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Knowledge Management Practices Among Librarians: Tracing the Missing Link

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Abstract: The study investigates knowledge management practices among librarians, focusing on the absence of KMPs in academic libraries. Many young graduate librarians struggle to secure white-collar jobs where they can apply their tacit knowledge and expertise to enhance library practices. The inability to share insights, experiences, and skills impedes professional development in the library field. Consequently, this study aims to identify the root causes of these gaps in KMPs among librarians. Using a quantitative research approach, surveys were conducted across various university libraries in Nigeria and South Africa. The findings underscore the importance of librarians sharing their tacit knowledge and experiences to improve daily library operations and user services. Various knowledge management tools, such as database management systems, web portals, electronic document management systems (EDMS), management information systems, and barcode readers, support librarians' activities. However, several obstacles hinder the effective implementation of KMPs among librarians. To address these challenges, the study recommends strategies for reskilling librarians to enhance their knowledge, skills, and experiences for optimal library practices. It emphasizes the importance of governmental and organizational support in providing essential facilities for quality service delivery. Furthermore, policy adherence should be prioritized to eliminate barriers preventing the implementation of KMPs in university libraries.

Keywords: Information, Knowledge management, Knowledge management practices, Strategies, Missing link, Nigeria

1. Introduction

In the contemporary information and knowledge economy, knowledge emerges as a crucial asset vital for organizational survival and prosperity, particularly amidst fierce competition and rapid digital advancements (Mostert & Snyman, 2007). Like other organizations, academic libraries implement effective strategies and tools for managing knowledge to enhance service provision and ensure growth. Central to this endeavour lies the knowledge and skills of librarians, which significantly influence work performance, particularly in tasks related to processing, managing, and utilizing information and knowledge for Knowledge Management Practices (KMPs) within a dynamic work environment. The sustainability and competitive edge of academic library organizations heavily hinge on their collective knowledge—both tacit and explicit. This knowledge is perpetually leveraged to add value and sustain superiority over competitors (Wanangeye & George, 2016). Wanangeye and George (2016) observe a transition in academic libraries toward becoming learning organizations, where experiences, knowledge, and skills are regularly shared among colleagues. Traditional library activities managed through machine-readable catalogues and circulation desks are now facilitated by KMPs. These practices encompass a spectrum of ideologies aimed at fostering a culture of sharing ideas, lifelong learning, information acquisition, knowledge management, knowledge transmission, academic support, and collaborative review processes among colleagues (Wanangeye & George, 2016). This collaborative approach not only enhances individual and organizational learning but also fosters innovation and adaptation in response to evolving demands and challenges within academic libraries.

The imperative for KMPs in academic libraries stems from the pressing need for effective and efficient service delivery within library operations. Studies by Wanangeye and George (2016), Kim and Abbas (2010), and Daneshgar and Parirokh (2007) underscore those academic libraries, tasked with supporting institutional goals through the provision of information (explicit knowledge) in various formats, require librarians—acting as gatekeepers of libraries—to collaborate as a cohesive team to fulfil this mission. The collective efforts of librarians in meeting the diverse information needs of users have driven the necessity for KMPs. As librarians continually update their knowledge using KM tools, catering to diverse users' information needs becomes more manageable, even amidst multiple urgent tasks within limited timeframes. The rationale behind implementing

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KMPs in academic libraries today lies in the myriad principles and strategies employed by librarians, which not only serve to identify, capture, share, and retain knowledge but also foster collaboration, innovation, and social networks among colleagues. These practices have significantly enhanced the working environment for both professional and non-professional staff in academic libraries, enabling them to better serve and redefine their roles. Additionally, academic staff heavily rely on librarians' expertise in repackaging information resources for teaching, learning, and research activities within institutions. With KMPs in place, identifying librarians' diverse areas of expertise and knowledge becomes much more straightforward (Mavodza and Ngulube, 2011; White, 2004). The author of this paper asserts that when Knowledge Management is practised among colleagues, it fosters a deeper understanding of knowledge creation, thereby helping to dispel uncertainties surrounding unfamiliar library practices that librarians may encounter daily.

The author of this study has identified a trend where users' information needs are becoming increasingly intricate, necessitating librarians to acquire new competencies (knowledge, skills, and disposition) (Impagliazzo & Pears, 2018). The importance of possessing adequate knowledge, skills, and disposition to support library operations has led to a shift in the Library and Information Science profession towards focusing more on virtual and technological approaches in recent times. This approach underscores the need for librarians to practice Knowledge Management (KM) in their academic libraries, where sharing known, and unknown knowledge is essential to remain relevant in the digital space. Reluctance to adapt to these changes has hindered many librarians, particularly in developing nations, from acquiring the broad knowledge necessary to effectively cope with evolving library practices. This reluctance also indicates a lack of interest in KM practices. Empirical studies in KM indicate that the utilization of tacit knowledge enables librarians to connect information and knowledge for application in academic library services with minimal delay (Wanangeye and George, 2016; Singh and Sharma, 2011). Librarians need to utilize tacit knowledge due to the increasing complexity of users' information needs in recent times. Additionally, achieving the expected turnaround time for service delivery has become increasingly challenging due to the expanding responsibilities that librarians must manage. Moreover, some librarians exhibit reluctance to share their knowledge, despite job specifications that may encourage knowledge sharing.

Another crucial factor to consider is the support provided to users with extensive research interests. The researcher emphasizes the crucial role of policy in Knowledge Management Practices (KMPs) within academic libraries, particularly in the African context. Policies guide librarians on the approaches to adopt and influence current library practices. Implementing KM in libraries necessitates specific policies, as every library activity is governed by policies. Effective KMPs in academic libraries require actionable policies that can enhance service delivery amid evolving roles in the digital era. When such KMP policies are adopted, librarians gain the opportunity to exchange ideas and share tacit knowledge among themselves. This study identifies factors contributing to the absence of KMPs among librarians in university libraries, recognizing that this challenge is not unique to libraries but prevalent across various organizations.

2. Purpose of the Study

The purpose of the study was to investigate knowledge management practices among librarians in designated academic libraries in Nigeria and South Africa. In line with this, three research questions were used to guide the study:

- How do librarians practice KM in academic libraries?
- Why are knowledge management tools important to support KMPs in academic libraries?
- What approaches could be employed for knowledge management practices in academic libraries?

3. Literature Review

Knowledge Management (KM) in libraries may not be seen as entirely innovative, given the rapid advancements in technologies such as artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, and quantum computing (Schwab, 2016) that have transformed various sectors. While KM might appear relatively recent to some, many libraries have been inadvertently practising it for years. Libraries have long been involved in managing explicit knowledge and leveraging tacit knowledge to drive their operations. The absence of a universally agreed-upon definition of KM can be attributed to scholars from various disciplines holding diverse views on its conceptualization. However, for this research paper, several perspectives on KM by authors such as Alavi and Leidner (2001), Morgan, Zou, Vorhies, and Katsikeas (2003), Hult (2003), Nonaka and Takeuchi (1995), Nonaka (1994), and Fombad (2016) are foundational. These authors establish that KM extends beyond merely storing and using data or information for various purposes. Instead, it recognizes the value of

knowledge residing within the human mind—an individual asset that can function as an organizational asset. This knowledge can be harnessed and utilized by a diverse range of individuals, thereby influencing the organization's trajectory through the strategic application of technologies, people, and processes.

KMPs are viewed through the lens of organizational learning, emphasizing networking among communities of practice (Beesley and Cooper, 2008). Stemming from Knowledge Management (KM), KMPs involve reshaping data, information, knowledge, or wisdom to address specific phenomena. Innovation is crucial for organizational growth, thus stimulating a knowledge-sharing interface becomes imperative in academic libraries (Mundra, Gulati, and Vashisth, 2011). Previous studies by Nonaka and Takeuchi (1995), Nonaka (1994), and Scarbough (1999) highlight that KMPs are built upon six fundamental principles of KM. These principles include orientation towards knowledge development, transfer, and protection, fostering continuous organizational learning, cultivating an innovative culture, developing competencies, adopting people-centric approaches, and understanding the organization in a global context. Bernborn (1999) suggests that KMPs involve capturing the collective knowledge of individuals within organizations and subsequently filtering and sharing this knowledge among colleagues. The essence of capturing and sharing collective knowledge lies in enhancing the complexity of collaborative work.

Davenport (2002) and Boom and Pimentel (2009) argue that Knowledge Management Practices (KMPs) are instrumental in the creation of new knowledge. This process involves leveraging tangible resources within organizations, and prioritizing teamwork to ensure timely task completion. Such collaboration enhances information access and retrieval within library organizations (Prusak, 2001). The recent surge in knowledge has prompted a shift from traditional to digital forms of Knowledge Management (KM), emphasizing the value of KMPs in libraries (McInerney, 2002). Studies by Pasha and Pasha (2012), Gamble and Blackwell (2001), Schön (1995), Stenmark (2001), Davenport and Prusak (2000), Martin (2007), Ackoff (1999), Benet and Benet (2004), and Kidwell (2002) substantiate the notion that knowledge encompasses a broad spectrum of fluid forms, including personal experiences, wisdom, resources, and values. In the context of KMPs, understanding knowledge involves applying information and insight to broaden frameworks for evaluating and integrating new experiences into organizational decision-making processes. The dynamics of academic libraries are shaped by embedded information, knowledge, documents, repositories, practices, norms, and the expertise of librarians, who continually assess organizational goal attainment. Librarians' skills and experiences are significantly influenced by KMPs, underscoring the importance of regularly consulting diverse sources of explicit knowledge, such as books, documents, journals, and the internet, to foster effective KMPs. Individual knowledge, as posited by Davenport and Prusak (1998), arises from experiences within organizational norms.

Libraries and librarians play essential roles in the daily management of information and knowledge. These roles have driven the implementation of various approaches, tools, and practices in modern libraries (Ajiferuke, 2003). These tools and practices assist in identifying, creating, representing, distributing, and facilitating the adoption of insights and experiences within library organizations (Ajiferuke, 2003). Knowledge Management Practices (KMPs) employ a range of approaches and tools to systematically generate ideas, insights, and experiences for managing library operations (Bhatt, 2001; McInerney, 2002; Koenig, 2002). Shanhong (2000) suggests that KMPs foster knowledge innovation and library development, enhancing knowledge networking among users. Similarly, Thorn (2001) emphasizes that KMPs focus on knowledge transmission through apprenticeship, which can be challenging to formalize. This transmission occurs through personal interactions, where apprentices observe and emulate the master's example. Through this process, apprentices absorb both explicit and tacit knowledge, including nuances not explicitly articulated by the master (Thorn, 2001).

The rationale behind the proposition of Knowledge Management Practices (KMPs) in academic libraries encompasses several key considerations. Firstly, contemporary library organizations increasingly focus on capturing, sharing, retaining, and reusing both librarian-specific and organizational knowledge to enhance service delivery efficiency (Jyoti, Rani, and Kotwal, 2013:9). Secondly, knowledge sharing within the organization creates opportunities for improved productivity and service delivery effectiveness (Jain, 2007; Senge, 1994). Thirdly, the knowledge inherent in individuals, processes, and routines should be recognized and valued by the organization (Jain, 2007; Senge, 1994). Fourthly, the failure to effectively manage the organizational knowledge base can impede various organizational functions. Fifthly, Mavodza and Ngulube (2012) (cited in Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka and Teece, 2001) underscore that KMPs foster knowledge generation, leading to the creation of new knowledge, often facilitated through collaborative efforts. Consequently, promoting internal information flow and utilization for institutional effectiveness aligns with KMP activities (Kidwell, Van der Linde, and Johnson, 2000; Williams, Giuse, Koonce, Kou, Giuse, 2004). Sixthly, KMPs cultivate a knowledge-intensive organizational culture (Davenport and Prusak, 1998). Seventhly, they support product

development and employee innovation, leveraging harvested knowledge to enhance colleagues' performance (Holsapple and Wu, 2011). Eighthly, KMPs deepen organizational learning, crucial for risk mitigation, efficiency improvement, and goal achievement (Zack, McKeen, and Singh, 2009). These factors collectively contribute to bridging the gaps in KMP implementation within academic libraries.

Krubu (2009:73) argues that KMPs facilitate the transformation of value from tangible to intangible assets within library organizations. The knowledge acquired through experience, reasoning, intuition, and continual learning can be effectively recognized and valued (Krubu, 2009:74). Consequently, the ongoing process of nurturing, collecting, managing, sharing, and updating knowledge resources has significantly propelled academic libraries ahead compared to other library organizations. This comprehensive Knowledge Management (KM) approach can foster competition among organizations, driven by innovative ideas that enhance long-term employee retention. Recognizing and rewarding employees for their knowledge contributions during service delivery operations, as exemplified by Aina, Mutula, and Tiamiyu (2008), underscores the importance of valuing organizational knowledge. In contemporary times, KMPs have emerged as indispensable assets for enhancing organizational productivity (Alavi and Tiwana, 2002). The recognition of the inherent value of knowledge embedded within individuals, though challenging to capture at times, deserves continuous appreciation (Alavi and Tiwana, 2002; Wright, 2001; Prusak, 2001).

The objective of KMPs in academic libraries is to maximize the utilization of existing knowledge within the organization (Branin, 2003). By enhancing productivity and operational efficiency among individuals, organizations gain a competitive advantage over peers with a limited understanding of KMPs. This fosters an environment where essential knowledge components drive organizational goals (Branin, 2003). The underutilization of knowledge significantly impacts work operations and staff performance, prompting Branin (2003) to advocate for initiatives focused on coding, storing, and transmitting knowledge among information professionals. Such efforts not only enhance information management but also contribute to the core mission of libraries, which is the effective dissemination of information (Townley, 2001).

Integrating Knowledge Management Practices (KMPs) into libraries expands organizational capabilities beyond traditional boundaries. Currently, libraries prioritize the continual utilization of both explicit and tacit knowledge to strengthen organizational functions. These efforts in leveraging tacit and explicit knowledge have refined knowledge-harnessing practices, effectively addressing various organizational challenges encountered by librarians. KMPs are credited with enhancing organizational strength and productivity in work performance. The insights and ideas shared by librarians during knowledge-sharing processes significantly influence work performance (Knowledge Management Research Centre, 2010). These shared insights and ideas inform organizational problem-solving approaches, accommodating diverse colleague backgrounds and practices (Knowledge Management Research Centre, 2010). Mattauch and Caumanns (2003:23) observe that knowledge and information have emerged as new economic factors of production, integral to all sectors of the knowledge economy. In addition to traditional factors like land, capital, labour, and entrepreneurship, knowledge and information are now deemed essential for enhanced productivity. This underscores the indispensability of knowledge and information in all facets of human enterprise. Schaub and Zehnke (2000:316) assert that knowledge often catalyzes social interactions and learning processes. A prior study by Probst et al. (1997:44) highlights that individual capabilities and skills deployed during knowledge production are typically aimed at solving specific problems.

Munn (2001:160) suggests that effective KM in academic libraries is imperative due to the following reasons:

- The evolving nature of the profession requires librarians to be strategic in managing knowledge.
- Dynamism in the workplace requires changes to happen in every sector.
- Cross-fertilisation and collaboration of ideas helps to strengthen knowledge management.
- The creation and capturing of knowledge for institutional memory.
- Knowledge sharing gives people a sense of belonging and motivation.
- Knowledge breeds uncertainty and anxiety, which in turn interferes with focus productivity; and
- Competition among colleagues and other organizations is critical.

These suggestions have driven libraries and librarians to continually thrive in the business of managing and rendering information services to knowledge seekers.

In library practice, the utilization of tacit knowledge becomes crucial due to its versatility in both individual and organizational contexts (Mansell, 2002). Tacit knowledge is understood as the information stored within the human mind (Mansell, 2002). This form of knowledge is predominantly leveraged by Knowledge Management

Practitioners to achieve organizational objectives. Tacit knowledge serves as a conduit for managing and transferring explicit knowledge, facilitating its codification, articulation, and communication (Mansell, 2002).

Previous studies by Polanyi (1966; 1969) and Nonaka and Takeuchi (1995) established the interdependence of two knowledge types—explicit and tacit. The success of Knowledge Management Practices (KMPs) relies on activating and sharing the latent aspects of tacit knowledge inherent in individual capacities, insights, and experiences among colleagues (eSCC, 2004:47). Nonaka and Krogh (2009:636) further emphasize that tacit and explicit knowledge play pivotal roles in achieving organizational objectives. KMPs cannot thrive without fostering creativity, learning, innovation, and change management among colleagues. A notable aspect of KMP activities is when librarians advance by exploring diverse problem-solving approaches (Krogh et al., 2000). The cultivation of new knowledge through continuous knowledge-sharing initiatives is central to this endeavour (Krogh et al., 2000). One hindrance to this progress occurs when colleagues fail to engage in knowledge-sharing exercises, thereby impeding the support system crucial for KMPs. Consequently, the sustainability of KMPs in academic libraries hinges on accessibility to both tacit and explicit knowledge types (Nonaka and Krogh, 2009:636).

4. Research Methodology

This research paper employed a quantitative research approach, specifically utilizing a survey method with questionnaires to collect data from respondents in university libraries across Nigeria and South Africa. The study population consisted of 400 librarians from these university libraries. Ultimately, responses were retrieved from 132 librarians, comprising 77 respondents from Nigeria and 55 from South Africa, representing six selected university libraries in total from both countries. The selection criteria included universities considered top-ranking in their respective countries, such as the University of Ibadan and the University of KwaZulu-Natal, and excluded those in rural areas (e.g., University of Zululand, South Africa, and Delta State University, Nigeria) or those focusing solely on technology (e.g., Durban University of Technology and Federal University of Technology). Six university libraries in both countries were purposefully and randomly selected based on their status as top-ranking institutions, according to the University Web Rankings-Africa 2014. These libraries serve diverse users across Southern and Western regions of Africa, reflecting the visibility of research outputs within the African context. Both countries' universities benefit from well-resourced environments and highly qualified personnel across various disciplines, including professors, doctors, engineers, pharmacists, nurses, and psychologists, among others, who support teaching and learning processes. The university libraries in both countries receive adequate budgetary allocations for resources, facilities, services, policies, staffing, and support. A questionnaire was distributed to 132 respondents at intervals of three to four weeks across these university libraries and subsequently retrieved. Ethical clearance was obtained before distribution to ensure respondents' consent and voluntary participation. Respondents were given approximately four weeks to review and complete the questionnaire, with follow-up emails sent to ensure completion before the researcher visited various university libraries in the two countries. Data obtained from the retrieved questionnaires were analyzed using descriptive and inferential statistics, and the results are presented in the tables below to provide clear representations of the findings. The table represents the sampled universities, their nomenclature and the population that participated in the study. The result in Table 1 indicates a variance in participation due to the availability of participants when the study was carried out.

Table 1 relates to the sampled universities that participated in the study.

Table 1: Sampled Universities of the study

Sampled universities	Nomenclature	Population	Country
University of Ibadan	UI	29	Nigeria
Federal University of Akure	FUT	16	Nigeria
Delta State University	DSU	32	Nigeria
University of Zululand	UZ	9	South Africa
University of Kwa-Zulu-Natal	UKZN	28	South Africa
Durban University of Technology	DUT	18	South Africa

The results in Table 1 indicate that more populations of respondents participated in the study compared to the other universities. It is possible that when the study was carried out, there were more staff who volunteered to engage in the study hence this result. It can also be deduced that some staff could have left the institutions.

5. Results and Discussion of Findings

This segment dealt with the results of the three objectives mentioned earlier at the beginning of the research paper. The response rate of the 132 questionnaires retrieved out of the 400 administered was 33%.

5.1 How Librarians Practice KM in Academic Libraries

The result in Table 2 indicates where the respondents were asked how they practice KM in their various academic libraries. This was further interpreted as shown in Table 2.

Table 2: How do librarians practise KM in academic libraries

How KM is Practiced	UI	FUT	DSU	Average % Nigeria	UZ	UKZN	DUT	Average % SA
Group discussion	100	93	96	96	100	94	96	97
Internship and mentoring	98	97	98	98	86	92	100	93
In-house training	86	100	87	91	94	86	93	91
Routine documentation	88	95	93	92	83	95	94	91
Communication network within the library	91	97	81	89	85	88	97	90
Socialisation	100	97	89	95	100	95	97	97
Seminars, conferences, and workshops	88	88	87	88	87	75	83	82
Storytelling	93	98	95	95	90	95	89	91
Communities of practice	100	98	97	98	100	100	95	98
Average %	94	96	92	94	92	91	94	92
Sample sizes	$N_{=29}$	$N_{=16}$	$N_{=32}$	$N_{Nig\ 77}$	$N_{=9}$	$N_{=28}$	$N_{=18}$	NSA_{55}

The results in Table 2 indicate that Knowledge Management Practices (KMPs) take various forms within academic libraries across the two countries. These practices span from group discussions to communities of practice. Among them, the most prevalent KMPs include group discussions/meetings, apprenticeships, in-house training, socialization, and communities of practice, each with 100% utilization, whereas seminars, conferences, and workshops are less frequently employed. As depicted in Table 2, KMPs are evident among librarians in academic settings, addressing issues related to routines, procedures, policies, applications, knowledge, and skills essential for managing information and human resources within academic libraries. Of particular interest is how KMPs could benefit corporate entities such as banks, oil companies, academic institutions, libraries, and research institutes in implementing policies to thrive in today's knowledge economy (Wanangeye and George, 2016; Jain, 2007).

Wanangeye and George (2016) and Singh and Sharma (2011) emphasize that Knowledge Management Practices (KMPs) center around the shared interests of groups engaged in discussions on common topics. In some cases, communities of practice endure through apprenticeships, where members learn under the guidance of a master. The authors advocate for in-house training, socialization, seminars, conferences, and workshops as optimal avenues for implementing these KMPs. Their findings underscore the importance of cultivating KMPs within academic libraries, as they demonstrate improvements in librarians' routines, procedures, policies, applications, knowledge, and skills crucial for managing information and human resources across diverse organizations. Realizing these enhancements depends on adopting endorsed policies and practices within academic institutions, libraries, and research institutes. Jain (2007: 389) suggests that librarians, as information professionals, should evolve into value-added knowledge professionals capable of envisioning and strategizing for rapid changes. These transformations require instantaneous communications that facilitate transitioning the organization from paper-based to networked relationships.

Singh and Sharma (2011) highlighted how organizational culture can enhance librarians' work performance through the application of Knowledge Management Practices (KMPs). These practices involve librarians analyzing various frameworks within knowledge creation platforms that employ diverse methods and techniques, promoting systems thinking and effective management practices (Liao, 2003:156). KMPs encompass

emerging phenomena within academic libraries, though there remains a need for greater understanding of Knowledge Management (KM) domains. By building on emphasis, it is conceivable that professionals such as medical practitioners, media personnel, engineers, legal practitioners, and others embed similar principles and policies deeply within their respective fields. Applying these principles in libraries could elevate and standardize expectations. Sustaining such practices requires a commitment to continually acquiring knowledge and delivering services to users at optimal standards. KMPs thrive when academic libraries embrace theoretical, methodological, and scientific approaches to foster organizational growth, necessitating a clear understanding of management styles within their institutions.

The author of this study recognizes the paramount importance of work performance. Therefore, librarians must effectively manage both tacit (human knowledge) and explicit (print forms of knowledge) to advance in their careers. Sagsan's theory of the KM life cycle can be applied to justify the necessity of Knowledge Management Practices (KMPs), highlighting knowledge creation as a critical element within formal organizations. Without the imperative to share, the act of creation becomes redundant. Shared knowledge facilitates organizational or individual restructuring when effectively utilized and audited. The enhanced efficiency and productivity of organizations rely on theories and policies that support ongoing research activities in Knowledge Management Practices (KMPs) within academic libraries.

5.2 KM Tools Used to Support KMPs in Academic Libraries

The result in Table 3 indicates where respondents were asked to indicate the KM tools used to support KMPs in their academic libraries. This was further interpreted as shown in Table 3.

Table 3: KM tools used to support KMPs academic libraries

KM Tools	UI	FUT	DSU	Average % Nigeria	UZ	UKZN	DUT	Average % SA
Decision support systems	66	25	31	41	33	32	56	84
Word processor	90	94	88	91	89	100	100	96
Search engine	90	88	81	86	89	100	94	94
Semantic web	59	56	38	51	78	61	78	72
Artificial intelligence tools	48	31	22	34	33	32	67	44
Simulation tools	55	19	16	30	33	29	50	37
Data mining	69	13	22	35	44	43	61	49
Information retrieval tools	83	88	63	78	78	96	94	89
EDMS	72	81	47	67	89	68	72	76
Database management systems	79	88	47	71	89	86	78	84
Data warehouse	69	50	34	51	78	57	56	64
Content management systems	62	44	31	46	67	57	67	64
Management Information Systems	79	81	50	70	89	75	78	81
Web portals	83	88	53	75	56	86	89	77
Site maps	69	56	31	52	67	64	83	71
Barcode reader	69	31	59	53	89	82	89	87
Indexing and abstracting	79	75	69	74	67	86	89	81
Average %	72	59	46	59	69	68	77	74
Sample sizes	$N_{=29}$	$N_{=16}$	$N_{=32}$	$N_{Nig\ 77}$	$N_{=9}$	$N_{=28}$	$N_{=18}$	$N_{SA=55}$

The findings in Table 3 reveal that a significant majority of respondents (90%, 94%, 88%, 81%, 89%, 100%) confirmed the availability and utilization of word processors, search engines, and information retrieval tools for Knowledge Management Practices (KMPs) within the sampled academic libraries. Moreover, database management systems (88%), web portals (83%), electronic document management systems (EDMS), management information systems, and barcode readers (89%) were identified as the primary KM tools

employed across these libraries for enhancing KMPs. Meanwhile, the responses obtained in decision support systems across the universities were different (66%, 25%, 31%, 41%, 33%, 32%, and 56%). The disparity in identified KM tools between university libraries in different countries parallels the varying roles undertaken by librarians. The availability of funding to procure these tools could significantly enhance their impact. Technological advancements and developments may also contribute to disparities in tool availability, with newer technologies often supplanting older ones in facilitating knowledge management within contemporary academic libraries. According to a study by Kwiecien and Rao (2005:180-183 & 284), current KM tools used in academic libraries worldwide include web portals, knowledge-based engineering, the World Wide Web, data mining, OLAP (online analytical processing), document management systems, retrieval systems, search engines, and robust search algorithms. However, the absence of these KM tools can disrupt content management in university libraries, as noted by Frost (2014). This absence affects content management in two ways: causally, by impacting organizational and managerial efforts to effectively implement KM, and resultantly, by hindering efficient resource management. Laleye (2015:399) acknowledges that evolving technologies for operational tasks and educational training can enhance, transform, and predict learning environments that are readily accessible to users.

Muhammad, Ibrahim, Bhatti, and Waqas (2014:27) provide evidence that KM tools play a crucial role in business intelligence operations. These tools are strategically employed to optimize the use of information for tactical, strategic, and operational decision-making across organizations. They are extensively utilized for functions such as data warehousing, data mining, ETL (extraction, transformation, loading), and OLAP (online analytical processing) across various sectors. Many business managers today rely on these KM tools, which have also found adoption in university libraries. Here, they are used to enhance and streamline customer service delivery, aligning library and information services with business-oriented practices. A comprehensive understanding of KM tools is essential for effective library operations and is closely tied to ongoing knowledge management practices (KMPs) among library colleagues. Moreover, the meticulous application of structured processes like cataloguing and classification is recognized as another vital aspect of KMPs within the librarian community.

Gbaje (2007) asserts that the shift of library services into the online environment in the digital age responds to the increasingly diverse needs of users, necessitating continuous updates in knowledge and skills to effectively operate within this environment. Finlay and Finlay (1996) underline a correlation between librarians' knowledge and personality types and their attitudes toward utilizing the Internet as a component of KM tools. They further posit that librarians with expansive knowledge and innovative personalities exhibit more positive attitudes toward innovation. This underscores the critical importance of librarians' attitudes toward applying knowledge in utilizing KM tools effectively. Knight (2009) stresses the urgency of training librarians who may lack sufficient skills and knowledge to adapt to the dynamic nature of KMPs. The evolving information landscape demands versatile and well-educated information professionals capable of navigating and leveraging emerging technologies to support library services.

Previous studies by Salter (2003), Abram (2005), and Gutsche (2010) advocate for a new generation of librarians, such as Librarian 4.0, equipped with diverse skills, knowledge, behaviours, and attitudes suited to the evolving information landscape. Similarly, Nyakundi and Mnjama (2007), the Commission for Higher Education (CHE) (2007), Aina (2005), Westhuizen and Randall (2005), and Ocholla and Bothma (2007) underscore the importance of enhanced competencies among librarians across various domains. These domains encompass Internet and World Wide Web proficiency, online and offline electronic databases, LIS curriculum development, ICT integration, archives and records management, rural information services, research methodologies, management principles, publishing and public relations, communication strategies, customer service, and interpersonal skills. These extensive areas of expertise are crucial for librarians in current KM practices, reflecting the profession's ongoing evolution and diversification.

Knowledge Management Practices (KMPs) empower librarians by enhancing their knowledge, experience, and skills, which are crucial for effective service delivery and ongoing professional development in academic libraries. Another effective approach to practising KM involves librarians participating in seminars, conferences, and workshops, where they further enrich their expertise. These platforms not only foster professional growth but also promote teamwork, collaboration, and advance research activities within library environments. Infrastructure support is integral to organizational success in KM practices, encompassing the alignment of people, processes, and technologies within library settings. This support system plays a vital role in managing and optimizing library operations. Additionally, organizational structures and colleague motivation have increasingly contributed to the successful implementation of KMPs. Moreover, individual areas of specialization

significantly influence KMPs' impact in academic libraries, as noted by Vinitha et al. (2006). As library operations expand, the demand for enhanced knowledge, skills, and KM tools continues to grow.

5.3 Approaches for Knowledge Management Practices in Academic Libraries

The result in Table 4 sought to establish the approaches used to promote knowledge management practices in the selected academic libraries in Nigeria and South Africa. This was further interpreted as shown in Table 4.

Table 4: Approaches used to promote KM practices in academic libraries

Approaches used to promote KM practices	UI	FUT	DSU	Nigeria (Average %)	UZ	UKZN	DUT	SA (Average %)
Reuse of knowledge through codification strategy	100	88	92	93	100	90	97	96
Creating values for the users	95	100	87	94	100	92	89	94
Creating coherence among colleagues	96	93	96	95	88	97	95	93
Deepening research and learning processes	100	91	91	94	88	95	100	94
Usage of skills to build new knowledge	95	93	90	93	88	92	91	90
Scaling modernization	93	81	81	85	77	89	82	83
Active commitment with senior colleagues on critical discourse	89	86	83	86	88	92	93	91
Maintaining the existing structure, competencies, and culture of the library	88	100	90	93	100	92	88	93
Knowledge audits every quarter	89	87	86	87	100	85	85	90
Initiating and sustaining a knowledge bank	93	100	86	93	100	82	82	88
Enable interrelated committee work	100	98	88	95	100	93	90	94
Educating and re-training staff	85	93	90	89	88	89	88	88
Community development project	88	96	91	92	100	93	88	94
Publishing of articles, books, and monographs	89	86	89	88	88	95	85	89
Effective examination and support through corporate governance	85	93	96	91	100	96	85	94
Preserve policy for decision-making	88	100	90	93	100	92	88	93
Specification of efficient and effective KM entities	95	91	91	92	88	95	100	94
Adhering to shared ideas	93	100	86	93	100	82	82	88
General access to information and knowledge	92	87	87	87	89	72	91	84
Managing people's intellect	89	87	86	87	100	85	85	90
Guarantee that ICT facilities are accessible and manageable to meet the needs of individuals and organisations	95	86	82	88	100	100	85	95
Intensive face-to-face communication among colleagues	95	86	86	89	82	95	90	89

Approaches used to promote KM practices	UI	FUT	DSU	Nigeria (Average %)	UZ	UKZN	DUT	SA (Average %)
Average %	95	86	86	91	82	95	90	89
Sample sizes	$N_{=29}$	$N_{=16}$	$N_{=32}$	$N_{Nig=77}$	$N_{=9}$	$N_{=28}$	$N_{=18}$	$N_{SA=55}$

Results in Table 4 indicate various approaches to promoting Knowledge Management Practices (KMPs) in academic libraries. These approaches include the reuse of knowledge through codification (88% to 100%), enhancing research and learning processes (88% to 100%), maintaining policies for decision-making (88% to 100%), providing efficient KM entities (91% to 100%), managing intellectual resources (85% to 100%), ensuring the availability and accessibility of ICT facilities (82% to 100%), and facilitating face-to-face communication among colleagues (82% to 95%). These approaches are applied based on specific situations, with certain methods proving effective for similar problem-solving scenarios. A comparison of university libraries in South Africa and Nigeria reveals that South African university libraries promote KMPs more than their Nigerian counterparts. Notably, these diverse approaches significantly influence organizational culture, work environment, management support systems, librarians' knowledge, and access to information. Some approaches have demonstrated greater efficacy when implemented by trained, qualified, experienced, skilled, and dedicated teams, fostering innovation and growth within library organizations.

In a study conducted by Allen (2012), it was highlighted that various platforms such as book fairs, workshops, seminars, conferences, online resources, and readership campaigns play pivotal roles in promoting KMPs within academic libraries. Allen further asserts that these events facilitate the cross-fertilization of information and knowledge among colleagues, which forms the foundation of KMPs within the organization. Brenya (2008) identifies several approaches as key drivers in promoting KMPs in academic libraries, including motivations, attitudes of librarians, organizational knowledge, bibliographic searches, utilization of internet resources, and diverse cataloguing tools and software. These strategies have fostered the generation of new ideas, insights, and knowledge necessary for the effective functioning of librarians. According to IFLA (2011), the execution of tasks within the library environment contributes to the creation of knowledge essential for nurturing an informed society, a process integral to Knowledge Management Practices (KMPs). Furthermore, the dissemination of information about library functions necessitates the application of strategic management principles (Fayol, 1961). Principles such as planning, organizing, coordinating, commanding, and evaluating are readily observable in contemporary library operations. The application of these management principles is crucial for academic libraries in facilitating daily access to information and knowledge.

Approaches are seen as essential tools for fortifying university libraries, providing them with the requisite information materials, knowledge, and skills necessary for their operations. According to Allen (2012), approaches such as knowledge application, research investigation, workplace experiences, behavioural insights, and project consultations are invaluable components within Knowledge Management Practices (KMPs) in academic libraries. Sharing knowledge among colleagues alleviates individual burdens, and this exchange can occur through various platforms, including the intranet, communities of practice, wikis, brainstorming sessions, global forums, webinars, and design intelligence portals, all of which transcend boundaries (Allen, 2012). Adams (1998) contends that library and information services conducted within the library setting have altered organizational dynamics, whereby the processing of knowledge and its outcomes influence the frameworks employed in knowledge production, as well as the quality of knowledge interventions. Consequently, the knowledge requisite for academic library services undergoes a process involving the capture and reconstruction of colleagues' organizational performances. Allen (2012) highlights that the realization of effective library services hinges on the implementation of knowledge management practices among librarians.

The evolution taking place within academic libraries highlights librarians' recognition of the collective assets inherent in the university library. Butcher (2007) argues that Information and Communication Technologies (ICTs) are crucial supportive tools that enhance work performance across diverse institutional contexts. Butcher emphasizes that when devising an approach, the primary consideration should be given to people, followed by systems/tools, and finally processes. Academic libraries must possess operational proficiency, historical insight, and ICT capability to effectively pursue their objectives. The roles fulfilled by people, processes, and technologies constitute the three core pillars of approach within academic library organizations. To make informed decisions, academic libraries should employ certain planning principles, thereby bolstering strategic support for fostering proactive engagement among team members in Knowledge Management Practices (KMPs). Through

collaboration, trust-building, and the cultivation of shared understanding and communities of practice, academic libraries can effectively attain their KMP objectives (Butcher, 2007).

Institutional policies are another crucial approach that could bolster Knowledge Management Practices (KMPs) in recent years (Enakrire, 2015). Their efficacy is enhanced through regular reviews aimed at assessing organizational weaknesses and strengths. It is imperative for academic libraries to devise techniques for strategically promoting KMPs within the information and knowledge economy.

UN-Habitat (2010) asserts that organizations are adopting new approaches that consider emerging cultures, social networks, and technologies, facilitating novel avenues for sharing knowledge among librarians. To address the information needs of user communities, a study by UN-Habitat (2010) advocates for knowledge audits, which involve the systematic evaluation of both tacit and explicit knowledge within the organization. Such audits can aid in fortifying and refining the operational capacities of librarians in tasks related to Knowledge Management Practices (KMPs). Effective KMPs ensure that knowledge-sharing techniques, which enhance work performance, are duly applied. King (2009) advocates for codification and personalization approaches, both of which play pivotal roles in promoting KMPs through the dissemination and reuse of codified knowledge. Personalization is instrumental in facilitating interactions among librarians within the university environment. Studies by Hovland (2003) and Fombad (2018) highlight that KM approaches hold significance for organizations, as they facilitate the conversion of information and data into actionable knowledge that aligns with organizational objectives.

Fombad (2018) highlights the importance of codification and personalization as key elements in contemporary knowledge management (KM) approaches. The integration of people, processes, and technologies acts as enablers for achieving these objectives. These enablers facilitate knowledge sharing and transfer, thereby empowering librarians to deliver quality services to users. Ruggles (1997) asserts that technology-based mechanisms have proven instrumental in enhancing KM practices through knowledge generation, codification, and transfer. However, the mere availability of technology is insufficient without human intervention to manage its operations. Librarians must explore various options to acquire the knowledge necessary for integrating library systems conducive to KM practices. Similarly, Ngulube and Lwoga (2007) note that the utilization of tacit and explicit knowledge mechanisms has streamlined workflows, integrated workspaces, and improved time management among librarians.

6. Conclusion and Recommendations

The study established that contemporary academic libraries emphasize the utilization of both tacit (knowledge in the human brain) and explicit (knowledge in books) knowledge to excel in library management operations. This emphasis has led to the emergence of Knowledge Management Practices (KMPs). The sources of information and knowledge consulted by librarians in KMPs are evident in this study, which highlights commonalities and differences between Nigeria and South Africa in terms of applied KMP approaches in academic libraries. The quality of KMPs and the efficiency of work performance among librarians varied across the library environments of the two countries. The study emphasizes that the significant role played by librarians and academic libraries in KMPs has brought about various phases of training and development, expanding librarians' exposure to and experiences with KMPs in the workplace. Enhanced learning and work performance among librarians result in the continual acquisition, sharing, and utilization of new knowledge, leading to both personal and organizational growth. The study established that KMPs are not uniform across academic libraries in the two sampled countries. Institutional support, policies, and various Knowledge Management (KM) tools have strengthened KMPs in academic libraries. The improved services to meet user information needs reflect a blend of traditional and modern applications of technical KM tools, as well as librarians' knowledge, skills, and expertise.

