good relationships significantly reduce the time and costs to build and deploy resources and systems (Weill and Broadbent, 1998). The theory proposes that resources and capabilities possessed by an organization positively contribute to its organizational performance. It argues that an organization's explicit resources and abilities that are uncommon and difficult to emulate or substitute are linked to performance (Barney, 1991). The resources have synergistic benefits that may accrue when integrated with technology (Keen, 1991). Intangible resources, such as knowledge, organizational culture, reputation, and environmental orientations, are key drivers to superior performance (Winter, 1987). They enable an organization to achieve superior capability benefits such as better customer services, improved product quality, and market responsiveness, among others, which are used in evaluating information systems (Brynjolfsson, 1997). Therefore, strategic information systems leadership needs to identify resources or competencies and assemble teams that work together to achieve organizational effectiveness and performance. Therefore, the study makes a proposition that IS resources have no significant moderating effects between shared IS knowledge and IS function performance.

3. Model Conceptualization

The study model was conceptualized and guided by research works from various scholars. From the literature, the study variable items were identified. Information systems (IS) leadership is viewed as a continuum that spans from IS project teams to global IS management (Karahanna and Watson, 2006), where the project team leadership approach is the driving instrument of IS success. Research findings by Worthen (2007) found that eighty-seven (87%) business leaders acknowledge the importance of IS resources to attain business strategies. However, organizations experience insufficient coordination of work, knowledge sharing, and IS use due to the business-IT gap (Mojca, 2011), where on average, only one in three senior managers has enough knowledge about the operations of IT/IS in their organizations (Mojca, 2011). Reich & Benbasat (2000) noted that intellectual and social aspects are the two dimensions used to explain business-IS alignment. Intellectual alignment results when business and IS plans exist that are superior and related, while social alignment arises when the IS and business executives understand each other's mission, objectives, and plans. Several studies have focused on the intellectual dimension, leaving the social dimension (Tan & Gallupe, 2006). The social dimension focuses on the relationships and shared understanding between businesses and IS executives who form part of the TMT.

Shared understanding is proposed as one of the significant factors needed to establish the social dimension (Reich & Benbasat, 2000). While the existing literature has emphasized the importance of good relationships between ISE and the TMT as a key driver for organizational performance, plenty of the research has been

subjective, failing to provide a strong theoretical foundation (Tan & Gallupe, 2006; Benbasat, 2000). The social mechanisms and how they nurture relationships have received little attention (Tan & Gallupe, 2006). This study takes the social dimension approach, and the items addressing each variable are discussed.

3.1 Shared IS Knowledge

Shared IS knowledge is the awareness and understanding of a set of information and how it can be used to support specific tasks or reach a decision (Stair, 2006, p.6). It involves structures that exist in an organization to facilitate the sharing and exchange of IS knowledge. The IS literature identifies structures such as shared language, involvement in TMT meetings, number of interactions between teams, the structural distance between the CEO and IS executive (Feeny et al., 1992, Watson, 2005), as well as formal and informal meetings (Anggraeni, 2014) as indicators that can facilitate the sharing of IS knowledge. These elements (IS shared language, ISE-TMT shared knowledge, and interaction structures, whether formal or informal) were conceptualized to form the shared IS knowledge construct. Several researchers acknowledge that the lack of a common vision and understanding between the TMT and information systems executives (ISE) regarding IS creates a barrier to strategic leadership and strategy alignment (Armstrong & Sambamurthy, 1999; Chan, 2002; Tan & Gallupe, 2006). Formal and informal meetings, seminars, workshops, and other forums facilitate knowledge integration and understanding between the strategic teams (Anggraeni, 2014). Other researchers have recommended collaborations, partnerships, and frequent interactions as some of the solutions to address such IS-business gaps, as they develop trusting relationships, improve organizational agility, and create synergistic relations between the strategic partners (Hickman & Akdere, 2017; Nevo & Wade, 2010).

3.2 IS Resources

Organizations continue to make huge investments in IS which are deemed to be enablers for sustainability and performance. However, these investments fail to automatically guarantee any continued advantage, but organizations control their investments to create unique IS resources and skill sets that define an organization's overall performance (Watson, 2005). Research has also revealed that information technology (IT) is a vital component that distinguishes successful organizations from their competitors (Jude, 2022). IS resources are categorized in terms of human, technological, and relationship resources (Broadbent, 2005). According to Anggraeni (2014), resources are the existing stocks that are possessed or controlled by the organization and include physical and intangible assets like knowledge, experience, and culture, which are rooted in the organization. Therefore, IS systems and technologies held or existing in the university are essential sets of resources available for exploitation. The study conceptualized the IT infrastructure, human resources, intangible resources such as synergy between the teams or employees, customer orientation (customer-centric), and quality as the items making the IS resources construct.

Further, the Resource Base View (RBV) notes that resources are existing stocks that are possessed or controlled by the organization and include physical and intangible assets like knowledge, experience, and culture, which are rooted in the organization (Anggraeni, 2014). From these perspectives, universities use their existing IS resources and capabilities to compete and enhance their IS performance (Bhatt, 2009), noting that knowledge sharing allows a better understanding of the organization's resource use, requirements, or potential limitations, and could encourage executives to transfer resources to other business areas that are deficient or are likely to experience change (Tailon and Pinsonneault, 2011).

3.3 IS Function Performance

The IS function is all individuals, groups, or departments in an organization responsible for daily IS-associated operations (Chang & King, 2005, Rajesri, 2008). The importance of measuring IS performance is evidenced by references to various IS "issue" studies and approval by many IS magazines such as "Insights and Computer World Premier 100 among others (Niederman, 1991). Performance is the final result of an organization's work processes and activities, and how well the goals or capabilities are achieved to meet stakeholders' needs and ensure their continued existence (Everlyin, 2015). Chang (2005) argues that though there exist ways and instruments to evaluate aspects of IS, such as data centers, efficiency, and quality, the measures cannot be used in any express way as a basis for determining the sources of overall performance. Due to its criticality and lack of pragmatic measures, multiple and diverse perspectives from stakeholders exist, making performance assessment difficult (Weiss, 2011). Several models for example, Pitt and Watson (1995), Seddon (1997), and Heo and Han (2003). The study adopted the input-output logic model suggested by Chang and William (2005) to evaluate IS performance in universities. The model shows that IS function uses resources such as hardware, software, and humans combined with managerial and technical capabilities to enhance IS function performance,

which further impacts business process effectiveness and organizational performance. The study, therefore, adopted the model developed by Chang and King 2005 to measure IS function performance and adopted the model instrument. The study adopted the instrument which identified the following three items, Service performance, Systems performance, and Effectiveness of information as the key indicators to measure IS function performance. In addition, the study was guided by guidelines developed by Cameron and Whetton (1983). These guidelines have been used by IS researchers to explain conceptual developments and examine IS functional effectiveness (Benbasat Moore, 1991). The indicators, of system performance assessed the quality characteristics of the systems experienced in the university, such as reliability, response time, and ease of use, among other characteristics, and the impact the systems have on the user's work. Information effectiveness evaluates the quality of information about the design, operation, use, and value it provides, and the information effects it has on the user's job, and service performance is assessed through the user's experience with the services provided by the University's IS function. IS knowledge gaps, limitations, and understanding are postulated to contribute to universities' inability to reap the benefits of IS poorly impacting their performance.

4. Methodology

4.1 Research Design

This study adopted a descriptive, exploratory, and cross-sectional research design. The motivation for using this design includes the ability to help researchers overcome shortcomings associated with a single strategy and makes it possible to combine the strengths associated with qualitative and quantitative approaches (Mingers, 2003). Further, as Johnson & Onwuegbuzie (2007) note mixed-method approach helps one to address a wide range of research questions in a more comprehensive way, as well as helps to boost the generalizability of the study findings (Venkatesh & Bala, 2013). One is also able to triangulate the findings to reach convergence and corroboration of the results (Agerfalk, 2013). The population for this study was public and private universities operating in Kenya.

4.1.1 Data collection process

The study used a survey method to collect both quantitative and qualitative data. An online structured questionnaire with a five-point Likert scale with items ranging from 1= "Strongly Disagree", 2= "Disagree", 3=Neutral", 4="Agree", 5 = "Strongly Agree" was prepared and used to collect the data. The questionnaires were administered using an online Google Form using official emails to the university's top management team. The study was undertaken for three months from September to December 2022. A pilot study with two universities (public and private) was carried out in August 2022. This ensured the accuracy of the questionnaires and also two experts in the area of information systems confirmed content validity, with minimal amendments done to address sequencing of the questions, clarity, and grammar. In addition, the respondents were able to express and give their views using open-ended questions about the strategic team's information systems capabilities, information system resources, and the performance of information system functions in universities. Questionnaires were administered to all public and private chartered universities in Kenya. Out of 76 chartered universities, 42 returned usable questionnaires, representing a 55.3% response rate, while 32 universities, representing 42.2%, did not respond, and all efforts to reach the key informants were fruitless. A sample of 42 respondents was considered appropriate for structural equation modeling (Hair et al., 2017) and a good representative of the population (Krejcie & Morgan, 1970).

4.1.2 Data preparation and processing

The study used MS Excel software to prepare and code the data. The data was later exported into Smart-PLS software version 4.0. The coded data file was prepared to ensure its structure and format conformed to PLS-SEM software data requirements before analysis. Data screening was also done to inspect data properties and normality (Byrne, 2013). To address missing data, the online survey questionnaire was designed in a way that made it impossible for the respondents to skip any question when filling in or to enter values outside the set scale range.

As a control measure, the questions were made mandatory to ensure the respondents answered all the questions. For those questionnaires that were delivered physically, through the drop-and-pick-up method, the researcher cross-checked for completeness to ensure they were filled out. In addition, PLS-SEM automatically checks for any missing data when the data file is loaded into Smart PLS software. Further, the study adhered to ethical considerations in social science research. Measures were taken and implemented to ensure the confidentiality and anonymity of both the respondents and the participating universities. Before administering

the questionnaires, an ethical clearance certificate was obtained from the University ethics committee. On the cover page of the research instrument, a section was included for the respondents to consent before continuing with the study.

4.1.3 Data description

The study data was prepared using Microsoft Excel, capturing the responses. The data was then converted into a CSV file and later imported into Smart PLS software. The dataset contained raw data for the specific latent variables (strategic information systems leaders, information system culture, shared IS knowledge, Information system resources, and information system function performance). A new project was created in SmartPLS and then the data was imported. The in-built features in SmartPLS software checked for essential data properties to ensure conformity. Data was collected from 76 chartered universities operating in Kenya. Structural Equation Modelling (SEM) using the partial least squares (PLS) method was later used to test the theoretical model, assess the structural model, and understand the direct and indirect effects of the variables.

4.1.4 Data characteristics

The study achieved a response rate of 55.27%, 64.30% of which were public universities, and 35.7% of which were private universities. About 78.6% of universities had fewer than 1000 employees, while 52.4% had fewer than 10000 student enrolments. Only 4.8% of the universities had over 40000 student enrolment. 76.2% of the universities had an IS strategic plan, and 71.4% had ICT steering or management boards to steer and manage IS initiatives. 35.7% of the respondents indicated they play the role of IS executive, and 64.3% play the role of TMT. In terms of IS executive gender, 79.7% were male and 20.3% were female, 79.7% of the university IS strategic team were in the age bracket between 30-49 years, while only 3.8% were above 61 years of age, with a majority of them (84.8%) having a masters degree and above in their education. 26.6% of the IS strategic team had worked for over 14 years. 87.3% of the IS strategic teams in universities have computer-related specializations, 44.3% had IT Director as their job title, and only 2.5% had CIO or IT head job titles respectively. 59.5% of the respondents were formal members of their university IS strategic team, while only 40.5% were informal members.

4.1.5 Data analysis process

The study used the Partial Least Squares structural equation modeling (PLS-SEM) method to analyze the data and to assess the research model. The technique was deemed flexible in handling the data requirements and relationship specifications, and can handle complex models (Sarstedt, 2019). Due to its emerging popularity, many researchers have acknowledged the technique, and it is being applied more frequently (Hair et al., 2019a; Hair et al., 2022a; Ringle et al., 2015; Sarstedt et al., 2020). PLS-SEM was chosen primarily in this research because of data characteristics, such as its ability to handle small sample sizes and its capability to handle non-normal data. (Hair et al., 2017; Hair et al., 2014a). In addition, the constructs in the study were reflectively modeled with direct and mediation hypothesized relationships (Richter et al., 2016). A two-step approach was used to assess the model, where the measurement and the structural models were evaluated. Measurement models with reflective indicators need to be assessed for construct reliability and validity, including convergent and discriminant validity as proposed by Hair et al. (2017). To assess the structural model, the key criteria used are the size, sign, and significance of the path coefficient, the R^2 values, and the effect size f^2 (Hair et al., 2017; Ali et al., 2018). The significance of the path coefficients was assessed using the bootstrapping technique with 10,000 subsamples with replacement as recommended by Hair et al. (2017). SmartPLS version 4.0 software was used for quantitative data analysis. The inbuilt procedure for Smart PLS was used to calculate mean values, standard deviations, skewness, and kurtosis, and to explore statistical relationships between the measurement items of each construct and among the constructs as recommended by (Ringle et al. 2015).

5. Results and Discussion

Findings

The sections that follow outline the findings of the study.

5.1 Moderation

Moderation defines a situation in which the relationship between two constructs is not constant but depends on the values of a third variable (moderator variable). The moderator variable can strengthen or weaken and even change the direction of the relationship among constructs in a model. Effects of the relationship between the two variables, nature of the impact of the predictor on the criterion vary according to the level or value of

the moderator (Holmbeck, 1997). The moderator specifies the conditions under which given effects occur and the conditions under which the direction or strength of the effect varies Baron and Kenny, 1986, pp. 1174. Figure 1 below presents the moderation effect conceptualization in the research.

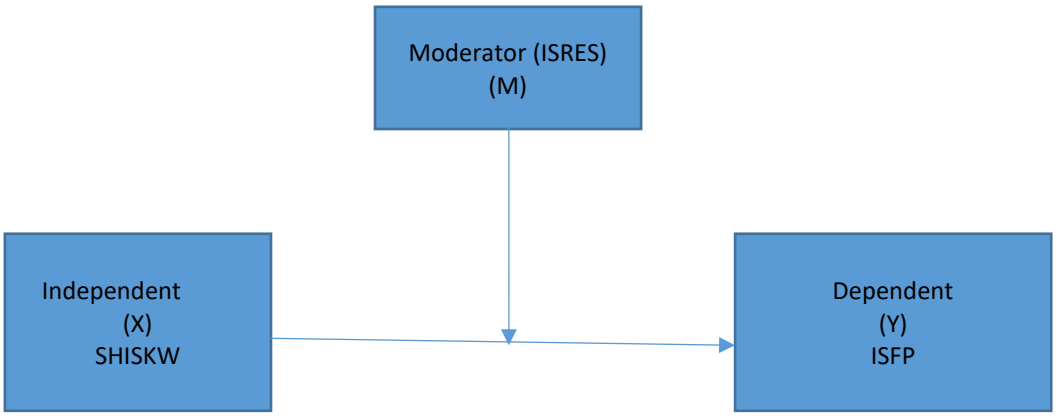

Figure 1: Moderation Model

Statistically, the visualization of the model differs from how it is conceptualized in the model graphically as an interaction term as depicted by X*M (Z) is included with an arrow point to the dependent variable. Figure 2 depicts how the model was represented with the interaction term.

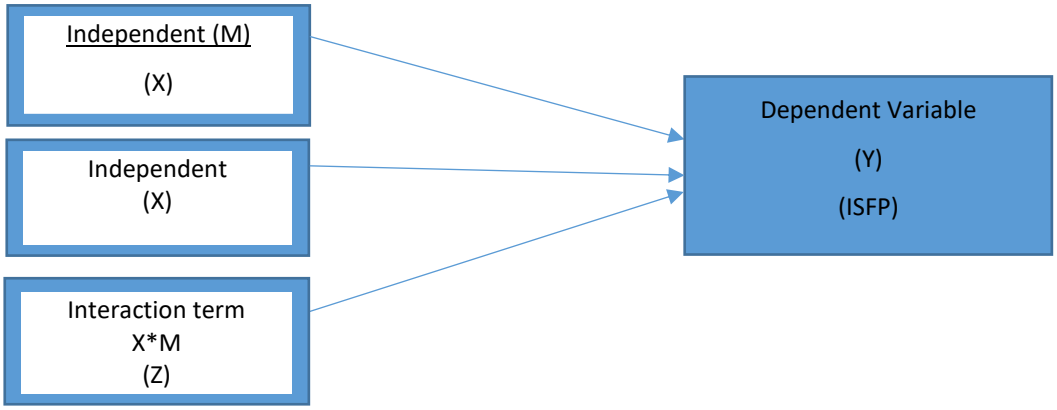

Figure 2: Depicts a statistical model representation-Interaction Term

5.2 Approaches of Models Assessment

There are many approaches that researchers employ to examine the interaction effect of the moderating variable. Common approaches include; Product-Indicator Approach as advocated by (Chin, Marcolin & Newsted, 1996; 2003), Two-Stage Approach by (Henseler et al. 2012, Chin et al., 2003) and orthogonalizing Approach by (Henseler & Chin, 2010). The study hypothesized one model relationship ($H0_n$), that information system resources (ISRES) have no moderating effects on the relationship between the independent variable (SHISKW) and the dependent variable (ISFP). The researchers used the two-stage approach as guided by (Henseler et al. 2012; Chin et al., 2003) to moderate the effect of ISRES on the relationship between SHISKW and ISFP. In stage one, main effect model was run to get the latent variable scores for Y1, Y2 and M i.e. VLS (Y1), VLS (Y2) and LVS (M). The Latent variable scores of Y1 and M were then multiplied to form the single item which is used to measure the interaction term (Y1.M) in stage two. The latent variables Y1, Y2 and M are each then measured using the single item of the latent score obtained in stage one. One advantage of using a two-stage approach is that it has a higher power and is able to detect a significant interaction. In addition, it supports small sample sizes. Figure 3 shows a basic moderation model as conceptualized in the study. The main effects model was drawn using smart PLS-SEM software, as depicted in Figure 3 below.

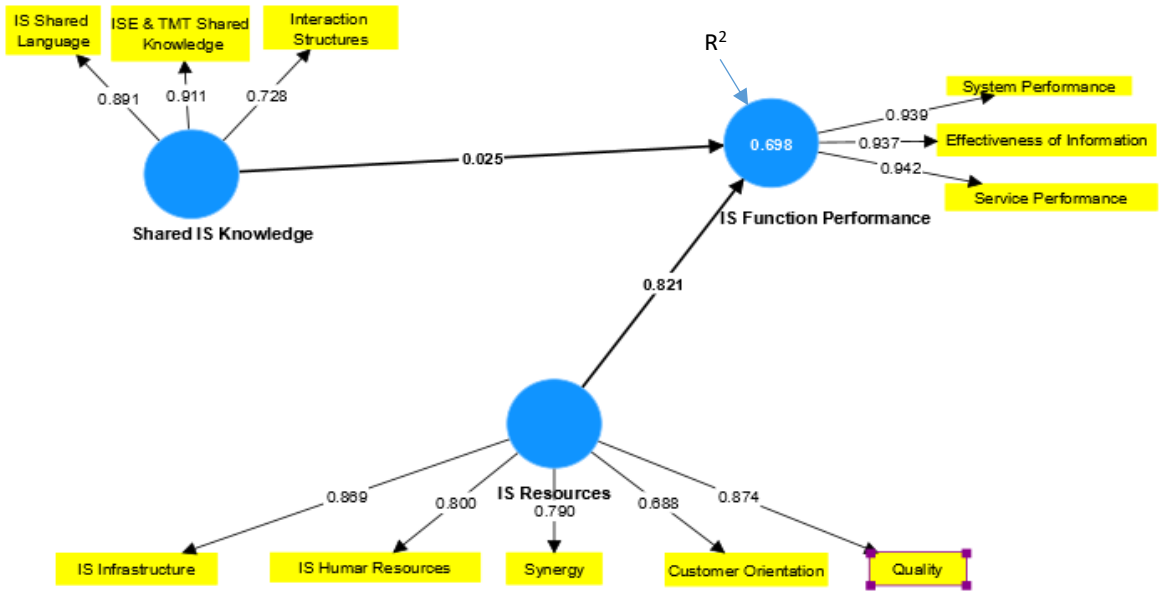

Figure 3: Main effect Model

5.3 Assessment of the Measurement Model

We used the (PLS-SEM) two-step approach to assess the model, evaluating both the measurement and structural models. Measurement models with reflective indicators need to be assessed for construct reliability and validity, including convergent and discriminant validity, as proposed by Hair et al. (2017). Indicator/item reliability, Internal Consistency reliability, convergent validity, and discriminant validity were used to evaluate the reflective measurement model. From the results of the analysis, all were above the recommended threshold of 0.7, showing good reliability. The internal consistency was based on Cronbach's alpha score, which estimates observed correlations among and within variables (Hair et al., 2017). Hair et al. (2017) recommend the use of composite reliability as the alpha score reacts to the number of items in the scale and often underestimates the internal consistency reliability. The reliability based on composite scores in the study was as follows: IS resources 0.813, shared IS knowledge 0.801, and IS function performance 0.933. All surpassed the minimum criteria of 0.7 as shown in Table 1.

Table 1: Construct internal consistency and reliability

Constructs	Alpha	CR	AVE
IS Resources	0.813	0.877	0.642
Shared IS knowledge	0.801	0.883	0.718
IS Function Performance	0.933	0.957	0.882

5.4 Convergent Validity

Convergent validity is the degree to which observed variables correlate within a construct (Wong, 2013). The Average Variance Extracted (AVE) of each latent variable was assessed to verify convergent validity. Convergent Validity is confirmed when AVE values are greater than the acceptable threshold of 0.5 (Wong, 2013; Fornell & Larcker, 1981). Average Variance Extracted (AVE) was used to assess convergent validity. When AVE values are greater than the acceptable threshold of 0.5 (Fornell & Larcker, 1981), convergence is usually confirmed. The results of the analysis showed that constructs' AVE values ranged from 0.642 to 0.882, pointing to good acceptable levels compared to the minimum acceptable threshold value of 0.50.

5.5 Discriminant Validity

Discriminant validity measures the extent to which a construct is empirically distinct from other constructs in the structural model. There are three common methods used to assess discriminant validity. This includes the Fornell & Larcker criterion (1981), Heterotrait-monotrait (HTMT) ratio, and cross-loadings.

This study adopted the Fornell & Larcker criterion (1981) to assess discriminant validity. The method compares the square root of the average variance extracted (AVE) with the correlation of latent constructs. In this approach, a latent construct should explain the variance of its indicators better rather than the variance of other latent constructs' indicators. Therefore, the square root of each construct's AVE should have a greater value than the correlations with other latent constructs. For example, the correlation value for IS resources is 0.642, therefore, its AVE value (0.801) should be higher than it correlates with other constructs. Table 2 presents the results. However, the AVE value of IS resources (0.801) is lower than it correlates with IS function performance (0.822). This signals issues of insufficient discriminant validity. From the study, IS function performance latent variables explain more variance in observed variables than IS resource latent variables. This could result from high correlations between the items, and the items could be measuring the same construct. As a result, one is not sure whether the observed variables are good measures of IS resources, and this reduces the researcher's confidence in the model (Bove, 2009). Further, this may weaken the findings of the research, and more research needs to be done.

Although Fornell and Larcker criterion (1981) is one of the common methods used to assess discriminant validity, recent research has shown that this metric is not suitable for assessing discriminant validity (Henseler, Ringle, and Sarstedt (2015) especially when the indicator loadings differ only slightly ie when indicator loadings are between 0.65 and 0.85, meaning there is a little distinction between the indicator loadings. Further, Farrell (2010) noted that Radomir & Mousescu (2019) reported that in empirical applications, the Fornell & Larcker criterion (1981) often fails to identify discriminant validity problems reliably and should be avoided. In addition, the conclusions made regarding relationships between constructs under investigation may be incorrect. For example, the strength of a relationship could be overestimated, or a relationship may be confirmed when in fact there is no real relationship (Farrell, 2010).

Researchers have suggested using different methods to address issues of lack of discriminant validity. One of the latest approaches recommended to address issues of discriminant validity with much higher levels of specificity is the HTMT criteria (Jörg Henseler, 2014). Other suggested approaches include: using a common method factor as it may help reduce variance inflation and reduce shared variance estimates between latent constructs and observed variables. One can also conduct further analysis using residual terms, partialling out shared variance (e.g., Little, Bovaird, and Widaman, 2006), or use other techniques such as tolerance analysis (Nunnally and Bernstein, 1994). One can also check the number of items representing each construct. In this case, IS resources had more than four items as per the minimum number recommended. Further, one can check for item statements to ensure they are easy to understand and have no overlaps to ensure they measure the same construct. Checking and removing items with cross-loadings less than 0.40 (Hair et al. 2014), however, care should be taken during item removal. Researchers need to be aware of the trade-off between the number of scale items (for face validity or construct coverage) and measurement scales that perform well and discriminate. To further confirm discriminant validity in the model, the cross-loadings were used.

Table 2: Discriminant Validity (Fornell & Larcker) Criterion

Constructs	IS Function Performance	IS Resources	Shared IS knowledge
IS Function Performance	0.939		
IS Resources	0.822	0.801	
Shared IS knowledge	0.513	0.617	0.847

5.6 Cross Loadings

A cross loading is simply the items that load on two (or more) factors, rather than they were supposed to load on the main factor. In this study, cross-loadings were assessed, and each measurement item indicator loadings were expected to load higher with its associated construct (Hair et al., 2017). The results confirmed that the cross-loading of each measurement item loaded higher on its construct than it loads on other constructs, and therefore, we concluded that discriminant validity was established. Table 3 represents the results.

Table 3: Cross Loadings

CONSTRUCT	ITEMS	ISFP	ISRES	SHISKW
IS Function Performance	SERPER	0.944	0.778	0.536
	SYSPER	0.939	0.741	0.465
	EFF-INFOR	0.935	0.796	0.443
IS Resources	ISINFR	0.788	0.883	0.447
	ISSYN	0.674	0.806	0.646
	ISHR	0.618	0.797	0.477
	CUSTORIN	0.515	0.709	0.410
Shared IS Knowledge	ISSHLAG	0.509	0.667	0.891
	ISETMTSHKW	0.424	0.513	0.911
	INTERSTRUCT	0.352	0.339	0.729

6. Structural Model Assessment

After assessing the measurement model to confirm its reliability and validity, the anticipated structural model was assessed. Potential issues of collinearity need to be tested in the structural model between the exogenous constructs (Hair et al., 2017). Variance Inflation Factor (VIF), which measures the strength of the correlation between the independent variables in the regression model, was also tested. Variance Inflation Factor (VIF) values obtained ranged from 1.426 to 4.056. The values were less than 5, as the recommended threshold by (Hair Jr et al., 2014) among others, for each of the exogenous constructs. The results of the model assessment showed that the model was reliable and valid. After confirming the validity and reliability of the moderation model, the interaction effect was created by drawing a linking line from the moderator (ISRES) to the line linking SHISHW and ISFP and then running the PLS-SEM Algorithm. Figure 4 represents the interaction effect of the model.

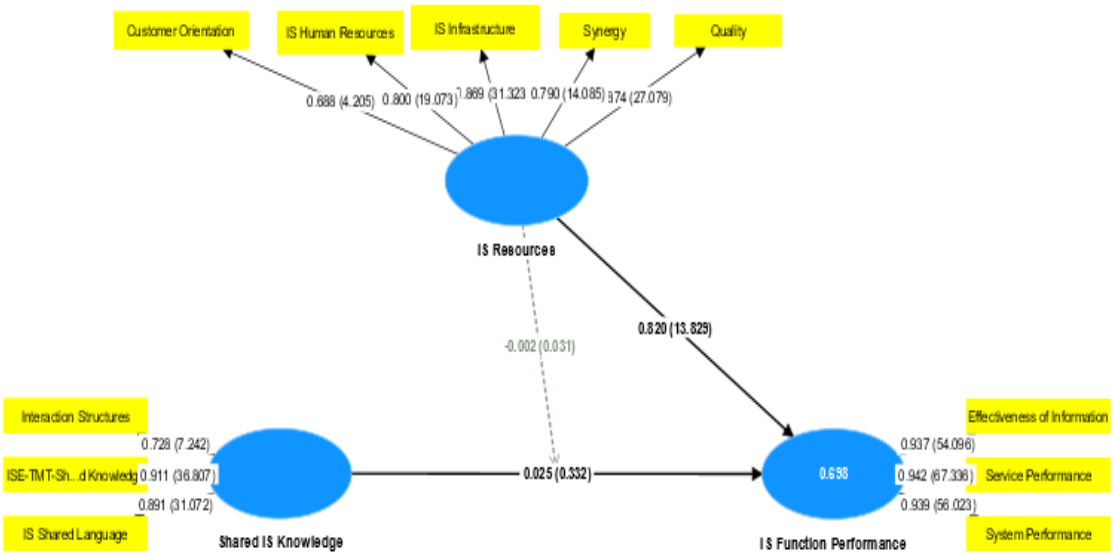

Figure 4: Interaction Effect Model

From the results of the analysis, R^2 remained the same. The initial R^2 for the main effect model was 0.698, signifying that 68.9% of the dependent variable (ISFP) can be explained by the independent variable. After introducing the interaction effect, R^2 remained the same (0.698), meaning the addition of the interaction term (SHISKW*ISRES) did not introduce any additional variance. The next step involved calculating the f^2 value.

According to Chin et al. (2003), a low effect size f^2 does not imply that the underlying moderator effect is negligible. Small interaction effects can be meaningful under certain conditions, and it is important to account for these conditions" (Wynne W. Chin, 2003).

6.1 Hypothesis Testing

The results of the beta coefficient for the interaction term SHISKW * ISRES were negative (-0.002) and small. It is important to confirm if the beta value is statistically significant or not. Thus, the bootstrapping procedure was used to get the t-values to find if the effect was significant. Table four presents the results.

Table 4: Bootstrap Results

Relationship	Beta	Mean	Std Dev	T values	P values
IS Resources -> IS Function Performance	0.820	0.831	0.059	13.904	0.000
Shared IS Knowledge -> IS Function Performance	0.025	0.024	0.074	0.336	0.369
ISRES x SHISKW -> ISFP	**-0.002**	**0.002**	**0.078**	**0.031**	**0.488**

From the results of the analysis, ISRES negatively moderates the relationship between SHISKW and ISFP. It weakens the relationship between shared IS knowledge and information system function performance. Thus, we failed to reject the hypothesis**.** Table 6 shows the results of the moderation analysis; ISRES (β = - 0.002, t-value 0.031, and p-value 0.488) has a negative moderation effect on the relationship between SHISKW and ISFP. Table 5 shows the results of the full model after creating an interaction effect.

Table 5: Results of ISRES Interaction Effect

	Path Coefficient	Standard deviation	T statistics	P values
ISRES -> ISFP	0.820	0.059	13.904	0.000
SHISKW -> ISFP	0.025	0.074	0.336	0.369
ISRES x SHISKW -> ISFP	-0.002	0.078	0.031	0.488

Table 6: Summary Results from Moderation Analysis

Hypothesis	β	SE	T	P	Results
SHISKW->ISRES->ISFP	-0.002	0.078	0.031	0.448	Failed to Reject

NB: β=Beta Coefficient, SE=Standard Error, T-Value=T statistics, P-Value=Probability Value *0.000, Relationships are significant at P<0.001, SHISKW= Shared information system knowledge, ISFP= Information system function performance, ISRES=Information system Resources

From the results of Table 6 above, the interaction between SHISKW * ISRES is negative and statistically insignificant (β = - 0.002, t-value 0.031 and p-value 0.488). Therefore, the study failed to reject the Null hypothesis (**$H0_n$**) that IS resources have no significant moderating effect on the relationship between shared IS knowledge and IS function performance. This shows there could be other factors that moderate the relationship.

7. Discussion of Findings

Moderation occurs when the relationship between two variables depends on a third variable (moderator). The moderating variable specifies the conditions under which a predictor variable relates to an outcome. Moderation implies an interaction effect, where introducing a moderating variable changes the direction or magnitude of the relationship between the dependent and independent variables. The moderation effect could be enhanced, where the moderator would increase the effect of the predictor variable on the outcome-dependent variable. It could also buffer up, where increasing the moderator would decrease the impact of the predictor on the outcome and vice versa. Therefore, moderation is where the relationship between an independent variable and a dependent variable changes according to the value of a moderator variable (Dawson, 2014). Several ways, such as theoretical grounding and detailed literature review, discussion with experts and key informants, literature review, and meta-analysis (Frazier, et al., 2004), are used to identify a moderation variable. In this study, theoretical grounding and literature review were used, where resource-based theory (RBV), an influential theory in information systems, was reviewed. RBV, proposes that the resources possessed by the organization

are the primary determinants of its performance and contribute to a sustainable competitive advantage of the firm (Ranjan & Read, 2016). Resources are the existing stocks that are possessed or controlled by the organization and include physical and intangible assets like knowledge, experience, and culture, rooted in organizations (Anggraeni, 2014).

According to Broadbent (2005), IS resources in organizations can be classified as human, technological, and relationship resources. The theory postulates that organizations possess resources that are heterogeneous and are used to plan, select, and implement organizational strategies, which are likely to be different, and the strategies contribute to and explain why there are differences in organizational performance, suggesting that organizational performance is related to its resources. Entrenched in management strategy literature, the theory suggests that organizations compete at the heart of "unique" valuable, rare, difficult to imitate, and non-substitutable corporate resources (Lertwongsatien & Ravichandran, 2014). The study adopted a two-stage approach as recommended when both the independent variable (X) and the moderator (M) are formatively modeled (Henseler et al., 2009). The latent construct scores were first calculated and saved, building the interaction term Z (X*M) as the element-wise product of the construct scores of X (Shared IS knowledge and M (IS resources). This interaction term together with the latent variable scores of X and M were thus used as independent variables in a multiple regression on the latent variable scores of Y (Information system function performance) (Fassott et al., 2016, p. 1891).

As advocated by the RBV theory, the results showed that ISRES (Moderator) has a positive and significant effect on (Y) IS function performance, supporting proponents of RBV and dynamic capability theories. The results revealed that the path coefficient (0.820), t-statistic at (13.904**),** and p-value (0.000), which support Bharadwaj (2000), that there is a positive relationship between IS resources and organizational performance. This shows that IS resources have a moderating effect on IS function performance. Further, the findings also showed that shared IS knowledge has a positive and insignificant effect on IS function performance (**β** = 0.025, t-value 0.336, and p-value 0.369). The findings showed the value of R^2 as 0.689, signifying that 68.9% variance can be explained. However, the findings showed that the effect size of ISRES on IS function performance is large (**β** =0.820) while shared IS knowledge showed a moderate effect size (0.025). The bootstrapping procedure was used to confirm the significance of the effects, which showed the effect size (ISRES*SHISKW) on IS function performance is very low (-0.002), signifying that it has a very low moderation effect on IS function performance. The study proposed that increasing IS shared knowledge (predictor) of IS executives and the TMT could result in a better IS understanding, appreciation of IS value, frequent interactions between the strategic teams, better support of IS projects, allocation resources as well as a positive IS culture change resulting to improved IS function performance. The findings did not support Hambrick (2005) and Veiga (2006), who found that team efforts often yield direct positive effects on performance. Further, the upper echelon theory argues that the multiplicity of skills in TMT brings improved information understanding and decision-making, eventually increasing team performance and organizational performance. This opens an opportunity for further research.

From the study findings, challenges in IS shared understanding between the university strategic teams, limited time to share information between TMT and ISE, limited CEOs engagements with IS executives, inadequate training to bring synergy between institutional management, and lack of understanding of business processes could have contributed to inefficient use of IS resources and low exploitation of resources. Further non-supportive cultures and inadequate communication mechanisms reported in the findings may contribute to reducing IS function performance, and universities must look for ways to address such challenges.

8. Conclusions

Understanding the role of moderating variables is important for managers and academicians. Researchers, academicians, and practitioners can see and explain beyond what is happening between the two variables, why it is happening or why not happening, and devise ways to address the changes, and also where to lay more emphasis. Such an understanding may provide insights to researchers and policy makers to make changes and to strengthen the relationship between the independent and the dependent variables. Further, it could provide an opportunity for researchers, decision makers to challenge prior research findings and provide new evidence that may need further investigation.

The findings of the study provide useful information about IS resources, the importance of shared IS knowledge, and how they affect IS function performance. The contributions further underscore why TMT and IS executives need to work together to improve information systems' functional performance. Also, these findings may be useful for information technology or systems managers and industry practitioners in appreciating practices that bring positive contributions to their information systems performance. The research findings can also provide

valuable insights to IS and management literature. Scholars can gain an understanding of how shared IS knowledge can contribute to how organizations can benefit from shared interactions and valuable use of IS resources.

The study had limitations. One, the study only utilized a small sample, as only a few university strategic leaders in universities were involved. Many leaders could have provided a better representative sample. Two, the researcher had a short time to collect and analyze the data. Third, the communication culture existing in universities hindered the sharing of information, resulting in low responses. Finally, future empirical work can be carried out to find out and evaluate what other factors could work with IS resources to moderate the relationship between shared IS knowledge and IS function to bring enhanced IS function performance in organizations.

AI statement: The authors declare that this research work did not use any generative artificial intelligence tools.

Ethical Statement: All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Nairobi, Approval No. KNH-UON ERC P178/03/2022 and the National Commission for Science, Technology & Innovation, License No: NACOSTI/P/21/14920.