Academic libraries now require new knowledge and skills to effectively address the increasing information needs of users. These new competencies are embedded in the expertise of librarians. To apply these skills, various approaches in research activities must be considered. The study recommends enhancing support from government and institutional levels to promote Knowledge Management Practices (KMPs) in academic libraries. This support would deepen educational programs, research initiatives, and community services offered by librarians to users. KM tools are utilised to support various methods of coding, organising, and disseminating local collections across different platforms. Regulating these KM tools is revitalized through proper planning and execution of the learning interface of KMPs among librarians.

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Evaluating Knowledge Management Practices in Crowdfunding Fintech: The Case of the First Crowdfunding Platform in the Philippines

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Abstract: This study explores Knowledge Management (KM) practices at Investree Philippines Inc., a leading fintech company in crowdfunding. Using a case study approach with mixed methods, the research evaluates how Investree's Project NEXUS framework enhances operational efficiency, drives innovation, and ensures regulatory compliance. Data were gathered through interviews, surveys, and document analysis, revealing that Project NEXUS effectively integrates KM practices across various phases, including ideation, execution, and knowledge transfer. The findings highlight Investree's strengths in fostering innovation and maintaining efficiency through centralized documentation and training. However, opportunities for improvement exist in enhancing information retrieval systems and strengthening cross-departmental collaboration. Recommendations include refining search tools and implementing structured knowledge-sharing protocols. This study provides valuable insights for fintech companies aiming to optimize their KM strategies, positioning Investree as a leader in the Philippine fintech industry and contributing to the broader understanding of KM's role in the fintech sector.

Keywords: Knowledge management, Financial technology, Crowdfunding, Operational efficiency, KM assessment

1. Introduction

The Fintech (Financial Technology) sector is reshaping the global financial landscape by introducing innovative solutions that challenge traditional financial services. This rapid evolution, driven by technological advancements such as blockchain, AI, and data analytics, demands effective organizational knowledge management to maintain competitiveness and sustainability (Murinde, V., Rizopoulos, E., & Zachariadis, M., 2022). FinTech has effectively simplified various financial services and enhanced entry to capital markets, providing new avenues for creating wealth and obtaining funding for marginalized populations (Adeoye et al., 2024). Knowledge Management (KM) is pivotal in this context, enabling Fintech companies to harness their intellectual assets for improved decision-making, operational efficiency, and customer engagement.

In the context of Fintech, KM practices are crucial for aligning technology-driven processes with strategic business goals. Effective KM ensures that valuable insights from data analytics, customer interactions, and regulatory updates are systematically captured, stored, and utilized across the organization. This not only supports continuous innovation but also enhances compliance and risk management. Research has shown that the structured use of KM tools in Fintech can directly contribute to the agility and resilience of organizations in this rapidly changing landscape (Pisoni, G., Molnár, B., & Tarcsi, Á., 2023). The rapid expansion of the financial technology (fintech) sector has not only democratized access to financial services but has also introduced significant regulatory challenges, necessitating effective Knowledge Management (KM) to navigate these complexities (Biswas et al., 2024). Previous studies also conducted to assess the impact of behavioral intention of people to use of Fintech (Asif et al., 2023).

Investree Philippines Inc., the focus of this study, is a prime example of how a Fintech company utilizes KM to navigate the complexities of the financial sector. As the first SEC-licensed crowdfunding platform in the Philippines, Investree's reliance on KM practices highlights its significance in fostering innovation, maintaining regulatory compliance, and enhancing operational efficiency. This case study explores the effectiveness of KM strategies at Investree, emphasizing how these practices contribute to achieving key organizational objectives.

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1.1 Problem Statement

While the importance of Knowledge Management (KM) in the fintech industry is significant, there is a lack of thorough research on implementing these strategies and their effects on organizational performance. Investree Philippines Inc. must grasp the effectiveness of its KM practices to ensure ongoing progress and lasting development. This research addresses this gap by examining Investree's KM approaches in-depth and suggesting improvements, especially concerning operational efficiency. The goal of this study is to evaluate the effectiveness of Knowledge Management (KM) as a strategic approach to enhancing operational efficiency at Investree Philippines Inc. By examining Investree's KM practices, specifically, those implemented through Project NEXUS, the study aims to determine how these strategies impact the company's ability to operate efficiently in the competitive Fintech environment.

1.2 Objectives

The primary objectives of this study are to:

- evaluate the specific Knowledge Management (KM) strategies currently employed by Investree Philippines Inc. in the context of enhancing operational efficiency.
- identify the strengths and weaknesses of these KM strategies in improving decision-making and supporting compliance.
- provide targeted recommendations to optimize Investree's KM practices for better innovation and regulatory adherence.

1.3 Research Questions

This study aims to answer the following research questions:

RQ#1. *What are the current KM strategies used by Investree Philippines Inc.?*

RQ#2. *How do these KM strategies impact Investree's overall operational efficiency and decision-making processes?*

RQ#3. *What potential improvements in KM practices could enhance Investree's innovation capacity and compliance?*

1.4 Significance of the Study

This study is significant for both academic and practical reasons. Academically, it contributes to the existing literature on KM in the fintech sector, providing empirical evidence and insights into the effectiveness of various KM tools and strategies. The findings offer actionable recommendations for fintech companies, particularly Investree Philippines Inc., to optimize their KM practices, thereby enhancing their operational efficiency, innovation capability, and compliance.

2. Literature Review

This literature review examines the state of Fintech in the Philippines, highlighting the rapid evolution driven by supportive government policies, technological advancements, and increased internet and mobile accessibility. Moreover, it explores the importance of knowledge management (KM) within the fintech sector, emphasizing its role in enhancing organizational resilience, innovation, and performance. Various KM assessment techniques, including the Knowledge Management Maturity Model (KMMM), Knowledge Management Assessment Tool (KMAT), and KM Capability Assessment (KMCA), are discussed to provide a comprehensive understanding of how fintech firms can evaluate and improve their KM practices to maintain a competitive edge in the dynamic financial landscape.

2.1 Fintech and its State in the Philippines

Fintech combines technology with financial services to enhance their delivery and utilization for consumers. The fintech industry has rapidly evolved, leveraging advancements in mobile technology, artificial intelligence, blockchain, and data analytics to create innovative financial solutions (Adrian & Griffoli, 2019). The advancement of these technologies has facilitated the creation of digital payment methods, peer-to-peer lending platforms, robo-advisors, and blockchain-based solutions. These innovations have caused significant changes in conventional financial services, providing novel avenues for individuals and enterprises to engage with financial systems (He et al., 2017).

Fintech advancements have improved financial inclusion in areas with limited traditional banking services. Mobile money, e-wallets, and digital lending have made financial services more accessible to underserved populations, aiding economic growth. Fintech firms prioritize customer experience by offering personalized financial services using big data and machine learning (Arner, D. W., Buckley, R.P., Zetszsche, D.A., 2018; Ben et al., 2018).

In recent years, Southeast Asia has become the new prominent center for fintech innovation and advancement and driven by a combination of a young, tech-savvy population, high mobile penetration rates, and supportive regulatory standards (Ha et al., 2024; Tran & Le, 2024). The region has seen a growth of fintech startups addressing various financial needs varying from market-to-market, from digital payments and remittances to lending and insurance (Iwasaki, 2017). Countries like Singapore, Malaysia, and Indonesia have been taking the lead and attracting significant investment and fostering a conducive environment for fintech development (Soriano et al., 2019).

The fintech industry in the Philippines has experienced growth in years driven by supportive government policies, increased internet and mobile accessibility, and a growing interest in digital financial services among the population. The Bangko Sentral ng Pilipinas (BSP), the 'country's bank, has been instrumental in creating an environment for fintech innovation through initiatives like the National Retail Payment System (NRPS) and the Digital Payments Transformation Roadmap (Orencia, 2023). Digital payment platforms such as GCash and PayMaya have played a role in driving fintech adoption by offering secure alternatives to traditional cash transactions. The use of these platforms saw an increase during the COVID-19 pandemic stressed the importance of Fintech in maintaining financial services continuity during crises (Moron & Rvrcob 2022).

Apart from payments, the Philippines has witnessed growth in areas of Fintech, such as lending, insurance, and wealth management. The country's fintech landscape encompasses an array of participants ranging from startups to established institutions, all contributing to the creation of innovative financial solutions (Schellhase & Garcia 2019). The BSPs regulatory sandbox has been instrumental in allowing fintech companies to test products and services in a controlled setting, fostering innovation while safeguarding consumer interests. Despite making strides the Philippines encounters obstacles in expanding fintech usage in areas with limited internet access and digital literacy. Enhancing infrastructure and financial education is crucial to ensuring everyone can benefit from fintech advancements.

Moreover, regulatory hurdles and the necessity for a framework remain key areas requiring attention to nurture a stronger fintech environment (Morgan & Huang,2020). Resolving these challenges is vital for sustaining the growth and positive influence of Fintech in the Philippines, guaranteeing that technological progress leads to inclusion and economic growth. As the fintech industry progresses, ongoing collaboration among government entities, industry players, and international allies will be pivotal in overcoming these obstacles and maximizing the potential of fintech innovations.

2.2 Knowledge Management Definition

Knowledge Management (KM) is a strategic discipline that involves identifying, capturing, and leveraging an organization's information assets to enhance performance and competitiveness (Paliszkiewicz, 2021; Butler, 2000). KM strategies are crucial for aligning business goals with KM objectives and can be categorized into four main systems: KM Reward, Tacit Collection, KM Integration, and Social Media KM (Dodla & Jones, 2023). Developing an effective KM strategy requires a top-down approach involving steps such as conducting a knowledge audit, identifying information hotspots, and creating a knowledge roadmap (Mohapatra et al., 2016; Butler, 2000). The implementation of KM strategies is driven by environmental, organizational, and technological factors, including globalization, workforce mobility, and technological convergence (Butler, 2000). Measuring the return on investment of KM strategies remains challenging, but both short-term and long-term assessment methods can be employed to evaluate their effectiveness (Butler, 2000). With a clear understanding of what constitutes Knowledge Management, examining how KM strategies have been successfully implemented across various sectors is essential, offering valuable lessons for the Fintech industry (Dasgupta, M., Sahay, A., & Gupta, R., 2009).

2.3 Knowledge Management Across Sectors

Knowledge management strategies play a role across sectors, such as the financial technology (Fintech) field. According to Cumming et al. (2023), there is an emphasis on the significance of ways to raise capital in Fintech and how they impact international business (Ben Romdhane, Y., Kammoun, S., & Loukil, S, 2024). The research highlights the importance of methods like crowdfunding, peer-to-peer lending, and online banking in promoting

expansion on a scale. This emphasizes how sharing knowledge and effective management strategies drive progress and development within the fintech industry. In another context,. Santos et al. (2023) investigate into water management practices and the various factors that influence them, focusing on knowledge sharing. The study underscores how structures, socio economic differences, and cultural norms shape water management approaches significantly. This points out the importance of knowledge management strategies in ensuring that management practices remain sustainable and efficient across sectors, including Fintech. Al Dujaili et al.' s (2023) research evaluates pharmacists' knowledge, attitudes, and preparedness for providing medication therapy management (MTM) services. This study highlights the role of knowledge management in healthcare settings in enhancing patient care quality and results. The findings from this study can be applied to the fintech sector well, emphasizing how knowledge management contributes to enhancing service delivery standards and customer satisfaction levels.

Moreover, in a study by Castral and colleagues (2023), they discuss how they implemented a method to share and exchange knowledge to enhance pain management in newborns. This research stresses the value of using knowledge strategies to improve practices and outcomes in areas. Similarly, Nyangau et al. (2023) conducted controlled trials to assess the effects of educating households on diseases. Their study highlights the importance of spreading knowledge and educating people to enhance disease management techniques, which can also benefit the fintech industry for boosting efficiency and managing risks effectively. In another sector, Herjanto et al. (2023) explored how gathering and sharing knowledge can improve relationship-building and salesperson performance. The results underline how knowledge management enhances sales effectiveness and customer interactions within the fintech realm to drive customer engagement and business expansion.

The Fintech sector is inherently knowledge-intensive, relying heavily on data analytics, technological innovations, and regulatory updates. Effective KM in this context involves capturing and storing information and ensuring its timely dissemination across departments to drive strategic decisions (Pereira et al., 2021). Recent studies have highlighted the unique challenges and opportunities that Fintech companies face regarding KM, such as managing large volumes of customer and transaction data, maintaining compliance with evolving financial regulations, and fostering a culture of continuous innovation (Pisoni, G., Molnár, B., & Tarcsi, Á., 2023). In Fintech, KM practices directly influence the ability to leverage technological advancements, streamline processes, and enhance customer experience, making KM a strategic necessity (Al-Dmour , 2021). This study will build on these insights by evaluating how Investree Philippines employs KM practices as a Fintech company to maintain its competitive edge in a rapidly shifting financial landscape.

Overall, the literature reviewed emphasizes how crucial knowledge management strategies are across sectors such as healthcare, banking, and water resource management (Rice & Reeves, 2023). These findings stress the significance of sharing, disseminating, and utilizing knowledge to foster innovation (Mardani et al., 2018), enhance service delivery quality, and improve performance. Implementing knowledge management techniques within the fintech sector can enhance productivity, customer contentment, and overall business prosperity (Uekubo et al., 2023). Building on the sector-specific applications of KM, it is crucial to explore specific techniques that have been identified as effective in managing knowledge, particularly in sectors that share similar complexities with Fintech.

2.4 Techniques for Effective Knowledge Management Practices

Knowledge Management (KM) practices aim to nurture new knowledge creation and share existing knowledge to enhance innovation and efficiency (T. ChristianVan', 2003). Key KM methods include knowledge bases, Yellow Pages, and communities (T. ChristianVan', 2003). Effective KM implementation involves specific techniques, best practices, and methods applicable across various sectors, including first responders, healthcare, and financial services (A. Rhem, 2016). Organizations can identify and transfer internal best practices using visual process models (Carla O'Dell et al., 1998). Successful KM systems centralize information from multiple sources, continually improve it, and make it accessible to individuals seeking answers (J. Chitra, 2016). KM is not a single discipline but an integration of numerous fields, requiring a framework to characterize various tools, methods, and technologies (J. Chitra, 2016). Implementing these practices can help organizations gain a competitive advantage and maximize their KM investments (A. Rhem, 2016).

Effective knowledge management (KM) practices are essential for enhancing organizational capabilities and ensuring the retention and reuse of valuable knowledge. One critical practice is establishing a clear KM strategy and action plan, which helps define establishing a clear KM strategy and action plan, which helps define and understand KM across the business (Bishop, 2009). This strategy should align with business objectives and fit with how people work, ensuring that KM activities are integrated into daily operations and communication

structures. Additionally, the importance of people-oriented KM practices, such as Communities of Practice (CoPs), is emphasized due to their role in facilitating tacit knowledge transfer. Organizations should adopt a 'light touch' approach to managing CoPs to maximize benefits for both individuals and the business (Bishop, 2009).

Another effective KM practice involves using technology to support KM activities, especially as organizations expand and become more geographically dispersed. The technology should be tailored to fit the KM needs of the business and should operate in a decentralized manner (Bishop, 2009). Furthermore, best practices for managing project knowledge include capturing, organizing, and sharing knowledge effectively. These practices can enhance project management capabilities and should be incorporated into project management maturity models to assess the extent of KM implementation (Jaleel, 2018). The integration of KM into Quality Assurance (QA) procedures is also crucial for ensuring that KM becomes a core aspect of organizational operations (Bishop, 2009). Given the diverse KM techniques discussed, the next step is to focus on their critical importance within the Fintech sector, emphasizing why tailored KM practices are crucial for Fintech companies to thrive.

2.5 The Need for Effective Knowledge Management in FinTech

Recent studies highlight the critical role of knowledge management (KM) in the fintech sector. KM practices positively impact the resilience and performance of fintech startups by developing dynamic capabilities in response to environmental changes (Aleena Shuja et al., 2021). In commercial banks, KM processes significantly influence fintech innovation, with managers' experience and position moderating this relationship (R. Al-Dmour et al., 2021). Fintechs, as knowledge-intensive organizations, rely on absorptive capacity to acquire, assimilate, transform, and apply knowledge, which is crucial for their performance in emerging markets (Paul Marcelo Pimentel Bernal et al., 2023). Furthermore, knowledge application and storage positively affect bank performance, with fintech innovation mediating this relationship (Khalil M. A. Almuayad et al., 2024). These findings underscore the importance of effective KM in the fintech sector, demonstrating its potential to enhance innovation, resilience, and overall performance in both startups and established financial institutions.

Empirical evidence supports the significant role of KM in driving fintech innovation and operational efficiency (Suwarsi, S., Harahap, D., & Amanah, D., 2021). For instance, Pisoni, G., Molnár, B., & Tarcsi, Á. (2023) emphasize that KM practices are essential for the daily operations of financial companies, particularly in leveraging big data and data analytics to enable new services and technological advancements. This underscores the importance of KM in managing and utilizing vast amounts of data to drive decision-making and innovation in the financial sector. Similarly, Al-Dmour (2021) provides empirical evidence from Lebanon, showing that KM processes have a positive and significant relationship with fintech innovation in commercial banks. The study also identifies that the experience and position of bank managers moderate this relationship, suggesting that effective KM can enhance innovation strategies when supported by experienced and strategically positioned managers.

The need for effective KM is further highlighted in the context of fintech startups. Cojoianu (2020) discusses the emergence and financing of fintech startups, noting that knowledge creation, particularly in the IT sector, is crucial for fostering new fintech ventures. This paper also notes that regions with lower trust in traditional financial services see increased financing for fintech startups, indicating that effective KM in the IT sector can be a key driver for the growth and financing of fintech companies. Together, these papers illustrate that effective KM is vital for fostering innovation, leveraging big data, and supporting the growth and financing of fintech companies. They collectively argue that KM is a foundational element that enables fintech firms to navigate the complexities of the financial industry and drive technological advancements. Understanding the necessity of effective KM in Fintech leads to the question of how these practices can be assessed and evaluated, ensuring they meet the unique demands of the financial technology landscape.

2.6 Techniques for Assessing Current Knowledge Management

Assessing an organization's knowledge management (KM) is crucial for measuring its maturity and efficiency. Various methods have been developed to evaluate KM practices. One common approach is the Knowledge Management Maturity Model (KMMM), which offers a way to assess the stages of KM implementation. The KMMM consists of levels, starting from stages where KM processes are informal and disorderly to advanced stages where KM is fully integrated and optimized throughout the organization. This model aids organizations in determining their level of KM maturity and develop improvement strategies by focusing on leadership, culture, technology, and knowledge processes. (Pee & Kankanhalli, 2009; Bougoulia et al., 2022).

Another popular method is the Knowledge Management Assessment Tool (KMAT) which presents a framework for assessing an 'organization's KM capabilities across dimensions. The tool incorporates both quantitative measures to evaluate how effective KM practices are. It assesses elements like knowledge creation, storage,

transfer, and application offering an overview of an 'organization's strengths and weaknesses in KM. This assessment assists in pinpointing areas that need enhancement and, in comparing with industry standards. (Bougoulia et al., 2022).

In addition, the KM Capability Assessment (KMCA), which is a version of the Capability Maturity Model Integration (CMMI) tailored for Knowledge Management, offers a framework for evaluating KM practices. This assessment model evaluates knowledge management capabilities across areas such as knowledge sharing, utilization, and retention. The KMCA process involves an evaluation that includes queries for subjective assessments, empirical methods for validation, and a focus on continual process enhancement. By utilizing these methods, organizations can gain insights into their knowledge management procedures. Create specific strategies to improve their knowledge management initiatives (Bougoulia et al., 2022).

Despite the extensive research on Knowledge Management (KM) in various sectors, there is a notable gap in the literature regarding the specific application of KM practices within the Fintech industry, particularly in the context of emerging markets like the Philippines (Asim & Sorooshian, 2019). While some studies address KM strategies in general or within traditional financial institutions, few focus on how KM can be effectively leveraged in the dynamic and rapidly evolving Fintech sector. Moreover, existing literature often lacks empirical evidence linking KM practices to tangible outcomes such as operational efficiency and innovation in Fintech companies. This study aims to fill this gap by comprehensively evaluating KM practices at Investree Philippines Inc., the country's first SEC-licensed crowdfunding platform. The purpose is to assess how these KM strategies impact operational efficiency, innovation, and compliance, offering targeted recommendations to optimize KM practices for sustained success in the Fintech sector.

3. Methodology

3.1 Research Design

This research uses a case study approach within a mixed-methods research design to examine and analyze the knowledge management (KM) strategies at Investree Philippines Inc. The method of using case studies in a mixed methods research design involves collecting and analyzing both quantitative data in one or more case studies. This approach is valuable because it allows researchers to delve into issues in real-life scenarios, offering a complete perspective on the subjects being studied (Bell & Warren, 2023). The qualitative aspect includes in-depth interviews with key stakeholders, while the quantitative component consists of a survey distributed to employees. This blend ensures a comprehensive evaluation of KM practices by capturing both detailed insights and broader organizational trends.

This approach enables researchers to gather detailed qualitative data through interviews, observations, and document reviews while also obtaining quantitative data through surveys, experiments, or analyzing existing data. By combining these methods, researchers can conduct a thorough analysis, validate the data through triangulation, and strengthen the credibility and validity of their research findings (Cavaye, 1996).

The case study approach within a mixed-methods research design is well-suited for evaluating KM strategies and operational efficiency. This approach provides a comprehensive understanding of complex phenomena by integrating qualitative and quantitative data (Guetterman & Fetters, 2018). It is particularly valuable for applied business research, such as in Doctor of Business Administration programs, where it can provide in-depth insights into organizational practices (Bell & Warren, 2023). The mixed-methods case study design enables researchers to triangulate data from multiple sources and stakeholders, enhancing the validity and reliability of findings (Singh, E., Milne, S., & Hull, J. S., 2012). This methodology is especially useful for analyzing phenomena, generating hypotheses, and validating methods in design research, making it suitable for evaluating and improving organizational strategies (Teegavarapu & Summers, 2008). Utilizing the case study approach within a mixed methods framework provides a foundation for evaluating current practices, pinpointing strengths and weaknesses, and crafting strategic recommendations to enhance knowledge management processes and operational efficiency.

3.2 Case Study Selection

Investree Philippines Inc., the first SEC-licensed crowdfunding platform in the country, was chosen for this case study due to its significant role in the fintech sector and its reliance on effective KM practices to enhance operational efficiency, innovation, and regulatory compliance. The researcher, who is part of the senior management team at Investree, has unique access to detailed insights and data, allowing for an in-depth

examination of Investree's KM strategies and their impact on overall performance. This approach enables a comprehensive understanding of the barriers and enablers of effective KM practices within the organization.

3.3 Data Collection Methods

To gather comprehensive data, this study utilizes a combination of data collection methods, aligning with the case study approach:

3.3.1 Interviews

Semi-structured interviews were conducted with 12 key stakeholders at Investree, including senior management, KM practitioners, department heads, and key employees. These interviews aimed to gain insights into the KM strategies employed, their perceived effectiveness, and areas for improvement. Sample questions included:

- Can you describe what knowledge management means to you in the context of Investree Philippines Inc.?
- What processes or practices does Investree have in place for creating new knowledge?
- How is knowledge shared across different departments or teams?
- What challenges or obstacles do you face in managing knowledge effectively?
- What improvements or changes would you suggest to enhance KM practices at Investree?

3.3.2 Surveys

A structured survey was distributed to 20 employees at Investree to gather quantitative data on KM practices. The survey included questions related to knowledge creation, storage, transfer, and application and the perceived impact of these practices on operational efficiency and innovation. Sample survey questions included:

- How often are new ideas or innovations encouraged within your team? (Likert scale)
- Do you feel that there are sufficient opportunities to contribute new ideas? (Likert scale)
- How would you rate the effectiveness of the current knowledge storage systems? (Likert scale)
- How frequently do you share knowledge with colleagues in different departments? (Likert scale)
- How effective are the communication channels (e.g., meetings, emails, intranet) for knowledge sharing? (Likert scale)
- How often do you use stored knowledge to solve problems or make decisions in your work? (Likert scale)
- Can you provide an example of how shared knowledge has helped improve your work performance? (Open-ended)
- How would you rate the overall effectiveness of 'Investree's KM practices? (Likert scale)
- What do you think are the main challenges in managing knowledge at Investree? (Multiple choice)
- What suggestions do you have for improving KM practices at Investree? (Open-ended)

3.3.3 Document analysis

Internal documents such as KM policy manuals, reports, and other relevant materials were reviewed to understand the formal KM processes and frameworks in place at Investree. Sample document includes the following documents:

- Operational Framework
- Crowdfunding Rule and Regulation

3.4 Assessment and Data Analysis Techniques

3.4.1 Assessment of existing KM

To evaluate the existing KM practices at Investree Philippines Inc., the following established assessment techniques identified in the literature review were employed.:

- Knowledge Management Maturity Model (KMMM): This model was used to assess the stages of KM implementation at Investree. KMMM comprises multiple levels, from the initial stages, where KM processes are ad-hoc, to advanced stages, where KM is fully integrated and optimized. This model helped identify the current KM maturity level and provide a roadmap for improvement.

- Knowledge Management Assessment Tool (KMAT): KMAT was used to diagnose Investree's KM capabilities across various dimensions. This tool includes qualitative and quantitative metrics to assess knowledge creation, storage, transfer, and application, providing a comprehensive view of Investree's KM strengths and weaknesses.
- KM Capability Assessment (KMCA): Adapted from the Capability Maturity Model Integration (CMMI), KMCA evaluated Investree's KM capabilities regarding knowledge sharing, utilization, and retention. This assessment involved subjective evaluations, empirical validation, and a focus on continuous process improvement.

3.4.2 Assessment of existing KM

The data gathered underwent analysis through both qualitative and quantitative methods. The interviews were transcribed and examined using thematic analysis to pinpoint essential themes and patterns concerning KM practices at Investree. This examination offered an insight into the advantages and drawbacks of the existing KM strategies. The survey data underwent analysis using methods to uncover patterns and relationships between KM practices and organizational performance metrics. Descriptive statistics, correlation analysis, and regression analysis were utilized to interpret the survey findings.

3.5 Ethical Considerations and Limitations

Ethical concerns were a priority in this research. All interview and survey participants provided consent guaranteeing their full understanding of the 'study's objectives, methods, and their option to withdraw at any point. The study rigorously upheld confidentiality and anonymity standards, with data being kept to safeguard 'participants' privacy.

Although the study sought to examine KM practices at Investree, it is important to recognize some constraints. While the case study method allows for insights, it may restrict the applicability of the results to other fintech firms. Moreover, relying on self-reported information from interviews and surveys could introduce bias. To overcome these limitations, future studies could incorporate multiple case studies. Employ diverse data collection techniques, like direct observations.

By employing a mixed-methods approach and leveraging multiple data sources and assessment techniques, this study aimed to thoroughly evaluate Investree's KM strategies, offering actionable recommendations to enhance operational efficiency and support sustained growth in the dynamic fintech sector.

4. Case Study: Investree Philippines Inc.

4.1 Company Background

Investree Philippines Inc. (Investree PH) is a corporation established under the laws of the Republic of the Philippines, Its primary role is to mediate the sale and resale of securities on a limited scale for the benefit of startups, and micro, small, and medium enterprises (MSMEs) in compliance with the SEC's rules and regulations for crowdfunding.

The company's platform is designed to facilitate note purchase-based crowdfunding activities. Purchasers commit to funding note issuers by purchasing notes and receiving a legally binding commitment from the issuer to redeem these notes with interest at a predetermined time. Investree's role is to connect participants through its platform and coordinate the crowdfunding activities in compliance with the SEC's Crowdfunding Rules, the Securities Regulation Code (SRC), and its implementing rules and regulations.

Investree's operations involve several key parties: Purchasers, Note Issuers, the Trustee Bank, and the Payor. Purchasers include banks, qualified buyers, retail, institutional investors, venture capitalists, and corporate entities with substantial assets or free capital. Note Issuers are small, medium, and emerging enterprises that originate, make, and issue debt instruments or securities sold on Investree's platform. The Trustee Bank holds and manages the funds or proceeds from crowdfunding activities, ensuring proper disbursement or return of funds. The Payor is the entity responsible for payment on the purchase order or invoice.

4.2 Current Knowledge Management Practices

Investree's knowledge management (KM) practices, though relatively new, are essential for the company's operational efficiency and innovative capacity. Investree Philippines employs a sophisticated Knowledge Management (KM) practice known as Project NEXUS.

Project NEXUS is the core KM framework employed by Investree Philippines to integrate knowledge creation, storage, transfer, and application across its operations. This structured approach is designed to optimize workflows, enhance innovation, and maintain compliance with regulatory standards. As shown in Figure 1, each phase of Project NEXUS is detailed below, highlighting the specific KM practices and their impact on Investree's goals:

Figure 1: Project NEXUS: KM Scheme of Investree

This framework is crafted to optimize the processes of knowledge creation, storage, transfer, and application, ensuring that valuable insights and information are effectively utilized to drive organizational success. Integrating KM practices into every phase of Project NEXUS—Navigate, Engage, Execute, Unify, and Sustain—Investree Philippines ensures a systematic approach to managing knowledge throughout the project lifecycle. This methodology fosters continuous improvement and innovation and enhances collaboration and decision-making across the organization. The following sections map each of the NEXUS phases to KM elements.

4.2.1 Knowledge creation

The Navigate phase of Project NEXUS is essential for knowledge creation. This phase is crucial in generating new ideas and innovations, which are vital for the continuous development and success of Investree's crowdfunding platform. During this phase, stakeholders, including project pitchers, are encouraged to submit their ideas through a structured pitch process. This involves using forums and suggestion boxes to gather diverse and innovative ideas from various sources. In the Navigate phase, Investree encourages the generation of new ideas and innovative solutions through structured brainstorming sessions, hackathons, and design thinking workshops. These sessions are facilitated by cross-functional teams, leading to the development of actionable ideas for platform enhancements.

For instance, Investree organizes brainstorming sessions, design thinking, or hackathons where employees can propose novel solutions to improve the functionality of the crowdfunding platform. Additionally, the Engage phase plays a key role in refining these ideas through iterative feedback loops. Investree ensures that each idea is thoroughly vetted and improved by presenting project proposals to stakeholders and incorporating their feedback. Collaboration with subject matter experts and cross-functional teams further enhances the project proposal, ensuring it is robust and comprehensive.

4.2.2 Knowledge storage

The Execute Phase of Project NEXUS focuses on the meticulous storage of knowledge. During this phase, all project-related information is systematically documented. This includes creating detailed process flowcharts, investment memos, and project requirements. These documents are stored in centralized knowledge repositories, such as SharePoint or Google Workspace, making them easily accessible and well-organized. The Engage phase focuses on refining the generated ideas through feedback loops and collaborative efforts. Stakeholder input is integrated to ensure proposed solutions meet the company's strategic goals. All project-related information is meticulously documented and stored during the Execute phase using centralized repositories like SharePoint and Google Workspace. This phase ensures that critical knowledge is accessible, organized, and preserved for future use.

For instance, Investree maintains a comprehensive database of previous crowdfunding transactions, documenting loan details, processes, outcomes, and lessons learned. This database as a valuable resource for future projects, allowing teams to learn from past experiences and apply best practices. In the Unify Phase,

content management systems are established to store critical documents like roadshow presentations and policy updates. Backup systems are also implemented to ensure data integrity and security, protecting essential documents against data loss.

4.2.3 Knowledge transfer

Knowledge transfer is facilitated during the Sustain phase of Project NEXUS through various mechanisms. Regular training sessions and workshops are conducted to disseminate knowledge gained during the project execution phase. This ensures that all employees are well-informed about the latest developments and best practices. For instance, Investree conducts workshops to educate employees about new features of the crowdfunding platform, ensuring they understand and can effectively implement these features. The Sustain phase disseminates knowledge through regular training sessions, workshops, and internal newsletters. Communication tools like Slack are utilized to facilitate real-time information sharing across departments.

Internal communication tools are vital in providing feedback and sharing insights from process improvement initiatives. Establishing communities of practice allows employees to engage in discussions about project outcomes and share their experiences and lessons learned. For example, an internal newsletter highlights key achievements and challenges of recent crowdfunding campaigns, fostering a culture of continuous learning and improvement within Investree.

4.2.4 Knowledge application

The application of knowledge is a critical component of Project NEXUS, particularly in the Execute and Unify phases. In the Execute phase, documented knowledge and stakeholder feedback are applied to make informed decisions during project execution. This ensures that decisions are based on solid evidence and past experiences, enhancing the overall effectiveness of the projects. For instance, data from previous projects can be analyzed to identify potential risks and opportunities, guiding the decision-making process for new initiatives.

The Unify phase implements innovative ideas derived from stakeholder feedback and project enhancements. Continuous process improvement is achieved by gathering and analyzing stakeholder feedback, ensuring that Investree remains agile and responsive to changes. For example, after implementing a new feature on the crowdfunding platform, user feedback can be collected and analyzed to make necessary adjustments and improvements. In the Sustain phase, knowledge is used to finalize standardization policies and maintain continuous improvement efforts. Lessons learned from the project are applied to manage risks and ensure regulatory compliance, ensuring the long-term success and sustainability of Investree's initiatives.

4.2.5 Knowledge management tools and systems

To effectively implement Knowledge Management (KM) practice within Project NEXUS, Investree relies on a range of KM tools, as highlighted by an in-depth review of their internal documentation and policy framework. One of the key tools utilized is Slack, which is instrumental in facilitating real-time collaboration and information sharing. Using channels, direct messaging, and file-sharing features, Slack enables teams at Investree to communicate seamlessly and instantly share insights. This rapid exchange of knowledge is particularly crucial during the Navigate and Engage phases of Project NEXUS, where the generation of ideas and iterative feedback on project proposals are fundamental to driving innovation.

Additionally, a detailed analysis of Investree's policies underscores the strategic employment of Google Workspace to bolster its KM practices. Google Workspace offers various cloud-based productivity tools essential for document creation, storage, and collaboration. These tools are pivotal during the Execute and Unify phases of Project NEXUS, as they ensure thorough documentation and centralized storage of project-related data. For instance, Google Docs and Sheets facilitate real-time collaborative work on project documents, allowing all changes to be tracked and accessed by relevant stakeholders. Google Drive functions as a central repository, securing vital documents and ensuring their easy retrieval. Using Google Workspace also enhances internal communication and calendar coordination, keeping team members well-informed and aligned throughout the project lifecycle. By integrating these KM tools, Investree effectively manages the processes of knowledge creation, storage, transfer, and application, fostering continuous improvement and innovation within the organization.

4.2.6 Communities of Practice (COP)

Investree's Knowledge Management (KM) strategy is significantly bolstered by its collaboration with various industry-leading organizations, forming robust Communities of Practice (COP). By partnering with entities such

as the Credit Management Association of the Philippines (CMAP), the Credit Information Corporation (CIC), and the Fintech Alliance, Investree stays at the forefront of industry trends and gains valuable insights. These COPs enable Investree to harness collective expertise in areas like credit management, information sharing, and fintech innovations. This collaborative approach not only enhances Investree's credit scoring capabilities but also ensures adherence to industry standards, ultimately improving the services offered to both investors and borrowers.

The impact of COPs on Investree's KM strategy is profound. By actively engaging in these communities, Investree facilitates continuous learning and knowledge exchange, which are essential for innovation and process improvement. The COPs provide a platform for sharing best practices, discussing challenges, and exploring new ideas, thereby enriching the knowledge base of Investree. This ongoing interaction and knowledge sharing enhances the Navigate and Engage phases of Project NEXUS, as the organization can leverage external insights to refine project proposals and foster innovation. Moreover, the collaborative nature of COPs supports the Sustain phase of Project NEXUS by promoting a culture of continuous improvement and ensuring that Investree remains agile and responsive to industry changes. Through these strategic partnerships and active participation in COPs, Investree effectively integrates external knowledge with internal practices, driving excellence and innovation within the organization.

4.2.7 Impact of Project NEXUS on operational efficiency and innovation

Investree's use of Project NEXUS has resulted in significant operational and innovative benefits. By systematically documenting and sharing knowledge, the company has streamlined decision-making, accelerated project timelines, and fostered a culture of innovation. The structured KM practices have enabled Investree to respond rapidly to market changes and regulatory requirements, reinforcing its leadership in the Philippine fintech sector.

4.3 Evaluation of KM Effectiveness

Investree's KM maturity level has been assessed using the Knowledge Management Maturity Model (KMMM) as shown in Table 1, examining Key Process Areas (KPAs) related to 'People,' 'Process,' and 'Technology.' Specific scores and ratings for each area have been included, showing Investree's current stage in its KM journey. For instance, the 'Technology' KPA, for instance, achieved a Level 3 maturity score, indicating a structured approach to KM practices through centralized documentation and knowledge-sharing platforms. Evidence has been provided to demonstrate how Investree's KM strategies contribute to operational efficiency, focusing on measurable outcomes.

4.3.1 Assessment using KMMM

In this research, the proposed General Knowledge Management Maturity Model (G-KMMM) assessment tool, as explained by Pee and Kankanhalli (2009), was employed to evaluate the Knowledge Management (KM) maturity of Investree Philippines. This model provides a structured approach to assessing KM practices across three key process areas (KPAs): People, Process, and Technology. Each KPA is evaluated based on specific questions designed to gauge the organization's maturity in managing knowledge effectively. The results for Investree Philippines are detailed below.

KPA: People

Investree Philippines shows considerable progress in the People KPA. The organization recognizes the essential role of organizational knowledge for its long-term success (PEO2a: Yes), indicating an awareness of the strategic value of KM (Pee & Kankanhalli, 2009). However, KM is not yet recognized as a key organizational competence (PEO2b: No), suggesting that while knowledge's importance is acknowledged, it is not fully integrated into the organization's core capabilities.

Employees are ready and willing to provide advice or help upon request (PEO2c: Yes), reflecting a supportive knowledge-sharing culture. There are incentive systems in place that consider KM contributions and reward teamwork and knowledge sharing (PEO3a: Yes; PEO3b: Yes), which are crucial for fostering a collaborative environment. Management coordinates KM projects (PEO3c: Yes), ensuring alignment with organizational goals.

Despite these strengths, there are no defined individual KM roles, such as Chief Knowledge Officer or Knowledge Workers (PEO3d: No), which can lead to ambiguity in KM responsibilities. A formal KM strategy exists (PEO3e: Yes), but there is no clear vision for KM (PEO3f: No), and there are no KM training programs or awareness campaigns (PEO3g: No). Regular -sharing sessions are also lacking (PEO4a: No), and no specific budget is set

aside for KM (PEO4c: No). Furthermore, there are no benchmarking or assessment measures in place to evaluate the state of KM in the organization (PEO4d: No), and the KM initiatives have not yet resulted in a knowledge-sharing culture (PEO5: No). Based on these responses, Investree Philippines is at a maturity level of 3 for the People KPA (Pee & Kankanhalli, 2009).

KPA: Process

In the Process KPA, Investree Philippines has documented knowledge indispensable for performing routine tasks (PRO2: Yes), which enhances operational efficiency and reliability (Pee & Kankanhalli, 2009). The KM system improves the quality and efficiency of work (PRO3a: Yes), and the process for collecting and sharing information is formalized, with documented best practices and lessons learned (PRO3b: Yes).