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The Role of Knowledge Management and Knowledge Capabilities in Driving Innovation and Business Performance in e-Commerce SMEs

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Abstract: Small and medium-sized businesses (SMEs), especially those in the e-commerce industry, are finding it more challenging to use intangible assets to support innovation and commercial performance in the knowledge-based digital economy. Few studies have thoroughly investigated how various aspects of knowledge capability collectively impact business performance through innovation capability, particularly in the context of emerging economies like Vietnam, despite the substantial body of literature on knowledge management (KM) and innovation. By integrating five essential knowledge factors—knowledge management, knowledge absorptive capability, knowledge application, knowledge transformation, and knowledge sharing—and evaluating their effects on innovation capability and business performance, this study seeks to close this gap. A quantitative research strategy was used to accomplish this goal. Using a standardized questionnaire with validated scales, 567 SMEs in the Vietnamese e-commerce industry were surveyed to collect primary data. To test the hypotheses and assess the structural links between the constructs, the data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show that all five knowledge-related elements have a beneficial impact on corporate performance and innovation capability. Interestingly, knowledge transformation had the most significant influence on innovation potential, while knowledge management had the most significant direct impact on company performance. The association between knowledge components and business results was also found to be somewhat mediated by innovation capability, underscoring its function as a dynamic capability that transforms knowledge into concrete value. The theoretical presumptions of the Knowledge-Based View (KBV), the Resource-Based View (RBV), and the Dynamic Capabilities theory are all supported by these findings. The results show how knowledge management and knowledge capabilities can be used to boost innovation and enhance business performance in the digital economy, with practical implications for SME managers, legislators, and other stakeholders.

Keywords: Knowledge management, Innovation capability, Business performance, E-Commerce SMEs, Absorptive capacity, Dynamic capabilities

1. Introduction

In today's fast-evolving digital economy, knowledge has become one of the most valuable assets for organizations seeking to sustain competitiveness and achieve superior performance. Small and medium-sized enterprises (SMEs), particularly those operating in the e-commerce sector, are facing increasing pressure to innovate and adapt quickly to rapid technological advances and shifting consumer behavior. In this context, effective knowledge management (KM) is not merely a support function but a strategic imperative that enables organizations to harness, apply, and transform knowledge into value-creating innovation.

In modern organizations, knowledge serves as a fundamental basis for competitive advantage (Zack, 1999), while information technology is considered an essential enabler for effective knowledge management (Bose, 2016). In today's dynamic environment, two critical factors determine an organization's survival and long-term success: e-commerce and customer knowledge. These elements drive e-commerce adoption and promote the use of the Internet as a platform for accessing and gathering valuable customer insights. In other words, the success of e-commerce increasingly depends on how well organizations manage their knowledge resources (Borges et al., 2007; Saeed, Grover & Hwang, 2005).

Knowledge Management (KM) has emerged as a strategic tool that enables organizations to enhance organizational learning capabilities, improve operational efficiency, and lay the foundation for innovation. In the context of e-commerce—an environment characterized by rapid change and intense competition—the ability

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to effectively acquire, store, share, and apply knowledge, both internally and externally, is critical for organizational adaptation, growth, and long-term sustainability. By making data and information accessible and visible to organizational members when needed, effective KM can help create new sources of competitive advantage.

While a growing body of research has explored the relationship between KM and organizational outcomes, there remains a limited understanding of how the distinct dimensions of KM individually influence those outcomes. Previous studies often treat KM as a unidimensional construct by aggregating all its dimensions into a single variable, thereby limiting the ability to assess the specific impact of each KM component (Koohang, Paliszkiewicz

& Goluchowski, 2017; Bamel & Bamel, 2018). In the digital era, where data and information have become strategic assets, KM plays a pivotal role in sustaining and enhancing business competitiveness—particularly in the fast-paced, constantly evolving landscape of e-commerce. E-commerce is not merely a shift to digital transactions; it requires organizations to skillfully collect, store, analyze, and creatively apply knowledge to generate superior value.

According to Damiyana et al. (2024), e-commerce cannot reach its full potential without a strong KM foundation. While the adoption of e-commerce allows businesses to access information more quickly and interact with customers more efficiently, turning that information into actionable knowledge for strategic decision-making demands an appropriate KM system. This is especially vital for small and medium-sized enterprises (SMEs), which often face resource, financial, and human capital constraints. KM enables these firms to leverage both internal and external knowledge to compensate for these limitations.

For instance, according to the Vietnam E-commerce Association (VECOM, 2023), over 40% of SMEs in the e-commerce sector struggle to sustain growth due to limited knowledge management practices and weak innovation capability. A recent World Bank report (2022) also highlighted that SMEs in emerging markets often cannot absorb and apply external knowledge, hindering their competitiveness in the digital economy. These examples underscore the importance of understanding how knowledge factors and innovation capability shape the performance of e-commerce SMEs in Vietnam.

In the e-commerce environment, knowledge exists not only in structured formats like documents and databases but also in experiential know-how, customer feedback, digital platform interactions, consumer behavior data, and emerging technological trends. Effectively managing these knowledge flows allows SMEs to strengthen innovation capabilities, improve product development, optimize operations, and ultimately enhance customer experience. In this sense, KM serves as a strategic bridge between technology and business objectives—empowering firms not only to use e-commerce but to thrive in it.

Furthermore, the COVID-19 pandemic accelerated digital transformation across all sectors, compelling SMEs to adapt swiftly in order to survive. Those enterprises equipped with robust KM systems—able to harness knowledge to refine workflows, develop digital sales channels, and manage risks flexibly—demonstrated greater resilience and sustainability than their less-prepared counterparts. Thus, KM has evolved from a supportive function into a core component of digital business models.

The study by Damiyana et al. (2024) also highlights that KM not only directly impacts the sustainability of micro, small, and medium enterprises (MSMEs) but also serves as a crucial mediating factor linking innovation and performance to long-term development. These findings send an important message to business leaders and policymakers alike: in order for e-commerce to truly catalyze digital economic growth, it is essential to prioritize the development of KM capabilities, particularly among MSMEs.

This study contributes to the existing literature in several novel ways. First, it focuses on e-commerce SMEs in Vietnam, an emerging economy where empirical evidence on knowledge management and innovation remains limited. Second, unlike many prior studies that adopt a single theoretical lens, this research integrates the Resource-Based View (RBV), Knowledge-Based View (KBV), and Dynamic Capabilities theory into a unified framework. Third, the study employs PLS-SEM with a large sample of 567 SMEs, yielding statistically robust results in an underexplored context. Collectively, these aspects enhance the research's novelty and provide valuable insights for both theory and practice.

In line with the research objectives and the identified gaps in the literature, this study seeks to address the following research questions:

RQ1: How does knowledge management influence innovation capability and business performance in e-commerce SMEs?

RQ2: What roles do knowledge absorptive capacity, knowledge transformation, knowledge application, and knowledge sharing play in shaping innovation capability and business performance?

RQ3: To what extent does innovation capability mediate the relationship between knowledge-related factors and business performance in e-commerce SMEs?

2. Literature Review

2.1 Concept

2.1.1 Knowledge management

Scholars have conceptualized "knowledge capability" in multiple, complementary ways. Early work emphasized knowledge as an organizational process—concerned with activities for creating, storing, sharing, and applying knowledge (Davenport & Prusak, 1998; Wiig, 1997). Another strand framed knowledge as a strategic resource that underpins competitive advantage (Resource-Based View) and therefore called for capabilities to manage and exploit knowledge assets (Grant & Phene, 2021). A third, more dynamic perspective emphasizes the firm's capacity to sense, seize, and reconfigure knowledge in changing environments (Zahra, Petricevic & Luo, 2022). Together, these approaches suggest that knowledge capability is multi-dimensional—encompassing structures and systems (architecture), processes (absorptive, transformation, application), and relational practices (sharing, governance) that convert information into strategic outcomes. Building on these traditions, many empirical studies adopt multi-factor constructs to operationalize knowledge capability. Common dimensions found across prior work include: (1) mechanisms for knowledge governance and management, (2) absorptive capacities, (3) mechanisms for knowledge transformation/integration, (4) the ability to apply knowledge in operational and innovation processes, and (5) practices for sharing and dissemination. The five-factor framework used in this study synthesizes these strands and captures both the static (resources, systems) and dynamic (learning, transformation, application) facets of organizational knowledge capability.

Knowledge is widely recognized as a fundamental element in society, representing an individual's perception and understanding of reality (Nonaka, 1994). It stems from personal experiences and educational backgrounds, and is inherently internalized within an individual's mind (Harrington, Srai & Kumar, 2019). From an academic standpoint, knowledge management refers to the systematic approach through which organizations acquire, disseminate, utilize, and retain knowledge, ultimately fostering the creation of new knowledge and competencies that support ongoing innovation (Weerasinghe & Sedera, 2023). Consequently, knowledge management involves multifaceted processes and components. Kiessling et al. (2009) emphasize that a business's sustained success is significantly influenced by its knowledge management practices. In both public and private sectors, knowledge management is regarded as essential for boosting organizational efficiency and adaptability (Mårtensson, 2000). Furthermore, it plays a critical role in driving organizational growth, as firms must not only possess valuable knowledge resources but also ensure their uniqueness and the capacity to renew dynamic capabilities (Koshelieva et al., 2023). According to Gurteen (1998), knowledge management encompasses a strategic framework of processes, structures, technologies, and tools designed to support knowledge workers in enhancing their competencies, fostering innovation, and contributing greater business value.

Knowledge absorptive capacity (KAC). Absorptive capacity denotes the ability to identify, assimilate, and apply external knowledge—critical for learning from partners, customers, and markets (Chichkanov, 2020). Studies show that higher absorptive capacity enhances firms' innovation outcomes by enabling effective exploitation of external knowledge flows (Khraishi et al., 2022).

Knowledge transformation (KT). Transformation involves converting knowledge forms, integrating new knowledge with existing knowledge bases, and reconfiguring routines to embed learning (Mele et al., 2023). This capability is closely linked to organizational adaptation and the generation of novel ideas that can be operationalized into innovation (González-Ramos, Guadamillas & Donate, 2022).

Knowledge application (KA). Application is the capability to put knowledge into practice—improving decisions, processes, products, and services (Rajagopal et al., 2022). Many scholars stress that knowledge only yields economic value when it is applied effectively; thus, application capability links intellectual assets to tangible performance gains (Ali et al., 2021; De Matos Pedro, Alves & Leitão, 2020).

Knowledge sharing (KS). Sharing covers the dissemination and exchange of knowledge across individuals, teams, and organizational boundaries. Practices such as communities of practice, training, and inter-unit interaction

accelerate innovation and reduce duplication of effort (Awada & Youssef, 2024). Knowledge sharing also strengthens absorptive and transformative processes by widening the firm's knowledge base.

Together, these five dimensions capture complementary aspects of organizational knowledge capability: KM provides the enabling architecture; absorptive capacity brings in external inputs; sharing expands and diffuses knowledge; transformation reorganizes and integrates knowledge; and application converts knowledge into innovations and performance. Empirically measuring these interrelated capabilities allows the present study to examine not only direct effects on innovation and performance, but also the mechanisms (e.g., mediation by innovation capability) through which knowledge is translated into firm outcomes.

While the five knowledge-related factors share conceptual linkages, they are theoretically and empirically distinct. Knowledge Management (KM) provides the overarching architecture and governance systems that support all other knowledge processes. In contrast, Knowledge Sharing (KS) specifically refers to the relational practices of disseminating knowledge across individuals and units. Similarly, Knowledge Absorptive Capacity (KAC) emphasizes the ability to recognize and assimilate external knowledge, which differs from Knowledge Transformation (KT)—the internal process of reconfiguring and integrating knowledge into existing routines. Knowledge Application (KA) represents the final stage, whereby accumulated and transformed knowledge is put into practice to create value.

Despite these distinctions, potential overlaps and synergies among the factors cannot be ignored. For instance, effective KM systems often facilitate KS, and high absorptive capacity may enhance transformation and application processes. Such complementarities suggest that interaction effects may exist, in which the combined presence of two or more knowledge capabilities strengthens their overall impact on innovation and business performance. Although the present study focuses on direct and mediating relationships, future research should explore possible interaction effects using advanced analytical techniques, as these may yield additional insights into how different knowledge processes jointly drive organizational outcomes.

2.1.2 Business performance

Business performance is literally defined as a measure of how well a company implements its strategies and achieves its objectives (Lau et al., 2022). Business performance is commonly evaluated using key performance indicators (KPIs) tailored to an organization's specific goals and industry standards (Van De Ven et al., 2023). High levels of business performance are often associated with profitability, growth, competitive advantage, and sustainability. By focusing on continuous improvement and aligning strategies with objectives, organizations can enhance performance and position themselves for long-term success (Yasir & Majid, 2017). Understanding and applying these elements can drive growth and development for SMEs in the broader economic and business context, thereby improving their performance (Wang & Yang, 2016).

2.1.3 Innovation capability

Innovation has long been recognized as a critical factor for gaining a competitive edge (Drucker, 1985; Kafetzopoulos, Gotzamani & Gkana, 2015). Kuhn and Marisck (2010) define innovation as the conversion of ideas or discoveries into valuable products or services that effectively address and fulfill customer needs and expectations. In a similar vein, Crossan and Apaydin (2010) characterize innovation as the generation, adaptation, and implementation of novelty and added value in business and production. This process includes enhancing and diversifying products, services, and markets, as well as developing new production methods and management systems. The importance of innovation in shaping both economic and social systems has intensified to the extent that some scholars view the contemporary economy as being fundamentally innovation-driven (Zhou, Mavondo & Saunders, 2019; Aujirpongpan & Hareebin, 2020). According to Acosta, Popa & Martinez-Conesa (2018), innovation refers to the degree to which organizations introduce new or improved products and services to the market. This encompasses novel products, ideas, technologies, institutions, behaviors, values, and practices—in essence, innovation represents either the refinement or the invention of ideas aimed at continuous advancement to meet evolving customer expectations (Sanchez-Famoso et al., 2019). For innovation to be sustained, leaders must pay attention not only to technologies, products, and processes but also to the organizational culture, norms, and underlying values that shape company behavior (Srisathan, Ketkaew & Naruetharadhol, 2020; Muafi, 2020).

2.1.4 E-Commerce

E-commerce refers to the advancement of buying and selling activities facilitated through digital platforms and internet-based technologies (Chamorro et al., 2019). Essentially, it allows consumers to engage in online

shopping with greater convenience, speed, and flexibility—anytime, anywhere—as long as they are connected to the internet, setting it apart from traditional retail methods. According to the World Trade Organization (WTO, 1998), e-commerce encompasses "the production, distribution, marketing, sale or delivery of goods and services by electronic means." Over time, e-commerce has undergone significant development, accompanied by a growing number of users exchanging electronic documents, both within organizational settings and among individual consumers.

2.1.5 SMEs

Small and medium-sized enterprises (SMEs) play a critical role in most economies by driving innovation, creating employment, and contributing to GDP (Storey, 2016). Unlike large firms, SMEs are typically characterized by limited resources, less formalized structures, and a strong reliance on flexibility and entrepreneurial decision-making (Freel, 2000). These characteristics mean that SMEs often face significant challenges in developing and sustaining competitive advantage, especially in dynamic, knowledge-intensive environments. Knowledge management in SMEs tends to be more informal and people-oriented compared to the codified, IT-driven systems found in larger firms (Scuotto et al., 2017). For example, SMEs often rely on direct communication, mentoring, and day-to-day interactions to transfer and integrate knowledge across teams (Durst & Edvardsson, 2012). At the same time, their agility and flatter organizational structures allow them to transform and apply knowledge more quickly, enabling rapid responses to changing market conditions (Shaikh, 2024). Focusing on e-commerce SMEs is especially relevant. Operating in highly dynamic, digitally mediated markets, these firms are continuously exposed to external knowledge flows from customers, platforms, and competitors. They must therefore develop strong knowledge-related capabilities to capture, share, and apply knowledge effectively in order to innovate and remain competitive (Damiyana et al., 2024). In emerging economies such as Vietnam, where SMEs dominate the business landscape and digital adoption is accelerating, understanding how knowledge factors drive innovation and performance provides valuable insights for both theory and practice.

2.2 Theoretical Foundation

2.2.1 The resource-based view – RBV

The Resource-Based View (RBV) is one of the foundational theories in strategic management, focusing on internal resources to explain differences in performance and competitive advantage among organizations (Barney, 1991; Wernerfelt, 1984). Rather than emphasizing external factors such as industry or market conditions, RBV highlights the critical role of a firm's unique resources and capabilities. Penrose (1959) was the first to conceptualize this view by proposing that a firm is essentially a collection of resources managed and combined through human knowledge and capabilities. These resources include physical assets (e.g., machinery and equipment), human assets (e.g., skills and experience), and organizational assets (e.g., corporate culture, processes, and organizational knowledge). Among them, knowledge—especially tacit knowledge—has increasingly been recognized as a valuable, rare, and difficult-to-imitate strategic resource (Bontis, 1998; Curado & Bontis, 2006).

According to Barney (1991), in order for a resource to generate sustainable competitive advantage, it must satisfy four criteria: (1) Value, (2) Rarity, (3) Inimitability, and (4) Non-substitutability, known collectively as the VRIN framework. Intangible resources such as organizational culture, innovation capability, or specialized knowledge often possess these characteristics, thereby enabling firms to maintain superior long-term performance (Peteraf, 1993). However, traditional RBV emphasizes the possession of resources. Teece, Pisano & Shuen (1997) extended the theory with the concept of dynamic capabilities, which refer to an organization's ability to integrate, coordinate, and reconfigure resources in response to changing environments. Especially in today's knowledge-based economy, the management, transformation, and flexible application of knowledge are key factors in maintaining sustainable competitive advantage (Grant, 1996).

2.2.2 Knowledge-based view – KBV

The Knowledge-Based View (KBV) is an extension and deeper development of the Resource-Based View (RBV), emphasizing that knowledge is the most important strategic resource of a firm in the modern business environment (Grant, 1996; Curado & Bontis, 2006). While RBV considers resources—both tangible and intangible—as the basis for competitive advantage, KBV specifically highlights knowledge as the core factor that provides differentiation and sustainability. According to KBV, a firm is not merely a production entity but a "learning entity"—where knowledge is created, retained, transferred, and applied to generate value (Nonaka & Takeuchi, 1995; Curado & Bontis, 2006). Knowledge within organizations exists in various forms: explicit and

tacit knowledge, the latter being difficult to share or replicate and thus serving as the foundation for sustainable competitive advantage (Winter, 2003; Szulanski, 2003).