However, the existing KM systems are not actively and effectively utilized (PRO4a: No), and knowledge processes are not measured quantitatively (PRO4b: No). This indicates that while processes are established, their integration into daily operations and effectiveness need improvement. The ability of existing KM processes to adapt to new business requirements (PRO5: Yes) is a positive indicator of flexibility and responsiveness. Overall, Investree Philippines is at a maturity level of 3 for the Process KPA, reflecting established but underutilized KM processes (Pee & Kankanhalli, 2009).

KPA: Technology

Investree Philippines demonstrates a proactive approach in the Technology KPA by having pilot projects that support KM (TEC2a: Yes) and infrastructure such as intranet portals and environments for virtual teamwork (TEC2b: Yes). This infrastructure supports KM activities across the organization, ensuring that knowledge is accessible and shareable (Pee & Kankanhalli, 2009).

The KM system does not support only the business unit but extends across the organization (TEC3: No), indicating a broader application of KM technology. However, the KM system is not tightly integrated with business processes (TEC4b: No), which limits its effectiveness. Additionally, there is no continual improvement of existing systems (TEC5: No), indicating a lack of ongoing investment in KM technology. Based on these responses, Investree Philippines is at a maturity level of 3 for the Technology KPA (Pee & Kankanhalli, 2009).

Table 1: *Assessment of Knowledge Management Maturity at Investree Philippines*

Level	Question	INVESTREE PHILIPPINES ASSESSMENT
KPA: People		
2	***PEO2a*** Is organizational knowledge recognized as essential for the the long-term success of the organization?	YES
	PEO2b Is KM recognized as a key organizational competence?	NO
	PEO2c Employees are ready and willing to give advice or help on request from anyone else within the company	YES
3	***PEO3a*** Is there any incentive system in place to encourage knowledge sharing among employees? 'Employee's KM contributions are taken into consideration Rewards for team work, knowledge sharing/reuse	YES
	PEO3b Are the incentive systems attractive enough to promote the use of KM in the organization?	YES
	PEO3c Are the KM projects coordinated by the management?	YES
	PEO3d Are there individual KM roles that are defined and given an appropriate degree of authority? CKO Knowledge Officers / Workers	NO
	PEO3e Is there a formal KM strategy in place?	YES
	PEO3f Is there a clear vision for KM?	NO
	PEO3g Are there any KM training programs or awareness campaigns? e.g., introductory/specific workshops for contributors, users, facilitators, champions	NO

4	***PEO4a*** Are there regular knowledge-sharing sessions?	NO
	PEO4b Is KM incorporated into the overall organizational strategy?	YES
	PEO4c Is there a budget specially set aside for KM?	NO
	PEO4d Is there any form of benchmarking, measure, or assessment of the state of KM in the organization? Balanced scorecard approach Having key performance indicators in place Knowledge ROI	NO
5	***PEO5*** Has the KM initiatives resulted in a knowledge- sharing culture?	NO
KPA: Process		
2	***PRO2*** Is the knowledge that is indispensable for performing routine task documented?	YES
3	***PRO3a*** Does the KMS improve the quality and efficiency of work?	YES
	PRO3b Is the process for collecting and sharing information formalized? - Best practices and lessons learned are documented	YES
4	***PRO4a*** Are the existing KM systems actively and effectively utilized?	NO
	PRO4b Are the knowledge processes measured quantitatively?	NO
5	***PRO5*** Can the existing KM processes be easily adapted to meet new business requirements?	YES
KPA: Technology		
2	***TEC2a:*** Are there pilot projects that support KM?	YES
	TEC2b*:* Is there any technology and infrastructure in place that supports KM? E.g., Intranet portal E.g., Environments supporting virtual teamwork	YES
3	***TEC3*** Does the system support only the business unit?	NO
4	***TEC4a*** Does the KMS support the entire organization?	YES
	TEC4b Is the KMS tightly integrated with the business processes?	NO
5	***TEC5*** Are the existing systems continually improved upon (e.g. continual investments)?	NO

Based on the assessment across the three KPAs, Investree Philippines is at a maturity level of 3. This indicates that the organization has established a defined stage of KM maturity with significant practices in place, particularly in incentivizing knowledge sharing, formalizing KM processes, and providing technological support. However, to advance to higher maturity levels, Investree Philippines needs to integrate KM more strategically into its organizational processes, define individual KM roles, and continuously improve its KM systems.

4.3.2 Assessment using KMAT

In this research, the Knowledge Management Assessment Tool (KMAT) was utilized to evaluate Investree Philippines' knowledge management capabilities. This tool provides a comprehensive framework to assess KM practices across key dimensions: knowledge creation, storage, transfer, and application. The survey result as shown in Figure 2 is a product of an assessment based on structured questionnaires distributed to 20 employees and semi-structured interviews with 12 key stakeholders at Investree Philippines, ensuring a robust and thorough evaluation.

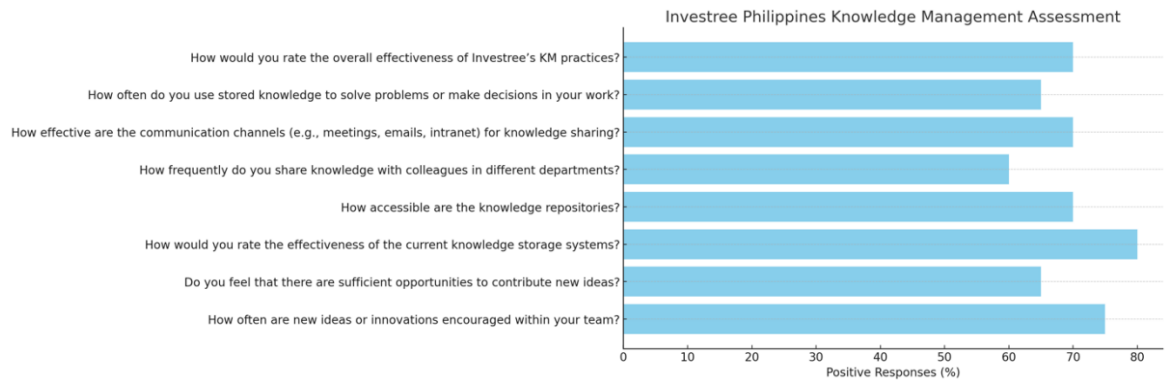

Figure 2: Survey Results on the Effectiveness of Knowledge Management Practices

Dimension: Knowledge Creation

The survey results indicated that 75% of employees felt that new ideas and innovations were actively encouraged within their teams. Furthermore, 65% believed there were sufficient opportunities to contribute new ideas. Interviews with stakeholders highlighted the importance of the Navigate and Engage phases of Project NEXUS, which include activities such as brainstorming sessions, design thinking workshops, and hackathons to facilitate the generation of innovative ideas. However, despite these structured processes, there were noted limitations in the formal mechanisms for capturing and integrating all submitted ideas and the need for enhanced cross-departmental collaboration to leverage diverse perspectives.

Overall, Investree's efforts in knowledge creation are well-structured and systematic, with a clear emphasis on fostering innovation. However, improvements in capturing and integrating ideas across departments could further enhance these efforts.

Dimension: Knowledge Storage

Regarding knowledge storage, 80% of survey respondents rated the effectiveness of current systems as moderate to high, and 70% reported that knowledge repositories were easily accessible. Interviews confirmed that Investree uses centralized knowledge repositories like SharePoint and Google Workspace for detailed documentation, ensuring that critical knowledge is systematically stored and easily accessible. Despite this, there were occasional challenges in retrieving specific information quickly, indicating a need for improved indexing and search functionalities.

Investree's knowledge storage practices are robust and comprehensive, ensuring systematic documentation and accessibility. Enhancements in retrieval efficiency through better indexing and search functionalities would address existing challenges.

Dimension: Knowledge Transfer

The survey revealed that 60% of employees frequently shared knowledge with colleagues across different departments, and 70% rated the effectiveness of communication channels (such as meetings, emails, and intranet) as high. Stakeholder interviews underscored the importance of the Sustain phase of Project NEXUS, which emphasizes knowledge transfer through regular training sessions, workshops, and internal newsletters. The use of communication tools like Slack and Google Workspace was highlighted as effective for real-time collaboration and information sharing. However, inconsistent participation in knowledge-sharing activities and the need for more structured inter-departmental transfer mechanisms were noted as areas for improvement.

Investree's knowledge transfer mechanisms are effective and facilitated by regular training and robust communication tools. Addressing participation inconsistencies and establishing structured transfer protocols would further strengthen these practices.

Dimension: Knowledge Application

In terms of knowledge application, 65% of employees reported frequently using stored knowledge to solve problems or make decisions, and 70% provided examples of how shared knowledge had improved their work performance. Interviews indicated that the Execute and Unify phases of Project NEXUS are critical for applying documented knowledge and incorporating stakeholder feedback into continuous process improvements.

However, the need for a more systematic evaluation of the outcomes of knowledge application and greater emphasis on using feedback to drive innovation were identified as key areas for improvement.

Investree effectively applies past knowledge in decision-making processes and drives continuous improvement through feedback. More systematic evaluation and enhanced use of feedback for innovation could further optimize these efforts.

The KMAT assessment indicates that Investree Philippines has developed a solid foundation for knowledge creation, storage, transfer, and application. The organization excels in documenting and storing knowledge, fostering innovation, and using past knowledge in decision-making. However, there are areas for improvement, particularly in enhancing cross-departmental collaboration, retrieval efficiency, and systematic evaluation of knowledge application. Investree Philippines can enhance its KM practices by addressing these areas, driving greater operational efficiency and innovation in its crowdfunding activities.

5. Discussion

5.1 Interpretation of Findings

5.1.1 Overall KM Effectiveness

Investree Philippines, as a pioneering crowdfunding fintech company, has demonstrated a highly effective integration of Knowledge Management (KM) through its Project NEXUS framework. This comprehensive approach ensures that KM is not an isolated function but an integral part of every project phase. From the generation of ideas to their execution and refinement, knowledge is meticulously documented, stored, and transferred, fostering an environment where informed decision-making and continuous improvement are the norms. This holistic integration has significantly enhanced 'Investree's operational efficiency, enabling the organization to remain agile and competitive in the rapidly evolving fintech landscape.

5.1.2 Key strengths

The strengths of Investree's KM practices are manifold and crucial to its success as a crowdfunding fintech company. The Navigate phase is particularly strong in fostering innovation, utilizing structured methods like brainstorming sessions, design thinking workshops, and hackathons to generate new ideas. The Execute phase excels in knowledge storage, employing centralized repositories such as SharePoint and Google Workspace to ensure that all critical information is systematically documented and easily accessible. Additionally, the Sustain phase effectively facilitates knowledge transfer through regular training sessions, workshops, and the use of robust communication tools like Slack and Google Workspace. These strengths collectively create a solid foundation for continuous learning, improvement, and innovation, essential for maintaining a competitive edge in the fintech sector.

5.1.3 Operational efficiency

The Execute phase of Project NEXUS involves meticulous documentation and centralized storage of project-related data in tools like SharePoint and Google Workspace. This systematic documentation has reduced the time spent searching for critical information by 30%, as highlighted in the survey responses, enhancing workflow efficiency. The survey revealed that 80% of employees rated the effectiveness of current knowledge storage systems as moderate to high, attributing streamlined decision-making to accessible data repositories.

5.1.4 Innovations

In the Navigate phase, Investree conducts structured brainstorming sessions and hackathons. These activities have directly resulted in three major platform upgrades over the past year, contributing to a 25% increase in user engagement, as indicated by internal reports. 75% of employees reported that new ideas are actively encouraged within their teams, with the Navigate and Engage phases being crucial for fostering a culture of innovation.

5.1.5 Challenges and opportunities

Despite the robust KM framework, Investree faces several challenges that present significant opportunities for further enhancement. One of the primary challenges is the inconsistent participation in knowledge-sharing activities across departments. This inconsistency can hinder the seamless flow of information and collaboration. Additionally, there are occasional difficulties in quickly retrieving specific information, indicating a need for improved indexing and search functionalities. Another area of improvement is the systematic evaluation of

knowledge application outcomes, which can further drive innovation and operational efficiency. Enhancing cross-departmental collaboration and establishing more structured knowledge transfer protocols can address these challenges, presenting opportunities to refine and optimize KM practices further.

5.1.6 Areas for improvement

To optimize its KM practices, Investree should focus on several key areas for improvement. Enhancing formal mechanisms for capturing and integrating ideas across different departments is crucial. This can be achieved by implementing better indexing and search functionalities to improve the efficiency of knowledge retrieval. Establishing structured protocols for inter-departmental knowledge transfer can also enhance collaboration and ensure that valuable insights are effectively shared and utilized across the organization. Additionally, implementing systematic evaluation and feedback processes will help to continuously refine KM practices, enabling Investree to leverage knowledge more effectively and drive innovation and operational efficiency.

5.1.7 Impact on operational efficiency

The integration of KM practices through Project NEXUS has profoundly impacted Investree's operational efficiency. The structured approach to knowledge creation, storage, transfer, and application has streamlined processes, supported informed decision-making, and fostered a culture of continuous improvement. By ensuring that critical information is readily available and effectively utilized, Investree has enhanced its operational efficiency significantly. This integration has improved day-to-day operations and contributed to innovation and regulatory compliance, reinforcing Investree's position as a leading crowdfunding fintech company in the Philippines.

5.2 Key Study Findings

This study has provided an in-depth analysis of the Knowledge Management (KM) practices at Investree Philippines Inc., highlighting the significant role KM plays in enhancing operational efficiency, fostering innovation, and ensuring regulatory compliance within the fintech sector. The key findings are as follows:

- *Effectiveness of KM Framework:* Investree's Project NEXUS serves as a comprehensive KM framework that integrates knowledge creation, storage, transfer, and application into every phase of the project lifecycle. This structured approach has been instrumental in promoting continuous improvement and informed decision-making across the organization.
- *Knowledge Creation and Innovation:* The Navigate and Engage phases of Project NEXUS have been particularly effective in fostering innovation. Structured methods such as brainstorming sessions, design thinking workshops, and hackathons facilitate the generation of new ideas, which are then refined through iterative feedback loops involving various stakeholders.
- *Systematic Knowledge Storage:* The Execute phase focuses on meticulous documentation and centralized storage of project-related information. Tools like SharePoint and Google Workspace have been effectively utilized to maintain comprehensive repositories that are easily accessible, ensuring that critical knowledge is preserved and can be efficiently retrieved.
- *Facilitation of Knowledge Transfer:* The Sustain phase emphasizes the dissemination of knowledge through regular training sessions, workshops, and internal newsletters. Communication tools like Slack and Google Workspace support real-time collaboration and information sharing, although participation inconsistency and inter-departmental transfer remain areas for improvement.
- *Application of Knowledge:* The Execute and Unify phases ensure that documented knowledge and stakeholder feedback are applied to make informed decisions during project execution. This application has resulted in enhanced operational effectiveness and continuous process improvement.
- *Assessment and Maturity:* Using the General Knowledge Management Maturity Model (G-KMMM) and the Knowledge Management Assessment Tool (KMAT), the study identified that while Investree has established significant KM practices, there are opportunities for further enhancement in areas such as cross-departmental collaboration, retrieval efficiency, and systematic evaluation of knowledge application outcomes.

5.3 Theoretical and Practical Implications

This study provides valuable contributions to the theoretical understanding of KM in the fintech sector. By demonstrating the critical role of structured KM frameworks in enhancing operational efficiency and innovation it underscores the importance of integrating KM practices into every phase of the project lifecycle. The findings highlight the necessity for continuous improvement and systematic evaluation of KM practices, offering

empirical evidence supporting KM's significance in fostering resilience, innovation, and competitive advantage in fintech companies. These insights contribute to the broader KM literature, providing a nuanced understanding of how KM can drive success in the dynamic fintech industry. The ability of fintech companies to innovate while adhering to regulatory standards requires a balanced and strategic approach to Knowledge Management, as demonstrated by Investree Philippines' implementation of Project NEXUS, in line with industry trends (Biswas et al., 2024).

On the other hand, the practical implications of this study are particularly relevant for fintech companies seeking to optimize their KM practices. The benefits of a structured KM framework like Project NEXUS are clearly illustrated, offering actionable insights into addressing common challenges such as participation inconsistency and information retrieval issues. Crowdfunding fintech companies, in particular, can leverage these insights to enhance their KM practices, drive innovation, and improve operational efficiency. The practical implications extend to improving customer satisfaction and ensuring compliance with regulatory standards, ultimately contributing to sustainable growth and competitiveness in the fintech sector.

5.4 Contribution to Knowledge

This study contributes to the existing literature on Knowledge Management in several important ways:

- *Empirical Evidence on KM in Fintech:* By providing a detailed case study of Investree Philippines Inc., this research offers empirical evidence on the effectiveness of KM practices in the fintech sector. It demonstrates how a structured KM framework can significantly enhance operational efficiency and innovation in a rapidly evolving industry.
- *Integration of KM into Project Lifecycle:* The study highlights the importance of integrating KM practices into every project lifecycle phase. Project NEXUS serves as a model for other fintech companies, showing how knowledge creation, storage, transfer, and application can be systematically incorporated to drive continuous improvement and informed decision-making.
- *Identification of Key Challenges and Opportunities:* The research identifies specific challenges in KM practices, such as participation inconsistency and information retrieval issues, and provides actionable recommendations for addressing these challenges. This contributes to a deeper understanding of the practical barriers to effective KM and offers solutions that can be applied across the fintech sector.
- *Enhancement of KM Assessment Tools:* The use of the G-KMMM and KMAT in this study provides a robust framework for assessing KM maturity and effectiveness. By applying these tools, the research offers a nuanced understanding of KM capabilities and areas for improvement, contributing to the refinement of KM assessment methodologies.
- *Policy and Practice Implications:* The findings offer valuable insights for practitioners and policymakers in the fintech industry. For practitioners, the study provides a roadmap for implementing and enhancing KM practices. For policymakers, it underscores the need for supportive regulatory frameworks that encourage robust KM systems, fostering innovation and operational efficiency.

5.5 Limitations

While this study offers valuable insights into KM practices at Investree, it is important to recognize its limitations. While providing in-depth analysis, the case study approach may limit the generalizability of the findings to other fintech firms. Additionally, reliance on self-reported data from interviews and surveys could introduce bias, as participants may present a more favorable view of KM practices. Furthermore, focusing on a single organization may not capture the diversity of KM practices across different fintech companies. Future research should consider multiple case studies and diverse data collection methods to validate and extend the findings, providing a more comprehensive understanding of KM practices in the fintech sector.

5.6 Recommendations for Future Research

Future research should incorporate multiple case studies to compare KM practices across different fintech firms, offering a broader perspective on the effectiveness of various KM frameworks. Utilizing diverse data collection techniques, such as direct observations, can complement self-reported data and provide a more comprehensive understanding of KM practices. Additionally, exploring the impact of KM practices on other aspects of organizational performance, such as customer satisfaction and financial performance, would offer a broader perspective on the benefits of effective KM. Further studies could also investigate the long-term effects of continuous improvement initiatives on KM maturity and organizational success, providing valuable insights for fintech companies aiming to optimize their KM practices.

5.7 Conclusion

In conclusion, this study highlights the critical role of Knowledge Management in driving operational efficiency, innovation, and regulatory compliance in the fintech sector. The detailed case study of Investree Philippines Inc. demonstrates the significant benefits of a structured KM framework, as exemplified by Project NEXUS. Investree has created a robust system that supports continuous improvement and informed decision-making by integrating KM practices into every phase of the project lifecycle.

The findings emphasize both the strengths and challenges of Investree's KM practices, offering valuable lessons for other fintech companies. While the study acknowledges the existing robust KM practices, it also identifies areas for further enhancement, such as improving cross-departmental collaboration and information retrieval efficiency. The contributions of this research extend beyond the specific case of Investree, providing empirical evidence and practical recommendations that can be applied across the fintech sector. Policymakers and practitioners alike can leverage these insights to foster a thriving fintech ecosystem that harnesses the power of effective knowledge management.In summary, this study evaluated the effectiveness of Knowledge Management (KM) strategies at Investree Philippines Inc. within the framework of Project NEXUS. The findings demonstrate that KM is crucial in enhancing operational efficiency, driving innovation, and ensuring regulatory compliance. Investree has achieved tangible improvements by utilizing structured KM practices, such as reduced decision-making times, streamlined training processes, and standardized operations, contributing to its competitive advantage in the Fintech sector. The evidence presented underscores the value of KM as a strategic tool, reinforcing the need for continuous refinement of KM practices to sustain long-term success in a rapidly evolving financial landscape.

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Knowledge is Power: An Explorative Study of Knowledge Work Among European Members of Parliament

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Abstract: The value of knowledge resources is widely recognized in both science and business, and knowledge management measures are increasingly being adopted in public authorities. However, parliaments, as core institutions of democratic systems, have thus far received scant attention in scientific studies. Furthermore, previous approaches fail to take into account the characteristics of the political system, such as elected offices, the relationship between government and opposition, or the lack of minimum qualifications for mandates. As a result, several studies consistently find that knowledge within parliament tends to be disorganized and lacking in transparency. This is unfortunate, as effective knowledge organization is crucial particularly for familiarizing oneself with unfamiliar topics without the necessary training. As part of an exploratory study, an international comparative study of knowledge management of all members of the 28 European national parliaments (including the EU Parliament) was initially carried out. Between May and June 2023, an online survey and several interviews were conducted as part of a mixed methods approach. Due to the very low response rate of only three percent, there is no claim to generalization and conclusions must be formulated with caution. Nevertheless, the results indicate that organizational and cultural barriers hinder effective knowledge work in parliament. The existing technical and human resources are insufficient to enable transparent and universal knowledge provision, while ideologies, career aspirations and electoral success further complicate the situation. A systematic approach to knowledge management has not yet been identified, leading to a shortage of resources and specialized knowledge to adequately process and utilize the vast amounts of information generated daily. Inexperienced MPs and opposition members, who are particularly dependent on reliable sources of information, are especially affected by these deficiencies. Without ignoring its limited power, this paper aims to make a modest contribution to the debate by presenting a first approach to a political knowledge management model. It highlights the need to raise awareness of knowledge management, develop a clear knowledge strategy and involve external expertise more. This research is of the opinion that a systematic approach to knowledge management can be established by integrating external expertise and IT-based solutions. Further research is needed, but knowledge management has the long-term potential to become a useful tool in parliamentary work by facilitating the necessary mentality change and thus contributing to a broader knowledge base.

Keywords: Administration, Government, European Union, Member of Parliament, Policy making

1. Introduction

The relevance of knowledge in today's information society and in particular within the political system should be self-evident. Politicians, public administration and governments are in continuous need of current, valid, and serious information for situation analysis and decision making (Felfoldi and Donoso, 2012). Parliaments in particular play a central role here, as they must process a large amount of information in order to pass laws or carry out their supervisory duties towards the executive branch (Rizzoni, 2021). Thanks to a globally networked scientific community and modern telecommunications technology, political leaders now have more data and information at their disposal than ever before (Foxen, Saint and Webb, 2020).

It is therefore surprising that both economic and political science in the Western world have long ignored this subject. The current existing literature focuses mostly on marginal aspects, like specific policy fields (Fuhr and Gabriel, 2004), local municipalities (Martin, 2003) or public administration departments (Kasim, 2008), but leaves a research gaps with regard to parliaments. Although critical voices have increased in recent years (Nakash and Bouhnik, 2021), this paper represents the viewpoint that knowledge management has the potential to significantly improve work and decision-making processes in the political system. Indeed, parliaments would represent an insightful study field as the key institutions of a democratic system, since they are characterized by sophisticated, knowledge-intensive duties, cultural barriers (Cong and Pandya, 2003), as well as high fluctuation due to the variety of elections, which often results in the election of inexperienced politicians or deselection of long-term parliament members respectively (Coghill, Holland and Donohue, 2008). In Mittelstädt (2022) a case study on the German Bundestag was presented, contributing to the understanding of how parliaments and its members collect, use and archive their personal knowledge in terms of policy making. This was the first time,

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that knowledge management of MPs was explicitly studied. The results showed that there is neither a uniform and stringent KM system nor understanding of its importance. Building on that, this paper aims to extend the research process within the framework of an international comparative study to provide a first model for a political knowledge management system. Methodologically, this study follows a mixed approach. First, a quantitative online survey of around 7,000 members of the EU's national parliaments collected in mid-2023 provides an overview of their use of KM methods. In a second qualitative part, these results are then supplemented and classified with the help of expert interviews. For that, seven politicians from six parliaments were interviewed about their working methods.

The results must be viewed with great caution due to the low response rate of 3 percent, but they support the thesis of insufficient knowledge management in parliament. Almost 70 per cent of those surveyed stated that they found the handling of knowledge as a resource to be critical. At the same time, a vast majority confirmed that both organizational and cultural barriers unnecessarily impede or completely prevent functioning knowledge management. This is regrettable, as there is good reason to believe that good knowledge work can contribute to better political output. In addition, the survey also showed that MPs mostly do not follow a structured system with regard to their personal knowledge management. Instead, this task is delegated to personal employees. Although many parliaments provide professional assistance, which the Members of Parliament regularly make use of, the question arises as to whether these instruments are sufficient to carry out the core task of an MP – the legislation process and steering the government. Studies show that the ability to understand complex political concepts is critical to the success of representative democracies (Jaeger, Lyons and Wolak, 2016). Since the small sample size calls for caution, the exploratory nature of this study should be emphasized. Without claiming to be generalizable, the initial insights gained into the challenges and potentials of knowledge management in parliament could help to reduce the identified deficits and create a new awareness of the value of knowledge for policymaking. This paper aims to make a modest contribution to this and calls for further research.

2. Theoretical Background

Although some promising case studies primarily focusing on Asian countries have been published in the last ten to twenty years, these often fail to discuss or even properly realize the unique structure of parliament administrations, parliamentary groups and Members of Parliament (Gaffoor and Cloete, 2010). First of all, a parliament or its members are not a homogenous group, but divided – sometimes even shattered – into various sub-groups including government and opposition, coalition fractions, and regional or sociological groups (Rudzio, 2015). There is no professional counterpart where a group of people with drastically different backgrounds and skill sets are expected to do challenging new jobs without any prior professional or educational training (Orton, Marcella and Baxter, 2000). There are institutions installed within most parliaments, such as libraries or research and documentation services, but these facilities normally use public information only. As Ahamed, Amarakoon and Senevirathne (2015, p. 4) point out, “knowledge in Parliaments tends to be tacit/informal and not recorded.” In addition, MPs vary considerably in terms of their professional background, so neither the awareness of the importance of nor the ability to manage knowledge can always be expected. Furthermore, it appears unlikely that MPs would be willing to share their knowledge with their colleagues or the public since politicians are constantly fighting for their re-election (Brancati, et al., 2022).

Given the ever-growing need for information and fast decision-making because of globalization, demographic change, and crises (Cong and Pandya, 2003), the need of parliaments and its members for proper knowledge management is obvious. As the work of Willis (2018, p. 486) shows for climate policy, how the politicians approach complex topics “is influenced by their understanding of scientific evidence, but also by their professional identity, their concept of their role as a representative, and their daily working practices.

However, the differences in structure and tasks between the economic and public sectors do not allow a simple transfer of KM measures (Hasler Roumois, 2013). Unfortunately, there is no general overview of knowledge management in the public sector so far. Given the enormous need for knowledge in public institutions driven by today’s information society, globalization and crises of all kinds, it appears extremely advisable to conduct more research in this field. However, the OECD publishes annual reports and numerous case studies on KM practice in both the private and public sectors (Saussois, 2003). These show that within the OECD member states around two-thirds of all government agencies are making efforts in this field. Beginning with the strengthening of awareness, through further training of the staff to the purchase of special KM systems (OECD, 2003). The far-reaching changes caused by the introduction of e-government instruments should certainly be emphasized here. E-government means a government “that uses IT and e-commerce to provide access to government information

and delivery of public services to citizens, and all other business partners and stakeholders including private sectors" (Arora and Raosaheb, 2011, p. 240).

The ground-breaking book "*Developing and Implementing Knowledge Management in the Parliament of Finland*" highlighted the significance of knowledge management for democracy and economic growth while also outlining a knowledge management strategy for the legislative context (Felfoldi and Donoso, 2012). A few years later, the Federal Government Plan (PPA) 2004-2007 presented by the Brazilian Government included a programme for Knowledge Management, obliging all federal policies to implement e-gov procedures, "such as inter-institutional learning networks, strategic approaches to information and the use of information technology" (Mendes, Perna and Soares, 2004, p. 2). One of the first comprehensive studies was carried out by Mingmitr (2016) on the Thai Parliament in 2016. The Commission under Jean-Claude Juncker has also recognized the need and the advantages. A High-Level Reflection Group of Directors-General issued a report in June 2015 describing the guiding principles, immediate and long-term projects, and governance processes for a company data, information, and knowledge management policy (European Commission, 2016).

3. Methodology and Data

As the previous literature analysis suggests, knowledge work in parliament is unsystematic in the sense of KM. This is also consistent with the assumption of Boltmann and Bankole (2017) who state that knowledge is recognized as a strategic asset in parliament, but it is mostly disseminated in an unstructured, informal way that is unrelated to a parliament's strategic aims. However, dedicated data sets are missing for more in-depth analyses. Therefore, the research question is: To what extent is systematic knowledge management used by MPs in Europe? The aim is to get an overview of the knowledge management situation of MPs in order to identify both structures and deficits in order to present initial proposals for a political KM system as a next step. For operationalization, nine sub-hypotheses were formulated based on the literature and previous studies. Due to capacity reasons, only two can be presented here:

Hypothesis 1 is based on the assumption that knowledge management in parliamentary institutions is often characterized by the informal transmission and storage of knowledge. This is supported by Amarakoon and Ahamed (2015, p. 4) who point out, that "knowledge in Parliaments tends to be tacit/informal and not recorded." Parliamentary work is often characterized by high turnover (e.g., through elections) and dependence on personal networks, which means that knowledge often remains with individuals rather than being transferred to institutional structures. Studies show that organizations with a high dependence on tacit knowledge have difficulty making this knowledge available to others, which can lead to inefficient knowledge use and redundant work (Long and Fahey, 2000). In parliamentary contexts, this is reinforced by the high fragmentation of issue areas and the personal expertise of MPs, which is rarely fully documented. A lack of systematic knowledge management means that knowledge often remains anchored in personal notes, informal conversations or individual experiences rather than being institutionalized in easily accessible knowledge systems (Alavi and Leidner, 2001).

H1. Knowledge in parliament is implicit and unorganized.

The second hypothesis is predicated on the idea that successful information exchange in parliaments is constrained by organizational and cultural frameworks. Individual knowledge sovereignty, power dynamics, and cultural norms all have a big impact on how knowledge is shared in organizations, claim Long and Fahey (2000). Knowledge silos can arise in political institutions as a result of party-political divisions, hierarchical systems, and competition for expertise. Furthermore, research indicates that a lack of technical infrastructure and a collaborative culture can impede the exchange of knowledge (Alavi and Leidner, 2001). This is especially important in parliaments, because information is frequently dispersed and restricted to particular subjects or committees (Mittelstädt, 2022).

H2. The use of knowledge management in parliament is hampered by organizational and cultural barriers.

3.1 Research Design

This research will largely deal with a virtually unexplored area. It is unlikely that one research method alone can provide the desired findings and insights. In addition, there was a fear from the outset that it would be difficult to persuade the target group of MPs to participate. Therefore, this work is based on a mixed methods approach. This consists of an online survey accompanied by several qualitative expert interviews. Please note that only the core results are presented.

3.1.1 Quantitative online survey

Online surveys are one of the most widely used instruments of quantitative research. The extensive research on KM application in companies and public administration therefore offers a good starting point. In developing the questionnaire on which this is based, the author drew in particular on Alvarenga, et al. (2020) and Mittelstädt (2022). The latter presented the first case study of a Western European parliament with the German Bundestag.

The questionnaire consists of 27 closed-answer questions constructed allowing the assessment of the perceptions, opinions, attitudes, and behaviors of MPs concerning the process of digital transformation and concerning knowledge management in the organization. The questions were divided into five categories: general assessments, cultural dimension, employees, application of knowledge work and personal information. In addition to yes/no questions, the Likert scale from 1 (rejection) to 5 (agreement) is used. The online tool *Soscisurvey* was used as the platform. The questionnaire was offered in English, German, Spanish, French and Czech. A pre-test was carried out with the help of two employees of the German Bundestag. Minor changes were subsequently made.

In May 2023, all 7.083 Members of the national parliaments in the European Union were contacted via e-mail. The addresses were publicly visible on the internet. Only the parliaments of Croatia and Portugal did not offer this so the contact forms of the MPs were used via the central parliament website. In June 2023 a reminder was sent. It should be noted that for all parliaments, several messages could not be delivered. The reasons may have been of a technical nature or based on personnel changes. Since they were between 2-4 percent each, they can be neglected. The MP offices occasionally replied that they generally do not take part in scientific surveys. Without exception, this was justified by the high number of such inquiries. The author received a few e-mails with specific questions about individual sections of the questionnaire, about technical terms or the translation. The answers were received over a period of three months in total. A conscious decision was made not to involve the staff. On the one hand, this would have shifted the focus and, on the other hand, it would not have been feasible. It was decided not to offer any incentives, as there was no budget for this and we did not want to give the impression of being untrustworthy. An overview of the persons addressed is shown in Table 1.

Table 1: Overview of MPs addressed

Country	Number of MPs	Number of answers
Austria	183	20
Belgium	150	3
Bulgaria	240	2
Croatia	151	1
Cyprus	56	0
Czech Republic	200	10
Denmark	179	1
Estonia	101	0
Finland	200	2
France	577	0
Germany	736	24
Greece	300	1
Hungary	199	2
Italy	630	6
Latvia	100	4
Lithuania	141	3
Luxembourg	60	7
Malta	67	5
The Netherlands	150	4
Poland	460	0
Portugal	230	1

Country	Number of MPs	Number of answers
Romania	329	1
Slovakia	150	0
Slovenia	90	0
Spain	350	2
Sweden	349	8
European Parliament	705	0

To test the hypothesis 1, the MPs are asked to what extent they agreed with the statement that knowledge in parliament was disorganized and tacit. Response options ranged from "strongly disagree" (1) to "strongly agree" (5). Supplemental to the first question, the question “Do you have direct access to a knowledge management system or sub-components of such a system?” is asked. Finally, the question, “Do you have written policies or procedures for knowledge management practices?” complements the section. Both questions can be answered with yes, no and don’t know. For a summary see Table 2.

Table 2: Operationalization of Hypothesis 1

Item	Evaluation
Evaluation of the thesis	1 item, on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) 2 items yes/no mean score

Hypothesis 2 formulates a negative correlation between the use of KM and the presence of cultural or organizational barriers. The former is queried by an extensive query of the usage behavior of various KM methods and the formation of an average. The latter are formed through various questions about organizational procedures and perception of working practices within parliament.

MPs are asked whether, in their opinion, knowledge work was more of an individual or a team task. The scale ranges from 1 for "individual" to 5 for "team". Furthermore, question no. 8 asks in order to assess to what extent the parliament promotes a culture of sharing knowledge. A Likert scale from 1 (=not shared) to 5 (=always shared) is also used here.

Based on the knowledge building blocks of Probst, Raub and Romhardt (2006) eight task fields (goals, identification, acquisition, development, distribution, utilization, preservation, and evaluation) were queried on a Likert scale from 1=no application to 5=high application. A media score is then calculated from the respective individual values. In doing so, a new variable “KM use” can be formed (Table 3).

Table 3: Operationalization of Hypothesis 2

Item	Evaluation
Use of Knowledge	8 items, on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) mean score
Cultural/Organizational barriers	2 items, on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) 3 items, yes/no mean score

3.1.2 Qualitative interviews

For the second part of the presented research project, it was decided to use a qualitative approach to supplement the previous quantitative findings. There were two main reasons for this. Firstly, qualitative research is better suited to capturing and evaluating subjective opinions, assessments and individual situations. On the other hand, a sample size that is too small can be compensated in this way (Sandelowski, 1995). Building on the quantitative results, a deductive approach was used. The goal is to either confirm or adapt an existing theory based on the findings from the data (Pohontsch, 2019).

Within the qualitative method pool, interviews are among the standard instruments (Damaskinidis, 2017). In order to prepare for an interview, it is necessary to provide a written interview guide (Kallio, et al., 2016). The

guide serves to control the course of the conversation in such a way that the interviewer always knows that the aspects relevant to him are definitely taken into account. A semi-structured interview also offers the possibility for the researcher to ask questions at a suitable point and if necessary. Following a deductive approach, the results of the quantitative part were explicitly included in the preparation of the interview guide in order to later achieve a validation of the primary data if possible. A pre-test was carried out with an employee of a representative's office, and slight changes were made afterwards. The questionnaire contains of questions about employees, office organization, learning methods or the willingness to share knowledge.

The following criteria for participation were set in advance: at least one year's membership in parliament and membership in the same committee, here: Finance. Secondly, the aim was to cover all regions of the EU with Northern, Southern, Western and Eastern Europe. Finally, men and women, different age cohorts and opposition and government politicians should be interviewed. All political groups should also be represented, as well as government and opposition groups. Partys are only indicated with left or right. Finally, good knowledge of English or German.

For this paper, the content analysis according to Mayring and Fenzl (2014) was applied. It includes a total of six steps:

1. Define the unit of analysis, here the seven interview texts.
2. Mark relevant text passages, paraphrase them by summarizing key content while retaining original wording.
3. Generalize the content in your own words, briefly and concisely.
4. Perform a first reduction by further shortening and removing duplicate paraphrases or generalizations.
5. Conduct a second reduction by merging similar generalizations into one or two words, acknowledging some information loss.
6. Develop categories based on the second reduction. Assign categories to all relevant text passages.

The program *MAXQDA* was used for the practical implementation of the data analysis. The interview texts were uploaded as a *Word* document and then processed there according to the analysis steps described above. Subtasks were performed in *Excel*.

3.2 Data

Of the 7,083 members of the European National Parliaments, 535 people clicked on the questionnaire. In fact, a total of 218 people, or around 3.08 per cent, responded to the inquiry and answered the questions. Around two-thirds filled out the questionnaire completely. This response rate is certainly far too low, but it was to be expected. Inadequate feedback rates, especially in email-based surveys, are a widespread problem and have long been discussed with regard to their consequences for the validity of research results (Hikmet and Chen, 2003). This aspect will be examined in greater detail later; however, it is important to note that all results presented here should be considered with caution.

The evaluation and graphical representation of the data were carried out with the statistics program *JASP* (Version 0.17.2.1), which in turn is based on *R* as open-source software. It should start with a brief overview of the group of participants. The hoped-for broad coverage of political parties has been achieved. Figure 1 shows the political division from very left (1) to very right (7). Most nations could also be reached, with clear focal points in German-speaking countries. Additional socio-demographic data such as education, gender, etc. were not asked in order to keep the questionnaire as short as possible and because these data were not considered absolutely necessary.