Unlike traditional resources that may be depleted when used, knowledge increases in value the more it is utilized and can be applied across various contexts without diminishing its intrinsic worth (Spender, 2002). Additionally, KBV acknowledges the critical role of social and cultural factors in knowledge sharing and development—this underpins innovation capabilities and strategic adaptability. Curado and Bontis (2006) propose that value creation in KBV depends on an organization's ability to: (1) accumulate knowledge (through learning and acquiring new knowledge), (2) integrate knowledge (by combining individual and organizational knowledge), and (3) apply knowledge in practice to generate innovation and performance.

2.2.3 Dynamic capabilities theory

The Dynamic Capabilities Theory is regarded as a significant extension of the Resource-Based View (RBV), especially in the context of continuously changing business environments. While RBV focuses on the possession of valuable, rare, inimitable, and non-substitutable (VRIN) resources to achieve sustainable competitive advantage (Barney, 1991; Eisenhardt & Martin, 2000), the Dynamic Capabilities theory emphasizes a firm's ability to continuously restructure, integrate, and renew its existing resources to adapt to environmental changes (Teece, Pisano & Shuen, 1997). Accordingly, dynamic capabilities are defined as "a firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." The six key components of dynamic capabilities include sensing, seizing, reconfiguring, absorptive capacity, connectivity, and integration—enabling firms to generate more flexible and sustainable competitive advantages in uncertain environments.

2.2.4 Absorptive capacity theory

The Theory of Absorptive Capacity was first introduced by Cohen & Levinthal (1990) and has since been further developed by numerous scholars both theoretically and empirically. Absorptive capacity is defined as a firm's ability to recognize, assimilate, and apply new knowledge to generate commercial value.

Cohen and Levinthal (1990) initially argued that absorptive capacity is a byproduct of efforts in innovation and problem-solving within a learning organization. This organizational capability is influenced by the absorptive capacity of individual employees (Minbaeva et al., 2003) and the diversity of expertise within the organization (Cohen & Levinthal, 1990) and tends to improve in environments that support knowledge sharing and effective internal communication (Chalos & O'Connor, 2004). An individual's absorptive capacity is affected by their prior related knowledge and the level of personal effort exerted (Cohen & Levinthal, 1990).

Previous studies have identified several factors influencing the absorptive capacity of local partners, such as trust, cultural similarity, industry relevance, technical and managerial support, and joint venture goals (Lane, Salk & Lyles, 2001), as well as learning orientation and the possession of relevant knowledge (Park & Choi, 2014). In this study, "knowledge absorptive capacity" is included as one of the variables in the research model—directly derived from this theory. The theory complements the dynamic capabilities framework, emphasizing the importance of learning from external sources as a critical condition for innovation and firm performance.

2.3 Development of Hypothesis

2.3.1 Knowledge management (KM)

In today's highly competitive markets, innovation has become an essential element for organizational survival and long-term growth (Hurley & Hult, 1998). The capacity for innovation within organizations is deeply linked to how well they generate and utilize their internal knowledge resources. In particular, knowledge management plays a critical role in driving and sustaining innovation (Duan, 2017). A qualitative investigation by Ibarra et al. (2020) conducted with 78 small and medium-sized enterprises (SMEs) in Spain revealed that the flow of information regarding both market demands and technological capabilities—along with collaborative networks involving customers and partners—is a key enabler of innovation within firms. Hence, efficient knowledge management systems are essential for enhancing a company's competitive position, strengthening customer orientation, improving relationships and employee capabilities, boosting innovation, and lowering operational costs. Numerous researchers have stressed that adopting knowledge management practices significantly contributes to innovation (Ibarra et al., 2020; Al-Mamoori & Ahmad, 2015). By developing and applying knowledge-sharing infrastructures, organizations are encouraged to move beyond traditional mindsets about intellectual property and work culture, embracing new processes and disciplines that promote organizational change and innovation.

Knowledge management is widely regarded as a strategic tool for enhancing competitiveness (Audretsch & Thurik, 2004), since knowledge itself is a key resource that enables firms to achieve greater innovation and performance outcomes (Chirico, 2008). Supporting this, Barney (2007) argues that effectively managed knowledge leads to better organizational performance. Activities such as acquiring, generating, sharing, storing, and applying knowledge are fundamental for attaining high performance (Soderberg & Holden, 2002). Therefore, firms aiming to stay ahead in the market must invest in the strategic management of knowledge assets to drive profitability, sales growth, and market expansion. Empirical studies have consistently found a positive connection between knowledge management and firm performance. For instance, Wang and Lin (2013) demonstrated that a strong orientation toward knowledge management enhances organizational performance in Chinese firms. Likewise, Noruzy et al. (2013) identified a positive impact of knowledge management on the performance of manufacturing enterprises. Roland (2006) further emphasized that organizations striving for sustained high performance must develop robust systems for knowledge generation, transfer, and integration.

Based on the above discussions, the study proposes the following hypotheses:

H1: Knowledge management positively affects innovation capability.

H2: Knowledge management positively affects the business performance of SMEs in the e-commerce sector.

2.3.2 Knowledge absorptive capacity (KAC)

A well-developed knowledge base often serves as the foundation for business innovation, which is understood as a continuous process of accumulating and integrating knowledge from diverse sources. As such, the breadth and depth of a firm's knowledge base are closely linked to its level of innovation performance (Zhou & Li, 2012). Absorptive capacity—a firm's ability to recognize, assimilate, and apply external knowledge—plays a pivotal role in influencing innovation outcomes through key elements such as information technology, organizational culture, and structural design. Information technology, in particular, facilitates knowledge transfer by enabling both formal and informal communication channels, thereby encouraging knowledge exchange across different departments and functions, and ultimately increasing the occurrence of innovative activities (Scuotto et al., 2017; Trantopoulos et al., 2017). Furthermore, an organizational culture that fosters innovation can enhance employees' motivation and creative engagement by cultivating an environment that supports experimentation and new ideas (George, McGahan & Prabhu, 2012). In parallel, a flexible and adaptive organizational structure enables businesses to realign internal operations in response to external changes, thereby reducing lag time and supporting faster innovation (Vendrell-Herrero, Bustinza & Opazo-Basaez, 2021). Altogether, absorptive capacity enables more effective organizational learning and product development, thereby boosting the frequency, depth, and speed of innovative efforts.

Several studies have found that absorptive capacity significantly contributes to business performance. Najafi-Tavani et al. (2018) explored the importance of product and process innovation capabilities as independent mechanisms through which cooperative ecosystems enhance new product success, finding that innovation networks significantly impact innovation capabilities only when absorptive capacity is present. Considering technology firms from an organizational learning perspective, Garcìa-Morales, Ruiz-Moreno & Llorens-Montes (2007) found that absorptive capacity positively influences both learning and creativity, and that increasing absorptive capacity within an organization motivates individuals to pursue and understand new ideas; thus, organizational learning and innovation improve business performance. Similarly, Gebauer, Worch & Truffer (2011) demonstrated that knowledge transfer between exploration and exploitation learning processes significantly impacts business performance when absorptive capacity is stronger. Liu, Dutta & Park (2020) also revealed how companies can focus on labor productivity by leveraging absorptive capacity to achieve high performance.

Based on the above discussions, the following hypotheses are proposed:

H3: Knowledge Absorptive capacity positively affects innovation capability.

H4: Knowledge Absorptive capacity positively affects the business performance of SMEs in the e-commerce sector.

2.3.3 Knowledge transformation (KT)

Knowledge is increasingly viewed as a strategic asset that facilitates the transmission of information about market needs and trends, which can then be incorporated into new organizational routines, products, or

processes to address the demands of dynamic markets (Vasconcelos et al., 2018). As a key element of organizational learning, knowledge transformation is the process of converting novel ideas, data, or behaviors into forms that firms can internalize and utilize (Yew, 2021). However, establishing effective transformation mechanisms presents a significant challenge, as firms must carefully distinguish between existing knowledge and newly acquired insights that require validation, integration, or rejection (Muñoz et al., 2022). This process of embedding new knowledge into organizational frameworks is essential for driving enhanced business performance (Cruz-Ros, Guerrero-Sánchez & Miquel-Romero, 2018).

For innovation to take place, organizations must possess the necessary innovation capabilities (Laforet, 2011). Innovation is typically categorized into product/service innovation—what the firm delivers—and process innovation—how those offerings are created and delivered, especially within the context of sustainability (Adams et al., 2015). Firms that introduce highly novel offerings often rely on diverse knowledge inputs during the development phase and are more likely to learn through the innovation process itself (Rhaiem & Amara, 2019). Collaboration with external partners plays a critical role in this, as firms with strong alliances tend to develop more robust innovation capabilities that contribute to improved outcomes (Mention, 2010). High levels of collaborative innovation facilitate direct engagement between the focal firm and external stakeholders, thereby enhancing the flow of strategic resources essential for innovation (Ireland & Webb, 2006). Engaging with outside actors enables organizations to broaden their resource base and accelerate the development of new products and services.

Transforming knowledge remains a complex endeavor, as it demands continuous evaluation of what knowledge should be retained, tested, or discarded (Muñoz et al., 2022). The significance of this process has been demonstrated across various industries, including tourism. For example, Batra et al. (2021) highlight how knowledge transformation drives improved performance in tourism settings. Likewise, Liu and Dong (2021) note that it fosters innovation, enhances service quality, reduces operational costs, and ultimately boosts profitability. Successfully converting individual knowledge into organizational knowledge requires robust knowledge management practices (Liebowitz, 2001), especially amid ongoing technological advances that have transformed how knowledge is digitized and managed, opening new avenues for virtual collaboration and e-commerce (Tiago et al., 2007).

Based on the above arguments, the following hypotheses are proposed:

H5: Knowledge transformation positively affects innovation capability.

H6: Knowledge transformation positively affects the business performance of SMEs in the e-commerce sector.

2.3.4 Knowledge application (KA)

Knowledge application refers to an organization's capacity to leverage accumulated knowledge to drive innovation efforts (Ha et al., 2021). It enhances innovation performance by effectively deploying relevant knowledge across different innovation types, particularly in the development of new products and technologies. Given that knowledge application is inherently a process of transforming intellectual capital into tangible innovative outcomes, firms must strategically manage this capability. Specifically, they need the competence to assess external opportunities and threats arising from environmental shifts, while simultaneously leveraging internal knowledge assets to support innovation. Moreover, the integration and transformation of knowledge across various units and external partners are essential components of successful knowledge application. This integration process fosters a steady flow of innovative ideas and strengthens the organization's ability to capitalize on emerging opportunities (Shujahat et al., 2017). In essence, the application of knowledge is both a foundational requirement for achieving organizational objectives and a critical driver of innovation effectiveness. Knowledge that has been absorbed and transformed through prior processes becomes economically valuable only when applied in real-world business contexts. By doing so, organizations can not only unlock new avenues for innovation but also enhance the likelihood of commercializing knowledge-based outputs.

Applying knowledge enables businesses to respond more quickly to changing business conditions by integrating knowledge into new products or processes (Gold, Malhotra & Segars, 2001). According to Alavi and Leidner (2001), knowledge application is the most important management process to improve organizational performance. Zaim, Muhammed & Tarim (2018) argue that knowledge application has the greatest impact on business performance. Moreover, knowledge application plays a vital role in enhancing operational processes and driving better decisions, all contributing to improved business performance (Loke et al., 2020; Xie, Zou & Qi,

2018). According to Serrasqueiro et al. (2010), R&D activities can significantly contribute to the development of small and medium enterprises.

Based on the above arguments, the author proposes the following hypotheses:

H7: Knowledge application positively affects innovation capability.

H8: Knowledge application positively impacts the business performance of SMEs in the e-commerce sector.

2.3.5 Knowledge sharing (KS)

Studies show a positive relationship between knowledge sharing and innovation. Knowledge sharing contributes to improving innovation speed and quality, as well as overall company performance (Doğan & Doğan, 2020; Fern, Ashraf & Batool, 2022). The relationship between knowledge sharing and innovation is particularly important in high-tech industries and manufacturing sectors, where rapid technological changes and fierce competition require continuous innovation (Fern, Ashraf & Batool, 2022). Therefore, it is important to implement knowledge-sharing activities to improve innovation and overall company performance. Wang & Wang (2012) and Wang, Sharma & Cao (2016) indicated that knowledge sharing facilitates better flow of information and resources within organizations, leading to measurable increases in performance. Knowledge sharing clearly involves codified knowledge such as documents and manuals, which can improve innovation speed and financial performance (Wang & Wang, 2012). Knowledge sharing is an essential part of open innovation strategies. In inbound open innovation, knowledge sharing and innovation strategies fully mediate the relationship between open innovation efforts and performance, ensuring that these efforts lead to tangible outcomes (Bagherzadeh et al., 2020).

Knowledge sharing takes place through multiple channels, including training sessions, communication, observation, technology transfer, replication of routines, presentations, and interactions with both suppliers and customers, encompassing various types of relationships within and between organizations (Chua & Pan, 2006). This process has been shown to enhance the performance of manufacturing firms and their suppliers (Fugate et al., 2008). Additionally, effective knowledge sharing contributes to improved design outcomes by fostering new insights and enhancing capabilities (Chen & Huang, 2008). Consequently, performance improvement is considered crucial for manufacturing companies aiming to achieve their innovation goals (Cabrera & Cabrera, 2002). Numerous studies have confirmed the positive effects of knowledge sharing on organizational performance in the manufacturing sector (Law & Ngai, 2007). Indeed, this connection is often viewed as a fundamental prerequisite, enabling knowledge sharing to support and amplify other business activities and drive superior business results. Based on the above arguments, the author proposes the following hypotheses:

H9: Knowledge sharing positively affects innovation capability.

H10: Knowledge sharing positively impacts the business performance of SMEs in the e-commerce sector.

2.3.6 Innovation capability (IC)

In the face of growing competitive pressures, small and medium enterprises (SMEs) need to consistently evaluate their competitive standing by fostering sustainable innovation. Audretsch & Belitski identify that search by Agyapong, Agyapong & Poku (2017) indicates a positive correlation between innovation activities and the business performance of SMEs. Similarly, Bahta et al. (2020) highlight that SMEs' innovation capabilities significantly enhance productivity and operational efficiency. Exposito & Sanchis-llopis (2018) also found that innovation plays a crucial role in influencing the business effectiveness of SMEs in Spain. Maldonado-Guzmán et al. (2018) reported that innovations across product development, processes, marketing, and management have a positive and meaningful impact on the performance of SMEs. Moreover, empirical evidence from Arsawan et al. (2020) supports a positive link between innovation capabilities and SME business outcomes. From a theoretical standpoint, the dynamic capabilities framework stresses the strategic value of intangible assets as key drivers of firm performance (Teece, Pisano & Shuen, 2001). Based on this, the following hypothesis is proposed:

H11: Innovation capability positively impacts the business performance (BP) of SMEs in the e-commerce sector.

The research model presented in Figure 1 illustrates the relationship between knowledge factors, innovation capability, and business performance.

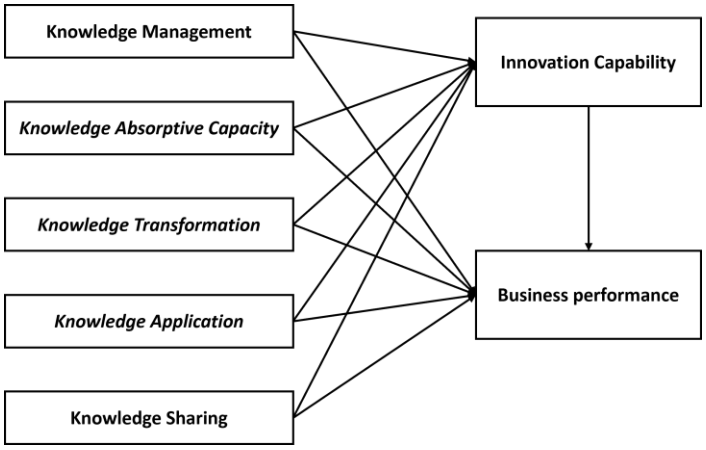

Figure 1: Proposed research model

3. Research Methodology

3.1 Qualitative Research Method

Based on the research objectives, the author develops the research model and hypotheses, identifies the observed variables and measurement scales for the research concepts, and evaluates and synthesizes results from previous related studies.

After completing the initial version of the measurement scales, the author conducted interviews with two English-proficient students to assess translation accuracy and ensure the scales were appropriate in terms of terminology.

Next, in-depth interviews were carried out with five lecturers specializing in Business Administration and E-commerce to verify the reliability of the measurement scales and the suitability of the proposed research model. The purpose of this study is to adjust the concepts in the measurement scales (possibly adding or removing factors, observed variables, and refining wording to suit the research context) through two rounds of discussions with five experienced experts:

Round 1: Discussion on factors in the proposed research model

Round 2: Discussion on observed variables in the measurement scales

3.2 Quantitative Research Method

This study is divided into two stages: preliminary quantitative research and official quantitative research.

3.2.1 Preliminary quantitative research

Preliminary quantitative research was conducted via a survey of 60 respondents from small and medium enterprises (SMEs). The goal was to evaluate the content and format of statements in the draft measurement scales to finalize the official scales used in the main study (evaluating form, wording, and grammar of statements to ensure consistency, clarity, and no confusion for respondents) and to assess the reliability of observed variables using a 5-point Likert scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree), so that inappropriate variables could be removed and the official questionnaire could be finalized. This preliminary quantitative study aimed to evaluate the Cronbach's Alpha reliability coefficient. After the scales were finalized, they were used for the official quantitative study.

3.2.2 Official quantitative research

The official quantitative research was conducted via a survey targeting approximately 567 SMEs in Vietnam. The surveyed firms represent a variety of e-commerce-related industries, including retail (fashion, electronics, household goods), services (education, travel, logistics), and digital products (software, online platforms). This diversity ensures that the sample reflects the heterogeneity of Vietnam's e-commerce ecosystem. The growth rate of e-commerce in Vietnam reached 27% in 2024, with the online retail market size hitting USD 32 billion, strengthening the country's solid position in e-commerce. Building on this foundation, along with a series of policies and legal documents that came into effect or were issued in 2025, VECOM assessed that Vietnam's e-commerce is entering its fourth phase—a stage of rapid and sustainable development. At the same time,

Vietnamese small and medium-sized enterprises (SMEs) often face financial, technological, and human resource constraints, which hinder their ability to manage knowledge effectively and foster innovation. This makes Vietnam a highly relevant yet underexplored context for examining the role of knowledge and innovation in SME operations. Data collection was conducted in 2025, a year of strong recovery in the digital economy, providing a unique opportunity to observe how SMEs leverage knowledge capabilities to enhance innovation and business performance.

Business performance (BP) was measured using a validated multi-item scale adapted from Truong & Nguyen (2024). The scale includes both financial (e.g., profitability, sales growth) and non-financial (e.g., customer satisfaction, market share) dimensions. All items were rated on a five-point Likert scale. Descriptive analysis confirmed that the BP construct follows an approximately normal distribution, with skewness and kurtosis values falling within acceptable thresholds, ensuring suitability for PLS-SEM analysis.

After data collection, the author performed statistical aggregation of the survey data, reliability testing of each measurement scale component through Cronbach's Alpha, and hypothesis testing using Partial Least Squares Structural Equation Modeling (PLS-SEM).

3.3 Sampling Method and Sample Size

The study applied a non-probability convenience sampling method, targeting SMEs in the e-commerce sector in Ho Chi Minh City. The sample size was determined based on two factors, as outlined by Hair et al. (2006): a minimum of 50 samples and the number of variables included in the analysis. The formula is:

$$n = \sum_{j=1}^{m} kPj$$

Where:

- m is the number of measurement scales,
- P_j is the number of observed variables for scale jjj,
- The sample-to-variable ratio k is either 5:1 or 10:1.

In this research model, there are 7 factors and a total of 35 observed variables. Using k = 5: 1, the minimum sample size required is n = 35 × 5 = 175

Additionally, the author considered studies by Comrey & Lee (2013) and Tabachnick & Fidell (2007). According to Comery & Lee (2013), sample sizes of 100 are poor, 200 are acceptable, 300 are good, 500 are very good, and 1,000+ are excellent. Tabachnick & Fidell (2007) suggest that 300 observations are sufficient for SEM models, and 500 are very good. Therefore, to balance resource constraints and account for invalid responses, this study planned for an estimated sample size of 600 observations. This satisfies the minimum of 160 observations recommended by Hair et al. (2006) and is considered a very good sample size per Comrey & Lee (2013) and Tabachnick & Fidell (2007).

3.4 Secondary Data Collection

Secondary data were collected from reputable sources on knowledge management, e-commerce, business performance, and innovation capacity, both domestically and internationally. These data supported the importance of knowledge management in businesses today.

The study also reviewed foundational theories and previous research on knowledge management in books, academic journals, and scientific articles from databases such as ScienceDirect, Elsevier, Sage, Taylor & Francis, SpringerLink, Google Scholar, and Emerald Insight. Most sources were published on these platforms and have been peer-reviewed for scientific credibility.

3.5 Primary Data Collection

Primary data was collected in three steps:

Step 1: After qualitative research, the author developed a preliminary (draft) survey using a 5-point Likert scale (from 1 = Strongly Disagree to 5 = Strongly Agree).

Step 2: From the draft survey, 60 SMEs were selected to assess the scales' reliability and refine the questionnaire into the official form.

Step 3: The official questionnaire survey was conducted. The collected data were analyzed using SmartPLS 4.0.

4. Result

4.1 Descriptive Analysis

Table 1 provides a descriptive overview of the study sample, comprising 567 respondents. Regarding gender distribution, males accounted for 56.97% of participants, while females accounted for 43.03%. Regarding age, the majority of respondents were between 24 and 30 years old (41.62%), followed by those aged 30 to 36 years (21.69%) and over 42 years (17.28%), indicating that the sample primarily consists of individuals in their prime working years. Regarding educational attainment, a significant proportion of respondents held a university degree (82.01%), while 10.93% had completed college and 4.76% held postgraduate qualifications, reflecting a generally high level of education among participants. In terms of income, the most common range was 15-20 million VND per month (39.86%), suggesting a moderate to upper-middle income profile. Regarding company size, the majority of respondents worked in small enterprises (62.79%), followed by micro enterprises (19.75%) and medium-sized enterprises (17.46%). In terms of job position, technical specialists accounted for the highest proportion (43.56%), followed by sales managers (21.34%). Most respondents were employed in companies that had been operating for more than five years (53.79%), indicating a relatively stable business environment. Lastly, in terms of enterprise type, private enterprises accounted for the largest proportion (56.97%), followed by joint-stock or joint-venture enterprises (43.03%).

Table 1: Description of the study sample

Personal Information		Frequency	Percent (%)
Gender	Male	323	56.97
	Female	244	43.03
Age	From 18 to 24 years old	36	6.35
	From 24 to 30 years old	236	41.62
	From 30 to 36 years old	123	21.69
	From 36 to 42 years old	74	13.05
	Over 42 years old	98	17.28
Education Level	Lower secondary school	3	0.53
	Upper secondary school	10	1.76
	College	62	10.93
	University	465	82.01
	Postgraduate	27	4.76
Income Level	Under 10 million VND	68	11.99
	From 10 to 15 million VND	126	22.22
	From 15 to 20 million VND	226	39.86
	From 20 to 25 million VND	100	17.64
	Over 25 million VND	47	8.29
Company Size	Micro enterprise	112	19.75
	Small enterprise	356	62.79
	Medium enterprise	99	17.46
Job Position	Marketing Director	56	9.88
	Sales Director	78	13.76
	General Director	65	11.46
	Sales Manager	121	21.34
	Technical Specialist	247	43.56
Business Operating Time	Less than 5 years	262	46.21
	More than 5 years	305	53.79

Personal Information		Frequency	Percent (%)
Type of Enterprise	Private enterprise	323	56.97
	Joint stock – Joint venture enterprise	244	43.03

Table 2 presents the descriptive statistics for all measurement items. The mean values ranged from 3.69 to 4.22, indicating generally positive responses across constructs. Standard deviations ranged from 0.71 to 1.10, suggesting moderate variability in participants' evaluations.

Table 2: Descriptive statistics of survey items

Item	N	Mean	SD	Min	Max
KM1	567	3.79	1.01	1	5
KM2	567	3.70	1.10	1	5
KM3	567	3.76	1.01	1	5
KM4	567	3.75	0.99	1	5
KM5	567	3.80	0.96	1	5
KAC1	567	3.76	0.89	1	5
KAC2	567	3.81	0.79	1	5
KAC3	567	3.76	0.89	1	5
KAC4	567	3.79	0.85	1	5
KAC5	567	3.69	0.81	1	5
KT1	567	4.05	0.85	1	5
KT2	567	4.02	0.81	1	5
KT3	567	3.99	0.80	1	5
KT4	567	4.00	0.82	1	5
KT5	567	4.04	0.75	1	5
KA1	567	4.15	0.82	1	5
KA2	567	4.17	0.76	1	5
KA3	567	4.18	0.81	1	5
KA4	567	4.22	0.79	1	5
KA5	567	4.19	0.71	1	5
KS1	567	4.11	0.74	1	5
KS2	567	4.08	0.74	1	5
KS3	567	4.20	0.73	1	5
KS4	567	4.19	0.73	1	5
KS5	567	4.20	0.75	1	5
IC1	567	4.09	0.84	2	5
IC2	567	3.98	0.71	2	5
IC3	567	4.05	0.74	2	5
IC4	567	4.09	0.84	2	5
IC5	567	4.13	0.82	2	5
BP1	567	3.74	0.85	1	5
BP2	567	3.79	0.82	1	5
BP3	567	3.78	0.77	1	5
BP4	567	3.78	0.75	1	5
BP5	567	3.78	0.74	1	5

Table 3 shows the mean scores of survey items across five respondent groups. Overall, the evaluations are consistent, with most scores ranging between 3.7 and 4.2. The KA and KS items received the highest ratings (above 4.1 across groups), while the IC and BP items were relatively lower (around 3.7–3.9). These findings suggest that although perceptions vary slightly across items, differences between respondent groups are minimal.

Table 3: Mean scores of survey items by respondent group

Item	Marketing Director	Sales Director	General Director	Sales Manager	Technical Specialist
KM1	3.79	3.79	3.79	3.78	3.79
KM2	3.70	3.70	3.70	3.70	3.70
KM3	3.75	3.76	3.75	3.75	3.76
KM4	3.74	3.75	3.75	3.75	3.75
KM5	3.80	3.80	3.80	3.80	3.80
KAC1	3.76	3.76	3.76	3.76	3.76
KAC2	3.79	3.81	3.82	3.82	3.81
KAC3	3.74	3.76	3.76	3.76	3.76
KAC4	3.77	3.79	3.79	3.79	3.79
KAC5	3.72	3.69	3.69	3.69	3.68
KT1	4.07	4.05	4.06	4.06	4.05
KT2	4.03	4.02	4.02	4.02	4.02
KT3	4.00	3.99	3.99	3.99	3.99
KT4	4.01	4.00	4.00	4.00	4.00
KT5	4.04	4.04	4.04	4.03	4.04
KA1	4.17	4.14	4.14	4.14	4.14
KA2	4.20	4.17	4.16	4.15	4.17
KA3	4.21	4.18	4.18	4.18	4.18
KA4	4.24	4.22	4.22	4.22	4.22
KA5	4.23	4.22	4.22	4.21	4.22
KS1	4.21	4.19	4.19	4.18	4.18
KS2	4.12	4.11	4.11	4.12	4.11
KS3	4.09	4.08	4.08	4.09	4.08
KS4	4.22	4.19	4.20	4.20	4.19
KS5	4.22	4.19	4.19	4.19	4.19
IC1	4.05	4.04	4.04	4.04	4.05
IC2	3.97	3.98	3.98	3.98	3.98
IC3	4.05	4.05	4.05	4.06	4.05
IC4	4.08	4.08	4.08	4.08	4.08
IC5	4.12	4.11	4.11	4.11	4.11
BP1	3.74	3.74	3.74	3.73	3.74
BP2	3.78	3.78	3.78	3.78	3.79
BP3	3.76	3.76	3.76	3.75	3.76
BP4	3.78	3.78	3.78	3.77	3.78
BP5	3.78	3.77	3.77	3.77	3.78

4.2 Measurement Model

For evaluating the discriminant validity, convergent validity, and reliability of the constructs in order to determine how well the measuring model performed. The findings of the reliability analysis of the constructs using Cronbach's alpha (CA) are indicated in Table 4. All of the constructions' CA values are greater than 0.7, indicating their reliability. This study used average variance extracted (AVE), composite reliability (CR), and outer loadings (OL) to evaluate convergent validity. All numbers are over the 0.7 threshold, and no indicator loading is below it. With AVE values greater than 0.5, each construction satisfied the requirements. Convergent validity is supported by composite reliability values that exceed 0.7 (Hair et al., 2022).

Table 4: Reliability and Validity

Factor	Cronbach's Alpha (CA)	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)	Outer loading (OL)
BP	0.937	0.938	0.952	0.800	0.844 – 0.918
IC	0.884	0.884	0.915	0.683	0.777 – 0.867
KA	0.888	0.890	0.918	0.691	0.795 – 0.869
KAC	0.893	0.894	0.922	0.702	0.782 – 0.879
KM	0.893	0.894	0.921	0.700	0.803 – 0.872
KS	0.881	0.885	0.913	0.678	0.791 – 0.859
KT	0.819	0.820	0.873	0.580	0.726 – 0.778

This study computed the heterotrait-monotrait correlation ratio (HTMT) to assess discriminant validity. Table 5's HTMT values are below the 0.9 threshold, indicating discriminant validity (Henseler, Ringle & Sarstedt, 2014). As a result, the measurement model showed sufficient discriminant and convergent validity.

Table 5: Validity – HTMT Ratio

	BP	IC	KA	KAC	KM	KS	KT
BP							
IC	0.758						
KA	0.607	0.541					
KAC	0.485	0.482	0.349				
KM	0.674	0.581	0.353	0.341			
KS	0.597	0.594	0.482	0.380	0.380		
KT	0.754	0.740	0.545	0.374	0.565	0.560	

4.3 Structural Model

The f^2 effect sizes in Table 6 ranged from 0.024 to 0.153, indicating minor but acceptable effects of the exogenous variables on innovation and business performance. Specifically, KA, KAC, KS, and KT had minor effects on IC, with f^2 values ranging from 0.028 to 0.143. Among them, KT had the most potent effect on IC with an f^2 value of 0.143 (approaching the medium level), while KA and KAC had minimal effects (f^2 = 0.028 and 0.042, respectively). The effect of KM on IC was small (f^2 = 0.066), indicating a moderate role in shaping innovation capability.

For BP, KM had the largest effect size (f^2 = 0.153), indicating that knowledge management plays a significant role in improving business performance. KT and KA had minor effects (f^2 = 0.077 and 0.067), while KAC and KS had minimal effects (f^2 = 0.024 and 0.031).

Overall, the f^2 values ranged from 0.024 to 0.153, indicating that the exogenous variables had effects ranging from very small to medium on innovation capability (IC) and business performance (BP).

All Variance Inflation Factor (VIF) values were below the critical value of 5, indicating no multicollinearity among the variables. Furthermore, the endogenous constructs—innovation (Q^2 = 0.533) and business performance (Q^2 = 0.646)—showed Q^2 values above zero, which confirms the model's predictive relevance. Overall, the evaluation of effect size (f^2), VIF, and predictive relevance (Q^2) suggests that the structural model demonstrates satisfactory predictive power and no multicollinearity concerns among the constructs.

The analysis results showed that the R^2 value for the business performance variable (BP) reached 0.670, indicating that 67% of the variance in business performance was explained by the independent variables in the model, including innovation capability and knowledge-related factors. This is considered a high explanatory level, suggesting the model has good predictive power for the business performance of e-commerce enterprises. Meanwhile, the innovation capability variable (IC) had an R^2 value of 0.540, indicating that the knowledge-related factors explained 54% of the variance in innovation capability. According to Hair et al. (2022), both R^2 values fall within the medium to high range, reflecting that the research model has strong explanatory power and is appropriate for testing the proposed hypotheses.

Table 6: Result of f^2 , Q^2 , and VIF

Construct	F^2		VIF		Q^2	R^2
	BP	IC	BP	IC		
BP					0.646	0.670
IC	0.067		2.193		0.533	0.540
KA	0.067	0.028	1.445	1.406		
KAC	0.024	0.042	1.275	1.223		
KM	0.153	0.066	1.461	1.371		
KS	0.031	0.056	1.527	1.446		
KT	0.077	0.143	1.903	1.665		

The PLS-SEM analysis in Table 7 shows that all hypothesized relationships are supported, as all path coefficients are positive and statistically significant ($p < 0.01$). These findings indicate that knowledge-related factors (KA, KAC, KM, KS, KT) and innovation capability (IC) positively influence business performance (BP). Additionally, knowledge factors play a crucial role in enhancing firms' innovation capability.

Specifically, innovation capability (IC) positively affects business performance ($\beta = 0.219$, $t = 6.600$, $p < 0.001$), supporting Hypothesis H1. This result suggests that as firms enhance their innovation capabilities, their business performance improves correspondingly.

Regarding the knowledge-related factors, all have a positive impact on business performance. Knowledge management (KM) has the most decisive influence ($\beta = 0.270$, $t = 9.942$, $p < 0.001$), followed by knowledge transformation (KT) ($\beta = 0.219$, $t = 6.487$, $p < 0.001$), knowledge application (KA) ($\beta = 0.178$, $t = 5.830$, $p < 0.001$), knowledge sharing (KS) ($\beta = 0.124$, $t = 4.307$, $p < 0.001$), and finally, knowledge absorptive capability (KAC) ($\beta = 0.100$, $t = 3.779$, $p < 0.001$). These findings reinforce the positive role of knowledge resources in enhancing a firm's business performance. In addition, the knowledge-related factors also positively influence innovation capability (IC). Among them, knowledge transformation (KT) has the most significant impact ($\beta = 0.329$, $t = 8.088$, $p < 0.001$), indicating that transformation plays a key role in the innovation process. The other factors include: knowledge absorptive capability (KAC) ($\beta = 0.153$, $t = 5.145$, $p < 0.001$), knowledge sharing (KS) ($\beta = 0.193$, $t = 4.888$, $p < 0.001$), knowledge management (KM) ($\beta = 0.203$, $t = 6.067$, $p < 0.001$), and knowledge application (KA) ($\beta = 0.134$, $t = 3.406$, $p = 0.001$). These results show that knowledge-related factors are essential foundations for promoting innovation in e-commerce enterprises. Overall, the research model confirmed all proposed hypotheses, clarifying the mediating role of innovation capability in the relationship between knowledge and business performance.

Table 7: Results of Structural Model

Relationships	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
IC -> BP	0.219	0.216	0.033	6.600	0.000
KA -> BP	0.178	0.179	0.030	5.830	0.000
KA -> IC	0.134	0.138	0.039	3.406	0.001
KAC -> BP	0.100	0.101	0.026	3.779	0.000
KAC -> IC	0.153	0.151	0.030	5.145	0.000
KM -> BP	0.270	0.271	0.027	9.942	0.000
KM -> IC	0.203	0.201	0.033	6.067	0.000

Relationships	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
KS -> BP	0.124	0.123	0.029	4.307	0.000
KS -> IC	0.193	0.196	0.039	4.888	0.000
KT -> BP	0.219	0.220	0.034	6.487	0.000
KT -> IC	0.329	0.328	0.041	8.088	0.000

This research employed SmartPLS bootstrapping with 5,000 resamples to investigate the mediating effect of innovation capability (IC) on the relationship between knowledge management components and business performance (BP) (Hayes, 2013). Due to its effectiveness in accurately estimating indirect effects, this approach is widely recommended for assessing mediation within PLS-SEM frameworks. The results demonstrated that innovation capability partially mediates the impact of the three knowledge management dimensions on business performance. The mediating effects are summarized in Table 8, which details the role of innovation capability in linking knowledge management to business outcomes.

Table 8: Result - Mediating Role of Innovation

Relationships	Indirect effect			Direct effect			Mediation Role	Result
	Beta	T Statistics	P Values	Beta	T Statistics	P Values		
KA -> IC -> BP	0.029	3.085	0.002	0.178	5.830	0.000	Partial	Supported
KAC -> IC -> BP	0.034	4.050	0.000	0.100	3.779	0.000	Partial	Supported
KM -> IC -> BP	0.045	4.596	0.000	0.270	9.942	0.000	Partial	Supported
KS -> IC -> BP	0.042	3.938	0.000	0.124	4.307	0.000	Partial	Supported
KT -> IC -> BP	0.072	4.817	0.000	0.219	6.487	0.000	Partial	Supported

The mediation analysis results from the PLS-SEM model indicate that innovation capability (IC) partially mediates the relationship between knowledge resources and business performance (BP) in small and medium-sized e-commerce enterprises in Ho Chi Minh City. Figure 2 presents the PLS-SEM model, illustrating the relationships among the latent variables in the research model and the magnitude of their effects.