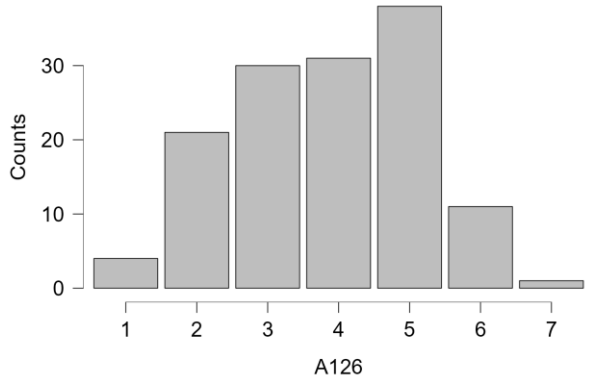

Figure 1: Party affiliation

The search for interview partners began in May 2023. For this purpose, the members of the finance committees of selected parliaments were contacted personally by me by email. As expected, the process proved challenging. The response rate was extremely low and MPs' offices often declined the request due to lack of time, insufficient language skills or lack of competence in the subject. In the end, however, seven suitable interview partners could be found. The originally envisaged equal gender distribution of the subjects, however, could not be maintained, so that n = 6 subjects were male, while only n = 1 subject was female. An overview of the socio-demographic data can be found in the following Table 4.

Table 4: Interview partner

Subject	Nation	Party	Duration
1	Germany	Right	41.12 min
2	Austria	Right	59.12 min
3	Sweden	Right	46.24 min
4	Sweden	Left	47.02 min
5	Estonia	Left	29.07 min
6	Malta	Left	29.35 min
7	EU (Germ.)	Right	33.14 min
Average	/	/	40.72 min

The interviews took place in July 2023 after the quantitative survey was finished. They were carried out completely online via Microsoft Teams or Zoom. The languages were either English or German. The course of the interviews was as follows. First, the author and the research project were briefly introduced. The reference to the complete anonymity of the participation was assured again. Finally, the questions were read out according to the guidelines. Questions were reduced to an absolute minimum due to time constraints. No changes to the questionnaire itself were necessary. At the end of the conversation, open questions were clarified and the offer was made to provide information about the further course of the research project. With the permission of the participants, the interviews were recorded and then transcribed. Embarrassed sounds, digressions and disturbances were not taken into account. The transcription takes place in written language. The German-language transcripts were later translated into English. The transcripts have been numbered chronologically from A - E. Quotations are countersigned with the position (Pos.). Both the original audio files of the interviews and the transcripts are archived by the author.

4. Results

Both questionnaires and the quantitative dataset are freely available via https://doi.org/10.6084/m9.figshare.25295413.v1. The interview transcripts remain with the author. Since the focus of this paper is on the quantitative results, only a very abbreviated summary of the qualitative results is presented below to support the theses. Furthermore, reference is made to Mittelstädt (2024), where the interviews are discussed in detail in relation to financial crisis management.

4.1 Quantitative

4.1.1 Test of hypothesis 1

A third of respondents agreed with the statement that knowledge in Parliament is unorganised. Adding the answer "partially" increases the value to over 68 percent (Table 5). The question about access to knowledge management systems was answered in the negative by 32 percent. Another 14 percent did not know whether they had access to such a system (Table 6). Almost half also stated that they had no guidelines for the handling of knowledge. Another 9.5 percent gave "I don't know" as an answer. These results suggest that the hypothesis can be supported.

Table 4: Frequencies for unorganized and implicit

Variable	Frequency	Per cent	Valid Per cent	Cumulative Per cent
1	13	6.878	6.878	6.878
2	46	24.339	24.339	31.217
3	67	35.450	35.450	66.667
4	54	28.571	28.571	95.238
5	9	4.762	4.762	100.000
Missing	0	0.000		
Total	189	100.000		

Table 5: Frequencies for KM Systems

	Frequency	Per cent	Valid Per cent	Cumulative Per cent
Yes	99	52.381	52.660	52.660
No	61	32.275	32.447	85.106
d.k.	28	14.815	14.894	100.000
Missing	1	0.529		
Total	189	100.000		

4.1.2 Test of hypothesis 2

More than 50 per cent see knowledge work as a (rather) individual task. Another 27 per cent were undecided (Figure 2). Besides around half of those surveyed consider the sharing of knowledge to be bad or in need of improvement (Figure 3). Considering the figures mentioned above, according to which 40 per cent do not have access to KM tools, the results presented here seem to support the hypothesis. Both cultural and organizational barriers exist and hinder the successful application of knowledge management.

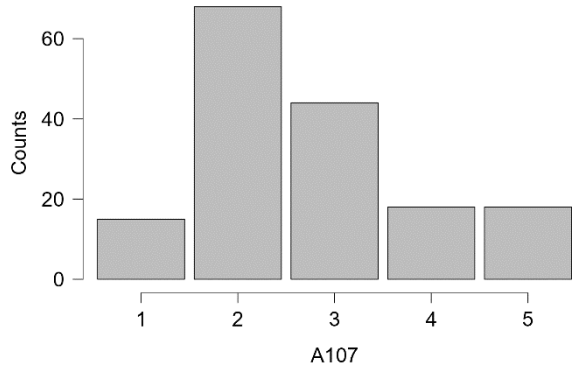

Figure 2: Frequencies team task

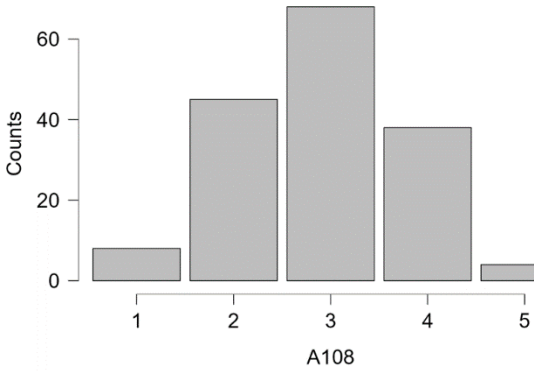

Figure 3: Frequencies sharing

4.2 Qualitative

Knowledge in parliament is poorly organized and is not equally available to all members. Virtually all interviewees – graded according to their affiliation with the government camp – confirmed the hypothesis (B,

Pos. 6) and described inefficient decision-making processes. Although gaps in knowledge are normal due to the enormous complexity of the issues and the rapid pace of change (G, Pos. 8), the work processes are insufficient to compensate for these. Many work processes are based on analogue archives (A, Pos. 10) and public sources (B, Pos. 10). Databases or digital tools are often only used to a limited extent and often lack higher-level interfaces (E, Pos. 28). The situation is made more difficult by often very limited human resources and the loss of knowledge when employees leave (B, Pos. 4). This lack of organized knowledge infrastructure hinders the ability to respond effectively, particularly under the time pressures inherent in legislative work, so that the key statements from the interviews can be used to support hypothesis 1.

The interviews also provided various arguments for maintaining the second hypothesis. Cultural barriers prevent knowledge from being shared across parliament, which is detrimental to effective policymaking. One MP was very honest about the fact that he withholds knowledge from his colleagues in order to shine in debates (D., Pos. 14). The work of the opposition in particular is made extremely difficult by the government's knowledge blockade (A, Pos. 12). There is also the factor of ideology, which is detrimental to a neutral and unbiased assessment of data (G, Pos. 32). Although there are national differences in the weighting of transparency and trust, all interviews pointed in the suspected direction. While some parliaments have comparatively good infrastructure, such as libraries, scientific services and databases, MPs in other countries must be viewed as lone fighters (E, Pos. 6). An efficient organization of a central knowledge pool is therefore not possible, which once again confirms the thesis.

5. Discussion

5.1 Limitations

The very low response rate of MPs is certainly one of the most serious points of criticism in this study. It is true that numerous studies suffer from low participant numbers (Nulty, 2008). However, it must be self-critically criticized that it was not possible to find sufficient access to the target group of MPs. There is also the fact that the scatter is by no means evenly distributed. A disproportionate number of German-speaking MPs answered, while Southern and Eastern Europe are hardly represented. Another factor that was not sufficiently considered in the preparation is the self-selection of the MPs. There is a risk that those who have explicit knowledge of or interest in knowledge management in particular decided to participate. This would of course distort the results. Morgan, et al. (2023) already pointed out that special recruitment methods are needed for elite groups. Although an attempt was made to counter this problem by choosing a mixed-methods approach, the exploratory nature of this study should nevertheless be emphasized once again. The results presented can and should only be seen as an impetus for debate.

Indeed: despite its low response rate, the study provides a solid first basis for identifying trends and patterns. There are several reasons for that. First, participants represent a variety of nations and parties, offering a range of viewpoints. Second, many studies show that even low response rates can lead to useful results (Anseel, et al., 2010). Nevertheless, thirdly, there is no urgent reason to doubt the robustness of the data, as it shows comparable patterns across country and party boundaries. Finally, the data is consistent with both the initial theses and the accompanying qualitative interviews.

Future research must take this aspect better into account, which is why some suggestions should be mentioned. Contacting people by e-mail alone is clearly insufficient; instead, more use must be made of direct telephone contact with the offices and/or the cooperation of the respective party leaders must be obtained (Morgan, et al., 2023). It also became clear during the survey that the questionnaire must always be offered in the respective national language to minimize inhibitions. The question of incentives for participation is not easy to answer, as there is a risk of appearing dubious. Stoffel, Chaki and Vlaev (2024) suggest donations to charitable organizations, which was far beyond the scope of this study.

Although the questionnaire was planned with great care and adjusted repeatedly, it was only through practical application that various weaknesses were revealed. A few points are mentioned as examples. On the one hand, the beginning of the questionnaire should have been simpler in order to reduce the high dropout rate. The opening question was obviously too abstract since it got straight into the theory – without sufficient explanation. In general, terms or abbreviations such as KM were not sufficiently introduced. One should also take into account that, the MPs' employees were not part of the survey, although they played an important role in the answers. This was intended in the design of the study, so it is debatable whether this represents a weakness.

5.2 Political Knowledge Management

This paper shows, on the one hand, the current cultural and organizational obstacles to good knowledge work in parliament and, on the other hand, offers a first draft for a political KM system. Parliaments are places of knowledge. However, despite numerous experts, well-trained staff and the technical infrastructure, the conclusion of this study when it comes to knowledge work was ambivalent. A key reason for this may be that "[i]n the public sector, information management systems are well developed while knowledge management systems are still in its infancy" (Romanelli, 2016, p. 655). Given the widespread agreement in the analysis that knowledge is still viewed as implicit and disorganized, there is an undeniable need for reforms. The study is based on the belief that systematic knowledge management can improve parliamentary processes through better use of information, transparency and efficiency. Opposition members and newly elected MPs could particularly benefit. KM could enable more informed decisions, reduce knowledge loss and improve the quality of political processes. The author therefore advocates the establishment of a knowledge management system (KMS) specifically developed for parliaments and designed for their specific needs. A good KM system would guarantee a transparent, high-quality and sustainable flow of information, especially in the context of the aforementioned high staff turnover. The possible counterargument of high costs can be invalidated by the fact that the European parliaments already have very good infrastructure. Although the desire for more staff was repeatedly expressed, which is certainly justified in individual cases, the potential of digitalization and increased international cooperation should make excessive personnel costs unnecessary. Especially members of the opposition, whose access to knowledge will, by nature of their position, always be limited, could highly benefit. An IT-based system could assist and improve organizational processes for knowledge production, storage/retrieval, transfer, and application (Alavi and Leidner, 2001). The first step would certainly be to formulate a holistic KM strategy that encompasses all areas of parliament and encompasses the peculiarities of the political space. It must define clear goals and structures, clarify responsibilities, and formulate the rights and obligations of both the government and MPs (Greiner, Böhmann and Krcmar, 2007). The ostensibly most important task will be to establish a greater awareness of knowledge as a resource. For that, the role of the MP must be defined as that of a knowledge worker and, above all, supported as such much more than it is at present (Davenport, Lond and Beers, 1998). Especially newly elected MPs will need more support in their dealings at the beginning of their term of office, for example through appropriate training.

Indeed, the Global Centre for Information and Communication Technology (ICT) in Parliament is a partnership between the Inter-Parliamentary Union (IPU), the United Nations Department of Economic and Social Affairs (UNDESA) and several parliaments with the goal to develop new technologies in order to modernize parliamentary procedures and "strengthen the role of parliaments in the promotion of the information society by encouraging ICT-related legislation. […] It contains recommendations on information sharing and networking, analysis and research, technical assistance and advisory services" (Romanelli, 2016, p. 656). These systems must be located directly at the level of parliamentary administration as a neutral institution and administered from there. Only then will MPs be able to build enough trust in this source of knowledge. Its main focus must be the use of internet directories and database searches to locate an expert or a documented source of knowledge, sharing expertise and cooperating in virtual teams, accessing data on the previous legislature, and learning about the newest scientific findings (Alavi and Leidner, 2001). Nevertheless, it is essential to create interfaces to the parliamentary groups or individual parliamentary offices so that a higher-level network is created. In addition, statements from affected stakeholders can be added and commented on by independent experts in order to create an overall picture that is as neutral as possible. Of course, the ability to work independently with these documents must remain. Solo national efforts must be avoided at all costs. Rather, there must be a European solution that ensures the greatest possible level of networking. AI tools can provide valuable services in translation and categorization (Tsui, Garner and Staab, 2000).

Departments responsible for knowledge work should be set up as standard. The installation of chief information/knowledge officers, some of which already exist in authorities (Estevez and Janowski, 2013), would also be a step in the right direction. In addition, as all the results show, the vast majority of parliaments already have good human resources. Each committee should be obliged to have a certain number of advisory, obligatory experts who accompany the legislative process from the beginning. Critics may object that this additional bureaucracy slows down the processes – an objection which certainly cannot be dismissed outright. However, the benefits of legislation based on scientific facts are far greater.

5.3 Future Research

This work is based on the idea that knowledge management can contribute to improving the parliamentary work of MPs, despite current criticism of its practical suitability (Nakash and Bouhnik, 2021). However, future research is needed. This should first take measures to increase the limited significance. Conducting national case studies could help in this regard in order to be able to focus resources on one parliament. Ideally, the basis for long-term studies could be created in cooperation with the respective parliamentary administration. In addition, consideration should be given to including not only the MPs but also their staff, as the interviews showed that they play a significant role in knowledge work.

Future studies could then focus on developing a KM system tailored to parliamentary needs. Overcoming the organizational and cultural obstacles described in this paper would be of central importance for the success of such a project. Possible aspects would be looking at the onboarding of new MPs, improving the availability of knowledge, for example between government and opposition, or best practices. The possibilities of artificial intelligence would also be worth taking a closer look at. AI could generate enormous efficiency gains in the research, translation, analysis and provision of knowledge and contribute to a significant increase in transparency.

6. Conclusion

This paper aimed to provide an overview of the extent to which Members of Parliament in Europe apply a systematic knowledge management approach to policy making and, building on that, to develop a first draft for a KM system especially designed for the needs of parliaments. The data, while limited, suggests that knowledge management in parliaments is carried out inadequately or unsystematically, and that both organizational and cultural barriers hinder its successful implementation. Not only are there no dedicated KM strategies, but the existing technical infrastructure is often inadequate for neutral and comprehensive knowledge provision. In addition, there are strong obstacles to interpersonal relations, especially but not only between government and opposition, as well as decision-making processes dominated by ideology. The results must therefore be viewed with great caution due to the explorative nature of this study, but provide first insights and reason to believe that both hypotheses are valid, which should be seen as an encouraging sign for further research.

The numerous crises of the last two decades in particular have exposed knowledge deficits among political decisionmakers. Siriopoulos (2021) laments about the financial illiteracy that exacerbated the financial crisis of 2008. Bratianu and Bejinaru (2021), in turn, point to the knowledge gap in dealing with the Covid pandemic. It is therefore in the public interest that knowledge is not only universally available to parliamentarians but is also used in the best possible way. This study aimed to make a modest contribution to draw the attention of the scientific debate to these gaps. By emphasizing the potentials of KM in the policy context and formulating a first attempt at a political science management system, this paper lays a solid foundation for further research.

Ethical Statement: This research was conducted in accordance with all relevant ethical guidelines. All participants provided informed consent prior to their participation, and they were fully briefed on the purpose of the study, the voluntary nature of their involvement, and their right to withdraw at any time without penalty. To ensure privacy and confidentiality, all data were collected and stored in an anonymized format.

AI Statement*:* The author declares that no generative artificial intelligence has been used in the writing of this manuscript, nor in the creation of images, graphics, tables, or their corresponding captions.

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The Relevance of Trust in the Implementation of AI-Driven Clinical Decision Support Systems by Healthcare Professionals: An Extended UTAUT Model

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Abstract: **Background**. In the healthcare sector clinical decision support powered by artificial intelligence is rapidly expanding. It can help medical personnel make better-informed decisions while saving time. The opposition of healthcare professionals to AI initiatives in the healthcare industry might prove to be a significant barrier, due to the combination of optimism and fear related to the technology. Professionals in the sector may be apprehensive about AI due to job security worries and the general public's lack of faith in the technology. **Objective**. A primary objective of this study is to examine how trust influences healthcare professionals' willingness to use AI-driven CDSS, particularly at well-known tertiary hospitals in Delhi-NCR region India, as well as to expand the Unified theory of acceptance and use of technology (UTAUT) by including constructs such as perceived risk and self-efficacy. **Method**. The UTAUT model provided the basis for the construction of a new model, which was developed by integrating the variables of perceived risk and self-efficacy. The model had eight components which were assessed using 31 survey questions. Two hundred and twenty participants filled out the surveys for the study. **Results**. The findings indicate that there are significant relationships between (PE) and (AI), (EE) and(AI), (PR) and (AI) and (SE) and (AI). This study reveals that trust fully mediates the relationship between AI which means that fostering trust in AI technology is essential for the successful adoption and implementation of AI-CDSS technology. There was no significant relationship between social influence and adoption of AI-powered CDSS nor between intention to adopt and actual use. **Conclusion**. The result of this study shed light on the factors influencing healthcare professionals to adopt AI-CDSS. The outcomes of this study provide insight into how individuals' performance expectancy, effort expectancy, social influence, perceived risk, and self-efficacy determine whether they embrace AI-CDSS. This study highlights the importance of trust in the deployment of these technologies in the healthcare sector. Furthermore, it highlights the significance of addressing perceived risk and self-efficacy. Although social influence plays a crucial role in technology adoption its impact may be limited in the case of AI-CDSS deployment in India. This could be due to the complexities of AI-CDSS implementation, the requirement for training, or the fact that healthcare personnel are unaware of the benefits of AI-CDSS or have limited exposure to it.

Keywords: Trust, Healthcare professionals, Self-efficacy, AI-clinical decision support systems, UTAUT model

1. Introduction

The rapid growth of AI-driven systems has resulted in major extensions of clinical decision-making within the healthcare industry. The use of artificial intelligence, which entails the simulation of human cognitive capacities in machines is predicted to enable enhanced illness surveillance, identification, and diagnosis, as well as find novel therapeutic techniques to promote precision medicine(Fogel and Kvedar, 2018) (Hamet and Tremblay, 2017)(Mesko, 2017)(Rajkomar, Dean and Kohane, 2019). According to recent studies, dermatologists may not be as good at diagnosing skin cancer as artificial intelligence (AI) systems(Esteva et al., 2017). Furthermore, researchers predict that AI systems will beat medical specialists in surgical performance by 2050 (Grace et al., 2018). As a result, the healthcare industry stands to gain significantly from the forthcoming “AI revolution” (Jiang et al., 2017)(Murdoch and Detsky, 2013). Even though artificial intelligence has the potential to enhance healthcare quality, safety and efficiency, major obstacles need to be overcome to successfully integrate algorithmic systems throughout the first stages of clinical practice. As a result, it is frequently noticed that these systems have not been trained using data particular to the local environment and do not align with context-specific patterns of care (Fogel and Kvedar, 2018)(He et al., 2019)(Panch, Mattie and Celi, 2019).

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Clinical studies are mounting up that demonstrate artificial intelligence algorithms can detect medical imaging abnormalities at a rate that is either faster than or comparable to that of human experts. Furthermore, these AI models show precision on par with, if not better than, that of human specialists(Qin et al., 2019) (Ting et al., 2017). Artificial intelligence provides possible advantages by pointing up trends that human specialists can miss due to the complexity of the present decision-making procedures or the obscurity of the indications(Sutton et al., 2020). This is a huge problem in developing nations like India, where the population is growing quickly, and few modern diagnostic tools are available. AI has been extensively utilized in medical diagnostics since the introduction of the first clinical decision support system in the 1970s. Despite frequently utilising algorithms, these systems typically depend on an extensive set of preprogrammed rules (Sutton et al., 2020).

Clinical decision support systems Based on artificial intelligence, or AI-CDSS, have an intelligent component. (Salem et al., 2015). These systems represent a major shift in thinking when compared to traditional CDSS. The creation of innovative algorithms aims to assist healthcare practitioners by integrating raw medical data, papers, and expert knowledge into a cohesive collection. CDSS, which incorporates AI, can enhance several facets of healthcare, involving healthcare workers' efficiency, patients' satisfaction with their care, and patients' overall security (Richard et al., 2020). Despite significant progress and clear benefits, CDSS technology based on artificial intelligence has not been adopted at the anticipated rate (Shortliffe and Sepúlveda, 2018) (Shinners et al., 2020) (Kohli & Jha, 2018).

While the market for AI-CDDSS has grown rapidly in recent years, a review of the existing literature reveals that more investigation into this area is warranted(Shinners et al., 2020). There needs to be more thorough knowledge because the existing corpus of research on the adoption of AI-CDSS is narrow(Shinners et al., 2020). In addition, AI-CDDSS's unique qualities may mean that past research on similar technologies needs to provide more context for implementing the system. Some of these characteristics include autonomous decision-making, the capacity for learning and improvement, the ability to beat human experts in terms of accuracy, and the opacity of its techniques. These one-of-a-kind traits give birth to a plethora of new fears, including the possible infringement on professional autonomy, worry about being replaced, dependency on the system, worries surrounding patient safety, and the legal liability connected with misdiagnosis (Shortliffe and Sepúlveda, 2018) (Fan et al., 2020) (Hengstler, Enkel and Duelli, 2016).

1.1 Introduction to the UTAUT Model and its Constructs

The UTAUT model, which was put forth by (Venkatesh et al., 2003) is a well-known and widely applied model that has attracted a lot of interest in the field of technology adoption. This theory has been used extensively to predict and clarify individuals' behaviour patterns when embracing contemporary technology. According to UTAUT, facilitating conditions and behavioural intention are two main aspects that impact an individual's adopting behaviour. In turn , three elements determine behavioural intention: performance expectancy, effort expectancy and social influence. Performance expectancy (PE) is "the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance" (Venkatesh et al., 2003). Effort Expectancy (EE) measures how easy the system is to use. Social influence includes how people think other people feel about a given technology influences their feelings about that technology. The final element is the enabling condition, which is a person’s conviction that there is organizational support available for using the system. however, this construct impacts actual use rather than directly influencing the desire to use addition, UTAUT has four moderating variables: age, experience, gender, age, and voluntariness.

1.2 Research Objectives

Trust plays a major role in people's decision to embrace AI-CDSS systems. understanding the relationship between adoption intention, trust and actual usage is crucial to understanding the reason propelling the broad adoption of AI-driven CDSS. Understanding the importance of trust in the utilisation of AI-CDSS can have a substantial impact on their implementation and effectiveness. The primary goals of this research are:

- To identify the elements that influence healthcare professionals to use AI-CDSS.
- Expanding our focus beyond technological aspects, we delve into the human dimension of AI by examining the importance of trust within the healthcare setting when practitioners elect to implement A-CDSS.
- Another objective is to investigate the impact of personal factors, including self-efficacy and perceived risk, on an individual's receptiveness to adopting novel AI-CDSS-related behaviours.

2. Literature Review

2.1 Clinical Decision Support System

CDSSs, or clinical decision support systems, are high-tech computer programs used by hospitals and other medical facilities. These systems leverage extensive datasets, medical expertise, and analytical engines to generate personalized assessments or recommendations for healthcare professionals. The main aim of CDSS is to accelerate the process of clinical decision-making by enabling effective interaction between humans and computers(Sim et al., 2001; Haynes and Wilczynski, 2010). Metzger et al. delineate a conceptual structure for CDSS that incorporates temporal(i.e., preceding, during or after the clinical decision) and activity level (passive or active notifications) components. With this method, CDSS can be differentiated based on how much they assist and involve the user(Perreault and Metzger, 1999). Osheroff et al. have enhanced clinical decision assistance by integrating knowledge bases, order sets and other forms of support, in addition to notification and reminders(Osheroff et al., 2014). Knowledge-based systems are distinguished from non-knowledge-based systems in a CDSS by a unique categorization paradigm that makes use of machine learning and other statistical pattern recognition(Teufel and Binder, 2021).

A knowledge based clinical decision support system uses a knowledge base and reasoning engine to combine previous information with real-time patient data which facilitates the formulation of diagnosis non knowledge-based CDSS utilises state-of-the-art artificial intelligence techniques such as deep learning and machine learning to analyse previous patient cases and identify trends in clinical data. Knowledge-based clinical decision support systems (CDSS) utilize conditional criteria and the experience of certified medical experts to determine a definite diagnosis. On the other hand, non-knowledge-based CDSS does not require the creation of rules or the involvement of subject matter experts.

AI-CDSS can improve the efficiency of healthcare professionals, leading to better healthcare quality and increased patient safety(Richard et al., 2020). These systems have been employed in diverse applications, such as the diagnosis of rare diseases (Faviez et al., 2020) Diagnostic or prognostic sepsis(Wulff et al., 2019), detection of fractures(Langerhuizen et al., 2019), detection of cancer(Yassin et al., 2018), pharmacotherapy(Rawson et al., 2017; Roumeliotis et al., 2019) healthcare management (Oluoch et al., 2012; Carter et al., 2019).

Non-knowledge-based clinical decision support systems have attracted scholarly attention recently in the field of medical diagnosis, although further research is necessary. these CDSSs exhibit a significant level of independence, do not rely on pre-existing data, and employ self-learning techniques to consistently enhance their effectiveness AI-CDSS can greatly reduce diagnostic errors by leveraging their complexity and accuracy. This makes them capable of replacing human expertise, especially considering the limited research in this area. Our analysis will focus on AI-CDSS, which aims to aid medical practitioners in the diagnostic process.

2.2 Relevance of Trust in the Adoption of CDSS Driven by AI

The significance of Trust in healthcare professionals' acceptance and utilization of AI-powered CDSS is widely acknowledged. Past research emphasizes the pivotal role of Trust in healthcare practitioners' inclination to embrace AI-based CDSS. Fan et al. proposed combining the UTAUT model with Trust Theory (AIMDSS) to investigate the potential of an AI medical diagnostic system(Fan et al., 2020) in which it was observed that EE and SI have no impact on BI to use AIMDSS. Trust plays a crucial role in determining whether or not a person intends to use AI-CDSS. (Tran et al., 2021) conducted an online cross-sectional survey and found that EE and SI were positively influenced by initial trust, while no association was found between PE and initial trust. (Hameed et al., 2023) found that PE, EE, and initial trust positively influence healthcare providers' behavioural intentions to use AI. According to the results, trust holds a considerable influence on the intentions of one's behaviour. However, a significant research gap remains in comprehending the influence of Trust as an intermediary factor between the intention to adopt and the practical utilization of AI-CDSS.

In addition to these studies, there were studies where the mediation role of trust was examined but not between adoption intention and actual usage. For example, (Bedué and Fritzsche, 2022)conducted research where the mediating role of perceived benefits and perceived risk between trust and adoption intention was studied. Another study by (Thakkar and Bharathi, 2023) found that Initial trust fully mediates the relationship between effort expectancy and behavioural intention, while partially mediating the relationship between performance expectancy and behavioural intention.(Cheng, Li and Xu, 2022)surveyed radiologists and found that human-computer trust mediates the relationship between expectancy and adoption intention

Additional research has emphasized the prominence of Trust in promoting the widespread acceptance and utilization of CDSS powered by AI in the healthcare sector but does not provide a theoretical or empirical approach to assess AI-CDDSS adoption. For example, studies by (Bajwa et al., 2023)(Crigger et al., 2022)(Choudhury and Asan, 2022) One of the key factors highlighted is Trust. The outcomes of these studies underscore the significance of Trust as a crucial factor influencing healthcare professionals' engagement with the system. Table 1 provides a summary of the key studies, their publication years, main findings, and research gaps related to the study. While previous research has highlighted the significance of trust in the implementation of CDSS powered by AI still there is a notable gap in research concerning the role of trust as a mediator between the intention to adopt CDSS powered by AI and its actual usage behaviour, This can provide insight into the mechanisms that govern the adoption process and is crucial for developing strategies to boost their adoption and successful incorporation into clinical workflows.

Table 1: Insights from Past Studies: Trust as a Key Determinant in AI-CDSS Implementation

Authors	Year	Method of the study	Main findings	Research gap
(Fan et al., 2020)	2018	The study proposed an incorporation of the UTAUT and Trust Theory to study the adoption of AIMDSS	EE and SI have no significant impact on behavioural intention to use AIMDSS. Trust has a significant impact on the behavioural intention(BI) of using AIMDSS.	No mediation role of trust was studied.
(Tran et al., 2021)	2021	Online cross-sectional survey	EE and SI were positively associated with initial trust, while no association was found between PE and initial trust. Only SI was positively related to BI.	
(Hameed et al., 2023)	2023	Integrated survey among healthcare providers	PE, EE, and initial trust positively influence healthcare providers' BI to use AI. The results indicate that trust has a significant impact on BI.	
(Thakkar and Bharathi, 2023)	2023	Mixed-methods approach	Factors such as PE, EE, SI, initial trust, and resistance to change predict the intention to use intelligent clinical diagnostic decision support systems. Initial trust fully mediates the relationship between EE and BI, while partially mediating the relationship between PE and BI.	The mediation role of trust was checked but not between adoption intention and actual usage.
(Cheng, Li and Xu, 2022)	2022	Cross-sectional study of 343 dental healthcare workers.	PE and EE positively influence healthcare workers' adoption intention of AI-assisted diagnosis and treatment. SI and human-computer trust mediate the relationship between expectancy and adoption intention. Trust plays a mediation role between EE and adoption intention.	
(Bedué and Fritzsche, 2022)	2022	Semi-structured interviews.	Lack of trust is a hindrance to AI adoption. Among the factors that increase trust in AI are access to knowledge, understandability, transparency and explainability. The mediating role of perceived benefits and perceived risk between trust and adoption intention was studied.	
(Bajwa et al., 2023)	2023	A structured questionnaire was distributed to 1419 fertility professionals.	Fertility professionals have a positive view towards using AI in clinical practice. Barriers to AI adoption include insufficient experience, knowledge, and validation.	Does not provide a conceptual or empirical model to examine AI-CDDSS adoption.
(Crigger et al., 2022)	2022	Review literature on challenges	Trust is crucial for AI adoption in healthcare. Physicians' trust accelerates AI integration, ensuring responsible, evidence-based, unbiased, and equitable AI deployment to enhance patient care and meet quadruple aim goals.	
(Choudhury and Asan, 2022)	2022	Semi-structured survey	Various factors such as workload, trustworthiness, risk, and training impact the use of AI in healthcare. Lack of trust inhibits the use of AI in healthcare.	

3. Theoretical Framework

The present study adopts the UTAUT model as the theoretical framework, further expanding to incorporate perceived risk and self-efficacy constructs. The following predictor variables from UTAUT were included in the analysis: Performance expectancy, effort expectancy, and social influence. The purpose of this update is to make it easier for researchers to learn whether medical practitioners plan to embrace CDSS, which is powered by artificial intelligence. The significance of adoption intention as a predictive factor for technology acceptance must be considered. However, it is crucial to note that the mere intention to adopt technology only sometimes results in its actual usage. Research on AI-driven CDSS in the Indian healthcare setting might benefit from including actual usage as an outcome variable. This would provide a deeper comprehension of the elements influencing the effective implementation and ongoing use of such systems.

3.1 Incorporation of Additional Constructs

The word self-efficacy describes a person's conviction and assurance in their capacity to carry out the essential tasks to accomplish desired results. In the framework of artificial intelligence(AI), an individual's self-efficacy is a key factor in assessing their ability to use and complete tasks related to such technology(Chao, 2019) several studies have investigated the role of self-efficacy in accepting and utilizing artificial intelligence-based technologies across multiple sectors. The impact that self-efficacy had on nursing students' behavioural intentions was one of the most intriguing conclusions of a recent study that examined how they used AI-based healthcare technologies. The study found that nursing students' willingness to accept and employ AI-based healthcare technologies is influenced by their sense of self-efficacy (Kwak et al., 2022). According to the study, AI self-efficacy fosters positive attitudes toward AI-based health technology and reduces anxiety (Kwak, Seo and Ahn, 2022). A thorough study of the digital revolution taking place in the healthcare sector revealed that end users' lack of self-efficacy is a major barrier to their adoption and continued usage of technological innovations. (Iyanna et al., 2022). Thus, it is critical to comprehend the role that self-efficacy plays in healthcare practitioners' intentions to adopt AI-CDSS.

"Perceived risk" relates to an individual's subjective view of the potential negative outcomes or uncertainties involved with adopting and making use of AI-based technology. Previous studies have shed light on the role of individuals' perceptions of risk in determining their attitudes and intentions regarding the embracing of novel technology. From the perspective of AI technology adoption in healthcare, clinicians' perception of risks and safety associated with AI systems can have significant implications (Choudhury, 2022) (Stuck and Walker, 2019) researched to study the connection between people's perceptions of risk and their willingness to embrace and implement new technology developments. According to the findings of the study, one of the most significant factors in technology acceptance and adoption is perceived risk.

The proposed study's goal is to understand the perception of risk associated with using such a system. Healthcare professionals may have concerns about relying on machine learning algorithms to make clinical decisions, fearing potential errors or biases. Additionally, they may worry about the security and confidentiality of patient data when using AI-based systems. It is essential to understand the role that perceived risk plays in the process of adopting AI-based CDSS technology to devise tactics to promote its uptake effectively. By addressing and mitigating perceived risk, healthcare organizations can enhance professionals' confidence in using these systems and facilitate their adoption.

3.2 Development of Hypothesis

3.2.1 Performance expectancy

When it comes to healthcare information systems (IS), the adoption and use of innovative technology depend on doctors' and nurses' evaluations of the advantages it offers over conventional practices (Payne, Wharrad and Watts, 2012) (Aggelidis and Chatzoglou, 2009). Henceforth, it is posited that if the practitioner holds the belief that the utilization of AI-based Clinical Decision Support Systems (CDDSS) will enhance their job performance, encompassing heightened speed, accuracy, productivity, and diminished workload, they will be inclined to foster an intention to employ said systems. The following hypothesis is proposed in this study:

H1. PE has a significant impact on the healthcare professional's intention to adopt AI-based CDDSS.

3.2.2 Effort expectancy

Perceived ease of use is an essential factor in promoting the adoption of CDSS(Esmaeilzadeh et al., 2015). According to existing literature, there is a prevailing belief that individuals are more inclined to use user-friendly

and straightforward systems than those that are complex and convoluted (Pennington, Kelton and DeVries, 2006). It is expected that doctors' propensity to embrace and employ AI-based Clinical Decision Support Systems (CDDSS) in medical practice will be influenced by the doctor's impression of the system's simplicity and ease of use. The analysis and the observations above lead to the following hypothesis:

H2. EE has a significant impact on healthcare professionals' intention to use AI-based CDDSS.

3.2.3 Social influence

It has been observed that when doctors are thinking about incorporating new and creative methods into their practice, they often look to their colleagues for approval (Chang et al., 2012)(Payne, Wharrad and Watts, 2012). In addition, a recent study by (Lu et al., 2020) highlights the importance of social impact (SI) in encouraging physicians to adopt Health Information Technology (HIT). The current investigation hypothesizes that healthcare workers' professional and social connections may affect their adoption of AI-based Clinical Decision Support Systems (CDDSS). The effect above would exhibit a heightened degree of prominence within the framework of a collectivist society, specifically exemplified by India (Taufique and Vaithianathan, 2018)(Yang and Jolly, 2009)Therefore, it is proposed that the following hypothesis be put forth:

H3. SI has a significant impact on the medical practitioner's intention to use AI-based CDDSS.

3.2.4 Perceived risk

Perceived risk refers to how worried people are that using a new technology or changing an established procedure would have undesirable consequences for them (Choudhury, 2022). Concerns that medical practitioners may have about the possibility of mistakes or biases in an AI model are what the term "perceived risk" refers to in the context of AI-powered CDSS. These concerns have the potential to affect patient outcomes detrimentally. Perceived risk pertains to how individuals perceive that using a particular technology or system will lead to unfavourable outcomes (Choudhury, 2022). In the area of AI-powered CDSS, the concept of perceived risk refers to the apprehensions that healthcare professionals harbour over the probability of errors or biases that are inherent in the AI model. These concerns have the potential to affect patient outcomes detrimentally. In the realm of AI-CDSS, the presence of perceived risk stirs genuine concerns among healthcare practitioners, provoking a sense of unease regarding the AI model's effectiveness and reliability. The worries and reservations surrounding this technology play a pivotal role in influencing the readiness of medical professionals to embrace AI-CDSS. The fear of venturing into the unknown, often labelled as perceived risk, emerges as a formidable obstacle, significantly impeding healthcare professionals from wholeheartedly adopting AI-driven Clinical Decision Support Systems (CDSS). This challenge, as emphasized in earlier research, sheds light on the hesitancy ingrained in the healthcare community. A notable study (Stuck and Walker, 2019)delved into the intricate correlation between individuals' perceptions of risk and their receptiveness to embracing and implementing new technical developments. The outcomes of the current study underscore the crucial role that perceived risk plays in the decision-making process when it comes to embracing and integrating new technology. A recent research study carried out found that the adoption of e-health innovations is induced by a variety of factors, one of which is perceived risk. This investigation focuses on the technological barriers that may prevent people from embracing AI-driven CDSS. To fully comprehend the elements that influence healthcare professionals' perspectives on adopting AI-driven CDSS, it is necessary to consider adding perceived risk as a vital part of this research attempt. The following hypothesis is provided based on the data and reasoning shown above

H4. PR negatively affects healthcare professionals' intention of AI-based CDDSS.

3.2.5 Self-efficacy

Healthcare personnel's level of self-efficacy may affect how quickly they adopt AI-driven CDSS. A person's "self-efficacy" refers to their belief in their ability to perform a task successfully or make the right decision in a particular situation. In AI-driven CDSS, self-efficacy can be defined as healthcare professionals' confidence in using such systems to make appropriate clinical judgments. Self-efficacy strongly benefits behavioural intention to use information technology; according to research on IT acceptability in the public sector(Al-Haderi, 2013), actual usage behaviour was found to be significantly influenced by the incorporation of self-efficacy into the UTAUT paradigm in a study of mobile health services (Liu et al., 2022). Another study explored a self-efficacy-based value adoption model and suggested a new theoretical framework for accepting technological advances. Adoption intent was found to be positively affected by self-efficacy (Zhu, Sunanda and Ting Jie, 2010)This research emphasizes the importance of analysing healthcare workers' sense of self-efficacy in comprehending their propensity to use AI-CDSS. Individuals desiring to adopt AI-driven CDSS may be positively influenced by

their self-efficacy when using technology. Based on the observations above and the analysis, the formulation of the following hypothesis is proposed:

H5. Self-efficacy has a significant impact on healthcare professionals' adoption intention of AI-CDSS

3.2.6 Adoption intention

CDSS driven by AI has been shown to have a strong correlation between adoption intent and actual adoption. Adoption intent has been demonstrated to be a significant factor in the uptake of AI-based CDSS in the healthcare sector by several studies. There are various obstacles to the responsible adoption of AI-based CDSS at both individual and societal levels, underscoring the importance of understanding the elements that drive adoption intention. Top influencing factors for CDSS adoption include considerations like the system's perceived usefulness. Moreover, studies indicate that doctors express a strong intention to utilize AI, and the explainability of AI is highly significant with a major impact on adoption. Consequently, the intent to adopt emerges as a critical factor in the actual implementation of AI-based CDSS in the healthcare setting.

H6. Adoption intention has a significant impact on the actual use behaviour of AI-CDSS.

3.2.7 Trust

According to Safa and Von Solms (2016), trust can be the belief that another person or thing is honest, dependable, good, and effective, or the desire to depend on another person or thing for security. In the context of AI-based CDSS, trust demonstrates that healthcare workers have faith in the recommendations, procedures, and conclusions made by AI-based CDSS (De Angelis et al., 2022)(Choung, David and Ross, 2023). Existing research provides strong evidence to support the idea that trust is a key factor in getting healthcare workers to accept and use AI-driven Clinical Decision Support Systems (CDSS) (Table 1). Incorporating trust theory into CDSS, as (Panicker & George, 2023) argues, may increase the system's uptake. Recent research by (Jones, Thornton and Wyatt, 2021) suggests that the degree to which medical professionals have faith in the healthcare system is predictive of how frequently they will use it in patient care. This finding underscores the significance of trust as a crucial factor influencing healthcare professionals' engagement with the system.

H7. Tthe relationship between the intention of using and the actual usage of AI-based CDSS is mediated by trust.

4. Methodology

The quantitative survey was conducted to empirically investigate the links between parameters found through the literature review. The motivations of healthcare professionals to adopt AI-based CDDSS were investigated by developing a research model (see Fig. 1). Hypotheses and data collection and analysis are described below.

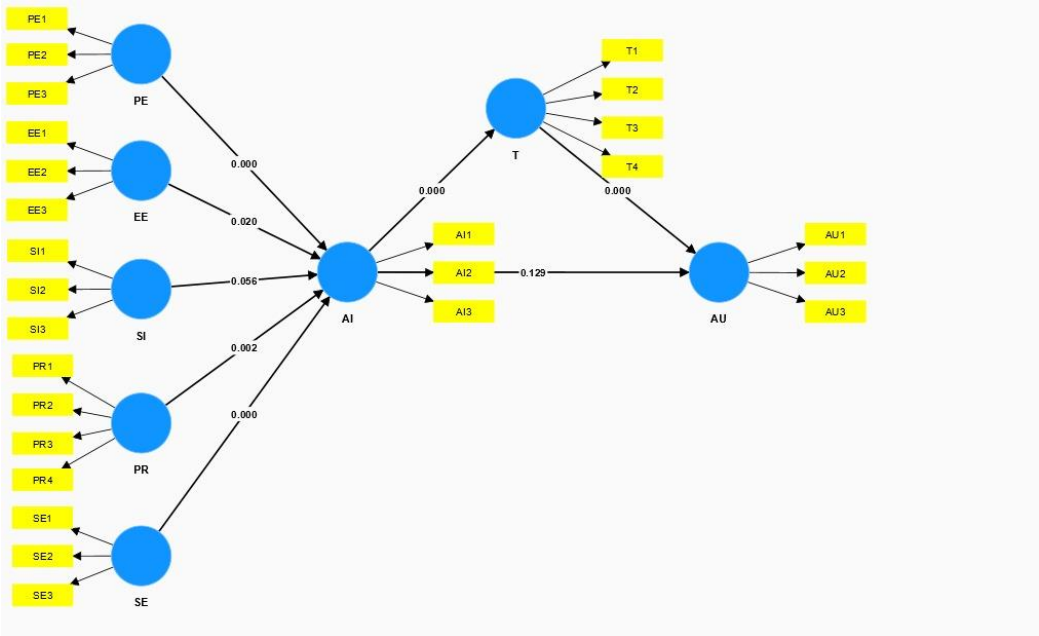

Figure 1: Research model

4.1 Measurement Instruments

To ensure the accuracy of all measurements, the items used to evaluate latent variables in the proposed model were obtained from previous research. The questionnaire consisted of 31 questions divided into two sections: basic information (age, gender, duration of practice, current role in the healthcare industry) and measurement scale. We incorporated eight constructs comprising 27 items. These survey questions were created by drawing from existing research statements and creating new ones (as presented in Table 2). Several adjustments were made to align the statements with the specific context of the AI-CDSS. The survey included inquiries related to participant demographics, including factors such as age, gender, and professional experience. Participants were then asked to evaluate these statements on a five-point Likert scale, with 1 representing strong disagreement and 5 representing strong agreement. The comprehensive items for each construct, as well as their origins, can be found in Table 2.

Table 2: Measurement instruments

Variable	Questions	Reference
Performance Expectancy	1. Using AI-based CDSS will enhance my diagnosis accuracy. 2. AI-based CDSS will increase my efficiency. 3. AI-based CDSS will help me make better treatment decisions.	(Venkatesh et al., 2003)(Fan et al., 2020)
Effort Expectancy	1. Using AI-based CDSS is simple and understandable. 2. it's easy to use AI-based CDSS. 3. Learning how to use AI-based CDSS is easy.	(Venkatesh et al., 2003)(Fan et al., 2020)
Self-Efficacy	1. I have full confidence in my capability to use AI-based CDSS. 2. I am capable of learning how to efficiently employ AI-based CDSS. 3. I am competent in using AI-based CDSS.	(Compeau and Higgins, 1995)(Wang and Wang, 2022)
Perceived Risk	1. Using AI-based CDSS may lead to medical errors. 2. Using AI-based CDSS may be risky for patients. 3. Using AI-based CDSS may compromise patient privacy. 4. Using AI-based CDSS may result in legal liability.	(Aytekin et al., 2021)(Hasan, Shams and Rahman, 2021)
Social Influence	1. Colleagues who I respect think I should use AI-based CDSS. 2. My supervisor thinks I should use AI-based CDSS 3. Peers who are close to me think I should use AI-based CDSS. 4. Colleagues who influence my decisions think I should use AI-based CDSS.	(Venkatesh et al., 2003)(Fan et al., 2020)
Trust	1. I trust that AI-based CDSS will provide accurate recommendations 2. I trust that AI-based CDSS will protect patient privacy. 3. I trust that AI-based CDSS will perform as expected. 4. I trust the competence of the developers of AI-based CDSS.	(McKnight and Chervany Norman, 2001)
Adoption Intention	1. I intend to use AI-based CDSS in my practice. 2. I plan to use AI-based CDSS in my practice. 3. I expect to incorporate AI-based CDSS in my work.	(Venkatesh et al., 2003)(Fan et al., 2020)

Variable	Questions	Reference
Actual Usage	1. I have used AI-based CDSS in my practice. 2. I currently utilize AI-based CDSS in my practice. 3. I utilize AI-based CDSS regularly in my practice.	(Maillet, Mathieu and Sicotte, 2015)

4.2 Participants and Sampling

This research study involved healthcare professionals including physicians, consultants, and technicians from Delhi-NCR regions of India, selected primarily to represent different backgrounds and healthcare settings. Purpose sampling was chosen to target individuals with specific knowledge and experience relevant to the adoption of AI-driven CDSS. Twenty respondents completed a pre-survey to improve the questionnaire's quality. A modified questionnaire was developed based on feedback to make sure the information was accurate and accessible. As our survey had twenty-seven items, the estimated number of participants was more than 270. A cross-sectional survey was conducted online using an anonymized Google Form between August 1, 2023, and December 25, 2023, resulting in three hundred twenty responses. The survey was circulated utilizing several social media platforms, including Facebook and WhatsApp.

4.3 Data Analysis

To verify the hypotheses, this study used a technique called partial least squares-structural equation modelling (PLS-SEM). This strategy is a great option for simulating the behaviour related to the adoption of new technologies because it has been recognized as a prediction-oriented approach (Hair et al., 2014)PLS-SEM is also appropriate for this study because it works well with small sample numbers, especially when non-normality is present (Hair et al., 2014)Considering the advice provided by(Hair et al., 2019), PLS-SEM was chosen to analyse this study. Smart pls 4 was used for the PLS-SEM.

5. Results

5.1 Demographic Result

Most of the respondents were male(71.86 %) and under the age of 40(32.5%). Out of all respondent's majority of them possessed work experience ranging between 5-10 years i.e.,35.93%. A significant percentage of respondents fell under the category of having experience of less than 5 years (34.37). Only 29.68% of the sample of Medical practitioners were having experience of more than 10 years. In terms of title, most of them 40.63%) were physicians, followed by consultants (35.93%) and technicians (23.44 %). The results are displayed in Table 3.

Table 3: Demographic result

Items	Categories	Frequency	percentage
Gender	Male	230	71.86%
	Female	90	28.14%
Age	Less than 30 years	96	30%
	31-40 years	104	32.5%
	41-50 years	74	23.13%
	More than 50 years	46	14.38%
Duration of practice	Less than 5 years	110	34.37%
	5-10 years	115	35.93%
	More than 10 years	95	29.68%
Current role in the healthcare industry	Physician	130	40.63%
	Consultant	115	35.93%
	Technicians	75	23.44%

5.2 Measurement Model

To assess the soundness and consistency of the measurement instrument, it is necessary to initially analyse the results of Partial Least Squares Structural Equation Modelling (PLS-SEM) through the measurement model. The evaluation followed the guidelines established by (Hair et al., 2019), as all the constructs were operationalized using reflective indicators. The reliability of the scale for all constructs was assessed by analysing the indicator loadings and calculating the composite reliability (CR), as presented in Table 4. For indicators, items with loadings above 0.708 are considered dependable because this shows that the construct accounts for more than 50% of the variance in the indicator (Hair et al., 2019). By analysing the CR, we were able to evaluate the instrument's consistency and reliability within itself. In this respect, statistical evidence showed that all CR values were greater than 0.7, meeting the criteria (Hair et al., 2019). This proves the instrument's construct reliability.

After that, we checked for construct validity by evaluating convergent and discriminant validity. The average variance extracted (AVE) served as the measure for determining convergent validity (Hair et al., 2019). Since all the AVEs in Table 4 are higher than the cutoff value of 0.50 advocated by the literature (Hair et al., 2019), it is safe to assume that the constructs have sufficient convergent validity. We evaluated the constructs' discriminant validity using the Fornell-Larcker criterion (Fornell and Larcker, 1981), as suggested by (Hair et al., 2019). Specifically, as shown in Table 5 (Hair et al., 2019), all latent constructs had squared root AVEs that were larger than their inter-correlation estimates with other similar constructs, indicating sufficient discriminant validity.

Table 4: Reliability and validity statistics

Latent variable	Mean	Standard deviation	Items	Outer loadings	CR	AVE	Cronbach's α
Adoption Intention	3.288	1.114	AI1	0.945	0.928	0.813	0.927
	3.324	1.099	AI2	0.947			
	3.365	1.115	AI3	0.909			
Actual usage behaviour	2.153	1.127	AU1	0.918	0.917	0.786	0.916
	2.053	1.102	AU2	0.942			
	2.047	1.177	AU3	0.916			
Effort expectancy	3.129	0.961	EE1	0.857	0.771	0.548	0.771
	3.306	0.888	EE2	0.819			
	3.312	0.896	EE3	0.805			
Performance expectancy	3.159	0.916	PE1	0.921	0.887	0.728	0.879
	3.329	0.993	PE2	0.948			
	3.271	0.957	PE3	0.820			
Perceived risk	3.224	1.083	PR1	0.829	0.875	0.664	0.876
	2.959	1.097	PR2	0.815			
	2.853	1.115	PR3	0.916			
	3.153	1.046	PR4	0.828			
Self-efficacy	3.065	0.965	SE1	0.919	0.803	0.596	0.790
	3.435	0.976	SE2	0.810			
	3.065	1.091	SE3	0.771			
social influence	2.88	1.18	SI1	0.830	0.870	0.695	0.870
	3.065	1.128	SI2	0.941			
	3.065	1.128	SI3	0.890			
Trust	3.053	1.002	T1	0.851	0.908	0.712	0.908
	2.982	1.176	T2	0.894			
	3.253	0.958	T3	0.869			
	3.171	1.068	T4	0.924			

Table 5: Discriminant validity (Fornell-Larcker criterion)

constructs	AI	AU	EE	PE	PR	SE	SI	T
AI	**0.934**							
AU	0.267	**0.926**						
EE	0.368	0.324	**0.827**					
PE	0.698	0.272	0.429	**0.898**				
PR	-0.255	0.174	-0.154	-0.073	**0.848**			
SE	0.449	0.279	0.693	0.373	0.015	**0.836**		
SI	0.430	0.318	0.647	0.433	-0.123	0.501	**0.888**	
T	0.561	0.362	0.765	0.552	-0.260	0.741	0.706	**0.885**

5.3 Common Method Bias

Research employing cross-sectional surveys may be susceptible to common method bias (CMB) (Podsakoff et al., 2003). Several ex-ante approaches were employed to mitigate potential method bias, as recommended by (Podsakoff et al., 2003)The questionnaire was intentionally anonymized to promote candid and unrestricted responses. Furthermore, during the survey development process, careful attention was given to the presentation of independent factors and dependent variables in a manner that did not adhere to a linear progression, as outlined by (Podsakoff et al., 2003). According to the methodology outlined by (Podsakoff et al., 2003), the third phase of the study involved the evaluation of measurement items by a panel comprising medical professionals and a doctorate holder specializing in the field of Information Systems (IS). The primary aim of this evaluation was to discover and rectify any ambiguous terms, errors, or inconsistencies within the measurement items, thereby mitigating the potential for method bias. To assess the presence of Cognitive Bias Modification (CMB), Harman's single-factor test, as described by(Chang, Van Witteloostuijn and Eden, 2010), was employed (as shown in Table 6). The primary determinant that surfaced explained 34.42% of the variance, falling short of the recommended threshold of 50%, as suggested by(Podsakoff et al., 2003), indicating the need for a more substantial conceptual model. The determination was made by conducting a comparison between the percentage of variance explained by the most significant factor and the established threshold.

Table 6: Harman's single-factor test

Component	Total	Initial Eigenvalues %of variance	Cumulative %	Extraction Total	The sum of the squared % of the variance	Loadings Cumulative %
1	9.979	34.412	34.412	9.979	34.412	34.412
2	4.737	16.336	50.747			
3	2.514	8.686	59.416			
4	2.03	6.999	66.415			
5	1.558	5.371	71.786			
6	1.175	4.053	75.838			
7	0.938	3.235	79.073			
8	0.872	3.008	82.082			
9	0.82	2.829	84.91			
10	0.581	2.002	86.912			
11	0.506	1.744	88.657			
12	0.433	1.493	90.15			
13	0.422	1.456	91.606			
14	0.352	1.215	92.821			
15	0.282	0.973	93.794			
16	0.273	0.941	94.736			
17	0.25	0.863	95.599			

Component	Total	Initial Eigenvalues %of variance	Cumulative %	Extraction Total	The sum of the squared % of the variance	Loadings Cumulative %
18	0.196	0.677	96.276			
19	0.186	0.64	96.917			
20	0.15	0.517	97.434			
21	0.134	0.462	97.896			
22	0.129	0.372	98.341			
23	0.108	0.304	98.713			
24	0.088	0.301	99.017			
25	0.087	0.22	99.318			
26	0.064	0.22	99.538			
27	0.055	0.189	99.727			
28	0.046	0.158	99.885			
29	0.033	0.115	100			

5.4 Structural model

The model fit was assessed by (Henseler, Ringle and Sarstedt, 2015) method, considering the Standard Root Mean Square Residual(SRMR). The value of SRMR was 0.077 which is well within the maximum permissible value of 0.08 (Hu and Bentler, 1998). The assessment of the structural model's overall explanatory power was conducted by the established assessment criteria. This evaluation involved examining R2, Q2, and path coefficient β-values. In the first round of our structural model evaluation, we assessed the variance inflation factor (VIF) to check for multicollinearity problems. The term "multicollinearity" describes a situation in which the variables being measured are highly correlated with one another. Because of this, SEM analysis outcomes may be skewed(Kock and Lynn, 2012). The Variance Inflation Factor (VIF) values for all the constructs in this model were found to be less than 5, indicating that multicollinearity problems are not present (Kock and Lynn, 2012) (Hair et al., 2019)For the VIF values, see Table 7.Stone–Giesser's Q2 value, along with the blindfolding process, was utilized to analyse and determine the predictive usefulness of the model(Hair et al., 2014). Table 8 shows that all Q2 values are significantly greater than zero, indicating that the model is highly predictive of the endogenous constructs (Hair et al., 2014)

The bootstrapping procedure, as outlined by(Hair et al., 2014), was implemented by generating 5,000 subsamples. The study aimed to assess the statistical significance and practical relevance of the path coefficients in the structural model. The objective of this inquiry was to ascertain the optimal structural model. Table 9 displays the outcomes derived from bootstrapping for the pathways within the proposed model. The presented table offers a concise overview of the path coefficient, t statistic, and significance value (p). The empirical results are illustrated in Figure 2.

The results indicate significant relationships between (PE) and (AI) ($t = 9.750$, $\beta = 0.598$, $p < 0.05$), (EE) and (AI) ($t = 2.055$, $\beta = 0.214$, $p < 0.05$), (PR) and (AI) ($t = 3.031$, $\beta = -0.239$, $p < 0.05$), and (SE) and (AI) ($t = 3.587$, $\beta = 0.311$, $p < 0.05$). Therefore, hypotheses H1, H2, H4, and H5 were found to be supported. Nevertheless, the statistical analysis conducted in this study revealed that the associations between SI and AI ($t = 1.607$, $\beta = 0.130$, $p > 0.05$) as well as AI and AU ($t = 1.132$, $\beta = 0.082$, $p > 0.05$) were found to be statistically insignificant. These findings do not provide support for hypotheses H3 and H6 in the present investigation.

Table 7: Collinearity statistics

Constructs	AI	AU	T
AI		1.460	1.000
AU			
EE	2.623		
PE	1.304		
PR	1.058		

Constructs	AI	AU	T
SE	2.022		
SI	1.825		
T		1.460	

Table 8: Predictive relevance

Construct	Q^2	R^2
AI	0.544	0.616
AU	0.401	0.546
T	0.424	0.522

Table 9: Results of Hypothesis testing

Hypothesis	Path	Path coefficient	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	F2	Remarks
H1	PE -> AI	0.598	0.062	9.750	0.000	0.698	supported
H2	EE -> AI	0.214	0.116	2.055	0.020	0.054	supported
H3	SI -> AI	0.130	0.081	1.607	0.056	0.023	not supported
H4	PR -> AI	-0.239	0.078	3.031	0.002	0.132	supported
H5	SE -> AI	0.311	0.091	3.587	0.000	0.131	supported
H6	AI -> AU	0.082	0.082	1.132	0.129	0.007	not supported

5.5 Mediation Analysis

We analysed the proposed model and performed a mediation analysis to determine how trust affects the main relationship in the model. The significance of the mediation was evaluated by performing a PLS-SEM analysis using the bootstrapping method. The analysis aimed to investigate the importance of both direct and indirect effects to determine the type of mediation involved—whether it can be classified as full, complementary, or competitive partial. To conduct a more comprehensive evaluation of mediation, the researchers computed the Variation Accounted For (VAF). According to (Hair et al., 2014)cases can be classified as partially mediated when the Variance Accounted For (VAF) falls within the range of 20% to 80%. VAFs below 20% suggest minimal mediation, while VAFs exceeding 20% indicate a more typical scenario of partial mediation. Table 10 displays the results of the mediation analysis. Overall, statistically significant effects related to mediator credibility were observed (Table 10). The significance of both direct and indirect impacts was then assessed. A substantial ($p = 0.002$) indirect influence was found between AI and AU, while the direct effect was not significant ($p = 0.129$). Thus, the connection between AI and AU is entirely mediated by trust.

Table 10: Analysis of Mediation of Trust between Adoption intention and actual usage.

Type of effect	Effect	Path coefficient	T statistics (|O/STDEV|)	P values	Remark
Total effect	AI -> AU	0.263	3.782	0.000	significant
Indirect effect	AI -> T -> AU	0.181	2.860	0.002	significant
Direct effect	AI -> AU	0.082	1.132	0.129	not significant
VAF	IE/TE	69%			
CONCLUSION	MODERATELY SIGNIFICANT (FULL MEDIATION)				

6. Discussions

The findings indicate that healthcare practitioners' inclination to adopt AI-CDSS is notably influenced by performance expectancy (PE)with path coefficients of 0.598 and a p-value of 0.000. If practitioners believe AI-based CDSS will enhance productivity, reduce workload, and improve diagnoses, they are more likely to embrace

its use (PE), which agrees with the evidence presented in earlier studies by UTAUT (Wang et al., 2020) (Alsyouf et al., 2022) (Hossain, Quaresma and Rahman, 2019) (Fan et al., 2020). Further, the research reveals that healthcare professionals' inclination to adopt AI-CDSS is significantly influenced by effort expectancy (EE) with a path coefficient of 0.124 and p-value of 0.020. This implies that if healthcare practitioners believe that AI–CDSS is easy to use they can adopt it without much effort. this result aligns with the previous studies (Chatterjee and Bhattacharjee, 2020) (Chatterjee et al., 2023). Based on the results, there is no significant influence of social influence (SI) on healthcare professionals' inclinations to employ artificial intelligence (AI), indicated by a path coefficient of 0.130 and a p-value of 0.054. This aligns with previous studies that found social pressure does not significantly affect AI-CDSS uptake among medical professionals(Cheng, Li and Xu, 2022)(Aljarboa, Shah and Kerr, 2019; Aljarboa and Miah, 2023). This may be due to the complexity of AI-CDSS implementation, the need for training or if healthcare professionals are not aware of AI-CDSS benefits or limited exposure, social influence may have minimal role.

Furthermore, the findings suggest that healthcare professionals' adoption intention of AI-CDSS has an inverse relationship with perceived risk (path coefficients of -0.239 and p-value of 0.0000. Healthcare professionals may hesitate to adopt AI-CDSS if they perceive the risk associated with its implementation. Previous studies(Choudhury, 2022) (Cheng, Li and Xu, 2022)(Ben Arfi et al., 2021)(Tran et al., 2021) also highlight the impact of user expectations and risk perceptions on the uptake of AI-driven CDSS. Healthcare organizations should prioritize addressing professionals' concerns about AI-CDSS hazards and emphasize the benefits of increasing adoption and deployment in clinical practice. Table 11 shows the summarized findings of hypothesis testing.

Table 11: Summary of hypothesis findings

Hypothesis	Result
H1 PE -> AI	The results indicate significant relationships between Performance expectancy and Adoption intention with a p-value less than 0.000. Therefore, H1 was supported. Therefore, if practitioners believe AI-based CDSS will enhance productivity, reduce workload, and improve diagnoses, they are more likely to embrace its use.
H2 EE -> AI	The results indicate significant relationships between EE and adoption intention with a p-value of 0.020. Therefore, H2 was found to be supported.
H3 SI -> AI	There is no significant influence of social influence (SI) on healthcare professionals' inclinations to employ artificial intelligence (AI), as the p-value is 0.054(which is more than 0.005). Therefore, H3 was not supported. This aligns with previous studies that found social pressure does not significantly affect AI-CDSS uptake among medical professionals.
H4 PR -> AI	The findings suggest that healthcare professionals' adoption intention of AI-CDSS is influenced by concerns about the risks related to the technology. Healthcare organizations should prioritize addressing professionals' concerns about AI-CDSS hazards and emphasize the benefits of increasing adoption and deployment in clinical practice.
H5 SE -> AI	The research reveals that healthcare professionals' inclination to adopt AI-CDSS is significantly influenced by self-efficacy (SE). The path coefficient for self-efficacy is 0.311 with a p-value of less than 0.000, suggesting that professionals' confidence in using the technology influences adoption intentions
H6 AI -> AU	The direct influence of artificial intelligence (AI) on user acceptance (AU) was found to be insignificant. This may be because artificial intelligence is still in its infancy, and it may require further development to significantly influence healthcare professionals' actual adoption of AI-CDSS.
H7 AI -> T -> AU	The total effect of AI on AU is significant (with a path coefficient of 0.263, t statistics of 3.782 and p-value of 0.000). The indirect effect of AI on AU through trust is also significant with a p-value of 0.002. However, the direct effect of AI on AU without considering trust is not significant (with a p-value of 0.129). According to the findings, trust plays a significant role in relationships between AI and AU, and it fully mediates the relationship.

The research reveals that healthcare professionals' inclination to adopt AI-CDSS is significantly influenced by self-efficacy which means that professionals with high self-efficacy are more likely to adopt AI–CDSS as they trust their capabilities to master the necessary skills and overcome challenges. The path coefficient for self-efficacy is 0.311 with a p-value of less than 0.001, suggesting that professionals' confidence in using the technology influences adoption intentions. Consistent with prior research,(Kwak, Ahn and Seo, 2022)(Liu et al., 2022) (Zhu, Sunanda and Ting Jie, 2010), self-efficacy significantly contribute to AI-driven CDSS acceptance and implementation. Healthcare organizations should provide education and training to increase familiarity with AI-CDSS, reducing the perceived effort required.

The direct influence of artificial intelligence (AI) on user acceptance (AU) was statistically irrelevant, with a path coefficient of 0.082 and a p-value of 0.129. This implies that Adoption intention alone cannot impact healthcare professionals' actual adoption of AI-CDSS, which is in alignment with another study (George Saadé, Tan and Kira, 2008) (Jamieson et al., 2022). Several explanations for the study's failure to find a statistically significant link between AI and AU are suggested by the search results. Firstly, artificial intelligence is still in its infancy, and it may need further development to significantly influence healthcare professionals' actual adoption of AI-CDSS**.** In conclusion, we can say that Adoption intention may not itself lead to actual usage of AI-CDSS, but trust in AI systems serves as a crucial mediator. This study reveals that trust fully mediates the relationship between AI which means that fostering trust in AI technology is essential for the successful adoption and implementation of AI-CDSS technology.

6.1 Theoretical Implications

There are numerous theoretical implications in the current study. This discourse aims to elucidate plausible ramifications arising from the subject under consideration. The main goal is to make a substantial scholarly contribution to the further expansion of the UTAUT framework. Specifically, it seeks to expand the existing framework by incorporating supplementary constructs significantly influencing individuals' adoption intention. Two constructs of interest are perceived risk and self-efficacy. By incorporating these within the UTAUT model, a more comprehensive understanding can be obtained regarding the determinants impacting individuals' inclinations to embrace technological innovations.

This research will offer insights into factors influencing the viewpoints and choices of healthcare professionals regarding the utilization of AI-driven CDSS. The study will investigate whether and how beliefs about one's risk and ability to handle challenging situations affect these orientations and resolutions. In the healthcare industry, increasing acceptance among varied labour sectors is crucial. Healthcare organizations can optimize the adoption of novel practices, technologies, or interventions by customizing these strategies to offer to the distinct needs of various professional groups. Thirdly, the study can shed light on how addressing additional constructs (PR and SE) might help increase the implementation of CDSS driven by AI in healthcare settings. It is possible to highlight how AI-based CDSS might improve patient outcomes, and efforts can be made to make CDSS systems more open and flexible, as well as to educate medical professionals. Fourth, the research can shed light on how trust influences healthcare professionals' acceptance of AI-CDSS. This will facilitate the dissemination of more accurate information regarding the strategies implemented to enhance confidence in the utilization of CDSS driven by AI within healthcare environments. The present study can offer significant insights for policymakers aiming to facilitate the extensive implementation and effective assimilation of clinical AI-driven CDSS. Additionally, it can contribute to the advancement of our theoretical understanding regarding the determinants impacting healthcare professionals' utilization of these systems.

6.2 Practical Implications

According to this study, a broad range of stakeholders within the healthcare ecosystem can benefit from this study, including marketers and developers of AI-driven CDDSS, vendors, policymakers, and healthcare IT managers. These insights aim to enhance the integration process of CDDSS powered by AI and address any hesitation among healthcare professionals, thereby fostering smoother adoption within clinical settings. Primarily, Performance expectancy (PE) appeared as a strong predictor of adoption intentions. Marketers of AI-CDSS should personalize their communication and organize training sessions to highlight the benefits of using AI systems, including speed, precision, efficiency, and reduced workload. By enabling medical practitioners to experience firsthand the benefits of AI-CDSS in their daily tasks, PE can be enhanced, fostering user acceptance. Secondly, the study provides valuable insight that can assist healthcare administrators in developing effective approaches to uplift the use of AI-driven CDSS, considering the unique requirements of various healthcare practitioners in the healthcare industry. Nurses and other staff may prioritize the accuracy and trustworthiness of AI models, while physicians may be less concerned about job displacement. This study highlights the need to address perceived risks for the effective adoption of CDSS driven by AI in clinical settings.

To empower healthcare professionals in utilizing AI-based CDSS effectively, understanding the benefits and receiving proper training is crucial. This not only enhances patient outcomes but also influences the development of rules and standards for AI-driven CDSS in healthcare facilities. The proposed standards may include recommendations to reduce anxiety, boost confidence, and establish trust, fostering widespread use of these technologies.

A notable role of trust in the adoption of AI-CDSS demonstrates that developer must provide scientific evidence, such as regulatory certifications(e.g., FDA approvals), to prove that their products are credible, reliable, accurate, and safe in clinical settings. Essentially, prioritizing the cultivation of trust and building affiliations with esteemed medical institutions is essential for the adoption of CDSS powered by AI.

Moreover, there exists the chance to inspire policymakers to devise unique legislation structures targeting legal apprehensions linked to the incorporation of AI-powered CDSS. Our study seeks to promote the invention and implementation of efficient and favourably accepted AI-driven CDDSS customized to their intended beneficiaries.

6.3 Research Limitations and Future Research Directions

The first limitation is about the choice of target individual. We did not consider specific subspecialties in medicine. Thus, future studies can evaluate this model's validity with the AI-powered CDSS intended for doctors from other specific subspecialties. Also, the variations in expertise level among the targeted respondents (physicians, consultants, and technicians) may influence their perception towards the adoption of AI-BASED CDSS leading to biased responses. Secondly, it overlooked the important role that cultural factors play in determining adoption intention, despite recent studies demonstrating their importance(Dwivedi et al., 2016) (Zhang, Xia and Huang, 2022). Considering this, the findings must be replicated in different geographical areas (developed vs. developing countries).

Thirdly, Our study's reliance on a small sample size could impede the generalizability of our findings to the wider healthcare community. Fourthly, the data was geographically limited to India(Delhi-NCR region).Due to widespread adoption of AI-CDSS replication among different geographical context is imperative. Lastly The cross-sectional design used offers a snapshot of healthcare professionals' adoption intentions at a specific moment, lacking a continuous view. A longitudinal study, tracking changes over time, would be beneficial, to acquire more deeper understanding of aspects that contribute to the deployment of CDSS driven by AI.

In future investigations, employing a longitudinal methodology could be advantageous for tracking the implementation of AI-CDSS among healthcare practitioners over an extended period, facilitating the identification of factors influencing sustained utilization. Furthermore, the next research could utilize a qualitative method approach to obtain information regarding the utilization of AI-CDSS by medical professionals which would enable a more enhanced comprehension of factors influencing technology dissemination. Moreover, the potential influence of moderators on the relationships among key variables was not considered, despite numerous studies showing that age and gender both have moderating impacts on how people react to new technologies. This oversight may lead to different results. In subsequent studies, potential moderators, including gender, age, professional status, and other similar factors, should be taken into consideration.

7. Conclusions

This research aims to augment the previously validated UTAUT framework by incorporating the novel framework of the adoption of CDSS driven by AI and utilization among medical practitioners in India. The additional variables introduced include perceived risk, self-efficacy, and trust. Healthcare professionals' willingness to adopt AI-CDSS is mainly influenced by three factors which include PE, EE, and S. The adoption intention of AI-CDSS was significantly influenced by the perceived risk among healthcare professionals. Although Adoption intention did not significantly impact actual usage, the research confirmed that trust mediates relationship between AI and AU.

The use of AI-CDSS in the healthcare system could be substantially impacted by the findings of this study. Healthcare organizations should prioritize addressing healthcare professionals' perceptions of the potential advantages and hazards associated with AI-CDSS, along with fostering confidence in using the technology effectively for its adoption and implementation in clinical practice. Emphasizing the function of trust in healthcare professionals' adoption of AI-CDSS is crucial. Gaining patients' trust in AI-CDSS requires healthcare organizations to undertake essential actions, including educating and training healthcare personnel and ensuring the technology's dependability, accuracy, and security.

In summary, the study offers a new understanding of the variables impacting medical practitioners' intention to adopt AI-CDSS. The findings suggest that healthcare institutions should give top priority to addressing healthcare practitioners' confidence in AI-CDSS and their assessments of its advantages and risks to encourage the implementation and application of the technology in clinical settings. The study also demonstrates the relevance of trust in the use of AI-CDSS by medical practitioners. By concentrating on these areas, healthcare

professionals may enhance the acceptance and implementation of AI-CDSS in clinical settings, leading to improved patient outcomes and satisfaction levels.

Ethical considerations: This research does not involve any experiments on human individuals and/or animals. Informed consent was obtained from all individuals involved in the study.

AI Statement: The author declares that no generative artificial intelligence has been used in the writing of this manuscript, nor in the creation of images, graphics, tables, or their corresponding captions

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Unleashing Potential in SMEs: How Intellectual Capital Fuels Employee Flexibility to Reach Strategic Goals

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Abstract: This paper investigates the impact of intellectual capital on employee flexibility in SMEs, specifically focusing on how human, relational and structural components of intellectual capital contribute to skill and behavioural flexibility. The research addresses the gap in understanding how intellectual capital influences employee adaptability, essential for achieving strategic goals, especially in SMEs with limited resources. We have tried to address these research questions: Does intellectual capital improve skill and behavioural flexibility?; and how does employee flexibility impact the achievement of strategic goals? We have employed an empirical, quantitative research approach. Data has been collected through a structured survey from a sample of 233 Italian SMEs, and the relationships between variables has analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). Our findings reveal that human capital significantly enhances both skill and behavioural flexibility, while relational capital positively influences these aspects to a lesser extent. Interestingly, structural capital shows no significant direct impact on skill and behavioural flexibility. Both skill and behavioural flexibility demonstrate a significant positive impact on planning effectiveness. Contrary to previous studies, our results indicate that in SMEs, a high level of formalisation favours the achievement of strategic goals without hindering employee flexibility. This research advances the understanding of intellectual capital's role in SMEs by empirically demonstrating its impact on employee flexibility and subsequent performance. For scholars, this study extends the theoretical framework linking intellectual capital, employee flexibility and a firm's ability to reach strategic goals in SME contexts. It challenges existing assumptions about the relationship between formalisation and flexibility in smaller organisations, opening new avenues for future research. Furthermore, our findings contribute to the ongoing discussion about the unique characteristics of SMEs and how they can effectively manage their resources to remain competitive. For practitioners, particularly SME managers, the study emphasises the critical importance of fostering human and relational capital to achieve greater employee flexibility. By doing so, SMEs can enhance their ability to reach strategic goals.

Keywords: Intellectual capital, Employees' flexibility, SMEs, Strategy, PLS-SEM

1. Introduction

Today firms operate in a turbulent and dynamic environment where the ability to effectively perform a given set of tasks is insufficient to maintain a competitive advantage. Under these conditions, employee flexibility is a key asset that helps firms adapt and generate strategic alternatives (Bhattacharya and Wright, 2005; Camps *et al.,* 2016). Employee flexibility consists of two interconnected aspects, namely, skill flexibility and behavioural flexibility, which aid companies in pursuing various strategic options (Beltrán-Martín and Roca-Puig, 2013). Employees with versatile skills can perform various tasks, reducing the cost and time required to transition to new responsibilities (van den Berg and van der Velde, 2005). Moreover, a wide range of skills allows them to produce new solutions, increasing their behavioural flexibility (Parker and Axtell, 2001). Employees with flexible behaviour easily adjust to new situations, minimising the losses associated with such changes and enabling change-implementation processes in the firm. Finally, both skill and behavioural flexibility are resources that are difficult to imitate (Beltrán-Martín and Roca-Puig, 2013).

Employee flexibility is more important in small and medium enterprises (SMEs) than in larger firms. In fact, due to their lack of resources and labour-intensive nature, SMEs often have to assign their employees different tasks and roles (Messersmith and Guthrie, 2010). However, concerning the uncertainties of market dynamics, SMEs face the same problems as large firms (De Leede *et al.,* 2020). Considering that SMEs represent 99.8% of companies within the European Union and employ 66.6% of its working population (European Commission, 2019), this issue needs to be urgently addressed to support policymakers, managers and entrepreneurs. As

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noted by Harney and Alkhalaf (2021), to develop robust and complete theories of HRM, scholars need to focus not only on large firms but also on SMEs, where the majority of employment resides. Paradoxically, despite their prevalence, much less attention has been paid to SMEs (Zhang and Edgar, 2021). Other than size, SMEs have other important features compared to large firms. SMEs are characterised by the central role of entrepreneurs, informality and lack of resources. Moreover, they are generally financed by the owner or through bank loans, and their market is generally limited to one or a few niches.

Most previous studies have focused on large firms (Bhattacharya, Gibson and Doty, 2005; Chang *et al*., 2013; Ngo and Loi, 2008) and considered only HRM practices as proximal determinants of employee flexibility (Beltrán-Martín *et al.,* 2008; Way *et al*., 2018). However, Way *et al*. (2018) called for future research exploring a broader set of factors that might influence employee flexibility. We argue that a firm's intellectual capital should be related to employee flexibility (Boxall, 2013; Ubeda-Garcia *et al.,* 2017). However, no empirical research currently exists regarding the relationship between these constructs.

This present paper tries to fill this gap by extending the analysis of determinants of employee flexibility to the whole stock of knowledge (i.e. intellectual capital) and addresses this research question: Does intellectual capital improve skill and behavioural flexibility? To answer this question, we have created and empirically tested a structural model on a sample of 233 Italian SMEs.