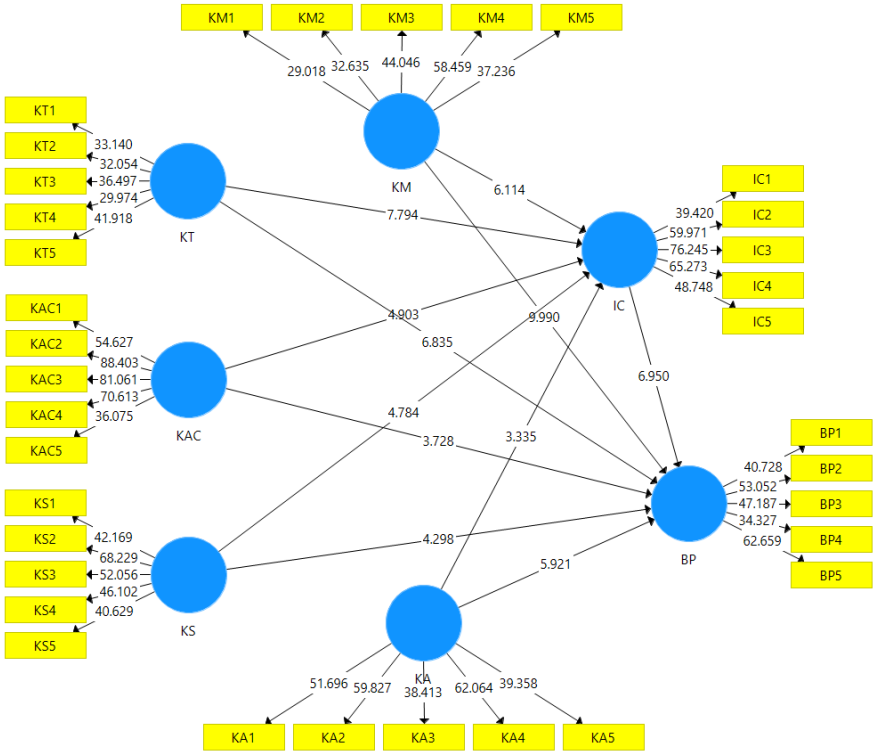

Figure 2: PLS – SEM Model

Specifically, knowledge application (KA) has a significant effect on business performance through two paths: a direct effect (β = 0.178, t = 5.830, p < 0.001) and an indirect effect via IC (β = 0.029, t = 3.085, p = 0.002). This indicates that when firms effectively apply knowledge in practice, they not only achieve immediate performance improvements but also enhance their innovation capabilities, which in turn further boost business outcomes. The partially mediated relationship by IC demonstrates that innovation acts as a crucial bridge between practical knowledge and ultimate business results.

Similarly, knowledge absorptive capability (KAC) also shows an indirect effect on BP through IC (indirect β = 0.034, t = 4.050, p < 0.001), alongside a direct effect (β = 0.100, t = 3.779, p < 0.001). This highlights that the ability to learn and absorb external knowledge (from markets, partners, customers, etc.) not only directly improves performance but also helps develop innovation capabilities to adapt to the competitive digital environment. According to the RBV theory, knowledge is a strategic resource, but innovation capability enables firms to reorganize those resources to create sustainable competitive advantage.

For knowledge management (KM) – the core component of a firm's knowledge base – the results show substantial impacts both directly (β = 0.270, t = 9.942, p < 0.001) and indirectly through IC (β = 0.045, t = 4.596, p < 0.001). This supports the argument by Nonaka & Takeuchi (1995) that an effective knowledge management system not only optimizes the use of existing knowledge but also serves as a launching pad for innovation in products, processes, and business models.

Knowledge sharing (KS) – the activity that facilitates the dissemination and exchange of knowledge within the firm – also influences BP through IC (indirect β = 0.042, t = 3.938, p < 0.001) and directly (β = 0.124, t = 4.307, p < 0.001). This suggests that a knowledge-sharing culture can trigger collective innovation capabilities, accelerating problem-solving, new product development, and improving service quality.

Lastly, knowledge transformation (KT) – the ability to convert tacit knowledge into explicit knowledge and vice versa – shows the most substantial indirect effect via IC on BP (β = 0.072, t = 4.817, p < 0.001), alongside a significant direct effect (β = 0.219, t = 6.487, p < 0.001). This clarifies the foundational role of the ability to convert knowledge into actionable capabilities. According to RBV, integrating and reconfiguring knowledge is essential for generating strategic value from intangible resources such as organizational knowledge.

All relationships reflect the partial mediation role of innovation capability, meaning that IC is not only a transmission mechanism but also an independent and important driver of business performance. These results underscore that to fully leverage knowledge resources, firms must focus on developing innovation capability as a dynamic capability—one that enables organizations to adapt and thrive in a volatile business environment.

5. Discussion

5.1 Discussion of Research Result

The research findings have confirmed the positive relationships between components of knowledge management and innovation capability in enhancing the business performance of small and medium-sized enterprises (SMEs) in the e-commerce sector in Vietnam. The PLS-SEM model analysis shows that all hypotheses (H1–H11) are supported at a high level of statistical significance (p < 0.001), reinforcing the central role of knowledge and innovation in driving firm performance. Each factor in the model contributes distinct insights, as discussed below:

Knowledge Management (KM) has the most substantial direct impact on business performance (β = 0.270) and a significant influence on innovation capability (β = 0.203). This supports the perspectives of the RBV and KBV theories, which consider knowledge a strategic resource and the ability to manage it as a critical driver of organizational success. According to Nonaka & Takeuchi (1995), effective knowledge management not only preserves existing knowledge but also fosters a continuous learning and innovation environment. This finding is also consistent with Wang & Lin (2013), who highlighted that a knowledge management orientation can enhance organizational performance.

Knowledge Transformation (KT) exerts the most decisive influence on innovation capability (β = 0.329), indicating that the ability to convert tacit knowledge into explicit knowledge (and vice versa) is a key enabler of innovation. This clearly supports the Dynamic Capabilities theory, which emphasizes the importance of reconfiguring knowledge in response to environmental changes. KT also positively impacts business performance (β = 0.219). This aligns with the findings of Muñoz et al. (2022) and Cruz-Ros, Guerrero-Sánchez & Miquel-Romero (2021), who stressed that knowledge transformation enhances product, service, and business model innovation.

Knowledge Sharing (KS) has a positive effect on both innovation capability (β = 0.193) and business performance (β = 0.124). This suggests that a knowledge-sharing culture within organizations fosters collective innovation, faster problem-solving, and improved operational efficiency. These findings support prior studies (Doğan & Doğan, 2020; Wang & Wang, 2012) and affirm the importance of knowledge sharing in open innovation strategies, especially in dynamic e-commerce environments.

Knowledge Application (KA) significantly impacts business performance (β = 0.178) and innovation capability (β = 0.134), emphasizing the role of applying knowledge in practice to generate value. Alavi & Leidner (2001) emphasized that knowledge application is the most critical phase of the knowledge management process, bridging the gap between theory and action. The findings also align with the KBV theory, which holds that knowledge only becomes a source of competitive advantage when effectively applied to support innovation.

Knowledge Absorptive Capacity (KAC) positively influences both innovation capability (β = 0.153) and business performance (β = 0.100). This validates Cohen & Levinthal's (1990) Absorptive Capacity theory, which posits that the ability to recognize, assimilate, and apply external knowledge is essential for innovation and organizational adaptation. The result is also consistent with Gebauer, Worch & Truffer (2012), who emphasized that absorptive capacity facilitates knowledge transfer and improves organizational outcomes.

Innovation Capability (IC) is not only a mediating variable but also has a direct and significant impact on business performance (β = 0.219). This highlights the role of IC as a dynamic capability that enables organizations to reconfigure and deploy resources to respond effectively to competitive environments (Teece, Pisano & Shuen, 1997). Prior studies (Bahta et al., 2020; Agyapong, Agyapong & Poku, 2017) have also shown that innovation capability significantly enhances SME performance in digital economies.

The mediation analysis confirms that innovation capability partially mediates the relationship between knowledge-related factors and business performance. All indirect effects are statistically significant ($p < 0.01$), proving that IC acts as a key mechanism for transforming knowledge into tangible business outcomes. This reinforces the theoretical integration of KBV and Dynamic Capabilities, where IC is viewed as the strategic converter of intangible resources into performance improvements.

The novelty of this study lies in its context-specific contribution, theoretical integration, and methodological rigor. By examining e-commerce SMEs in Vietnam, the research extends prior studies that have predominantly focused on developed economies or large enterprises. The integration of RBV, KBV, and Dynamic Capabilities theory provides a comprehensive explanation of how knowledge-related factors drive innovation and business performance. Moreover, by highlighting the partial mediating role of innovation capability, the study clarifies the mechanism through which knowledge resources are transformed into tangible business outcomes. These contributions enrich the existing body of knowledge and offer meaningful implications for scholars and practitioners.

5.2 Managerial Implications

The findings of this study provide important guidance for managers of small and medium-sized enterprises (SMEs) in the e-commerce sector. Since knowledge management (KM) showed the most substantial direct impact on business performance, managers should prioritize building robust KM systems that include effective processes for acquiring, storing, and utilizing knowledge. In practice, firms can adopt digital knowledge repositories, collaborative platforms, and internal wikis to ensure knowledge is accessible. Managers are also advised to establish reward and recognition systems that encourage employees to share knowledge, thereby reducing duplication of effort and accelerating innovation cycles. In addition, cross-functional workshops, mentoring programs, and after-action reviews can be used to strengthen knowledge transformation. To translate knowledge into tangible results, managers should integrate knowledge application into routine decision-making, product development, and customer service activities.

Beyond managerial practice, the results also have implications for policymakers. Government agencies and regulators can design targeted support programs—such as subsidies for digital knowledge systems, training initiatives to improve absorptive capacity, and incentives for collaborative innovation networks—that directly strengthen SMEs' knowledge capabilities. By creating an enabling environment, policymakers can help SMEs overcome structural resource limitations and enhance their contribution to the digital economy.

Other stakeholders also play an important role. SME associations can act as intermediaries by creating collaborative platforms and knowledge-sharing networks across firms. Universities and training institutions can integrate KM and innovation capability into educational programs, thereby equipping the workforce with the

skills required to support digital transformation. Investors and incubators can use knowledge-related capabilities as a key criterion in evaluating SMEs' growth potential, providing funding and mentorship to firms with strong knowledge and innovation systems.

Overall, the study highlights that managers, policymakers, and stakeholders must act in a coordinated manner. While managers focus on firm-level practices to strengthen knowledge processes and innovation, policymakers and ecosystem partners should provide complementary resources and support structures. Such alignment will maximize the impact of knowledge and innovation capabilities on the long-term performance and competitiveness of SMEs in Vietnam's digital economy.

5.3 Limitations and Future Research Directions

Despite the valuable insights provided by this study, several limitations must be acknowledged, which also open up potential avenues for future research.

This study was conducted with a sample of SMEs operating primarily in the e-commerce sector in Ho Chi Minh City, Vietnam. While this focus enhances the contextual relevance, it limits the generalizability of the findings to other geographic regions or industries. Future studies could expand the sample to include SMEs from other cities and rural areas, as well as across different ASEAN countries, to compare the cultural and economic effects on knowledge management and innovation.

The research employed a cross-sectional design, capturing data at a single point in time. As such, it does not allow for the assessment of causal relationships or changes in innovation capability and performance over time. Longitudinal studies are recommended to track how knowledge-related capabilities and business performance evolve in response to internal changes and external market dynamics.

Data for this study were collected using self-reported questionnaires, which may introduce response biases such as social desirability or subjective interpretation. Future research may benefit from incorporating multiple data sources, such as objective performance metrics, financial reports, or third-party evaluations, to enhance data accuracy and reduce bias.

Although the model explains a significant portion of the variance in innovation capability and business performance, other influential variables may not be included in this study. Factors such as leadership style, organizational culture, technological infrastructure, market turbulence, and digital maturity could also play mediating or moderating roles. Future studies should consider integrating these variables for a more comprehensive analysis.

While the study utilized validated measurement scales adapted from prior research, the context-specific nature of the Vietnamese e-commerce environment may require further refinement or development of culturally tailored instruments. Future research could employ qualitative methods or exploratory factor analysis in different cultural settings to refine scale reliability and validity.

This study focused on direct and mediating effects but did not fully explore the potential moderating effects or interaction terms among knowledge components. For instance, future research could investigate whether the relationship between knowledge application and performance is moderated by organizational agility or environmental uncertainty.

In conclusion, while the current study offers a robust model and empirical evidence regarding the role of knowledge and innovation in e-commerce SMEs, addressing these limitations in future research will further enhance theoretical contributions and provide deeper insights for both scholars and practitioners.

6. Conclusion

In the context of an increasingly dynamic and knowledge-intensive digital economy, especially in the e-commerce sector, the role of knowledge as a strategic resource has become more vital than ever. This study investigated the impact of knowledge-related factors—specifically knowledge management, knowledge absorptive capability, knowledge application, knowledge transformation, and knowledge sharing—on innovation capability and business performance among small and medium-sized enterprises (SMEs) in Vietnam. Grounded in the Resource-Based View (RBV), Knowledge-Based View (KBV), and Dynamic Capabilities theories, the research proposed and tested a comprehensive model using Partial Least Squares Structural Equation Modeling (PLS-SEM).

The empirical results confirmed that all knowledge components positively and significantly influence both innovation capability and business performance. Among them, knowledge management had the most substantial direct effect on business performance, while knowledge transformation had the most significant impact on innovation capability. Moreover, innovation capability partially mediated the relationship between knowledge-related factors and business performance, highlighting its importance as a dynamic mechanism that converts intangible knowledge assets into tangible organizational outcomes.

These findings make several theoretical contributions. First, they validate and extend the RBV and KBV frameworks by demonstrating how knowledge, when effectively managed and applied, can drive performance through enhanced innovation. Second, the study underscores the relevance of the Dynamic Capabilities theory by showing that innovation capability is essential in enabling SMEs to respond to market shifts and maintain competitiveness. Third, the model provides empirical evidence that supports integrating multiple theoretical perspectives to better explain organizational behavior in the digital age.

From a practical standpoint, the results offer actionable insights for SME managers, particularly in developing economies. To thrive in highly competitive e-commerce environments, firms must prioritize investments in knowledge systems, foster a culture of sharing and continuous learning, and institutionalize innovation as a core competency across all operations.

However, the study is not without limitations. Its scope was geographically constrained, the design was cross-sectional, and data relied on self-reported responses. Future research should address these issues by conducting longitudinal, multi-country studies, using mixed-methods, and incorporating additional variables such as digital transformation readiness, leadership style, and environmental turbulence.

In conclusion, this study affirms that strategic knowledge management, coupled with strong innovation capability, constitutes a foundational pathway for enhancing the business performance of SMEs in the digital economy. By understanding and applying these insights, both scholars and practitioners can help build more resilient, agile, and knowledge-driven enterprises in the years to come.

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Appendix A. Survey Measurement Items

Construct	Code	Measurement Item	Source
Knowledge Management (KM)	KM1	Our company frequently shares information and knowledge across departments to improve e-commerce business performance.	Tseng & Fan (2011)
	KM2	Our company has an effective system for collecting and storing customer information.	
	KM3	Our company encourages employees to apply their knowledge in their daily work.	
	KM4	Our company has processes that make it easy for employees to store and retrieve information.	
	KM5	Our company regularly updates and improves its knowledge management processes to better align with the e-commerce market.	
Knowledge Absorptive Capacity (KAC)	KAC1	Our company is willing to acquire and apply external knowledge (from customers, partners, competitors, etc.) to drive innovation in e-commerce.	Truong & Nguyen (2024)
	KAC2	Our company collects e-commerce industry information from both official sources (reports, conferences, government agencies) and informal sources (social media, forums, groups, etc.).	
	KAC3	Our company effectively utilizes acquired knowledge to improve performance and innovate products/services.	
	KAC4	Our company is willing to invest in suitable new technologies (e.g., AI, chatbots, data analytics) to enhance business performance.	
	KAC5	Our company regularly evaluates the impact of market changes in e-commerce to promptly introduce new products and services.	
Knowledge Transformation (KT)	KT1	Our company encourages employees to share ideas and professional knowledge.	Tseng & Fan (2011)
	KT2	Our company has mechanisms to convert individual experiences into shared organizational documents/guidelines.	
	KT3	Our company combines multiple sources of information to create new knowledge.	
	KT4	Our company applies best practices across different departments.	
	KT5	Our company encourages learning from past experiences to improve future performance.	
Knowledge Application (KA)	KA1	Our company has specific processes for applying accumulated knowledge from practical experience to e-commerce business operations.	Pérez-López & Alegre (2012); Dedunu, Weerasinghe & Wickcramasinghe (2025)
	KA2	Our company has procedures for leveraging internal knowledge to develop new e-commerce products or services.	
	KA3	Our company can adapt and apply knowledge to respond to changes in the e-commerce competitive environment.	
	KA4	Our company frequently applies lessons learned from past situations to current issues.	
	KA5	Our company encourages employees to apply existing knowledge to minimize risks when handling similar problems in the future.	
Knowledge Sharing (KS)	KS1	Our company can absorb new technical knowledge from partners.	Aisjah, Arsawan & Suhartanto (2023)
	KS2	Our company can solve practical problems by leveraging knowledge from partners.	
	KS3	Our company regularly collaborates with partners on training and professional development.	
	KS4	Our company proactively shares and updates partners on e-commerce industry trends.	
	KS5	Our company shares internal knowledge with partners to enhance business performance and improve customer service jointly.	

Innovation Capability (IC)	IC1	Our company has developed new operational or production methods/processes suitable for the e-commerce environment.	Lam et al. (2021); Truong & Nguyen (2024)
	IC2	Our company has introduced new (or improved) management methods/processes in the past three years.	
	IC3	Our company has introduced new (or improved) products/services in the past three years.	
	IC4	Our company regularly improves or adjusts existing products/services to meet market needs.	
	IC5	Our company demonstrates creativity in organizing and implementing business activities.	
Business Performance (BP)	BP1	Our company has achieved sustainable business growth over the past three years.	Truong & Nguyen (2024)
	BP2	Our company has a good reputation in the e-commerce sector.	
	BP3	Customers highly evaluate the quality of our products/services.	
	BP4	Our company has achieved its revenue targets over the past three years.	
	BP5	Our company has achieved its profit targets over the past three years.	

Knowledge Sharing and Innovative work Behavior: A Quantitative Study of Pharmaceutical Engineers in Morocco

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Abstract: In the fast-moving industrial environment of the world today, the importance of promoting innovation has clearly increased as a key driver of business performance. Nowhere is this more obvious than in the pharmaceutical industry, where the quest for advances in Research and development is viewed as crucial. Developing an awareness of the drivers of innovative working behavior among workforce members is of the highest priority, and this study investigates the link between knowledge sharing and innovative work behavior among pharmaceutical engineers in Morocco. Despite the increasing relevance of innovation in the pharmaceutical sector, studies on the effects of knowledge sharing in non-Western contexts are limited. This gap demonstrates the necessity for further research aimed at the Moroccan environment, where hierarchical structures and limited R&D capabilities influence knowledge-sharing practices. A sample of 286 pharmaceutical engineers contributed to a quantitative research study. The findings indicate that knowledge donating and knowledge collecting positively impact innovative work behavior, with knowledge donating exerts a greater influence. The paper highlights the value of promoting a culture of knowledge sharing to stimulate innovation. Limitations identified relate to the choice of convenience sampling and the restriction to a single sector. Additional investigation could be conducted in other sectors to better understand the links between knowledge sharing and innovative work behavior.