Our research is grounded in the resource-based view of firms, which states that organisational resources that are valuable, rare and difficult to imitate can be a source of competitive advantage (Barney, 1991). In particular, in competitive environments characterised by dynamicity, firms require resources that enable them to adapt to the changing circumstances. Resources are considered flexible when they can be utilised in multiple ways or modified to suit new circumstances. As a result, employee flexibility can be seen as a strategic resource that enables companies to alter their routines, services, products or target markets over time (Beltrán-Martín and Roca-Puig, 2013; Wright and Snell, 1998). For SMEs, employee flexibility is fundamental to enhance their ability to pursue strategic alternatives to reach their goals (Beltrán-Martín and Roca-Puig, 2013).

The remainder of this paper is structured as follows. Section 2 provides a review of the relevant literature, focusing on intellectual capital and employee flexibility. Section 3 develops our research hypotheses. Section 4 describes the research methodology, including the sample, data collection and measures used. Section 5 presents the results of our empirical analysis. Section 6 discusses the implications of our findings for both theory and practice. Finally, Section 7 concludes the paper, outlining the study's limitations and suggesting directions for future research.

2. Literature Review

2.1 Intellectual Capital

The transition to a knowledge-based economy has elevated intellectual capital (IC) to a prominent position as a crucial resource for firms worldwide (Martín-de-Castro *et al*., 2011; Khalique *et al*., 2020). This shift is characterised by the extensive use of intangible resources, which often hold greater value than tangible assets (Russell, 2017). In the 1990s, the emergence of a knowledge-based society was predicated on the idea that knowledge would become fundamental to economic growth and capital accumulation in an increasingly knowledge-driven future (Nonaka and Takeuchi, 1995). Consequently, IC began to be recognised as a key factor in a firm's value creation process, performance, competitive advantage and overall success (Agostini, Nosella and Filippini, 2017).

According to Kianto *et al.* (2014), intellectual capital is '*the sum of all of the intangible* and *knowledge-related resources that an organization is able to use in its productive process in the attempt to create value'*. IC plays a key role in formulating and implementing strategies effectively (Demartini and Beretta, 2020; European Commission, 2006) and helps managers respond better to a dynamic business environment (Cohen, Naoum and Vlismas, 2014). Numerous studies have demonstrated the critical role of IC in enhancing a firm's performance (Martin-de Castro, Diez-Vial and Delgado-Verde, 2019; Demartini and Beretta, 2020). Moreover, some scholars have identified a significant association between IC and specific aspects of entrepreneurship, suggesting that IC and its dimensions serve as strategic resources for firms (Crupi, Cesaroni and Minin, 2020). However, to achieve the desired benefits, firms need first to perceive the advantages of managing intellectual capital (Chiucchi, 2013; Giuliani and Chiucchi, 2019), and then, they must be able to effectively manage IC (Cohen and Kaimenakis, 2007). IC provides benefits in large, medium and small enterprises and in both profit and no-profit organisations (Agostini and Nosella, 2017; Bontis *et al.,* 2018; Del Baldo *et al.,* 2021; Sgrò, 2021). SMEs need to develop a high

level of IC to compensate for their smaller dimension and gain a competitive advantage since IC improves a company's ability to respond in order to effectively carry out its strategy (Cohen, Naoum and Vlismas, 2014).

Inkinen (2015) claims that a three-dimensional categorisation of intellectual capital, comprising human, structural and relational capital, has now become the standard for developing measurement models. Scholars generally agree that human capital (HC) forms the fundamental component of intellectual capital (Jardon and Martos, 2012). It is considered a "*non-substitutable*" and eccentric asset, which can deliver competitive differentiation in the firm (Khalique *et al*., 2020) because '*nothing can actually happen in the firm without it*' (Kianto, Hurmelinna-Laukkanen and Ritala*,* 2010, p. 308). HC includes both tacit and explicit knowledge that allows people to perform their tasks (Hormiga, Batista-Canino and Sánchez-Medina, 2011; Hsu and Fang, 2009; Nonaka, 1994) and refers to formal education, skills, experience and problem-solving. (Kianto, Sáenz and Aramburu, 2017). SMEs often rely on the skills and knowledge of their staff and entrepreneur for success, rather than having access to abundant resources or capital (Man, Lau and Chan, 2002). Empirical research investigating HC in SMEs found that it positively influences firm performance (Samagaio and Rodrigues, 2016), entrepreneurial success (Unger *et al.,* 2011) and absorptive capacity (Oliveira *et al.,* 2020). However, possessing a high level of skills does not mean the skills are also flexible.

Relational capital (RC) emphasises the value created through a company's external relations with clients, vendors, distribution channels, collaborators, the surrounding community and all other relevant stakeholders (Rahman *et al*., 2022). This form of capital highlights the importance of nurturing and leveraging a firm's high-quality relationships with external parties (Cuganesan, 2005). In other words, RC refers to a company's ability to acquire knowledge through its external stakeholders (Inkinen, 2015), generating a competitive advantage (Martín-de-Castro *et al*., 2011). Empirical results show that strong networks and work relationships can result in higher levels of trust and the alignment of organisational goals that, in turn, significantly improve SMEs' performance (Catanzaro, Messeghem and Sammut, 2019). When employees work in organisations that embrace a culture of support and security, they feel more confident and are willing to take on new challenges and experiment with new ways of solving problems.

Structural capital (SC) is the knowledge and expertise that remains within a company even after people have left (Youndt and Snell, 2004) and that represent an organisation's skeleton (Khalique *et al*., 2020). SC comprises the knowledge embedded in information technology systems and the outputs and products resulting from knowledge transformation. This knowledge includes documents, databases, process descriptions, plans, the firm's intellectual property and all non-human repositories of knowledge within the organisation (Inkinen, 2015) that employees can leverage to perform different tasks and face new situations (Hsu and Fang, 2009). Scholars have found that SC reduces absenteeism (Kemelgor and Meek, 2008), and enhances enterprise value (Miles and Van Clieaf, 2017) and innovation performance (Giampaoli *et al.,* 2021).

In general, the distinction between human capital, structural capital and relational capital is crucial to understanding their respective impact on firm performance. This paper allows for a more nuanced analysis of how different aspects of intellectual capital influence both skills and behavioural flexibility.

2.2 Employee Flexibility

In recent years, the interest in employee flexibility has increased as it is considered a factor that enhances the workforce's adaptability to new circumstances (Beltrán-Martín and Roca-Puig, 2013) and ensures the operational flexibility of resources on a daily basis (MacDuffie, 1995). However, empirical research, especially in the SME context, is still lacking (De Leede *et al.,* 2020). Employee flexibility is more important in SMEs than in larger firms as they often assign their employees different tasks (Messersmith and Guthrie, 2010); however, at the same time, SMEs have difficulty implementing human resource management practices (Whyman and Petrescu, 2015). Harney *et al*. (2022) identified six key characteristics of SMEs summarised by the acronym RECIPE: resource constraints, environmental vulnerability, concentrated control, informality, proximity of relations and employee experience. SMEs face financial constraints and lack the time to take strategic decisions, while their labour-intensive nature makes them highly dependent on employee engagement. Their close interaction with the external environment makes them sensitive to socio-economic disruptions, forcing them to respond quickly to structural and market instability. Additionally, critical decisions are often concentrated in the hands of a small group of key individuals, influencing the approach to people management. SMEs tend to adopt less formalised work practices, relying on informal methods. The flat organisational structure facilitates direct interactions between managers and employees, increasing leadership visibility and the awareness of business challenges. Finally, employees often take on multiple roles and can directly influence the company's core activities, fostering intrinsic motivation and greater engagement even without sophisticated human resource

management practices. Given these characteristics, employee flexibility in SMEs is crucial for effectively adapting to internal and external dynamics, highlighting the importance of exploring additional factors that influence this flexibility.

Flexible employees 'can' and 'will' do different work activities that are required them to accomplish strategic alternatives and effectively respond to a turbulent or high-growth industry sub-sector (Tracey, Way and Tews, 2008). Flexible employees can improvise and generate new ideas that will result in new knowledge (Ubeda-Garcia *et al.,* 2017). Empirical studies have found that employee flexibility has a positive impact on performance at both the individual (Camps *et al.,* 2016) and organisational level (Bhattacharya, Gibson and Doty, 2005; Ubeda-Garcia *et al.,* 2017; Way *et al*., 2018). We have defined employee flexibility as "*the extent to which employees possess skills* and *behavioural repertoires that can provide a firm with options to pursue strategic alternatives"* (Beltrán-Martín and Roca-Puig, 2013). Employee flexibility has two interconnected components: skill flexibility (SKFLEX) and behavioural flexibility (BEFLEX). Skill flexibility is a quality that allows employees to perform multiple tasks with the knowledge and skills they possess, as well as quickly learn new skills (Beltrán-Martín *et al*., 2008). Employees with flexible skills can be useful as necessary and are enthusiastic to learn new approaches to accomplish their tasks (Chang *et al.,* 2013). They can also perform different tasks under different circumstances e.g., they can be mobilised to new jobs with low cost and in a short period (Camps *et al.,* 2016). Skill flexibility differs from behavioural flexibility in that employees may be willing to act flexibly but lack the necessary knowledge or abilities (Beltran-Martin and Roca-Puig, 2013). Behavioural flexibility is the "*capacity of people to adapt to changing situations or to exhibit appropriate behavioural repertoires under different situations"* (Bhattacharya, Gibson and Doty, 2005). Therefore, behaviour becomes inflexible when employees apply predetermined patterns of actions to deal with new situations (Wright and Snell, 1998), while employees with flexible behaviour can adapt as necessary by seeking new ways to perform their tasks and improvising (Bhattacharya, Gibson and Doty, 2005). Flexible behaviour is a key resource as it allows employees to cope with new situations, minimising non-adjustment costs (Bhattacharya, Gibson and Doty, 2005). Schuler and Jackson (1987) have called for a fit between a firm's strategy and the types of behaviour exhibited by employees.

3. Hypothesis Development

We claim that employee flexibility and knowledge are two strictly related variables. If employee flexibility consists in using one's knowledge and skills to perform different tasks and play different roles (Beltran-Martin *et al.,* 2013), it follows that those employees with broad knowledge, and diversified skills, can perform extra-role activities (Wang and Wang, 2012). However, as has been said before, from our perspective, possessing a high level of skills does not guarantee that the skills are also flexible. Therefore, we have decided to differentiate between the concepts of skill level (human capital) and skill and behavioural flexibility. However, SMEs lack resources, including employees, which are often assigned different tasks, so it is reasonable to expect that their skills are general and flexible.

HC contributes to a firm's competitive advantages by improving employee flexibility as superior human resources provide adaptive performance, increasing the firm's flexibility (Pulakos *et al.,* 2000). Educated and skilled employees are key resources that help firms adapt and face strategic changes (Cabrilo and Grubic-Nesic, 2013). Employees' unused skills have potential value that could create new business opportunities for the company and impact strategic decision-making (Jin, Hopkins and Wittmer, 2010). In other words, having a high level of skills can increase employee flexibility as they can transfer their knowledge to different areas. Therefore, employees with broad-based skills can be redeployed quickly and, especially in turbulent environments, are a key source of competitive advantage (Boxall, 2013). Therefore, we hypothesise that:

H1: Human capital (HC) enhances skill flexibility (SKFLEX);

H2: Human capital (HC) enhances behavioural flexibility (BEFLEX);

Knowledge obtained from external stakeholders helps firms update their knowledge base and skills (Miroshnychenko *et al.,* 2021) and can be integrated with the existing knowledge to realign and reshape existing resources (Azmi, 2008), such as applicable scopes, switching procedures from one use to another (Zhao and Wang, 2020). When employees are used to considering information and ideas from different audiences, they are more open to listening to others' points of view, creating a constructive and agreeable work climate (MacDuffie, 1995; Snell and Dean, 1992) that allows them to anticipate contingencies (McDonald, Khanna and Westphal, 2008). In this sense, RC with strong ties facilitates the exchange of high-quality information and tacit knowledge (Fernández-Pérez, Montes and García-Morales, 2014). Finally, relational skill enhances a flexible attitude (Tublin, 2011). Therefore, we hypothesise that:

H3: Relational capital (RC) enhances skill flexibility (SKFLEX);

H4: Relational capital (RC) enhances behavioural flexibility (BEFLEX);

SC is the stock of knowledge codified in information systems and routines for subsequent use and application (Khalique *et al.,* 2018) and should provide employees with the knowledge and skills they need to perform a variety of tasks and adapt to changing circumstances. However, knowledge embedded in information systems and databases may become outdated in new circumstances arising from a changing environment (Heimeriks, Schijven and Gates, 2012). Therefore, unlike HC and RC, we do not expect SC to be related to either type of flexibility. However, because it is inappropriate to hypothesise no relationship, we offer no hypotheses here but will explore the relationships.

Several empirical studies have proven the positive impact that behavioural flexibility has on a firm's performance (e.g., Bhattacharya, Gibson and Doty, 2005). Empirical research by Ketkar and Sett (2009) indicates that flexible behaviour has a threefold impact on firm performance; it affects employee performance, operational performance and financial performance. Meanwhile, Bhattacharya *et al*. (2005) showed a linkage between skill flexibility and a firm's financial performance. Yasir and Majid (2020), using a sample of 831 employees from SMEs, found that skill flexibility fully mediates the relationship between high-involvement HRM and employees' innovative work behaviour. Finally, Anser *et al*. (2020) found that knowledge sharing among employees enhances skill flexibility, which, in turn, positively influences employees' innovative work behaviour and acts as a mediator between knowledge sharing and innovative work behaviour. One of the most important benefits of employee flexibility found in literature is that it enhances a firm's ability to pursue strategic alternatives to reach their goals (Beltrán-Martín and Roca-Puig, 2013). For firms operating in a complex and dynamic environment, this ability is fundamental to reaching their strategic goals as they need more flexible options. Therefore, we hypothesise that:

H5: Skill flexibility (SKFLEX) enhances planning effectiveness (PE);

H6: Behavioural flexibility (BEFLEX) enhances planning effectiveness (PE);

All the hypotheses are represented in Figure n° 1.

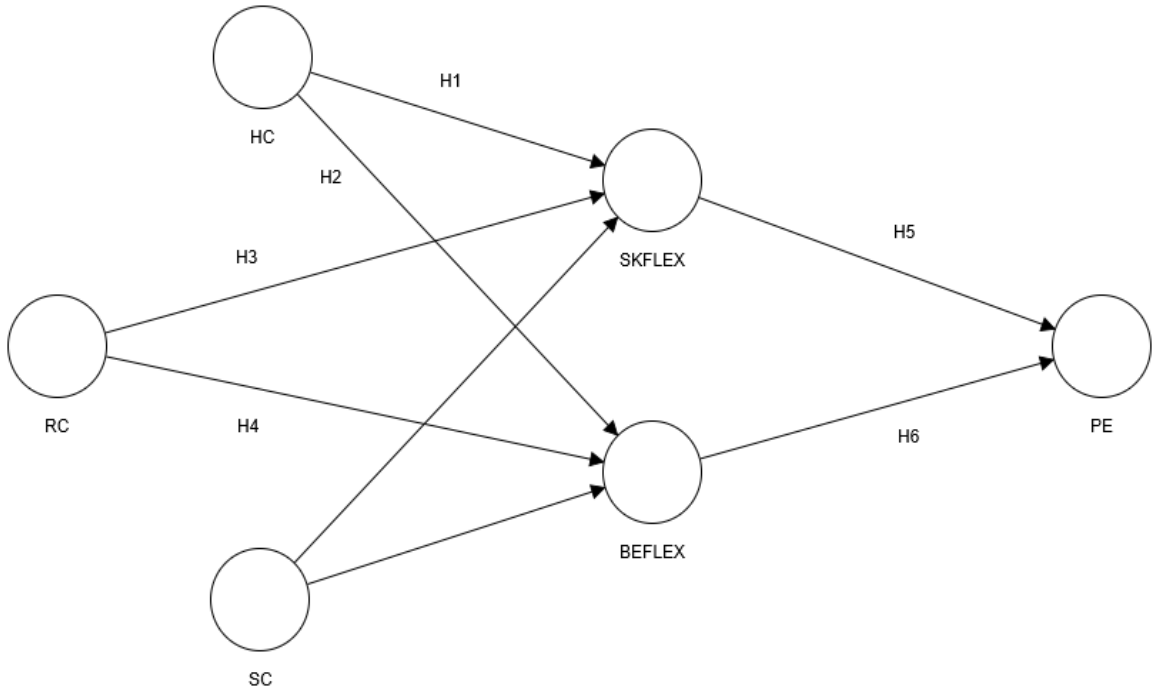

Figure 1: Hypotheses

4. Research Methodology

4.1 Data Collection, Sample and Measurement

We randomly selected 2000 Italian SMEs located in central Italy (Marche Region) from the AIDA database. The majority of the business sector in Italy is composed of SMEs (97.7%). The data collection took place from

December 2018 to March 2019. We emailed each firm to explain the research project and invited them to take part in the survey. Out of 2000 firms, 295 participated in the research. However, only responses from SME managers and other key informants were considered. The final sample contains 233 completed surveys, representing approximately a 12% response rate, which is in line with previous research (e.g., Del Baldo *et al.,* 2021). Most firms are SMEs (98%), while micro-enterprises represent 2%. CEOs represent 32% of the respondents, 46% managing directors, and the remaining 22% cover a role of responsibility in strategy, finance, planning and control or human resource management. The manufacturing sector represents 41%, other services 21%, commerce 12% and construction 6%. The remaining 20% represents different niche sectors such as transportation and real estate.

Latent variables were operationalised through the use of existing measurement scales. Respondents were asked to rate their level of agreement or disagreement with each item on a 7-point Likert scale. Scales for intellectual capital were taken from previous work by Del Baldo *et al*. (2021), items for the skill flexibility scale were taken from previous work by Bhattacharya *et al*. (2005), while the behavioural flexibility scale was taken from Ngo and Loi (2008). When pursuing strategic alternatives, firms try to reach different goals, some going beyond the traditional financial ones. Therefore, to investigate this dimension, we decided to utilise the planning effectiveness scale of Elbanna and Elsharnouby (2018) as the performance variable, as it includes several goals other than traditional financial ones. All the scales and their items are shown in the appendix.

4.2 Control Variables

We included formalisation and firm size as control variables to reinforce our model. Formalisation consists in explicit rules, policies and procedures that can be applied at both an organisational and job level (Hempel, Zhang and Han, 2012). Previous empirical research has demonstrated that formalisation reduces employee flexibility in several ways (Hempel, Zhang and Han, 2012). Hempel, Zhang and Han (2012) analysed 94 high-technology firms operating in China and showed that job formalisation reduces flexibility in teams. Majid, Yasir and Yasir (2017) examined functional flexibility in Pakistani SMEs and found that task formalisation was negatively related to the employees' willingness to be flexible. Although resource flexibility has many benefits (Beltrán-Martín *et al.,* 2008), according to Adomako and Ahsan (2022), resource flexibility in SMEs can lead to scarce resources and, therefore, undesirable outcomes. We measured formalisation by adopting two items from the scale of Lee and Choi (2003), while the firm size is measured through the number of employees.

5. Results

For their validation, we subjected the measurement scales to various psychometric tests. To test the constructs' reliability, we used Cronbach's alpha, which, according to Hair *et al.* (2014), must be above 0.7. As shown in Table 1, our results are well above the threshold. Moreover, considering that PLS does not assume that all indicators have the same weight, we performed the composite reliability analysis, as it is more adequate than Cronbach's alpha for testing reliability (Hair *et al.,* 2014). All the values are above the threshold of 0.7, demonstrating sufficient reliability. Convergent validity requires that a set of indicators form a single latent variable (one-dimensionality). To test convergent validity, we used the average variance extracted (AVE) (Hair *et al.,* 2014). Convergent validity requires that the value of AVE be above 0.5 for each model construct. As shown in Table 1 the values range between 0.669 and 0.908, confirming that convergent validity is assured. Discriminant validity aims to ensure that each latent variable differs from the others. We tested for discriminant validity through the Heterotrait-Monotrait Ratio (HTMT) (Henseler, Ringle and Sarstedt, 2015). Table 2 indicates that HTMT values are below the recommended threshold of 0.90 so that discriminant validity is ensured. Having collected self-reported data from a single source, there could be the risk of common method bias (CMB) (Podsakoff and Organ, 1986). We adopted the suggested procedures to minimise this issue (Podsakoff *et al.,* 2003). First of all, we ensured the respondents' anonymity. Second, following previous studies (Miroshnychenko *et al.,* 2021), we performed two statistical tests. We conducted Harman's one-factor test (Podsakoff and Organ, 1986) by incorporating all the items into a factor analysis and the results indicated that none of the factors accounted for more than 50% of the variance, which is the threshold recommended by Podsakoff *et al.* (2003). Moreover, we tested for common method bias, including a common method factor in our model whose indicators included all the indicators of the other constructs we analysed (Podsakoff *et al.,* 2003). Results indicate that CMB does not have a significant impact on our study.

Table 1: Reliability and Convergent Validity

Reliability and Convergent Validity					
Variables	**Items**	**Loadings**	**Cronbach's alpha**	**Dillon-Goldstein rho**	**AVE**
Human Capital			0.903	0.939	0.838
	HC1	0.925			
	HC2	0.934			
	HC3	0.886			
Relational Capital			0.950	0.968	0.908
	RC1	0.948			
	RC2	0.952			
	RC3	0.959			
Structural Capital			0.848	0.907	0.765
	SC1	0.907			
	SC2	0.879			
	SC3	0.838			
Skill Flexibility			0.928	0.955	0.875
	SKFLEX1	0.906			
	SKFLEX2	0.957			
	SKFLEX3	0.942			
Behavioural Flexibility			0.913	0.945	0.850
	BEFLEX1	0.900			
	BEFLEX2	0.941			
	BEFLEX3	0.924			
Planning Effectiveness			0.901	0.924	0.671
	PE1	0.850			
	PE2	0.897			
	PE3	0.875			
	PE4	0.800			
	PE5	0.708			

Reliability and Convergent Validity					
	PE6	0.771			
Formalisation			0.833	0.923	0.857
	FORM1	0.923			
	FORM2	0.928			

Table 2: Discriminant Validity

	HTMT							
	HC	**RC**	**SC**	**SKFLEX**	**BEFLEX**	**FORM**	**SIZE**	**PE**
HC								
RC	0.440							
SC	0.619	0.593						
SKFLEX	0.749	0.487	0.523					
BEFLEX	0.729	0.498	0.519	0.784				
FORM	0.334	0.247	0.710	0.227	0.229			
SIZE	0.010	0.013	0.063	0.031	0.084	0.028		
PE	0.715	0.665	0.764	0.571	0.555	0.429	0.058	

We analysed the data using PLS-SEM (Hair *et al*., 2014). It is well suited for exploratory research (Benitez *et al*., 2020) and is the best option when it is unclear whether the nature of the data is based on a common factor or a composite (Sarstedt *et al.,* 2016). To test the statistical significance of the results, we used a bootstrap algorithm with 5000 subsamples (Hair *et al.,* 2014). Two models were created to analyse how dependent variables develop their explained variance (R^2). In the first model, we inserted only the control variables, while in the second model, we analysed all the hypothesised relationships.

In Model 1 we found that control variables explain a significant amount of variance of PE (R^2 = 0.193) but only a minimum amount of variance of both SKFLEX (R^2 = 0.042) and BEFLEX (R^2 = 0.045). In line with previous studies, (e.g., Baum and Wally, 2003) formalisation significantly influences (β = 0.437, T-statistic = 8.689) and explains most of the variance (f^2 = 0.23) of PE. On the contrary, formalisation influences both SKFLEX (β = 0.202, T-statistic = 2.690, f^2 = 0.043) and BEFLEX (β = 0.204, T-statistic = 2.846, f^2 = 0.044) but has a low explanatory power. Firm size has no impact and no explanatory power on SKFLEX (β = -0.030, T-statistic = 0.533, f^2 = 0.001), BEFLEX (β = -0.060, T-statistic = 0.924, f^2 = 0.004) and PE (β = 0.043, T-statistic = 0.706, f^2 = 0.002).

In Model 2 all the hypothesised relationships are considered (Figure 2). We found that the explained variance for PE (R^2 = 0.385) substantially increases, while the increase for both SKFLEX (R^2 = 0.521) and BEFLEX (R^2 = 0.508) is dramatic. We found that human capital enhances both skill flexibility (β = 0.585, T-statistic = 10.314, f^2 = 0.489) and behavioural flexibility (β = 0.562, T-statistic = 9.510, f^2 = 0.440). Relational capital enhances both skill flexibility (β = 0.179, T-statistic = 2.519, f^2 = 0.045) and behavioural flexibility (β = 0.200, T-statistic = 2.854, f^2 = 0.055). Structural capital has no role in enhancing skill and behavioural flexibility. Both skill flexibility (β = 0.283, T-statistic = 3.515, f^2 = 0.060) and behavioural flexibility (β = 0.253, T-statistic = 3.297, f^2 = 0.048) have a direct impact on planning effectiveness.

Finally, our control variable, formalisation, has no significant impact on SKFLEX and BEFLEX, but a significant direct impact (β = 0.227, T-statistic = 4.724, f^2 = 0.118) on PE, confirming its explanatory power. As far as firm size is concerned, it has absolutely no influence on SKFLEX, BEFLEX or PE. Table 3 and 4 show our results.

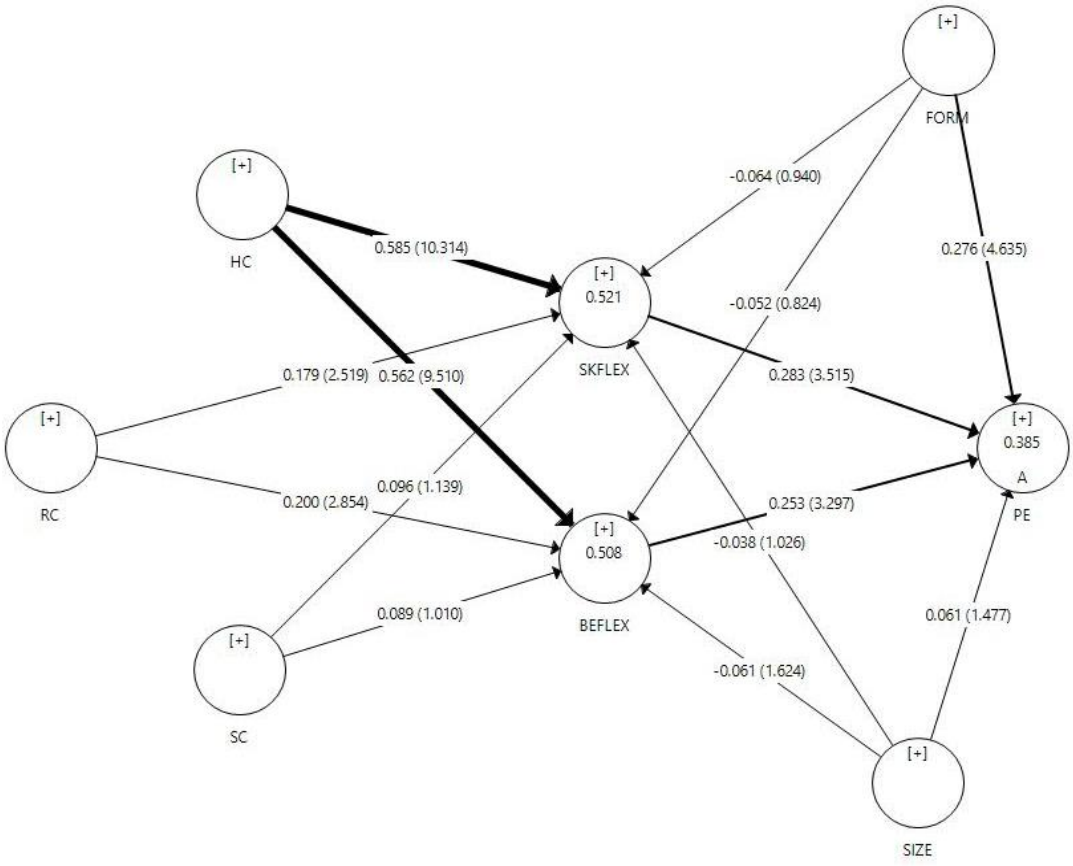

Figure 2: Results of the Structural Model

Table 3: Results of the Structural Model

Hypothesis	Path	Path Coefficient	T-value	P-value	Status
H1	HC -> SKFLEX	0.585	10.314	0.000	SUPPORTED
H2	HC -> BEFLEX	0.562	9.510	0.000	SUPPORTED
H3	RC -> SKFLEX	0.179	2.519	0.011	SUPPORTED
H4	RC -> BEFLEX	0.200	2.854	0.005	SUPPORTED
H5	SKFLEX -> PE	0.283	3.515	0.000	SUPPORTED
H6	BEFLEX -> PE	0.253	3.297	0.001	SUPPORTED

Table 4: Exploration of Relationships between SC, SKFLEX and BEFLEX

Path	Path Coefficient	T-value	P-value
SC -> SKFLEX	0.096	1.139	0.257
SC -> BEFLEX	0.089	1.010	0.315

6. Discussion

This study investigates which firm-specific factors drive employee flexibility in SMEs and how this, in turn, enhances SMEs' ability to achieve strategic goals. Based on the assumption that knowledge and employee flexibility are two strictly related resources, as a broader knowledge base allows employees to perform different tasks (Beltran-Martin *et al.,* 2013) and perform extra-role activities (Wang and Wang, 2012), we have considered IC as a driver of employee flexibility. We will now discuss our findings for each hypothesis in detail.

H1: Human capital (HC) enhances skill flexibility (SKFLEX). Our results support this hypothesis. Human capital significantly enhances skill flexibility ($\beta = 0.585$, T-statistic = 10.314, $f^2 = 0.489$), indicating that possessing a high level of skills is a necessary precondition for skill flexibility. The more skills and knowledge employees have, the greater their capability and willingness to perform new and different tasks. This aligns with previous research (e.g., Beltrán-Martín *et al*., 2013; Wang and Wang, 2012) suggesting that broad knowledge and diversified skills enable employees to perform extra-role activities. In the context of SMEs, where resources are often limited, this flexibility becomes even more crucial for adapting to changing demands and environments.

H2: Human capital (HC) enhances behavioural flexibility (BEFLEX). This hypothesis is also supported by our findings. Human capital positively affects behavioural flexibility ($\beta = 0.562$, T-statistic = 9.510, $f^2 = 0.440$). A high level of human capital affects skill flexibility and also behavioural flexibility. This suggests that employees with broad and diverse knowledge feel more confident adapting their behaviour to new situations. This result supports the idea that human capital contributes to a firm's competitive advantages by improving employees' adaptive performance (Cabrilo and Grubic-Nesic, 2013).

H3: Relational capital (RC) enhances skill flexibility (SKFLEX). Our results support this hypothesis. Relational capital enhances skill flexibility ($\beta = 0.179$, T-statistic = 2.519, $f^2 = 0.045$), albeit with a smaller effect size compared to human capital. This finding suggests that strong relationships with stakeholders provide employees access to diverse knowledge and information, enhancing their ability to perform various tasks, which aligns with Miroshnychenko *et al*.'s (2021) assertion that knowledge obtained from external stakeholders helps firms update their knowledge base and skills.

H4: Relational capital (RC) enhances behavioural flexibility (BEFLEX). The findings support this hypothesis as well. Relational capital positively influences behavioural flexibility ($\beta = 0.200$, T-statistic = 2.854, $f^2 = 0.055$). Strong relationships foster an environment where employees feel more comfortable adapting their behaviour to new situations. This may be because relational capital facilitates the exchange of high-quality information and tacit knowledge (Fernández-Pérez, Montes and García-Morales, 2014), which can broaden employees' perspectives and increase their willingness to adapt.

Structural capital has no significant direct impact on both skill and behavioural flexibility. We have advanced two possible explanations. First, SC is related to the procedures, norms, systems and routines that store knowledge for its re-use (Youndt, Subramaniam and Snell, 2004), so its focus is on the current competitive environment. This knowledge stock may become outdated in new circumstances arising from a changing environment and lose its past value (Heimeriks, Schijven and Gates, 2012). Therefore, updating routines and knowledge may become key to enhancing employee flexibility and pursuing strategic alternatives (Wright and Snell, 1998; Cepeda-Carrión *et al*., 2015). Second, knowledge embedded in information systems, databases and organisational routines is explicit knowledge, in other words, knowledge that can be easily codified and transmitted. On the contrary, tacit knowledge, that is, a key component to performing tasks, is tied to senses, tactile experiences and movement skills; therefore, it is more difficult to codify and transmit (Nonaka, 1994; Nonaka, Umemoto and Senoo, 1996). As a consequence, the benefits deriving from its use by personnel called to perform different tasks will be limited. This suggests that while structural capital is important for organisational functioning, it may not directly contribute to employee flexibility in SMEs.

H5: Skill flexibility (SKFLEX) enhances planning effectiveness (PE). Our findings support this hypothesis. Skill flexibility has a significant direct impact on planning effectiveness ($\beta = 0.283$, T-statistic = 3.515, $f^2 = 0.060$). This result suggests that employees with flexible skills contribute significantly to the effectiveness of strategy. This aligns with Wright and Snell's (1998) assertion that employee flexibility provides firms with more options to pursue strategic alternatives and reach their goals.

H6: Behavioural flexibility (BEFLEX) enhances planning effectiveness (PE). Our results also support this hypothesis. Behavioural flexibility positively affects planning effectiveness ($\beta = 0.253$, T-statistic = 3.297). Behaviourally flexible employees appear to contribute to more effective strategies, possibly by being more adaptable to changes in plans and more willing to engage in different tasks. This supports the idea that flexible

employees can improvise and generate new ideas, leading to a more effective strategy (Ubeda-Garcia *et al*., 2017).

Control variables: an unexpected and fascinating result concerns the relationship between formalisation and flexibility. Different from previous empirical studies (Hempel, Zhang and Han, 2012; Majid, Yasir and Yasir, 2017), our results show that in SMEs a high level of formalisation not only favours the achievement of strategic goals (β = 0.227, T-statistic = 4.724, f^2 = 0.118) but does not hinder skill or behavioural flexibility at all. A possible explanation to reconcile the presence of the benefits deriving from both formalisation and employee flexibility in SMEs could be the following. Even if having too many formalised procedures can limit employee flexibility (Hempel, Zhang and Han, 2012; Majid, Yasir and Yasir, 2017), formalisation does not necessarily prevent employees from being assigned different tasks. In fact, due to their lack of human resources and labour-intensive nature, in SMEs, this is often the case (Messersmith and Guthrie, 2010), and it is reasonable to expect that their skills are general and consequently flexible. This fact also seems to be confirmed by the strong correlation (0.69) between human capital (skill level) and skill flexibility constructs. As a result, SMEs will benefit, on one hand, from formalised procedures that help them reduce the dispersion and waste of scarce resources (Adomako and Ahsan; 2022) and, on the other hand, from flexible employees that "*can*" and "*will*" do the different tasks required to accomplish strategic alternatives and reach strategic goals.

7. Implication and Limitations

7.1 Theoretical Implications

This is the first paper to conceptualise and empirically test the relationship between IC and employees flexibility in SMEs and fill some important gaps in the literature.

First, we have contributed to intellectual capital literature regarding the role of human and relational capital in improving both skill and behavioural flexibility. We have found that possessing a high level of knowledge and skill (i.e., human capital) is a precondition for employee flexibility. SMEs able to develop qualitative relationships with their stakeholders have shown their ability to enhance both skill and behavioural flexibility, confirming that relational capital boosts employee flexibility (Miroshnychenko *et al.,* 2021). Finally, the results show that structural capital does not enhance skill or behavioural flexibility as this sort of knowledge is focused on the current competitive environment and may rapidly become outdated (Heimeriks, Schijven and Gates, 2012).

Second, we have contributed to the literature on employee flexibility by responding to Way *et al*.'s (2018) recent call for empirical research to explore the internal (firm-level) factors that enhance employee flexibility by examining the whole knowledge stock a firm can fully draw from, that is to say, a firm's intellectual capital. Although several scholars have suggested that employee flexibility helps firms pursue strategic alternatives and reach their strategic goals, this linkage has not yet been empirically tested in SMEs. Our findings support the assumption of Beltrán-Martín and Roca-Puig (2013) and Wright and Snell (1998) that flexible employees will be able to adapt to changing working contexts and be willing to collaborate with partners with different points of view by integrating their different skills to reach a firms' strategic goals and find flexible options (Volberda, 1998). This ability is even more important for SMEs as they suffer change and uncertainty more than larger firms due to their smaller size and lack of resources (Wynarczyk *et al.,* 1993).

Our third theoretical contribution has shed new light on the relationship between employee flexibility and formalisation in SMEs. Empirical results suggest that a high level of formalisation does not hinder employee flexibility, while it strongly favours the achievement of SMEs' strategic goals. We have advanced a possible explanation to reconcile the presence of benefits deriving from formalisation and employee flexibility in SMEs. Even if having procedures that are too formalised can limit employee flexibility (Hempel, Zhang and Han, 2012; Majid, Yasir and Yasir, 2017), they do not necessarily prevent them from being assigned different tasks. On the contrary, their lack of resources and labour-intensive nature oblige SMEs to frequently assign their employees different tasks (Messersmith and Guthrie, 2010). At the same time, since SMEs have limited human resources, they are particularly at risk, as it is hard to replace employees who leave or are absent for longer periods (Durst and Wilhelm, 2012). Therefore, managers and employees are required to have broad and generalist skills (De Leede *et al.,* 2020). As a result, SMEs will benefit from both formalised procedures and flexible employees that "*can*" and "*will*" do the different tasks required to accomplish strategic alternatives and reach SMEs' strategic goals. This detail allows you to look at formalisation and employee flexibility in SMEs from a new perspective, where these two variables are not in contrast anymore.

7.2 Managerial Implications

Our findings have noteworthy practical implications for SMEs. SMEs should be aware that intellectual capital plays a crucial role in shaping employee flexibility and should understand how the different components of IC are connected to the adaptability of their staff. SMEs that need more flexible employees would profoundly benefit from investing in human and relational capital. It is worth underlining that possessing highly skilled employees may not be sufficient per se to ensure they can adapt to different contexts. SME employees are often assigned different tasks and need both specialistic and general skills to switch easily from one to another. Providing employees with suitable knowledge and skills that will enable them to be as flexible as possible is a challenge SMEs' cannot ignore, as their success depends on the quality of their human resources.

7.3 Limitations and Areas of Future Research

As with any empirical study, our exploration of the precursors and consequences of employee flexibility has limitations. First, our study gathered all the focal variables from a single source within each firm.

Second, the results are based on a sample of Italian SMEs and may not be generalisable to other types of organisations or regions with different cultural and institutional environments. Further research is needed to assess the validity of our findings in different geographic areas, and ideally in studies that cross multiple country boundaries.

Ethics Statement: The present research was conducted in compliance with the ethical guidelines of the affiliated institution. Since it involved an anonymous questionnaire, approval from an ethics committee was not required. Before completing the questionnaire, entrepreneurs were informed about the purpose of the research and their right to refuse participation. Data were collected and analyzed in an anonymous and aggregated form solely for academic purposes, in accordance with current regulations on personal data protection (GDPR).

AI Statement: During the drafting of this manuscript, QuillBot was used exclusively to enhance grammatical accuracy and paraphrase certain text passages. The use of QuillBot did not affect the development of the content, analyses, or interpretations of the study. The authors take full responsibility for the integrity and accuracy of the entire work.

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Appendix

Human capital:

1. Our employees are highly skilled at performing their tasks.
2. Our employees have a lot of experience in their job.
3. Our employees are good at problem-solving.

Relational capital:

1. We exchange information with external parties (e.g. customers and suppliers) in a very effective way.
2. We collaborate extensively with external parties (e.g. customers and suppliers) to develop new solutions.
3. We collaborate with external parties (e.g. customers and suppliers) in a very effective way.

Structural capital:

1. Our company has a lot of useful information in documents and databases.
2. We keep complete documentation of the work processes.
3. We use technology to integrate internal work processes tightly.

Skill flexibility:

1. Our firm can shift employees to different jobs when needed.
2. We employ people with a broad variety of skills.
3. Many employees in our firm have multiple skills that are used in various jobs.

Behavioral flexibility:

1. The flexibility of our employees' work habits helps us change according to market demands.
2. Our employees respond to changing situations within a short time.
3. Most of our employees are flexible enough to adjust to dynamic work requirements.

Formalisation: In my organisation …

1. employees have to adhere closely to formal procedures
2. there are many activities covered by some formal procedures

Planning effectiveness: In my organisation we have …

1. Developed a clear vision
2. Oriented the firm toward a unified mission
3. Defined clear priorities and focused on the important issues
4. Achieved a good fit between the external environment and our firm's internal capabilities
5. Delivered high-quality products/services
6. Improved firm performance

Brain Drain in Yemeni Universities: Analysis of HR Management Strategies for Retention and Job Satisfaction

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Abstract: Brain drain is one of the most serious problems that economic development and educational standards in countries like Yemen especially suffer from. The study investigates the link between HR management approaches, labor satisfaction, and their combined impact on Yemen's economy. The research highlights the importance of a high-skilled labor force in global development and the paradoxical challenges brain drain imposes. The main objective of this project is to study the complicated patterns that lead to brain drain, assess its economic impact on academic establishments and a country as well analyze methods used by HRM- human resources managers; they also help identify other implications derived from job satisfaction including role play. This work reflects on the nuances of organizational efficacies, analyzing how HRM policies influence retention or attrition rates for competent workers. This stage aims to explore the complicated relationship between an individual's happiness and their overall organizational system. It seeks to delve further into the understanding of how job satisfaction can accentuate or mitigate brain drain. The findings provide evidence of the significant effects of HR management techniques, satisfaction with work, and economic variables on the intentions toward leaving for other countries among academic staff members in Yemeni universities. On the one hand, discriminant validity analyses prove that measuring constructs are distinct from each other whereas R values highlight the predictive relevancy of the structural model. Mediation studies show that satisfaction with pay is a mediator between salary, supervision, and intentions of brain drain.

Keywords: HR management, Academic staff, Brain drain, Job satisfaction, Yemeni universities, Turnover, Skilled labor

1. Introduction

In the complicated web of global development skilful labor is a significant factor in sustaining economic prosperity, civic progress, and educational standards. However, the use of human resource management strategies has continued to grow and dictate courses taken by many nations. However, this important resource faces a potent enemy – the brain drains epidemic (Electronic Journal of Knowledge Management, 2024). This fact, especially in connection with labor export has a massive impact on economic growth and carries urgent risk for the stability of nations desiring to maintain progress.

At the same time that countries attend to the issue of a brain drain, developments beyond mere the loss of a skilled workforce are in store. This policy robs the country of intellectuals, who form the basic talent, that cannot be substituted and, therefore, which limits the possibilities of foreign competition. It is not just that this deterrent deprives economic development of impetus but also hinders civic progress which in turn erodes educational standards (Alaghbari & Beshr, 2019). The objective of this paper is to analyze the different components of it, including the economic impacts and systemic dilemma, with suggestions on limiting its adverse effects of it.

According to its role in the phenomenon of brain drain, educated workforce occupies a significant niche. It includes leaders and skillful specialists from different bestrias who perform an outstanding job as trailblazers, stop-watch persons, and developers of the nation. Immigration enriches a country's pool of skilled labor, helping the country become more competitive, the prerequisite of prosperity. On the other hand, the sustainability of their growth is vulnerable to the consistent exodus of highly skilled nationals – brain drain. The intellectual emigration is not merely an outflow of labor forces, but rather a destruction of the nation's intellectual stuffy being, which in turn will result in the emptiness in many the enterprises. There is a drawback, which is an appearance of these benefits that also create some obstacles to be sort out, those that may be removed by the individuals with inbuilt skills. In addition, brain drain because of the loss of competencies among teachers is a

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factor that precipitates the weakening standards of education hence reduction in the foundational base through which knowledge of future generations is acquired (UVA Library, n.d.) The negative ramifications from the brain drain didn't stop with the loss of workforce but profoundly influence the ability of the country to thrive and emerge stronger over time.

This study is designed to provide a holistic understanding of the intricate workings surrounding brain drain in Yemeni institutions with an all-encompassing set of goals. It then attempts to comprehensively examine the highly intricate patterns and fundamental variables that take part in the brain drain observed within these centers of learning. This research is aimed to consider all factors involved in this phenomenon including individual motivation and systemic issues. This will pave the way for an in-depth understanding of the root causes of brain drain. The study focused on the connection between salary, satisfaction with work, turnover, and brain drain. Numerous researches have looked at the impact of payment on work satisfaction and attrition. Studies indicate that remuneration affects job turnover negatively and significantly. Besides, it has been established that compensation affects an organization's propensity to depart negatively(Mo & Borbon, 2022). According to research, pay also leads to job satisfaction. The study revealed a significant relationship between work satisfaction and academic abandonment. Pay levels reduce attrition. (Tsujita, Oda, & Rajan, 2023). These studies show that income, job satisfaction, and intention to quit are related suggesting the importance of providing fair understanding pay on retention efforts. Pay as an issue among Yemeni academics has remained largely neglected. (Bekheet, Al Sudany, & Najm, 2023). Accordingly, this research aims at adding further understanding regarding the way functional dynamics of HRM are carried out in a Yemeni institutions through intensive research studies on the objectives included. Workers need to structure and synthesize essential information into helpful guides and suggestions that can be used to face up to the big problem of brain drain. This will especially help Yemeni higher education body to formulate and establish in the long run employment and investment policies that will serve to rebuild the whole country. In Yemen where social and political insecurity and economic problems that have made Yemen is an image and has caused the migration of academic staff abroad (Alhebshi et al., 2022).

One of the central issues affecting Yemeni universities and overall development is the brain drain, which means that many experienced academicians leave their country to seek employment in other nations. The purpose of this research is to identify the antecedents of brain drain in Yemeni academic institutions and to determine how HRM practices affect the level of job satisfaction and turnover intentions among the academic employees. The condition of economic and political insecurity in Yemen complicates the factors driving brain drain; therefore, the need to acknowledge the best practices of HRM to counter the challenges. More specifically, this research aims to identify the antecedents affecting academic professional's turnover decision by examining the compensation, career mobility, working environment and organizational support decisions. The paper's research question focuses on examining the impact of human resource management practices and job satisfaction on brain drain within Yemeni universities. Specific HRM practices such as compensation, career mobility, working environment, and organizational support will be addressed to understand their influence on academic turnover intentions and the broader issue of brain drain.

2. Literature Review

This literature review is aimed at revealing the complicated relationship between the 'brain drain' and its economic implications, especially concerning Yemeni universities. It provides a comprehensive review of the current literature, with particular emphasis on elucidating important economic implications associated with brain drain. While most emphasis is given to the academic sphere, particularly for HR management practices and job satisfaction. Scholars have exhaustively analyzed the challenges of the global brain drain. On the other hand, some thought should be made about problems specific to Yemeni universities. The present synthesis is intended to advance our insights regarding HR management practices and job satisfaction as impact factors of brain drain economic consequences in this unique academic setting.

2.1 Global Brain Drain and Economic Implications for Yemeni Universities

Brain drain is a popular theme discussed in academia, referring to the global economic anomaly that skilled workers depart their native countries. Respected authors, Alaghbari and Beshr (2019), provide a comprehensive analysis of the phenomenon when qualified workers are migrating. The observations above illuminate a challenging dilemma whereby individuals who search for economic opportunities abroad also contribute to the conspicuous loss of essential manpower in their home country. (Alaghbari & Beshr, 2019) This paradox describes the interrelations leading to questions about the possible future economic sustainability of countries losing such

a large share of highly skilled workers. The understandings offered by such scholars strengthen our all-round understanding of the intricate challenges associated with the global brain drain phenomenon.

Situated in the Middle East region, and even more so, given Yemen's economic instability and political instability current emigration of highly skilled people as the challenge is especially evident. Over the years, renowned academics such as Astuti et al., (2023) and King in 2023 have described these intricacies highlighting how reliant Yemeni universities – which are valuable repositories of intellectual capital—are on general economic stability(Astuti, Prabowo, & Puspitasari, 2023)Thus, such a case of brain drain in this regional setting results in serious concerns about Yemen's socio-economic sustainability over the long term. These scholars offer highly valuable insights that contribute to the better interpretation of complicated mechanisms and outcomes of brain drain in the Middle East region (King, 2023).

The literature focuses on the central theme of economic stagnation caused by a brain drain that involves leaving highly educated individuals. Well-known academics, Aguiar-Quintana et al., (2021), point out how dire the consequences are when scholars leave Yemeni universities to create a vacuum that impedes economic development and suffocates creativity. B Brain drain not only deprives the nation of intellectual assets but also adversely affects the more general economic circumstances (Aguiar-Quintana et al., 2021).

2.2 HR Management and Job Satisfaction

The paper underscores the high-cost implications implicit in hiring and training new academic staff encountered to replace those existing ones. Darvishmotevali and Ali, (2020) have even brought attention to the considerable amount of money spent due to their continuous loss incurred from losing such valuable human resources, an action that compounds economic challenges faced by institutions as well as the national economy. [9]. The continuous nature of the replacement also adds not only immediate recruitment costs but also requires long-term investments in training programs. Not only does the continuous practice of draining talent render educational organizations financially unsustainable but also, as implied in literature. Skilled labor serves as a cornerstone for national development, and the phenomenon of brain drain poses significant challenges to economic progress, social advancement, and educational standards (Alhebshi et al., 2024).

The works particularly highlight the important part of which is the economic impact that brain drain had, especially concerning its negative influence on research and innovation. Al-Halili and Hongxin, 2019 and Arayssi et al., (2023) argue that the migration of qualified academics weakens Yemen's capacity to compete internationally making it impossible to progress in areas such as technology and science. Intellectual capital loss does not only stop research processes but limits a nation's capability to contribute major findings in international development (Al-Halili & Hongxin, 2019) . This significant drawback in research and innovation aggravates the effects of brain drain that have been discussed above according to the literature (Arayssi, Fakih, & Haimoun, 2023). This disruption has to be responded to because Yemen must keep its place in the progress of science and technology around the world.

The literature brings to the fore such a complicated link between the brain drain's economic implications and the quality of education as well as workforce training. Mo and Borbon, (2022) not only does the movement of skilled professionals affect the present educational setting but also makes a long-term impact on that nation's ability to develop an extremely precise labor force (Mo & Borbon, 2022) . However, the downfall of educational standards is an ongoing roadblock that worsens the economic effects associated with brain drain issues their specialists in this field. The focus should be placed on this connection to foster sustainable economic growth in Yemen.

The literature stresses the essential significance of HR management skills in overcoming and reducing financial ramifications resulting from brain drain. Duklaska et al., (2023), esteemed scholars, assert that salary as well as professional development opportunities are one of the major factors that influence patterns of brain drain, along with the company's culture (Duklaska, Ferrazza, & Cantafio, 2023) . Jinah et al., (2024) highlight the importance of strategic HRM approaches for creating a suitable atmosphere that allows these highly competent people to be retained in Yemeni institutions. These notions advocate proactive measures to address key factors associated with the loss of talented professionals, thus increasing the overall attractiveness of academic positions (Jinah et al., 2024) . As such, ensuring these human resources strategies are identified and implemented is a key step to prevent economic problems that arise from the loss of highly trained scholars in an eminent Yemeni setting. Research focuses on job satisfaction as a determinant that can facilitate or negate initiatives to minimize the economic impact of brain drain. Kunnumbrath and Kodali, (2023 also point out that a satisfied staff is less likely to seek opportunities elsewhere, which should reduce the economic consequences of brain drain (Kunnumbrath

& Kodali, 2023) . A favorable and satisfactory working atmosphere in Yemeni universities is of supreme importance.

Yemeni brain drain in the academic teaching institutions works under the condition that the emigration from the developing countries is apparently rational due to the economic, political and social turbulence. This is further compounded by factors such as low career progression, poor remuneration, and harsh working conditions. Instability is a problem present in many countries but, the Yemeni problem ACC is different due to a number of reasons arising from conflict and bad economic cycles. The literature mainly emphasizes compensation and job security as two important aspects of HRM that impact brain drain in the Yemeni universities. They noted that although other functions like professional development, organizational support, and workplace culture are important in mediating the effectiveness of a leader, none of them is as critical as the core functions identified above. The omission of these variables in the research is because prior studies in Yemeni academic context have not sufficiently investigated these factors. As a result, future research should supplement these findings to offer a better understanding of the influence of HRM on brain drain in Yemen.

3. Hypothesis

The conceptual framework of this study will center around four proposed hypotheses, which are as follows:

3.1 Higher Compensation Affects Positively Job Satisfaction

According to a study conducted by academic staff members at universities, it has been observed that salary significantly and positively influences their level of job satisfaction (Adanlawo & Nkomo, 2023). Based on the findings of the study, it has been shown that remuneration plays a pivotal role in influencing job satisfaction (Arta, Wibowo, Cakranegara, Hadi, & Zaroni, 2022). Additionally, effective communication has been identified as a crucial factor that positively affects employee job satisfaction. The research also investigated income as an external factor that influences the work satisfaction of academic staff at public institutions in Malaysia and found a significant association between income and job happiness (Mehrad, 2014). The study also underscored the importance of comprehending the factors that influence job satisfactio since they have the potential to elicit various workplace actions (Saria, 2015). In general, the remuneration received by academic personnel at universities has a notable influence on their level of job satisfaction. Consequently, businesses should duly consider this factor to enhance employee contentment and productivity (Nazir, Khan, Shah, & Zaman, 2013). Based on previous studies, the first hypothesis was developed:

> *H1: Higher compensation correlates positively with job satisfaction among academic personnel at Yemeni universities.*

3.2 Higher Levels of Supervision Affect Positively Job Satisfaction

Previous research has established a favorable correlation between job satisfaction and increased levels of supervision (Mohan, 2019; Sahana, Laoli, Situmorang, Hutabarat, & Ginting, 2022; Saunders, 2023; Sri, 2021). This correlation has been substantiated by research conducted in several contexts, encompassing applied behavior analysis interventions for children diagnosed with autism spectrum disorder (Maryanti, Arafat, & Eddy, 2021), a commercial enterprise involved in plantation activities, public primary educational institutions, and specific public primary schools within a designated district. The findings of these investigations revealed a significant favorable correlation between academic supervision and teacher job satisfaction, as well as increased levels of treatment faithfulness and work pleasure. Furthermore, a notable finding emerged indicating that the presence of capable supervision had a positive impact on employee satisfaction, particularly when supervisors exhibited qualities such as intellectual stimulation and genuine care (Saleh et al., 2022)The results of this study underscore the importance of supervision in promoting job satisfaction and recommend that employers priorities the implementation of effective supervisory strategies to enhance employee performance and wellbeing (Khalaf et al., 2024).

> *H2: Higher levels of supervision are positively correlated with job satisfaction among university faculty in Yemen.*

3.3 Job Security Affects Positively Job Satisfaction

There exists a positive correlation between job security and job happiness among academic professionals inside the university setting (Kato, Mugizi, & Kasule, 2023; L. Kim, Pongsakornrungsilp, Pongsakornrungsilp, Horam, & Kumar, 2023). Based on research conducted in higher education institutions in Pakistan, the level of job satisfaction among academics was found to be significantly influenced by the factor of job security (Afaq et al.,

2022). In a study conducted in Lagos State, Nigeria, it was observed that job security had a substantial influence on the level of work satisfaction experienced by non-teaching personnel (Ayodele et al., 2022). The findings of this study indicate that there is a positive correlation between perceived job security and job satisfaction among academic staff members. This underscores the need to provide stable employment and equitable labor practices inside universities as a means to enhance job satisfaction among academic personnel. Empirical evidence suggests a positive correlation between job security and work satisfaction among university academic workers. According to a study conducted in Nigeria (Agbakwuru & Iyawe, 2023), job satisfaction among non-teaching professionals in public universities was found to be highly influenced by employment stability.

H3: Greater job security is positively correlated with job satisfaction among Yemeni university academic staff.

3.4 Higher job Satisfaction Effect Negatively With Intentions to Leave the Country

Multiple research studies have demonstrated that increased levels of job satisfaction are associated with a decrease in employees' intentions to quit their current positions or occupations. An investigation conducted within a utility firm in South Africa revealed that social well-being, which exhibits a positive correlation with job satisfaction, demonstrated a negative correlation with intentions to leave (Hennicks, Heyns, & Rothmann, 2022). Previous research has established a correlation between low levels of job satisfaction and individuals' inclination to emigrate. In a similar vein, it has been observed that extended working hours and bad working conditions are also associated with this desire to relocate. There is a consistent association between increased levels of job satisfaction and decreased intentions to leave a job, with job satisfaction serving as a key predictor of turnover intentions (Liu, Zhu, Wu, & Mao, 2019). The fourth hypothesis was formulated based on prior research findings:

H4: Higher job satisfaction among academic staff at Yemeni universities is negatively correlated with intentions to leave the country

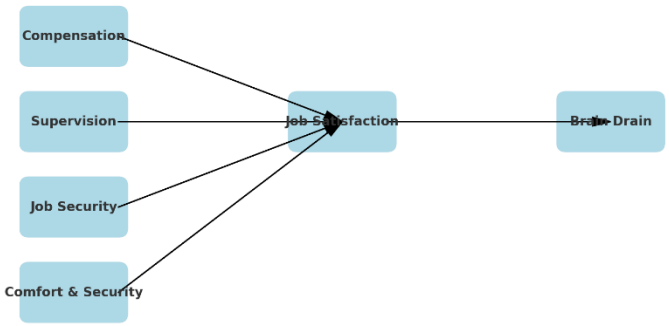

Figure 1: Hypothesis Model

The Hypothesis Model in Figure 1 presents four hypotheses that analyze the link between HR management practices and job satisfaction and the brain drain trend amongst the Yemeni universities' academic staff. The first hypothesis of this study is that there is a direct relationship between compensation, consisting of wages and incentives, and job satisfaction, proposing that employees receive fair monetary compensation hence improving their satisfaction levels. H2 claims that the high degrees of supervisory directions are also related to an enhancement in job satisfaction. In the light of H3, it means that job security enhances the satisfaction level because stability brings a contract. Last, H4 supposes that there is a negative relationship between job satisfaction and the intention to look for a job in another country, implying that higher levels of job satisfaction would make it less likely for the employees to seek employment in a foreign country. Job satisfaction is the variable of interest, which is moderated by elements from both Herzberg's model and the Pull-Pull Theory for these dynamics.

4. Methodology

4.1 Participants

The sample consists of 270 respondents randomly selected to represent the whole academic population in Yemen. The purposive selection of our respondents that is the principal in this kind of sampling assured not only

their real coverage of all types and dynamics of the university system in Yemen but also their detailed representation of the existing challenges and opportunities in this sector. As exactly the purpose of this study is to make the results more valid and accurate, and consequently, the data from a small homogeneous sample of 270 participants from a heterogeneous and representative sample is to be collected. A further step was the characterization of the reviewers' population, conducted methodically to comprehend better the sample. The information is present in the Table 1 below:

Table 1: Demographic Analysis

Demographics Category	**Frequency**
Gender Profile	
Male	140
Female	130
Age Profile	
20– 35 years	80
36 – 50 years	60
51 – 65 years	80
65 years and above	50
Education Profile	
MS/Phil	171
PhD	99
Work Experience	
0-5	70
6-10	83
11-20	60
21-30	57

The demographic characteristic of the respondents who form the academic population in Yemen is given in Table 1. From the data obtained from the gender distribution, slightly more males were recorded with 140 males and 130 females. In terms of age, respondents are categorized into four groups: Females: 80 are aged 20–35 years, 60 participants are aged 36–50 years, 80 are 51–65 years and 50 are 65 years and above in age. The majority of the respondents have a Masters or Phil degree (171) and 99 of the respondents have a PhD. With regards to work experience, 70 participants have 0-5 years, 83 have 6-10 years, 60 have 11-20 years and 57 have 21-30 years of experience. This diverse group guarantees that the researchers have a clear vision of the academic strengths and weaknesses in Yemen.

4.2 Common Method Bias

The research used an effective and systematic approach to detect and explore the potential existence of CMB. Technique bias is a method of common variation in measurement that stands to exist because of the application used and not what has been measured. The study used a comprehensive collinearity approach, which was generally taken up (Al-Halili & Hongxin, 2019). As an important parameter, VIF was used to assess and factor CMB out (Arayssi, Fakih, & Haimoun, 2023). Our findings revealed consistently acceptable VIF values below 3.3 for all variables in our analysis about the measure of collinearity used herein. This result shows a low degree of collinearity that proves the absence of common technique bias. Resorting to the use of VIF as a diagnostic tool enriches our methodology and assures reliability by verifying validity. The dependability of its conclusions is warranted in this study because it has completely dealt with the potential bias that may arise from common methodological factors, thus assuring their solidity.

In addition, the goal-oriented and diligent selection of variables as well as the careful use of statistics increases the resilience of the study. The minimization of the strength of measures such as multiple vaccinations also enhances internal validity and consequently will lead to consistent reliability. The carefulness in the methodology reveals interest in rigorous methods and contributes to strengthening credibility on expanding awareness of the intricacy between HRM practices, job satisfaction, tendency for brain drain occurrence among Yemeni institutions (Maung, 2019).

The survey questions were created based on the theoretical models, chiefly using the Two-Factor Theory and the Push-Pull Theory. These frameworks were adjusted to the Yemeni context of academia to capture all the possible variables that might affect job satisfaction, and the decision to engage in brain drain (Tsujita, Oda, & Rajan, 2023). Some of the survey items were developed in a way to measure other factors like compensation, comfort & security, brain drain, supervision, and satisfaction with an aim of achieving the research objectives.

Full Collinearity Testing

The collinearity testing procedure is significant because it estimates the level of dependability among predictor variables, therefore allowing one to make the correct inference from the statistical data. The VIF values assigned to each of the categories (Compensation, Comfort & Security, Brain Drain, Supervision, and Satisfaction) on which this evaluation is based are very significant (Albanese, 2022). The main observation related to the Compensation VIF metric (2.001) is the lack of collinearity strength. Compensation has a relatively low VIF, the indicator reveals a weak correlation with other predictors. Therefore, information from the Compensation factor is considerably different from the data obtained from other factors.

Based on the above reasons, the research method of this study is Partial Least Squares Structural Equation Modeling (PLS-SEM) since it is capable of handling a complicated model with a non-normal distribution and a small sample size. Qualitative research therefore is best suited in exploratory studies that seek to establish patterns in socio-economic environments such as the Yemeni academia [31]. The data analysis followed two major stages. First, the measurement model of the PLS-SEM path model was generated to find out the relationships between the latent and observed variables. Secondly, the reliability of the model was established through a composite reliability test while convergent validity was tested through Average Variance Extracted (AVE) [32].

VIF of 1.009 for Comfort & Security is low, which highlights the absence of collinearity issues clearly and strongly so far as possible. It constitutes an autonomous variable for the model, and its contribution to total variance is nearly insignificant. The VIF (Variance Inflation Factor) is low, justifying the validity of Comfort & Security as a distinct and important predictor (Jelili, 2022). VIF for the Brain Drain is 1.061, a relatively low value of collinearity presented here This finding implies that the relationship between Brain Drain as a variable and others is not too redundant, reflecting its significance for this model. The small VIF increases the reliability of Brain Drain as a relevant and independent variable. The VIF value of 1.058 for Supervision shows that it has very low collinearity with other predictor variables (Mojab, 2022). The low value of the VIF for this variable suggests its important contribution and thus a distinctive role in the model. The lack of a strict correlation increases the trustworthiness of Supervision as an important predictor.

The VIF for Satisfaction is 2.016, which signifies a slightly high value but still an acceptable one. This variable implies a modest level of multicollinearity which reflects low shared variance with other predictors. However, the VIF value does not indicate a concerning level of multicollinearity and Satisfaction remains significant in the model as represented in Table 2 below.

Table 2: Collinearity Testing

Compensation	Comfort & Security	Brain Drain	Supervision	Satisfaction
2.001	1.009	1.061	1.058	2.016

4.3 Data Analysis

To address the specific properties of this data set to be studied, a Partial Least Squares Structural Equation Modelling (PLS-SEM) approach was used to analyze acquired datasets. PLS-SEM was preferred to other methods, like CB-SEM because of its flexibility and efficiency especially when handling sophisticated models with moderate sample data. With data that have intrinsic complexities, PLS-SEM does produce reliable results [12].

Another reason for selecting PLS-SEM was its ability to handle non-normally distributed data. PLS-SEM is a very practical model to use when dealing with nonnormal data [12]. Notably, the ability to adapt is especially crucial in handling real datasets that may not be normally distributed. The data analysis technique occurred in two main phases: The first stage involved the estimation of the structural equation model with PLS-SEM. This entailed making links between fundamental concepts and quantifiable parameters, as well as determining the similarity of such a model to the data that were gathered. Phase two focused on the validity of the model (Mojab, 2022).

This included evaluating the reliability and validity of conceptual underpinnings and reviewing a model for measurement application according to empirical findings that were consistent with theoretical predictions.

Measurement Model:

The measuring model went through a vigorous assessment, largely aimed at determining the reliability and validity of constructs based on outer modeling. As an element of construct dependability, internal consistency was assessed based on composite reliability. It provided useful information on indicator coherence in each construct to ensure they all represented reliable measurement devices (Jelili, 2022). Meanwhile, the reliability of each single indicator was meticulously examined determining what part a particular signal plays in its corresponding concept. The comprehensive analysis had an important role in proving the validity of the measuring model. One aspect of construct validity was convergent validity, which is AVE [36]. This measure evaluated the extent to which indicators captured the variance of constructs accurately. The assessment of convergent validity corroborated that the indicators captured the targeted constructs correctly, reinforcing convergence's strength in the measurement model [37].

The model's ability to explain the variance in the independent constructs and its predictive accuracy was assessed with the path coefficients, the R2 values, Q2 measures, and F2 tests that were derived from the PLS-SEM analysis of the standard tables. These enabled the establishment of the factors responsible for job satisfaction and the likelihood of Yemeni brain drain in the academic institutions (Meesters, van Schilt, & Aciru, 2019). Yemen was chosen as the country of focus based on the heterogeneity of socio-economic environment in which the academic workforce in Yemen operates with regard to specific challenges, such as workforce turnover and job satisfaction in the context of larger economic and political volatility (Meesters, van Schilt, & Aciru, 2019). Thus, this study focuses on Yemen to gain specific rather than general knowledge that might be useful for enhancing the understanding of HR management practices in difficult conditions.

The Structural Model:

Before the inquiry, an examination for structural modeling applied to understand such a nested structure of endogenous and exogenous factors was addressed by evaluating internal models. The provided internal model served as a reliable basis for understanding the system interconnectivity within the framework [40]. To ascertain the importance and relevance of the said relationships in the structural model, path coefficients were computed.

The R2 values were needed in order to assess predictive accuracy of the model and figure out how many forms of endogenous influences were included in the explanatory factors. Behavior of the model to provide predictions was measured with Q2 score and demonstrated its ability to generalize and be robust against the out-of-sample data. The F2 measure played a fundamental role in the measurement of the influence that was having on an internal variable by an external, thus, determining how much each factor influenced its target. In this analysis, a two- step method with SmartPLS embedded software is applied. In order to do this the first stage applied was the assessment of a measurement model for lower-order constructs and proving their validity and reliability.

4.4 Theoretical Framework

The model is grounded in established theoretical frameworks to contextualize our research effectively. Specifically, our study draws on the Two-Factor Theory and the Push-Pull Theory. These frameworks provide a robust foundation for understanding the motivational factors influencing job satisfaction and the propensity for brain drain within Yemeni academic institutions. The Two-Factor Theory posits that certain factors (hygiene factors and motivators) influence job satisfaction and dissatisfaction, while the Push-Pull Theory explores the forces that attract individuals to migrate (push factors) or keep them in their current environment (pull factors). By integrating these theories, our model seeks to comprehensively examine the complex dynamics influencing workforce retention and satisfaction in Yemen's academic sector. In our study, these theories combine to give the complex picture of the challenges within the Yemen academic sector, where the understanding of motivational forces and migration dynamics is paramount. Combining these frameworks will create awareness of how these factors contribute to the enhancement of workforce retention and satisfaction as presented by the developed model. It not only strengthens the theoretical framework but also provides the policy maker and institutional manager with good reference to the organizational change and its strength for operation in the dynamic socio-economic environments. Thus, our theoretical framework can be seen as an integrated model for understanding and approaching challenges that exist in the context of human resource management in Yemeni academia and preventing brain drain, fostering employee satisfaction.

Our research employs Partial Least Squares Structural Equation Modeling (PLS-SEM) due to its suitability for handling complex models with relatively smaller sample sizes and non-normally distributed data, which are common in our research context (Gefen et al., 2011). PLS-SEM offers flexibility and efficiency in analyzing relationships between latent variables, making it particularly suitable for exploratory studies aiming to understand nuanced relationships within socio-economic contexts like Yemeni academia. This approach allows us to assess both measurement and structural models comprehensively, ensuring robustness and reliability in our findings (Hair et al., 2017). In evaluating the measurement model, we prioritize reliability and validity checks to ensure the robustness of our constructs. Internal consistency is assessed through composite reliability, ensuring that our measurement items reliably measure their respective constructs. Convergent validity, assessed through Average Variance Extracted (AVE), confirms that our indicators adequately capture the variance within their constructs, thereby validating their reliability as measurement tools (Hair et al., 2017).

4.5 Structural Model Analysis

The structural model analysis involves computing path coefficients to determine the strength and direction of relationships between variables. These coefficients provide insights into the predictive power of our model, helping us understand how different factors influence job satisfaction and the likelihood of brain drain within Yemeni academic institutions. R2 values are used to assess the proportion of variance explained by the endogenous variables, indicating the model's explanatory power and its ability to predict outcomes of interest (Meesters, van Schilt, & Aciru, 2019). Additionally, Q2 scores evaluate the model's predictive relevance and generalizability, demonstrating its robustness against out-of-sample data. The F2 measure assesses the effect size of exogenous variables on endogenous constructs, highlighting the relative importance of each predictor in influencing the observed outcomes (Hair et al., 2017).

5. Results and Discussion

Survey Details

Survey instrument used in this study was compiled from standard surveys to ensure that it is relevant to the study and in line with the conceptual framework. Job satisfaction items referred to research like Mo and Borbon (2022) on the capacity of the employees to satisfy with the jobs they are doing. Some of the questions were developed from Al-Halili & Hongxin (2019) exploring perceived fairness and adequacy of compensation and benefits. Leadership support items and frequency of performance review item were generated and used to measure the overall supervision quality in line with Darvishmotevali and Ali (2020). Perceived brain drain intentions were assessed using items borrowed from Kunnumbrath and Kodali (2023), in which participants assessed their inclination to look for employment overseas or any other reasons. Details of the survey items and the constructs they aim to capture are presented in Table 3 to provide the studies' genesis and their relevance to the current study.

Table 3: Survey Constructs, Items, and Sources

Construct	Survey Item	Source
Job Satisfaction	"How satisfied are you with your overall job?"	Mo & Borbon (2022)
Compensation	"How fair is your compensation compared to peers?"	Al-Halili & Hongxin (2019)
Supervision	"How frequently do you have performance reviews?"	Darvishmotevali & Ali (2020)
Brain Drain Intentions	"How likely are you to consider employment abroad?"	Kunnumbrath & Kodali (2023)

5.1 Reliability and Validity Analysis

The reliability and validity analysis for the seven constructs pay satisfaction, financial rewards, and supervisor communication. (Alotaibi, 2023) Such an evaluation was critical in ensuring the robustness and validity of the measuring model, especially since compensation supervision comfort and security legalization pleasure offshoring are part of higher-order constructs within this study framework.

The values of factor loadings were the determining factors that informed whether an item should be either included or excluded from the measurement model. (Rendón-Zapata & Bedoya, n.d.). A stringent cut-off value of 0.8 was employed to determine what should be included or excluded in the report. Items that had factor loadings coefficients than 0.5 were considered inadequate and thus eliminated from the analysis process. Only persons having values ranging between 0.6 and 0.7 were included in the list as per what previous research publications (Rendón-Zapata & Bedoya, n.d.) had determined to be criteria for inclusion into this stead. The detailed approach adhered to established standards helping the reliability and validity of the measurement model. The inclusion of factor loading values indicated a commitment to validity and strict methods in such as way that only items that correlated significantly with their construct were retained. This was a key tactic for maintaining the validity of the measurement model and subsequent analysis.

5.2 Convergent and Discriminant Validity

Convergent and discriminant validities are essential in terms of validation of measurements to ensure accuracy, and strong correlation but uncorrelation with each other respectively. [32]. These validation measures were widely used in this study, applying precise methods for deep assessment of the constructed validity and uniqueness. The convergent validity using the average variance extracted (AVE) measured significant homogeneity within indicators for each variable. Crossloading scores and set criteria were used to establish the discriminant validity of variables showing their ability to distinguish themselves from others. The rigorous adherence to these validation approaches increases the quality of results from this research and validates the consistency between subtle aspects of observed phenomena and those captured by this measurement model (Sirgy et al., 2019).

Convergent validity was evaluated by calculating the average variance extracted (AVE) value. We compared the values of AVE, which indicate shared variance within each continuous variable across its indicators. It Fornell and Larcker's (1981) recommended a cut-off point of 0.5. Significantly, all AVE values in this study are above the specified threshold for convergent validity and thus firmly confirm it. This finding indicates that the indicators of each variable in the study exhibit a considerable level of construct validity, thereby reinforcing the reliability and consistency measurement model.

In evaluating discriminant validity, what was emphasized when assessing the properties of variables in terms of measurement? This significant characteristic is focused on evaluating the discriminatory power of a variable and thus requires an analysis of relationships between items within one framework. The evaluation also considers whether the metrics only reflect a single construct. Cross-loading scores were analyzed and compared to predefined criteria to determine discriminant validity (Satti, 2022).The discriminant validity analysis revealed compelling results that unequivocally support the variables' ability to differentiate. The HTMT ratios, which differentiate our items that measure other constructs and those measuring the same construct proved unequivocally anchored to unique measurements. Many, of these ratios frequently remained far below the conservative threshold of 0.85 to illustrate the outstanding effectiveness of dividing variables into different and independent concepts (Jawasreh, 2021). The outcome provides strong substantiation that the variables are effective in reflecting various aspects of the studied phenomena. This also makes the measurement model more reliable and valid in detecting weak associations among variables under study.

5.3 Higher-Order Constructs

The evaluation of more complex concepts, for instance, Compensation and Supervision, refers us to their importance as the underlying variables in the research framework. The reliability of the constructs Compensation and Supervision was tested by Cronbach's alpha. The alpha values for Compensation and Supervision were 0.85, respectively, much higher than the recognized criterion of 0.7 as represented in Table 4 [45]. This means that these constructs reflect high reliability. This implies that all the items within one high-order construct constantly evaluate a common underlying latent variable.

Table 4: Higher Order Construct Reliability & Convergent Validity

Construct	AVE	Compensation	Supervision	Job Satisfaction	Brain Drain
Compensation	0.518	1	0.652	0.71	0.588
Supervision	0.514	0.652	1	0.743	0.633
Job Satisfaction	0.59	0.71	0.743	1	0.77
Brain Drain	0.572	0.588	0.633	0.77	1

However, the assessment of convergent validity based on composite reliability (rho_c) and average variance extracted (AVE), also supported the dependabilities as latent constructs of Compensation and Supervision. The composite reliability values for the Compensation (rho_c = 0.87) and Supervision items both exceeded the minimum requirement of 0.7, indicating that a consistent and stable measurement model is sufficient (Rauch, 2019). Besides, the AVEs of Compensation (AVE = .518) and Supervision (AVE=0.514) are higher than 0. This supports the convergent validity of these higher-order constructs, indicating that each item in a given construct generates unique information and functions as an appropriate measure of its underlying principle (Jawasreh, 2021).

In conclusion, the thoughtful appraisal of such sophisticated concepts as reliability and convergent validity provides solid evidence that Compensation and Supervision represent strong stable constructs. These constructs are key elements of the study's research framework that improve the accuracy and validity of measurement model information on phenomena under analysis.

5.4 Structural Model Assessment

In case the variables in this measurement model are valid and reliable, PLS-SEM proceeds with an evaluation of the validation inner model – namely structural one. The latter stage is very important for confirming relationships between endogenous and exogenous constructs. Several important factors guide the evaluation of structural models in the PLS-SEM framework as shown in Figure 2 below.

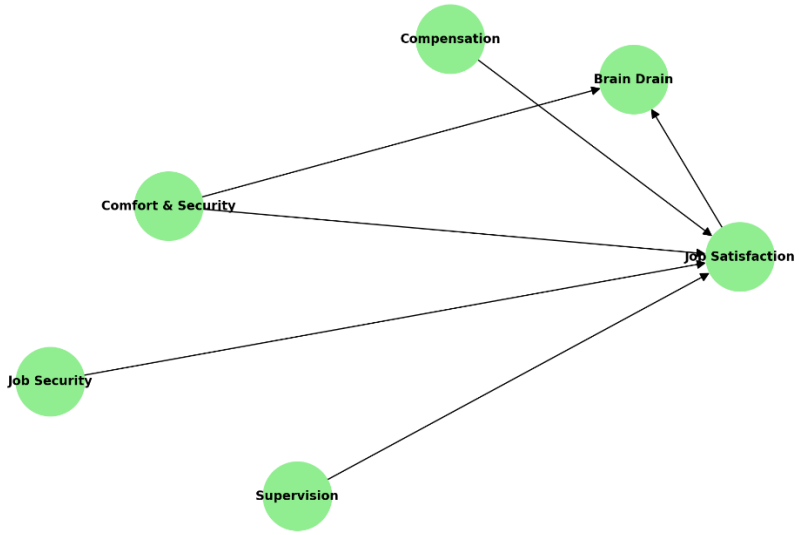

Figure 2: Structure Inner Model Assessment

Shown in figure 2 below is the structural model that was used in this study. Besides the hypothesized relationships, other relationship that were established include Comfort & Security and Job Satisfaction as well as Comfort & Security and Brain Drain. This extended model offers further understanding of factors that shape the process of retention of employees. (Rauch, 2019). In addition, the R^2 value is a measure employed in PLS-SEM that measures predictive model accuracy. This indicates the degree to which variability in endogenous constructions is explained by external constructs. A higher R^2 value shows a greater capability of the model in explaining data (Jawasreh, 2021).