Keywords: Knowledge sharing, Moroccan context, Pharmaceutical industry, Quantitative study, Innovative work behavior

1. Introduction

The relevance of research and development to the pharmaceutical business is reflected in overall R&D investment in the entire field, as well as at the level of individual firms. Global R&D investment by pharmaceutical and bio-pharma businesses has climbed significantly, from USD 108 billion (2006) to USD 141 billion (2015) (Schuhmacher, Gassmann and Hinder, 2016). As pharmaceutical corporations in low- and moderate-income economies struggle with research and development (R&D) budgets, legislation, foreign competitors and expiring patents, innovation is the key to their success and sustainability. In addition, scientific papers exploring innovation in a context like ours are scarce (Benali, I., Acha, N. and Barka, H. 2021). The pharmaceutical field in Morocco is witnessing energetic growth, embodying a strategic domain orientated around the research, development and provision of advanced medical equipment (El Mokrini, Benabbou and Berrado, 2018). At the heart of this change process, knowledge sharing is a key factor, representing an indispensable component in shaping the IWB of the workforce in this rapidly shifting context (Ganguly, Talukdar and Chatterjee, 2020). Although knowledge sharing has been largely investigated in the context of innovative work behavior in several sectors, little attention has been devoted to studies relating directly to the pharmaceutical industry in Morocco. Most previous investigations have been performed in Western and Asian environments, where company infrastructures, Research and Development budgets and knowledge-sharing processes are quite different (Akkari et al., 2016). In Morocco, the pharmaceutical sector is confronted with some issues, notably a heavy hierarchical culture, restricted Research and Development investment and heavy reliance on imported raw materials (El Mokrini, Benabbou and Berrado, 2018). These issues can affect the way knowledge is shared to promote innovative work behavior. In addition, cultural and organizational obstacles can impede the free flow of knowledge, making it vital to better elucidate the dynamics of knowledge donation and knowledge collection in this particular environment. The Covid-19 crisis proved the pivotal importance of knowledge sharing in stimulating pharmaceutical innovation (Montani and Staglianò, 2022). In the Kingdom of Morocco, this unusual challenge has revealed the importance of better internal cooperation and speedy exchange of knowledge to tailor production systems, maintain supply chains and implement alternative processes. This shows the necessity in investigating knowledge sharing among this sector.

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Despite the increased significance of innovation in the pharmaceutical sector, limited scientific studies have investigated the effect of knowledge sharing on the innovative work behavior of pharmaceutical engineers in non-Western contexts. Although studies have examined this topic in other industries, the cultural, organizational, and economic specificities of the Moroccan pharmaceutical industry are still largely unexplored. In particular, the impact of knowledge sharing in environments with heavy hierarchies and restricted R&D assets have not been examined extensively. This gap in the literature emphasizes the necessity of carrying out this investigation in order to improve our insight into how knowledge sharing mechanisms affect innovation in this vital sector. This research paper attempts to answer this research gap by investigating the fundamental question: To what extent does knowledge sharing impact the innovative work behavior of pharmaceutical engineers in Morocco? By examining this under-explored field, this investigation offers empirical insights and invaluable recommendations for boosting innovative work behavior through effective knowledge sharing practices appropriate to the Moroccan pharmaceutical sector. This research project seeks to shed light on the basic processes that determine this critical connection between knowledge sharing and the spread of innovation in the Moroccan pharmaceutical profession. The contemporary context necessitates an in-depth understanding of the forces that stimulate innovation, not only to keep a competitive place in worldwide business, but also to respond to the rising requirements of the healthcare industry (Liu, Fan and Yang, 2022). Innovation in the pharmaceutical field is a powerful driver in the delivery of more efficacious, secure and accessible drugs, boosting public healthcare around the world. Innovation provides personalized treatments designed to match the situation of each person. At the parallel, it performs a significant contribution to enhancing the provision of healthcare by proposing more widely available drugs and innovative techniques of distribution (Romasanta, van der Sijde and van Muijlwijk-Koezen, 2020). Innovation facilitates regulatory compliance and reinforces medication reliability and security (Darwish et al., 2020). Sharing knowledge among collaborators has a tremendous impact on the productivity of pharmaceutical businesses (Bhatti et al., 2021). By fostering innovation and creativity, it boosts the drug discovery chain. Sharing knowledge also supports ongoing training, helping staff to remain informed of new advances in the sector (Azeem et al., 2021). In conclusion, knowledge sharing is an indispensable component for boosting competitiveness and long-term prosperity for pharmaceutical businesses. Therefore, the aim of our investigation is to study the link between knowledge sharing processes and IWB in pharmaceutical businesses. Thus, the objective of this research is therefore to investigate how the donation and collection of knowledge affect IWB in the pharmaceutical sector in Morocco. This paper adopts a structured design approach. The literature review discusses the constructs of knowledge sharing and innovative behavior at work, investigating their interconnection. The methodology presents research design, the study population and the data collection approach. The findings section provides a description of the study's results, with a subsequent discussion explaining the findings and their deeper implications. The paper is completed with an examination of the research's limitations and recommendations for directions of possible future investigation.

2. Theoretical Framework, Hypothesis Formulation and Field of Investigation

In this point, we present a summary of the existing research literature on the primary concepts and theoretical framework employed to study the effect of gift-donating and knowledge-collecting on the IWB. The output of this section constitutes the research model.

2.1 Conceptualizing Innovative Work Behavior

The accelerating development of technology has driven companies to innovate in pursuit of competitiveness and long-term sustainability (Iqbal et al., 2020a). As a consequence, organizations have attempted to rethink many fields, such as work conception (Bysted, 2013). As digitization has resulted in changes in client expectations, the requirement for workers to adopt innovative work behaviors and develop new solutions has also intensified (Li et al., 2019). Innovative work behavior has been described as conducts linked to the initiation, direction and guidance of new or valuable thoughts/products, work processes for corporations (De Jong and Den Hartog, 2010). As a multi-step development procedure, IWB (Sethibe and Steyn, 2017) is a motivational process that is shaped by workers' qualifications, expertise and backgrounds (Bammens, 2016). Innovative work behavior is complex conduct that favorably influences corporate and employee effectiveness, identifies and generates novel thoughts, and involves citizenship behavior (Janssen, 2000).

It has been shown that innovative individuals are generally more inclined than non-innovative individuals to experiment, make mistakes and accept new risks (Sönmez and Yıldırım, 2014). All actions designed to accomplish corporate purposes, including new processes, new strategies, new products, and the R&D of new techniques, assuming that all aspects have been considered in the course of innovative work behavior (Yuan and Woodman,

2010). (De Jong and Den Hartog, 2010) and (Al-Omari, M.A., Choo, L.S. and Ali, M.A.M. 2019) conceived innovative work behavior as encompassing four components: idea exploration(1), idea generation(2), idea promotion(3) and idea implementation(4) : (1) The identification of novel insights resulting in innovation solutions or vulnerabilities; (2) Idea generation entails the quest for alternative methods of overcoming difficulties and enhancing the actual situation; (3) The promotion of ideas is described as the dynamic spreading of new views, by forming partnerships and alliances, with the purpose of securing the approval and trust of the stakeholders implicated; (4) Implementation, which entails transforming thought into action, experiencing innovation, adjusting it and integrating it into working procedures.

2.2 Knowledge Sharing

Knowledge sharing is defined as a social exchange in which workers exchange expertise, know-how and competencies inside the corporation (Lee, Tao, Li and Sun, 2021). Knowledge sharing is "a human conduct that comprises a set of actions involving the interchange of explicit and/or implicit feedback, and the incorporation of thoughts and expertise that enable knowledge for innovation inside companies" (Kumar and Che Rose, 2012). Knowledge sharing is a learning procedure between workers aimed at supporting each other to increase their capabilities, overcome difficulties and boost their productivity at work (Nguyen, Siri and Malik, 2021). Knowledge sharing covers the procedure for providing appropriate knowledge directly to co-workers inside the company (Grant, S.B. 2016)**;** (Zhang and Jiang, 2015). This is a pivotal process through which organizational stakeholders participate in knowledge development, innovation and, eventually, increased competitivity (Marouf and Khalil, 2015). (De Ridder and van den Hooff, 2004) consider knowledge sharing to be a phenomenon in which workers typically interchange their implicit and explicit information to generate new knowledge. Knowledge sharing is described as the exchange of job-related information, guidance and know-how to support and cooperate with colleagues in performing day-to-day duties, finding new solutions to challenges and generating new thoughts (Nguyen, 2021). Moreover, (Ortiz, J. et al., 2017) affirms that knowledge sharing arises when individuals energetically divulge their business knowledge or expertise to individuals in order to enable them to acquire new insights. Knowledge sharing is a continuous process of shifting experience and corporate knowledge into business procedures via lines of communication among workers, teams and companies (Sedighi et al., 2016).

Knowledge sharing is classified under the following components: knowledge donating and Knowledge collecting. The first is to successfully communicate knowledge, expertise and capabilities with other employees. This might be accomplished in a multitude of manner, such as teaching, coaching, tutoring, attending seminars and so on. The knowledge donating is grounded in the premise of providing what we have acquired to contribute to the advancement and progression of other individuals (Chen et al., 2021). Knowledge collecting: This comprises the cycle of examining, collecting, and gathering knowledge from a diverse range of sources. It's about collecting pertinent and valuable knowledge and then applying it to resolve issues, to create new insights and to be innovative. Knowledge collecting can entail documentary investigation, data analysis, observation, investigation and so on (Herjanto, Amin and Fatimah, 2024). The two components of knowledge sharing expand knowledge and foster progression in numerous areas of lifecycle, regardless of the business or scientific environment (Islamy, Yuniarsih and Wibowo, 2020).

2.3 The Link Between Knowledge Sharing and Workers' IWB

Several investigations into knowledge management have strengthened the idea that knowledge sharing results in enhanced corporate performance, such as innovation (Du Plessis, 2007). Innovation is described as "a process by which economic or social utility is derived from knowledge via the generation, propagation and conversion of knowledge to create novel or materially advanced products or services that are employed by the community" (Kahn, 2018). Modern corporations struggle to preserve their position of strength in the market by upgrading their talented and imaginative labor force. Much research has been devoted to the value of qualified HR and human capital in tackling corporate problems linked to sustainability and innovation (Long, C.S et al., 2014). Multiple findings have demonstrated that knowledge management is critical to enhancing corporate effectiveness (Kim, Newby-Bennett and Song, 2012). As knowledge is the greatest corporate asset, it provides new business outputs to be obtained, which also encompasses innovation (Areed, S., Salloum, S.A. and Shaalan, K. 2020). Knowledge sharing creates the potential for resolving problems as well as increasing productivity at the workplace (Rajabi Farjad, Mirsepasi and Naderi Mehrbani, 2021). Knowledge is the fundamental foundation of the innovation cycle. Besides a limited number of publications on knowledge sharing and IWB, the earlier studies remain limited in the drivers that encourage workers to embrace IWB (Akram et al., 2020). in the view of (Tran et al., 2021), a firm that fosters knowledge-sharing within its teams is expected to stimulate new thinking and new corporate initiatives, resulting in greater innovation actions. Many scientists have identified that

knowledge sharing exerts a significant beneficial effect on innovative behavior. Knowledge sharing provides individuals with the ability to transmit their skills to other individuals and provides others with the possibility of learning useful skills. (Azeem et al., 2021) examined the role of knowledge sharing in fostering innovation, finding that it has a significant effect on innovation.

Finally, scientific literature has also emphasized the importance of more in-depth analysis of innovation and knowledge sharing (Long, C.S et al., 2014). This paper discusses these major facets of knowledge sharing in association with innovative work behavior, which have received little debate in the field of scientific research. Innovation is the product of the mutual interchange of knowledge between workforce members. Sharing knowledge yields useful insights that then facilitate and predict innovative behavior (Castaneda and Cuellar, 2020). As a result, it can be postulated that the knowledge donating and collecting has a beneficial effect on the innovative working behavior of employees inside the corporation. While knowledge sharing is vital for promoting innovative work behavior, it is not without its shortcomings. Certain investigations emphasize that the withholding information for risk of compromising an internal competitive advantage can slow down the process of knowledge sharing (Davenport and Prusak, 2000). Furthermore, in environments similar to North Africa, cultural constraints that include inflexible hierarchies and a low degree of corporate trust can impede the sharing of knowledge (Hislop, D. 2013). In response to such challenges, a range of new solutions has evolved, notably informal learning and open innovation. Open innovation drives firms to exchange knowledge with external stakeholders to foster innovation and creativeness (Chesbrough, 2003). Informal learning is rooted in spontaneous unstructured exchanges, promoting innovation while avoiding the necessity of using structured knowledge management processes (Weick and Sutcliffe, 2001). These observations demonstrate that a flexible form of knowledge sharing, which considers cultural and corporate characteristics, is vital for successfully promoting innovative work behavior. Our work proposed the hypothesis that knowledge is indispensable for innovative behavior and that, as a result, KS plays a favorable effect on the generation of innovative work behavior among workers inside the firm. Drawing on previous debates and the examination of early articles, the next hypotheses are presented.

H1: knowledge donating influences pharmaceutical engineers' IWB positively and significantly.

H2: Knowledge collecting influences pharmaceutical engineers' IWB positively and significantly.

2.4 Field of Investigation

During the previous ten years, the Moroccan healthcare sector has been reinforced by the government's commitment to improving the pharmaceutical sector. Morocco's domestic pharmaceutical industry serves more than 70% of the market, with the residual 30% supplied by international suppliers such as Galencia, Pfizer and Pharma. In the wake of the COVID-19 crisis and the pharmaceutical sector's fast-changing environment, additional efforts are essential to adjust the economic structure of the Moroccan pharmaceutical sector. Morocco's pharmaceutical business is the second most profitable chemical industry in the kingdom, after phosphate manufacturing, which was integrated into the national plan for the promotion of priority industries in 2013. The Moroccan pharmaceutical business is ranked as one of the five best-performing businesses on the African continent. It is estimated to be valued at about 2.5 billion USD and represents about 0.13% of the total medicines trade in terms of value. The Moroccan pharmaceutical manufacturing industry achieves a sales figure of 13.7 billion DH (1.4 billion USD). Moroccan pharmaceutical exports have demonstrated dynamic expansion in the past few years. The kingdom exported pharmaceuticals to a total value of 1 billion USD, largely to certain countries in sub-Saharan Africa and the Middle East in 2023 (El-Akhdar, Mardhy and Kerak, 2015). The kingdom devotes approximately 0.8% of its Gross Domestic Product to R&D, a proportion that is still weak by international standards. The kingdom has the benefit of reduced production expenditures than European countries but continues to be reliant on imports of drug raw materials (Timur, Picone and DeSimone, 2011). While funding in R&D continue to be inadequate in relation to more advanced economies from the European union (Timur, Picone and DeSimone, 2011) and USA (Karamehic et al., 2013). In Europe, the pharmaceutical industry is estimated to represent 300 billion USD by 2025, i.e. 120 times the volume of the kingdom industry. Firms are spending 16-18% of their turnover on R&D, and some 60% of drugs sold are generics (Hernlund et al., 2013). In the USA, the industry is valued at 500 billion USD, with investments equivalent to 20% of turnover, i.e. approximately 100 billion USD annually. The United States is a leading producer of biotech and pharmaceutical innovation (Karamehic et al., 2013). In contrast, Kingdom's drug industry will generate approximately 2.5 billion USD by 2025, with 40% of the market devoted to generics, but it continues to outstrip these economies in both research and development investment and market volume. Nevertheless, it continues to be a regional leader in the African continent. The kingdom offers a supportive legal framework for the drug sector, with measures

aimed at enhancing access to medicines and encouraging domestic production. Nevertheless, significant challenges remain, notably regarding import dependency (El-Akhdar, Mardhy and Kerak, 2015)**.** The effects of public health policy reforms and the rising popularity of generic medicines present opportunities for market share development in Africa and elsewhere. From a cultural point of view, the Moroccan labor force combines a combination of traditional practices and contemporary innovations, with a slight resistance to the quick changes in managerial or technological infrastructures common in more mature pharmaceutical industries (Rana and Roy, 2015)**.**

3. Methodology and Data Analysis

3.1 Methodological Choice

The research methodology adopted in this research follows a quantitative method to investigate the association existing between KS and IWB among pharmaceutical engineers in Morocco. Data analysis is conducted using statistical tests including correlation analysis and multiple regression analysis to assess the hypotheses presented.

The questionnaire contains 16 items, structured into 3 major parts, dealing with topics such as Knowledge donating, Knowledge collecting and Innovative Work Behavior. Pharmaceutical engineers were requested to answer by means of a four-point Likert scale: (1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree). The 4-point Likert scale was adopted to avoid neutral answers and enhance measurement reliability. (Krosnick, 1991)**;** (Chang, 1994). Its ability to eliminate the possibility of a middle position obliges participants to adopt a precise viewpoint, thus enhancing comparability of findings and statistical significance (Cummins and Gullone, 2000); (DeVellis, 2017)**.**

The variables were operationalized following scales validated in the published literature: KD: Measured by items about readiness to share information, for example « When I have learned something new, I tell my colleagues about it ». KC: Measured by items regarding the intensity and efficiency of information collecting, for example « Colleagues in my company share knowledge with me when I ask them to». IWB: Measured by items on the generation, promotion and implementation of innovative ideas, for example « I Create new ideas for difficult issues ». To measure the sub-measures of knowledge sharing, our investigation employed the scale developed by Lin (2007). To measure innovative behavior, we employed the 9-item scale developed by (Janssen, 2000) **(Appendix 1).** Reliability (Cronbach's alpha) and validity (factorial analysis) tests were conducted to assure the robustness of the findings. We adopted the convenience approach because of lack of access to the whole population of pharmaceutical engineers in Morocco. The unavailability of an exhaustive database of these engineers, and the complexities associated with identifying the engineers available to contribute to the research, restricted the use of random sampling. This method was selected because it ensures rapid, cost-effective data gathering and a high enough response rate for meaningful statistical analysis. Nevertheless, we are aware that convenience sampling could result in a selection bias. In seeking to reduce this bias, we broadened the sources of respondents by inviting engineers from a wide range of businesses and from different levels of experience. Participants were reached mostly by email using professional and university networks, with phone follow-up to boost the answer rate. Anonymity and confidentiality of answers were strictly preserved throughout the process.

3.2 Data and Analysis Methods

Content data showed the findings as follows: 136 participants were women, while 150 were men. Respondents were between 30 and 50 years of age. Pharmaceutical engineers were e-mailed and requested to complete a self-administered research survey. At the beginning, 400 questionnaires were delivered, but only 286 were answered and received for review. The questionnaire was administered in English, the predominant language employed in the workplace. This guaranteed that participants clearly comprehended the different questions and were able to respond precisely. Our research was undertaken with pharmaceutical engineers employed in Morocco kingdom, an influential element as cultural specificities and organizational structures could have a significant effect on the findings, in particular hierarchy, which could in turn have an effect on the manner in which knowledge is exchanged. Descriptive statistics were employed to summarize the data gathered and offer an overall perspective on the principal features of the respondent population. A factorial analysis was completed to verify the convergent and discriminant validity of the concepts, verifying that the variables were accurately reflected in the model. Secondly, a regression analysis was conducted to investigate the influence of knowledge donating and knowledge collecting on innovative work behavior. This allowed us to establish meaningful standardized coefficients, revealing strong relationships between the variables. SPSS 27 software

has been employed for all statistical analyses, guaranteeing methodological accuracy and an accurate analysis of the findings.

4. Findings and Statistical Analysis

4.1 Summary of Descriptive Data Analysis

Table 1 indicates that the variables knowledge donating, knowledge collecting, and innovative behavior are assessed on a scale ranging from 1 to 4. The mean score for 'knowledge donating' is 3.31, accompanied by a standard deviation of 0.971, suggesting a notably high level of knowledge sharing. Similarly, knowledge collecting has an average score of 3.11 with a standard deviation of 0.954, reflecting a strong tendency for acquiring knowledge. Regarding innovative behavior, the mean score is 3.23, with a standard deviation of 1.05, highlighting a significant inclination toward engaging in innovative activities.

Table 1a: Descriptive Statistics of the scales

	N	Minimum	Maximum	Mean	Std. Deviation
Innovative Work Behavior	286	1	4	3.23	1.051
Knowledge Collecting	286	1	4	3.11	.954
Knowledge donating	286	1	4	3.31	.971
Valid N (listwise)	286				

The descriptive statistics of the items in each construct (Kd, Kc, Iwb) have a minimum value of 1 and a maximum value of 4, and the mean values range from 3.05 to 3.40, indicating that the responses tend to be in the upper part of the scale. Among them, Kd1 has the highest mean (3.40), while Kc5 has the lowest mean (3.05), indicating slight variations in the response trend between the different items. The standard deviations range from 0.92 to 1.08, showing relatively similar variability in the responses. Overall, the data reveals a general preference for high scores, with slight fluctuations between the different categories.

Table 1b: Descriptive Statistics of the items

	Minimum	Maximum	Mean	Std. Deviation
Kd1	1	4	3.40	1.000
Kd2	1	4	3.25	.950
Kd3	1	4	3.28	.960
Kc1	1	4	3.15	.980
Kc2	1	4	3.05	.920
Kc3	1	4	3.13	.960
Iwb1	1	4	3.30	1.050
Iwb2	1	4	3.15	1.030
Iwb3	1	4	3.25	1.070
Iwb4	1	4	3.20	1.000
Iwb5	1	4	3.28	1.060
Iwb6	1	4	3.18	1.020
Iwb7	1	4	3.22	1.040
Iwb8	1	4	3.27	1.080
Iwb9	1	4	3.24	1.050

4.2 Exploratory Factor Analysis

In the aim to test the convergent and discriminant validity of the constructs of our study, a factor analysis was conducted with the aid of principal component analysis (Table 2). To assess whether the data were adequate for PCA, the KMO test of sampling adequacy and Bartlett's test are employed. (Hair et al., 2014). The results of a factor analysis test demonstrate that the dataset complies with the basic requirements of factor analysis and exhibits suitable correlations. The KMO value was 0.79, and the Bartlett coefficient test revealed statistical

relevance ($p < 0.001$). Principal component analysis (PCA) with Varimax rotation has then been performed to categorize all variables into principal components. The Kaiser test was carried out to define the set of factors, retaining only those principal components whose eigenvalues were greater than 1, while those with eigenvalues below 1 were considered irrelevant and eliminated. The factor analysis resulted in a three-factor solution, accounting for a satisfactory total cumulative variance of 78.96%. Principal component analysis further showed that items designed to measure the same construct loaded significantly onto the same principal component, with the lowest loading being 0.65. This suggests shared common variance, thereby confirming convergent validity. Moreover, items intended to measure different constructs mainly loaded onto separate components, which supports strong discriminant validity.

Table 2: Rotated component matrix[a]

	Component		
	1	2	3
Kd1	.71		
Kd2	.77		
Kd3	.65		
Kc1		.69	
Kc2		.88	
Kc3		.76	
Iwb1			.78
Iwb2			.72
Iwb3			.82
Iwb4			.91
Iwb5			.81
Iwb6			.72
Iwb7			.73
Iwb8			.72
Iwb9			.66
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

4.3 Reliability Assessment Through Cronbach's Alpha

Before beginning the correlation analyzes and testing our hypotheses, we will study the reliability of the measurement scales studied with the help of Cronbach's Alpha. The findings of the reliability analyze of the constructs demonstrate that "Knowledge donating" with three items obtained a Cronbach's alpha coefficient of .762, denoting excellent reliability.

Reliability Statistics	
Cronbach's Alpha	N of Items
.762	3

Similarly, the "Knowledge Collecting" variable showed an alpha coefficient of .801 with three items, suggesting satisfactory reliability.

Reliability Statistics	
Cronbach's Alpha	N of Items
.801	3

The "Knowledge Sharing" variable combining the two previous variables presented satisfactory reliability with an alpha of around .783.

Reliability Statistics	
Cronbach's Alpha	**N of Items**
.783	6

Finally, the variable "Innovative Behavior" presented the highest alpha coefficient, at .872, with nine items. These results support the reliability of the variables studied in this research.

Reliability Statistics	
Cronbach's Alpha	**N of Items**
.872	9

4.4 Examination of Correlation Relationships

The correlation matrix (Table 3) illustrates the link between the variables of knowledge donating, knowledge collecting, and innovative behavior. The correlation coefficients are statistically significant at the 0.05 level. A notable positive correlation is found between knowledge donating and knowledge collecting ($r = .47$, $p < 0.05$), as well as between knowledge donating and innovative behavior ($r = .60$, $p < 0.05$). Furthermore, there is a significant positive correlation between knowledge collecting and innovative behavior ($r = .59$, $p < 0.05$).

Table 3: Pearson's Correlation Coefficient Matrix

		Innovative Work Behavior	Knowledge Collecting	Knowledge donating
Innovative Work Behavior	**Pearson Correlation**	--		
	N	286		
Knowledge Collecting	**Pearson Correlation**	.594**	--	
	Sig. (2-tailed)	<.001		
	N	286	286	
Knowledge donating	**Pearson Correlation**	.600**	.469**	--
	Sig. (2-tailed)	<.001	<.001	
	N	286	286	286
**. Correlation is significant at the 0.01 level (2-tailed).				

4.5 Hypothesis Evaluation Using Multiple Regression Analysis

The results concerning the overall fit of the model are shown in Table 4. This table shows an R^2 value of 0.49, indicating that 49% of the variance in innovative work behavior (IWB) can be explained by the predictor variables

Table 4: Goodness of fit

Model	R	R Square	Adjusted R Square
1	.696[a]	.485	.481
a. Predictors: (Constant), Knowledge Collecting, Knowledge donating			

The analysis of variance (ANOVA) reveals that the Fisher test further supports the model's relevance, with an F-statistic of 133.07 for 2 and 283 degrees of freedom. Then, the regression model provides a significantly better fit to the data compared to a model with no predictors.

Table 5: Analysis of variance [a]

The analysis of variance, presented in Table 5, confirms the relevance of the regression model, with an F-statistic of 133.07 and a significance threshold of less than 0.001. This suggests that the model significantly explains the variance in the innovative work behavior of pharmaceutical engineers.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	152.592	2	76.296	133.069	<.001[b]
	Residual	162.261	283	.573		
	Total	314.853	285			

a. Dependent Variable: Innovative Work Behavior

b. Predictors: (Constant), Knowledge Collecting, Knowledge donating

The results of the regression analysis presented in the table below demonstrate a significant impact of the variables knowledge donating and knowledge collecting on innovative behavior, with standardized coefficients of 0.441 and 0.446, respectively. This implies that a one-unit increase in knowledge donating corresponds to a 0.441 increase in innovative behavior, while a one-unit rise in knowledge collecting is associated with a 0.446 increase in innovative behavior. Both coefficients are statistically significant, with t-values of 8.285 and 8.519, and p-values both below 0.001. Concerning multicollinearity, the Variance Inflation Factor (VIF) values for both knowledge donating (2.283) and knowledge collecting (1.982) are below the threshold of 5, indicating no significant multicollinearity issues and thereby consolidating the robustness of our model.

Table 6: Regression coefficients and collinearity diagnostics[a]

The regression coefficients and collinearity diagnostics are presented in Table 6. This table shows standardized coefficients of 0.441 for knowledge donation and 0.446 for knowledge collection, both with significant t-values, confirming their positive impact on innovative work behavior. Furthermore, the collinearity indices (VIF) are below 5, indicating the absence of multicollinearity issues in our model.

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	.274	.162		1.696	.091		
	Knowledge donating	.441	.053	.400	8.285	<.001	.438	2.283
	Knowledge collecting	.446	.052	.412	8.519	<.001	.505	1.982

a. Dependent Variable: Innovative Work Behavior

Figure 1 shows the normal P-P (Probability-Probability) plot of the standardized regression residuals, which is used to test the assumption of normality in the residuals of our regression model. As indicated by the plot, the points closely follow the diagonal line, demonstrating that the residuals are approximately normally distributed. This confirms the validity of the normality assumption, which is crucial for making reliable statistical inferences from our model

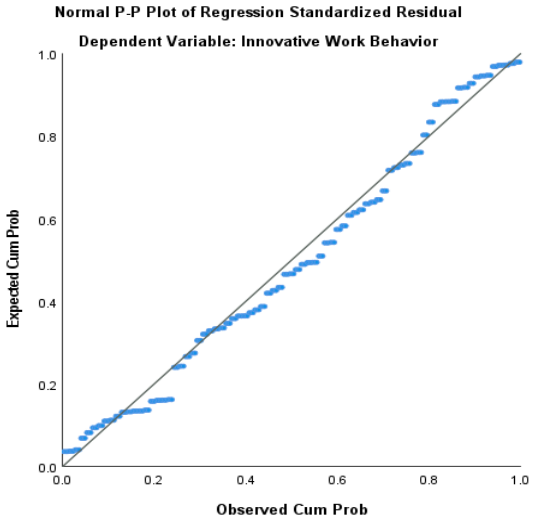

Figure 1: Normal P-P of standardized regression residuals

5. Analysis and Interpretation of Findings

The aim of this scientific research is to examine the effect of knowledge sharing on the innovative behavior of pharmaceutical engineers in Morocco. The experimental results of this survey strengthen the fundamental theoretical hypotheses. As a result of a detailed and methodologically accurate examination of the published papers, two major hypotheses have arisen, which have been consistently expanded and practically verified. This investigation aims to improve scientific insight by shedding light on the intricate interplay linking the interaction of KS processes and the encouragement of IWB in the pharmaceutical engineering field. The first hypothesis suggests that KD exerts a positive and statistically significant influence on the IWB of pharmaceutical executives.

The emerging evidence from this paper lends powerful weight to this hypothesis, pointing to the role of KD in promoting IWB. The study's conclusions underpin the suggestion that pharmaceutical engineers committed to the sharing of tacit and explicit knowledge inside their enterprise tend to exhibit a significantly higher level of devotion to the business's success. This conclusion is in keeping with the original paper by (Kmieciak, 2021)**,** who reported a positive correlation between KD and IWB. The second hypothesis posits that KC is positively correlated with the IWB of pharmaceutical executives. Our results validate this affirmation, supporting the underlying hypothesis. These insights reveal that employees with a desire to gain new knowledge in the corporate setting are significantly more likely to adopt a creative and innovative conduct inside their workplace which will improve the company’s performance. These results are in line with (Chen et al., 2021) insights, which reveal a positive correlation between KC and the IWB of IT firms. The KC process boosts workforce cognitive and intellectual capabilities, boosting the know-how pool critical to innovation. This perspective is endorsed by the pivotal papers of Smith (2006), who emphasize the importance of knowledge collecting in boosting competencies, resulting in the cultivation of IWB. The conclusions of this paper agree with existing scientific studies, in particular the research carried out by (Du Plessis, 2007)**,** who established that knowledge sharing operates as a catalyst to promote IWB. In agreement with these points, (Migdadi, 2020)**,** one of the leading academics in this field, has also stressed the positive benefits of KS in developing and sustaining IWB inside organizations. In addition, the empirical findings of this paper uncover important insights, proving that knowledge donating (KD) and knowledge collecting (KC) have a statistically relevant effect on staff's innovative behavior (IB). Our study indicates that giving and gathering knowledge play a major part in the promotion of innovative working behavior. (Swan and Newell, 2000) explains the notion of knowledge exchange covers much broader issues than merely the exchange of ideas: it refers to the harmonization, optimization and conversion of knowledge into practical, meaningful information. When staff learn actively from their workmates, they greatly boost their capacity to be creative (Obeidat, Al-Suradi and Tarhini, 2016)**.**

The empirical findings discussed strengthen the substantial and statistically relevant role of knowledge donating (KD) and knowledge collecting (KC) in the innovative behavior of pharmaceutical engineers. Analysis of the findings reveals that while Knowledge Collecting (KC) has a positive and significant effect on the Innovative Work Behavior (IWB) of pharmaceutical engineers, its influence is less marked than that of Knowledge Donating (KD). This result can be attributed to a number of organizational and behavioral reasons, such as the active

contribution of knowledge donating to the acceleration of innovation, when engineers actively share their skills and knowledge with others, they ensure fast access to practical thoughts and potential solutions, shortening the time required to test and introduce new processes, This finding is in agreement with the research by (Chen et al., 2021) who found that firms where knowledge sharing is promoted are more successful in implementing innovative practices, in addition, knowledge collecting requires a receptive and individual process, where the engineer must search for, understand and interpret data before using it. In contrast, knowledge donating creates an immediate collective workflow, where ideas are shared immediately, enabling a dynamic and collaborative exchange inside the company (Swan and Newell, 2000).

6. Conclusion and Managerial Implications

This research investigated the pivotal role of knowledge sharing in the fostering of innovative behavior by pharmaceutical engineers in Morocco. Using a strict methodological framework founded on quantitative research, the findings of this examination underline the importance of knowledge sharing (KS) in the Moroccan pharmaceutical industry, whether from a managerial or theoretical viewpoint. By implementing appropriate strategies, techniques and management methods that encourage the sharing of knowledge, organizations can not only promote innovation and boost productivity but also consolidate their competitive advantage in the global marketplace. The positive and significant findings concerning hypotheses H1 and H2 emphasize the fundamental relevance of promoting an organizational culture that encourages KS among pharmaceutical engineers which will push them to adopt innovative work behavior.

These findings are in alignment with prevailing theories on knowledge management and corporate innovation, demonstrating that the transfer and gathering of knowledge are vital drivers for boosting worker productivity and corporate performance. An interesting observation can be deduced from an examination of the results of the two components of knowledge sharing. On the one side, KD creates a supportive, participative culture in which engineers can exchange their know-how and develop the firm's collective capabilities. On the other side, knowledge gathering becomes more and more central to the process of producing innovative behavior, as it assists engineers in gaining new expertise, acquiring new insight. The managerial repercussions of this investigation are enormous. pharmaceutical businesses are expected to introduce more robust knowledge management processes, and ongoing learning to facilitate both the donation and collection of knowledge. It is also critical to develop a spirit of innovation, encouraging engineers to discuss and debate with each other, and to adopt a lifelong learning mindset. In addition, executives and HR leaders are expected to implement incentive mechanisms such as performance appraisal, and incentives for individuals who engage constructively in knowledge-sharing efforts.

The example of the Covid-19 crisis highlights the crucial role of knowledge sharing in accelerating innovation. During the pandemic, rapid knowledge exchange among pharmaceutical engineers, researchers, and organizations worldwide enabled the swift development of vaccines and treatments. In Morocco, collaborations between laboratories and institutions helped pharmaceutical companies quickly adapt to new production and distribution challenges. This example underscores that fostering knowledge-sharing practices not only enhances innovation but also strengthens resilience in times of crisis.

In short, this investigation points to a strategic issue for the Moroccan pharmaceutical business: enhancing intra- and inter-organizational collaboration to maximize the returns on innovation. In a worldwide environment characterized by accelerating technological developments and rigorous regulatory requirements, it is essential for pharmaceutical businesses to incorporate strategies based on co-development, collaboration with universities and membership of international scientific communities. The managerial implications of these findings are numerous. Moroccan pharmaceutical corporations are expected to implement collaborative platforms and provide special incentives to motivate sharing knowledge. It would also be advantageous to implement strategies for on-going training and the digitization of information circulation procedures to improve access to the best qualifications and scientific progress. In a highly regulatory and competitive industry, fostering a culture of collaboration and cooperation can be a major strategic asset. Although this research makes valuable advances in our understanding of the association between knowledge sharing and innovative work behavior, it has several limitations. First, the fact that the research concentrates on a single industry restricts the generalizability of the results to other sectors with varying organizational structures or resource deployment. Future investigations could investigate other industries, such as technology or manufacturing, to get a deeper insight into the universal applicability of knowledge-sharing techniques in various organizational environments. Second, although robust, the methodology applied in this research is based exclusively on quantitative measures, which restrict the understanding of qualitative dimensions that may affect knowledge sharing, like

personal incentives or organizational culture. More in-depth investigations could employ a mixed-method approach, using both quantitative surveys and qualitative interviews, to develop a more detailed insight into the personal and organizational forces that promote or inhibit knowledge sharing. Third, future investigations could investigate the moderating and mediating influences of leadership styles, technology, and organizational culture on the link between knowledge sharing and IWB, thereby furnishing a more complete picture for promoting innovation within the Moroccan pharmaceutical industry. Finally, Advanced exploration of the contribution of digital techniques and artificial intelligence to enhance knowledge sharing may also be a valuable avenue of investigation. Further investigations may examine the contribution of artificial intelligence and digital knowledge management systems to facilitating knowledge sharing and innovation for pharmaceutical organizations. The successful application of AI-based platforms could enhance real-time knowledge interchange and maximize the collaborative innovation cycle.

AI statement: "No artificial intelligence tools were used in this study."

Ethical statement: "This research was conducted in accordance with all applicable ethical guidelines."

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Appendix 1

Constructs	Items
Knowledge donating	When I have learned something new, I tell my colleagues about it When they have learned something new, my colleagues tell me about it Knowledge sharing among colleagues is considered normal in my company
Knowledge collecting	I share information I have with colleagues when they ask for it I share my skills with colleagues when they ask for it Colleagues in my company share knowledge with me when I ask them to Colleagues in my company share their skills with me when I ask them to
Innovative work behavior	I create new ideas for difficult issues I search out new working methods, techniques, or instruments I generate original solutions for problems I mobilize support for innovative ideas I acquire approval for innovative ideas I make important organizational members enthusiastic for innovative ideas I transform innovative ideas into useful applications I introduce innovative ideas into the work environment in a systematic way I evaluate the utility of innovative ideas