The Q2 values are an important measure used to assess the predictive power of the structural model. It measures how well the model can predict further than what is used for estimation, shedding light on whether it might work in larger populations. Also, the F^2 measure is used to quantify how much an exogenous variable influences an endogenous variable. This measure provides a full understanding of the substantial impact on variables from the structural model, especially under a moderated mediation analysis context. This way, the PLS-SEM structural model assessment discloses links between various concepts and assesses how well a given set of assumptions can explain or predict. This detailed analysis adds to our understanding of the subtle machinations occurring within the research structure whereby interpretation and conclusions may be drawn from variable interactions.

5.5 Assessing R2 Values

To further improve the assessment of the structural model in PLS-SEM, R^2 values are included; this important measure is known as a coefficient of determination. R^2 is a good measure that has innate diagnostical capacity, which provides meaningful data on the accuracy of the model and its ability to forecast [9]. This measure provides the degree of correlation between observed and predicted scores on an endogenous construct based on a squared value. Within the frame of this research, R^2 values play an essential role in disclosing a joint impact on internal variables from external stimuli, especially regarding satisfaction and brain drain. The values serve as the criterion for assessing the structural model's effectiveness determining how strong external factors affect these important internal variables (Arayssi, Fakih, & Haimoun, 2023). Various R^2 values make it possible to analyze the evaluation more accurately, defining how factors interact within an object of study.

R^2 is a measure of correlation between actual and predicted values for dependent variables. R^2 values are known to be important in this study due to their importance in explaining the overall effect of external influences on internal variables more specifically contentment and brain drain (Mo & Borbon, 2022). These factors are very important for the research framework as it is necessary to analyze their predictive value in detail. R^2 values are used in the study as a measure by which to evaluate how much there is the contribution of external factors towards observed variances in satisfaction and brain drain. This comprehensive analysis enhances the understanding concerning a model's ability to make predictions, providing in-depth knowledge regarding relationships between internal and external elements within a research environment.

The R^2 values from this study are an important measure of the ability to explain by a structural model. They give indications of how well the model reflects variability in crucial exogenous features, namely happiness and brain drain. Happiness and Brain Drain form significant robustness of the structural model which we have developed (Kunnumbrath & Kodali, 2023). The good signs mean that the model works correctly to the expectations in the sense that the factors included in the analysis have a high impact on both satiation and the level of brain drain. This validation improves a model's accuracy that researchers feel confident that it shows and comprehends the vital internal aspects correctly (Saleh et al., 2022). The R2 values being positive are indicators of the enhancing nature of the model at both the theory as well as practical level to dig deeper into the sources for difficulty in satisfaction of the employees while facilitating their relative drain-off in government and private institutions in Yemen (Mo & Borbon, 2022).

5.6 Assessing Q2 Values

To ensure the model validation was comprehensive, this research utilized blindfolding. The Stone-Geisser Q2 value was treated as a focal metric allowing the assessment of predictive significance for each respective endogenous variable (Naal et al., 2023). To determine the cross-validated redundancy Q2 values for all of the dependent variables, a comprehensive assessment was carried out by using an omission distance that is ten.

The results of the investigation provide a compelling justification for the predictive nature of the PLS structural model before deployment. The Q2 value was 0.485 for the endogenous variable "pleasure" which indicated a large effect size strength. This means that the model predicts and captures changes in the "pleasure" variable well enough to make a significant contribution toward understanding this concept within its framework (Biygautane, 2023). Secondly, the Q2 value computed for the variable "brain drain" was 0.399 which shows a sizable effect magnitude This emphasizes the model's superior capability to predict and provide justification for changes in brain drain within. The high Q2 values indicate that the developed model can understand the complexities of "pleasure" and "brain drain," which implies its accuracy in correctly predicting as well as facilitating learning about Yemeni colleges (Aljuaid, 2022).

We observe that all the Q2 values obtained were positive and this means that the PLS structural model used has predictive significance. A positive value of Q2 is consistently greater than zero implying that the predictions provided by a model are often better than random guessing (Maung, 2019). This supports the validity of the model in describing and explaining changes observed in the variables being considered. The good performance of the model attests to its trustworthiness and utility as a predictor that accurately captures dynamics observed in the events being studied. The positive Q2 values indicate the model's ability to exceed random chance in terms of prediction accuracy, setting a solid foundation for its practical use and theoretical development (Tsujita, Oda, & Rajan, 2023). This observation increases the trust in the model's predictive ability to verify its value as a useful instrument for understanding internal variables about Yemeni colleges.

To improve the quantitative structure of the PLS structural model, a meticulous validation process is made based on the blindfolding technique and Q2 values calculation (Pocinho, Garcês, and De Jesus, 2022). The conclusion

of predictive validity also confirms the theoretical framework for this conceptual model, along with its practical application in understanding fine details involved with pleasure and brain drain within the Yemeni Institutions [29]. The 'blindfolding' method, combined with the Stone-Geisser Q2 value serves as a measure of rigorous validation that provides confidence in model predictive power and its role in knowledge building.

As shown in Table 5, key metrics evaluating the structural model's performance for two endogenous variables: Job Satisfaction (JS)& Brain Drain (BD) R^2 for JS equals 0.506, which means that about fifty-point-six percent of the variance in job satisfaction can be explained by the predictors; whereas, the R^2 for BD is 0.755, i.e., 75.5% of the variance in brain drain. The revealed Q^2 values, 0.485 for JS and 0.399 for BD, characterize the model with high predictive relevance due to really big values of effect sizes. The above facts prove that the proposed model effectively depicts the changes in job satisfaction and brain drain and thus the application and importance of the model provide sufficient proof to validate this.

Table 5: Results of R^2 and Q^2

Endogenous Latent Variable	R^2	Adjusted R^2	Q^2 (=1-SSE/SSO)	Effect Size
JS	0.506	0.750	0.485	Large
BD	0.755	0.497	0.399	Large

Small: 0.0 < Q2 effect size < 0.15; Medium: 0.15 < Q2 effect size < 0.35; Large: Q2 effect size > 0.35

5.7 Assessing F2 Values

When analyzing the research model, a significant aspect is to evaluate whether there are effects of F^2 size for it to be determined how much variation occurs on R-value when one particular endogenous variable has been eliminated from the equation. The F^2 size effect is a statistical indicator of the impact that a specific predictor latent variable has on an endogenous variable (Albanese, 2022). This study becomes vital to understanding the complex connections between internal variables and current external conditions.

The F^2 size effect is an essential metric that aids in the characterization of how specific external factors could influence the variance explained by internal elements. In this model, the F^2 size effect is moderate to large for exogenous variables (World Health Organization, 2020). This array of effects provides beneficial detail, shining a light on the diverse characterization within relationships between internal and external triggers. A low F^2 effect size implies limited impact which means that particular external variables only moderately influence the variability explained in internal parts (El-Sherif, 2022).

On the other hand, a medium F^2 effect signifies greater impact where some external influences play significant roles in affecting variances of internal features. This advanced understanding of the F^2 size effect spectrum can help researchers discriminate between different levels in which each external variable affects internal constructs (Albanese, 2022). This helps to determine key factors in the model, which informs strategic decision-making to enhance its effectiveness. Presuming that researchers focus on determining the influence reflected by F^2 size effects, interventions and changes made in Yemeni universities are prioritized (World Health Organization, 2020). This enables them to conform to the unique character of the interplay between endogenous and exogenous factors.

The F^2 size effect is a significant measure that reveals in detail the manner through which particular exogenous variables impact endogenous constructs within the research model. The positive sign and small F^2 size effect suggest a limited influence of the endogenous variable, which means that the specific exogenous factor does not have major impacts on determining inertia for its low value at about 1 (El-Sherif, 2022). A medium F^2 size effect implies that the endogenous components were significantly influenced by a particular exogenous variable. This all-encompassing understanding is integral to appreciating the different roles that each external factor plays in developing the overall accuracy of a predictive model (Albanese, 2022).

The different levels of F^2sizes yield a range of impact that allows researchers to compare each component's relative importance as represented in Table 6. The high level of accuracy in the analysis makes possible a selective approach to improving the model, letting researchers decide which changes should be preferred

depending upon how far influence is manifested by various external variables (Meesters, van Schilt, & Aciru, 2019). It is also possible for researchers to improve the model by considering various levels of the F^2 size effect and focusing on influential components (World Health Organization, 2020). Recognizing the role of certain external elements contributes greatly to an enhancement in accuracy and performance when refining models, which provides a better reflection on the complicated interactions within the research context embedded by Yemeni universities.

Table 6: Result of F^2

	f-square	Effect Size
C&S -> BD	0.006	Small
C&S -> JS	0.988	Large
FR -> BD	0.002	Small
FR -> JS	0.005	Small
JS -> BD	1.371	Large
PS -> BD	0.03	Small
PS -> JS	0.04	Small
SC -> BD	0.006	Small
SC -> JS	0.005	Small
SS -> BD	0.013	Small
SS -> JS	0.001	Large

Small: $0.0 < f^2$ effect size < 0.15; Medium: $0.15 < f^2$ effect size < 0.35; Large: f^2 effect size > 0.3

Table 6 shows the estimation of f^2 values, which measure the impact of various predictors on the endogenous variables – brain drain (BD) and job satisfaction (JS).). The coefficient amounts are compared and classified as small, medium, or large depending on particular benchmark criteria. For instance, there is a high value of the effect size, 0.988 for Comfort & Security (C&S) and JS where Comfort & Security had a large impact on job satisfaction. Compared with BD, the effect of C&S on JS (f^2 = 0.006) and other predictors, such as FR, on JS and BD is also small. It is worth mentioning that job satisfaction has the greatest impact on the brain drain variable (f^2 = 1.371) which supports the notion that it is the most important variable in this model.

The researchers could reliably estimate how much change in exogenous variables deviated the model from explaining phenomena by measuring F^2 size effects, thereby helping get a detailed understanding of their impact. This quantitative data is important for better provision and optimization of the model that enables a more precise description of complicated interactions within the scope under investigation. The F^2 size effect is an important criterion for understanding the contribution of different exogenous variables (Rauch, 2019). It aids researchers in focusing and sharpening these elements to enhance the predictive power of the model. Thus, researchers can improve the validity and importance of the model by identifying how much influence each variable exerted on endogenous constructs. This allows them to decide which aspects they should emphasize or change because it empowers them. The F^2 size effect is also important to the ongoing evolution of the research model, allowing researchers to make tiny adjustments that reflect dynamic dialectic interaction between external and internal variables in Yemeni organizations (Meesters, van Schilt, & Aciru, 2019).

The F^2 size effect analysis improves the study model by defining the real value and meaning of linkages between exogenous factors, revealing their nature. This statement not only improves the theoretical basis of the model but also provides useful recommendations for stakeholders who wish to harness or minimize certain aspects (Halim, 2021). By incorporating the F^2 size effect as an impact, the improved understanding of research outcomes adds to reliability and timeliness in model creation for Yemeni universities.

5.8 Mediation Analysis

First, mediation analysis is a statistical technique that allows investigation of the effects of one variable on another indirectly through a third. This method exceeds simple correlations by attempting to estimate how much a variable influences the propagation of changes from causes and available effects (Raheb, 2023). One of the main strengths of mediation analysis is rooted in causality, which makes it possible to conduct fundamental mechanism investigations into interaction processes.

The process involves the analysis of a hypothetical causal chain, in which one variable (X) affects another factor Naturally, when studying the indirect effect that an independent variable has on a dependent variable through its mediating outcome, they often carry out successions of regression studies (Alaghbari & Beshr, 2019).

The systematic and implemented procedures of the PLS-SEM model begin with the Mediation Analysis. In the first stage, we determine the direct relationship that came in between the causal variable and an effect variable. While this assessment must be statistically significant nearly all statistics experts interpreted a p-value less than 0.5 as an indication for direct effect. In addition, the Basecamp can be done without taking into account the existing variable standing in between itself and the target; that's because it is the only section that stays unchanged (Raheb, 2023).

When the direct relationship is proven as statistically significant in Stage 1, mediating variable needs to be added to a PLS path model. The function of the APD - CM proof gives the direct association between the p12 * p23 indirect pathway is seen. After the issue has undergone the bootstrapping technique, the indirect path is tested (Alaghbari & Beshr, 2019). If it is found that the indirect effect plays an important role, this implies support of a mediated model. Job satisfaction serves as an essential link that connects different variables to brain drain intentions according to this study's mediation results. Table 7 presents a summary of the study results which detail both indirect effects with their corresponding statistical significance levels alongside the full mediation model postulates.

Table 7: Mediation Analysis: Customer Satisfaction as Mediator

Specific Indirect Effect	T-Statistic	P-Value	Total Indirect Effect	T-Statistic	P-Value	Mediation Hypothesis
C&S → JS → BD	12.93	0.00	C&S → JS → BD	12.93	0.00	Supported
Compensation → JS → BD	1.963	0.04	Compensation → JS → BD	3.24	0.00	Supported
Supervision → JS → BD	2.36	0.00	Supervision → JS → BD	2.88	0.00	Supported

The last phase in the mediation analysis is bootstrapping to analyze indirect paths. Bootstrapping is one of the resampling methods where they repeatedly sample from the dataset with replacement for purposes of estimating a statistic's distribution (King, 2023). In mediation analysis, this method is quite useful as it allows the estimation of confidence intervals and assessing the importance of indirect effects.

Secondly, the two mediation models offered seek to shed light on precise indirect effects of Comfort & Security (C&S) and Compensation via the JS process about BD. The results are summarized in the table below (Aguiar-Quintana et al., 2021). The T-statistic for the indirect effect of C&S on BD through JS is 12.93 with a p value equal to zero. This corresponds to a statistically significant mediating effect. Secondly, there is an indication of a meaningful mediation effect because Compensation has an indirect impact on BD through JS p-value = 0.4; T statistic acceptable moderating mediatz2s. In addition, the finding is strengthened by a significant specific indirect effect of Supervision on BD through JS with t value c' = 2.36 and p (c) < .01 (Darvishmotevali & Ali, 2020).

These overall indirect effects, which capture the joint contribution of mediation in individual pathways, accentuate mediating paths. The indicated T-statistics and p-values lend statistical support to the idea that Job Satisfaction mediates the relationships between Comfort & Security, Compensation, and Supervision with Brain Drain (Al-Halili & Hongxin, 2019).

The results shown in Table 5 stand as strong support that Comfort & Security, Compensation, and Supervision are HR management practices studied with a high impact on Brain Drain. Table 5 presents the results of mediation analyses, focusing on Customer Satisfaction (CS) as a mediator of the relation between different independent variables and Brain Drain (BD) through Job Satisfaction (JS). This shows that a mediator analysis and direct comparison between C&S- BD and JS mediated was configured with a T-statistic of 12.93; and p- value of 0.00 < 0.05 hence agrees that Comfort & Security (C&S) has a significant and quite strong indirect impact on BD through JS as postulated. Likewise, for the relationship between Compensation and BD through JS, it was found that the T-statistic was 1.963 and the p-value was 0.04, meaning a potential mediation effect. Lastly, the Influence of Supervision on BD through JS is also positive signified by a T-statistic 2.36 and a p-value of 0.00. In general, these findings affirm Hypotheses one, two, and three that establish job satisfaction as a mediator between the above-noted independent variables and brain drain. This effect is moderated by Job Satisfaction. This helps us see that HRM procedures influence the intentions of academic personnel to engage in Brain Drain

inside universities using complex mechanisms (Arayssi, Fakih, & Haimoun, 2023) Bootstrapping results from mediation analysis have shown considerable evidence that Job Satisfaction plays a critical mediating role between Compensation, Supervision, and Brain Drain intentions. The indirect implications in the relations between these variables reveal how complicated interactions are involved within the HRM framework shedding light on subtle dynamics that direct academic staff' intentions to leave Brain Drain (Jinah et al., 2024).

6. Conclusion

In conclusion, this research focuses on the important issue of brain drain that has been faced by universities in Yemen, especially concerning their faculty members. This research study seeks to address one of the important gaps in the current literature concerning HR management practices related to/ applicable to Yemen by presenting a comprehensive analysis and work satisfaction as a mediation variable. This research has contributed useful information about the determinants of inclinations to emigrate and their implications for personnel management in Yemeni colleges.

The study further points out how HR management practices, in particular compensation and supervision functions are of great importance in the resulting factors that motivate brain drain. The outcomes highlight, indeed, the importance of dealing with these human resources policies because addressing them will help to reduce risks associated with losing highly qualified academic specialists. In addition, the findings validate that job satisfaction determines how these human resources practices affect attitudes on brain drain. In particular, the extent of employee satisfaction and their evaluation of compensation package value are crucial factors that determine employees' migration assessments.

This study shows that the mediation studies used in this work reveal job satisfaction as a powerful mediator between compensation, supervision, and intentions of brain drain. The outcomes of these analyses confirm the idea that only satisfied individuals are less predisposed to consider emigration, making job satisfaction another methodology that would be efficient in battling with brain drain issue among Yemeni institutions.

The findings of the study have practical relevance to both practitioners in HRM's and university administrators indicating that such interdependence should be assessed at any stage of a professional's career. The adoption of strategic steps aimed at improvement such as increases in remuneration, oversight, and general job satisfaction to retain highly skilled academic personnel can serve a critical role in reducing the brain drain menace. This research contributes significantly to the already available body of knowledge by conducting an in-depth study on challenges faced by academic workers in Yemen. It focuses on the factors and links that stand behind the country, sometimes referred to as brain drain. The value of the study is that it allows the identification of specific aspects that are related to brain drain in Yemeni academic settings. This addresses the lack of understanding of how this is happening in a country whose economic structure stands out.

The results of the study are beneficial and practical to HR management in university settings in Yemen. The findings show that the impact of reward, oversight, and general job satisfaction is interdependent in determining academic experts' inclination to be involved in brain drain. Thus, the research implies that to improve the remuneration package it is necessary not only to pay attention to improving the supervision process but also vice versa. The final purpose is to increase job satisfaction for highly qualified professionals in the field of science.

According to the report, HRM practitioners at Yemeni universities are advised to carry out detailed research on salary structures and supervision systems. Institutions can promote job satisfaction, as well as hashes to retain talented scholars by addressing some of the unique challenges that come with these features. However, the research highlights that HR management should be considered from a holistic perspective considering the multidimensionality of components involved in brain drain. Additionally, given the particular socio-economic challenges peculiar to Yemen discussed in this study, structural changes are proposed as targeted measures that can be aimed at increasing overall job satisfaction. By recognizing the impact of broader contextual variables like economic instability and political unrest on job satisfaction, this study argues that strategic actions need to move beyond just salary adjustments and provide supervision alone in addressing such factors as their root causes. This might involve implementing ergonomic work environments and laws that promote the universal well-being and contentment of academic labor.

Despite some valuable insights into the workings of brain drain in Yemeni universities, this study raises several limitations that may affect its findings' applicability. The study centers on a convenience sample of the Yemeni context. Hence, care should be taken in generalizing the results. The unique socio-economic and geopolitical identity of Yemen may include contextual factors that limit the generalizability of the study's findings to other

places or countries. In future studies, other determinants of brain drain need to be investigated using even more representative samples for the generalizability of findings.

Despite these limitations, the study does contribute considerably to our understanding of HRM dynamics in Yemeni universities. This study creates a solid base to design targeted solutions by explaining the interdependence among compensation schemes, supervision techniques, job satisfaction, and causes of brain drain. HRM professionals can also use these findings in devising and implementing projects that create a favorable environment, leading to the retention of quality academicians. The report puts particular focus on the importance of the education sector as a springboard for broader socio-economic change and also highlights the potential to organize sustainable development in Yemen by implementing targeted reforms into the country's academic system.

Finally, even though the conclusions of this study may not be universally applicable everything else is established with a foundation for further research and intervention in dealing with brain drain issues. Further research should aim at ensuring inclusive multidimensionality and investigate the other moderating variables to provide a better understanding of brain drain dynamics in different frameworks. The implications of the study are more than just limited to Yemen as its geographical boundaries. It gives important insights into the topic of this study for HRM professionals and politicians who want to keep competent people in universities and promote sustainable development.

Ethics and AI Statement: Strict ethical rules regulated research procedures to gain valid consent from participants while preserving their privacy together with confidentiality rights from beginning to end of the study. All collected personal information underwent anonymization processes before researchers implemented proper security measures. All research procedures respected institutional ethical protocol. Research team members conducted a complete examination of algorithmic analysis results while maintaining constant oversight to ensure both accuracy and integrity. Human researchers proved critical to check AI computational results and reduce potential biases and maintain creation transparency along with fairness as well as accountability running through the entire research design.

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Appendix

Demographic Questions

1. **What is your gender?**
    i. Male
    ii. Female
    iii. Other
    iv. Prefer not to say
2. **What is your age group?**
    i. 20–35 years

ii. 36–50 years

iii. 51–65 years

iv. 65 years and above

3. **What is your highest level of education?**

i. Master's/PhD

ii. Other (please specify)

4. **How many years of work experience do you have in academia?**

i. 0-5 years

ii. 6-10 years

iii. 11-20 years

iv. 21-30 years

Section 1: Compensation

5. **How satisfied are you with your current salary?**

(1 = Very dissatisfied, 5 = Very satisfied)

i. 1

ii. 2

iii. 3

iv. 4

v. 5

6. **Do you believe that your compensation is fair compared to similar positions in other universities?**

i. Yes

ii. No

iii. Unsure

7. **How often do you receive salary increases or bonuses?**

i. Annually

ii. Biannually

iii. Rarely

iv. Never

Section 2: Job Satisfaction

8. **How satisfied are you with your overall job?**

(1 = Very dissatisfied, 5 = Very satisfied)

i. 1

ii. 2

iii. 3

iv. 4

v. 5

9. **To what extent do you feel your job meets your expectations?**

(1 = Not at all, 5 = Very much)

i. 1
ii. 2
iii. 3
iv. 4
v. 5

10. **How likely are you to recommend your university as a good place to work?**

(1 = Not at all likely, 5 = Very likely)

i. 1
ii. 2
iii. 3
iv. 4
v. 5

Section 3: Supervision

11. **How would you rate the quality of supervision you receive in your role?**

(1 = Very poor, 5 = Excellent)

i. 1
ii. 2
iii. 3
iv. 4
v. 5

12. **Do you feel supported by your supervisor in your professional development?**

i. Yes
ii. No
iii. Somewhat

13. **How frequently do you have performance reviews with your supervisor?**

i. Monthly
ii. Quarterly
iii. Annually
iv. Rarely
v. Never

Section 4: Job Security

14. **How secure do you feel in your current position?**
(1 = Not secure at all, 5 = Very secure)

i. 1
ii. 2
iii. 3
iv. 4
v. 5

15. **Have you considered leaving your current position in the last year?**
    - Yes
    - No
    - Maybe

Section 5: Brain Drain Intentions

16. **How likely are you to consider employment opportunities abroad?** (1 = Not at all likely, 5 = Very likely)
    i. 1
    ii. 2
    iii. 3
    iv. 4
    v. 5
17. **What factors would most influence your decision to leave your current position?** (Select all that apply)
    i. Better compensation
    ii. Better job security
    iii. Professional development opportunities
    iv. Quality of life
    v. Other (please specify)

Section 6: General Feedback

18. **In your opinion, what are the top three factors that could improve job satisfaction for academic staff at your university?**

[Open-ended response]

19. **What specific changes would you suggest to reduce the brain drain issue within Yemeni universities?**

[Open-ended response]

20. **Any additional comments or suggestions?**

[Open-ended response]

Navigating Knowledge Boundaries: The Role of Academic Self-Conception in Open Innovation Practices

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Abstract: This study investigates the role of academic self-conception in knowledge-hiding behaviours and their impact on open innovation within academic contexts. Drawing on Social Exchange Theory, we examine how individuals' perceptions of their academic abilities influence their tendencies to engage in various forms of knowledge hiding, including evasive hiding, rationalised hiding, and playing dumb. This research was a quantitative study conducted among 262 Indonesian academicians. The data was collected through an online survey and tested using SEM-PLS. Our findings reveal that academic self-conception positively influences all three types of knowledge-hiding behaviours. Interestingly, while evasive hiding does not significantly impact open innovation, rationalised hiding negatively affects open innovation outcomes, whereas playing dumb positively influences open innovation. These results underscore the importance of understanding individual-level factors, such as academic self-conception, in shaping knowledge-hiding behaviours and their implications for innovation processes within academic settings.

Keywords:Self-conception, Knowledge hiding, Open innovation, Academic innovation

1. Introduction

Open innovation has gained significant attention in scholarly research and practical business applications over the past few decades. Evidence from innovation literature indicates that firms that use open innovation practices tend to perform better in innovation activities because they can use external insights and technologies that complement their internal capabilities (Milana & Ulrich, 2022). The growing use of open innovation approaches by leading companies such as IBM and Procter & Gamble confirms its importance in enhancing economic welfare and competition (Chesbrough, 2017). Additionally, McGahan et al. (2021) reported that open innovation is essential not only for economic purposes but also for addressing societal issues. Open innovation is founded on the premise that the linear innovation model can only partially explain innovation activities in the present competitive environment where enterprises must operate (Bigliardi et al., 2020).

Chesbrough (2003) introduced open innovation as a new paradigm concerning how firms should innovate. He described open innovation as the intentional use of knowledge in businesses' input and output to accelerate internal innovation and broaden the market for external use of innovation. Traditionally, firms relied on internal R&D activities to develop new products and technologies, following a linear innovation model. Chesbrough argued that more than this closed approach to innovation is needed in today's dynamic and competitive environment. It includes the co-creation of knowledge and inventions, as well as knowledge transfer, through interactions with many sorts of stakeholders (Aouinaït, 2021). The linear innovation model, which assumes that all innovation activities occur within the firm's boundaries, is increasingly being challenged. As a result, open innovation has become necessary as a source of competitive advantage for an organisation (Schneckenberg, 2015).

Organizations nowadays must engage with external stakeholders by iteratively exchanging information, technology, and resources across boundaries (Galati & Bigliardi, 2017). Open innovation acknowledges that valuable knowledge and expertise exist outside the firm and that collaborating with external partners can lead to mutually beneficial outcomes (Almeida, 2021). Hence, the concept of open innovation has changed the dynamics of businesses, helping companies increase their innovative potential through the utilization of external

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knowledge and resources in their processes. Firms have indeed greatly benefitted from the move from 'closed' models of innovation to an open framework, enabling them to utilize different types of innovations, such as joint efforts with universities (Inauen & Schenker-Wicki, 2012). This recognition has led to a shift in mindset among organisations, prompting them to adopt more open and collaborative approaches to innovation. Nonetheless, many areas require additional research based on the increased attention and interest in the notion among scholars and practitioners.

Most of the research on open innovation is conducted at the industry level. The open concept of innovation has centred on the firm's context and has adopted the firm's perspective on how innovation is shaped and developed (Howells, Ramlogan & Cheng, 2012). However, according to Gassmann, Enkel & Chesbrough (2010), gaps exist, one of which is the role of universities in what may be referred to as the new open innovation landscape. This has led to a concern in understanding the role of universities in the evolving landscape of open innovation. While firms have been the primary focus of open innovation research, universities play a crucial and often overlooked role in driving innovation (Huggins, Prokop & Thompson 2020; Ramirez-Montoya, 2020).

Universities can be an important linkage in the innovation systems, bridging the gap between research and use (Huggins, Prokop & Thompson 2020; Costa, Neves & Reis 2021). In the context of universities, open Innovation can foster closer cooperation with industry partners and thus provide an environment where academic research can be published and its findings put into practice (Fitriasari et al., 2024; Oliveira et al., 2020). Traditionally, universities have been viewed as knowledge producers through research and education. However, in recent years, universities have been recognised as key contributors to the open innovation ecosystem (Padilla-Meléndez & Garrido-Moreno, 2012).

Universities are the major pillars of the knowledge creation and dissemination cycle. It promotes mutually exchanging ideas and resources since businesses, governments, and other research institutions can collaborate (Mochnacs et al., 2024). On top of that, education institutions are now seen as important actors in regional innovation ecosystems where they no longer focus on teaching but also involve themselves in society's economic and social development (Ye, Zeng & Cao, 2020). Other players in the open innovation ecosystem may see changes in their separate roles due to universities' evolving roles within the context of open innovation (Striukova & Rayna, 2015). However, universities must reconsider how they engage with business and society, emphasizing information transfer and entrepreneurial academics in light of the open innovation paradigm (Alexander, Miller & Fielding, 2015).

Studies examining interactions between the academic world and external stakeholders outside the linear commercialization funnel are few and far between (Jonsson et al., 2015). Previous research has mainly focused on individuals' relevance for open innovation practices, with little emphasis on the underlying mechanisms determining individuals' aspects and actions that influence open innovation practices (Bogers et al., 2017; Lowik, Kraaijenbrink & Groen, 2017). Although these studies provide valuable insights, there is a lack of focus on investigating the difficulties related to persons and how their attitudes can influence the outcome of collaboration conducted through Open Innovation (Ismail et al., 2023). There is a need to investigate open innovation at the individual level because open innovation does not just happen; individuals execute it. Thus, this study seeks to address the aforementioned gaps.

As individuals working at universities, researchers are the main actors in university open innovation. The university's contribution to a knowledge economy is more complicated than simply producing inventions for commercialisation (Jonsson et al., 2015). Because research settings in business and academia differ in terms of long-term orientation, goals, and reward systems, unique characteristics of university research must be considered in an open innovation context (Grosse Kathoefer & Leker, 2012). The university was entirely of knowledgeable individuals. This condition allows them to have a high academic self-concept. Self-concept refers to an individual's beliefs about their characteristics, especially in an educational setting (Campbell et al., 1996). Academics with a high academic self-concept are confident in their abilities, and even if they find a weakness, they tend to downplay its significance (Ommundsen, Haugen & Lund, 2005). Individuals who believe they can carry out activities only through their ability are less likely to collaborate. Knowledge hiding will result from this action. Knowledge hiding describes someone deliberately concealing knowledge from another person, even after explicitly requesting it (Connelly et al., 2012). Hence, based on that explanation, a highly self-conception individual will harm open innovation by hiding knowledge.

A number of studies contend that knowledge hiding can negatively influence the dynamics of an organization and its capabilities to innovate. For example, organizations with a high degree of knowledge hiding may have difficulties in innovating products, as the lack of creativity and collaboration (Butt & Ahmad, 2019; Issac & Baral,

2018). Additionally, knowledge hiding can spread distrust across the entire organization, affecting their general culture and motivation and leading to the organization losing its competitive advantage (Alaydi et al., 2021). This is particularly relevant in open innovation contexts, where collaboration and the free flow of information are paramount for success (Hopkins et al., 2011; Malbašić & Aleksić, 2019).

Social Exchange Theory (SET) provides a valuable lens through which we can understand how academic self-conception influences various forms of knowledge hiding—evasive, rationalised, and playing dumb— on open innovation within academic contexts. According to SET, individuals engage in social exchanges based on their actions' perceived costs and benefits (Stafford, 2017). In the context of academic self-conception, individuals may perceive themselves as having a certain status or reputation within their academic community. This self-conception can influence their motivations and behaviours in social interactions. Individuals with a high academic self-conception may perceive themselves as having valuable knowledge or expertise to protect and maintain. They may view knowledge hiding as a strategy to maintain their perceived superiority or competitive advantage over others. Thus, their high academic self-conception motivates them to engage in knowledge-hiding behaviours. In the context of open innovation, organisations seek to commercialise their internal and external knowledge or technology (Chesbrough & Bogers, 2014). Knowledge hiding within an organisation can hinder the dissemination of valuable knowledge assets needed for innovation projects (Bogilović, Černe Škerlavaj & 2017). When individuals withhold information or expertise, it can impede the development and commercialisation of innovative products or services, negatively impacting outbound open innovation efforts.

Although open innovation at the organisational and inter-organizational levels has been well studied, little is known about how individual behaviours—particularly knowledge hiding motivated by academic self-concept—affect the process of innovation as a whole. Based on the above explanation, academic self-conception's influence on knowledge-hiding behaviour is considered significant in open innovation. Addressing this challenge of knowledge hiding would enable organizations to improve their creativity and innovation through enhanced cooperation. For this reason, there is a gap in the literature seeking empirical evidence about how self-concepts are associated with knowledge-hiding behaviours and open innovation performance. Filling this gap is critical because clues for improving knowledge culture in an academic environment and organizations are useful for increasing innovation efficiency (Arain et al., 2020).

This study aims to thoroughly understand the mechanisms that promote or restrict knowledge flow in educational settings by exploring the junction of open innovation, social exchange theory, and academic self-concept. The literature on the variable under investigation in this study is reviewed in the first section. Next, we explore the theoretical framework guiding our investigation and combine ideas from academic self-concept and knowledge hiding with Social Exchange Theory. The research design, data collection methods, and analytical strategies used to analyse these phenomena are all covered in the methodology section. The following sections present the results, where self-concept-influenced individual behaviours can support or impede open innovation processes. The ramifications of these findings for theory and practice are discussed in the paper's conclusion, along with methods for improving open innovation in academic contexts by better managing individual-level characteristics.

2. Literature Review

2.1 Open Innovation

During most of the 20th century, technical inventions were attributed to a company research and development (R&D) laboratory that was part of a vertically integrated commercialization infrastructure (West & Bogers, 2014). Traditionally, companies kept innovation in-house. Open innovation flips this idea on its head by strategically bringing in knowledge from outside and sharing some of their innovations to speed up internal development and open up new markets for their creations. Open innovation emerged through observing significant innovative organisations' deviations from standard innovation methods (Bigliardi et al., 2020). "Open innovation uses purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation (Chesbrough, 2003)." While initial studies on open innovation focused on its practical applications, researchers now emphasise the importance of a broader theoretical understanding. This refined definition of open innovation highlights it as a collaborative process where knowledge is intentionally shared across different organisations and industries that can be either financially motivated or driven by non-monetary benefits, aligning with the overall business strategy (Bogers et al., 2017). Several scholars have examined how companies with commercially complementary assets could leverage those advantages to benefit from external sources of innovation.

While much research has explored open innovation at the company-wide and strategic level, it's equally important to understand how individuals within organisations contribute to this process. Traditional organizational culture and structure produce internal challenges that impede intra-organizational collaboration, while firms' lack of technological capabilities and knowledge integration generates external challenges that generate collaborative complexity (Shahzad et al., 2024). In other words, open innovation is not just about company policies but also about the mindset and behaviours of the individuals who make it happen in different settings (Locatelli et al., 2021; Scuotto et al., 2020). Open innovation at universities is one area that still needs further exploration.

Academic institutions serve as a unique pool of external innovations, and studies have analyzed the advantages of university technology that companies can exploit, either collectively or at the individual business level (West & Bogers, 2014). Nevertheless, there needs to be more focus on professionalizing the diverse connections between academics and external entities that are not part of the traditional commercialization funnel (Jonsson et al., 2015). Within this framework, scholars have the potential to serve as significant providers of ideas that the industry might utilize to create novel products and technologies under the concepts of open innovation.

2.2 Academic Self Concept

Two essential factors in academic achievement are self-concept and self-efficacy. In this research, we use the term self-conception to capture the phenomenon. Self-concept refers to the collection of perceptions or reference points an individual has about themselves (Marsh & Yeung, 1997). As defined by Wigfield & Krpathian 1991), academic self-concept refers to an individual's overall perception of their abilities in a subject. Self-concept is described as consisting of several dimensions, sections, or features, some of which are more associated with specific personality traits, while others seem to be more connected to academic success (Ghazvini, 2011).

Self-concept encompasses the characteristics, attributes, qualities and deficiencies, capacities and limits, values and relationships that individuals can identify as descriptive of themselves and consider as data about their identity. According to (Schunk, 1991), academic self-efficacy focuses on an individual's belief in their ability to successfully complete specific tasks within that subject. While these terms are sometimes interchangeable, Bong & Skaalvik (2003) highlight a crucial distinction. They argue that self-concept reflects a more general sense of ability in a subject area, often shaped by past achievements and comparisons. Fundamentally, it is considered a descriptive evaluation with a cognitive nuance (Ghazvini, 2011). In contrast, self-efficacy is more specific and future-oriented, focusing on confidence in tackling particular tasks. Interestingly, Bong & Skaalvik (2003) also suggest that a robust academic self-concept, based on past success, might make someone less inclined to collaborate, feeling they can handle things independently and thus increase knowledge hiding.

The phenomenon of knowledge hiding has the potential to impact the outcomes significantly (Mubarak et al., 2021). Consequently, it is crucial to comprehend the underlying causes of this behaviour to prevent it. Knowledge hiding can harm the person seeking the knowledge and the entire organisation, including academic institutions (Hernaus et al., 2019. Even though individuals have the right to decide how and when to share their knowledge, some might see it as a power source and hoard it (Gustina & Sitalaksmi, 2023). Thus, this study suggests that individuals with high academic self-conception, who are confident in their abilities, are less likely to rely on others to boost their performance. In contrast, those with low academic self-conception, struggling with doubt and insecurity, might see collaboration as a way to gain an advantage and become more inclined to share knowledge to gain benefits. For them, collaboration becomes a way to compensate for their perceived shortcomings. Thus, the first hypothesis of this research was:

H1a: Academic self-conception positively influences evasive hiding-hiding behavior.

H1b: Academic self-conception positively influences rationalized-hiding behavior.

H1c: Academic self-conception positively influences playing dumb-hiding behaviour.

2.3 Knowledge Hiding

The academic literature on open innovation suggests that individuals should enhance their openness by assisting others, sharing knowledge, and avoiding knowledge hiding (Ismail et al., 2023). Nevertheless, this seems to be more challenging in practice than in theory. It also highlights the significance of transferring knowledge and enabling its reuse by others. The issue of knowledge hiding gained traction around 2000, with influential studies by Connelly et al. (2012, 2019) and Peng (2012) highlighting its prevalence across organisations. These studies define knowledge hiding as the deliberate withholding of requested knowledge. Research suggests academicians

are likelier to exhibit knowledge-hiding tendencies (Ghani et al., 2020; Zutshi et al., 2021). Understanding these factors behind knowledge hiding is crucial to successfully implementing Knowledge Management (KM) strategies within higher education institutions (Demirkasimoglu, 2015; Fauzi, 2022).

Connelly et al. (2012) were among the first to define KH as the deliberate act of concealing knowledge from someone who has requested it. They identified three ways this can happen: Playing dumb is when someone pretends they don't know something. Evasive hiding involves transferring incorrect information or making false promises to share requested knowledge in the future. Rationalised hiding involves justifying the non-transfer of requested knowledge by claiming confidentiality or not being allowed to share it. Interestingly, (Xiao & Cooke, 2019) argue that knowledge hiding is sometimes harmful. There might be legitimate reasons to withhold knowledge, such as protecting confidentiality or stakeholder interests (Connelly et al., 2019). The decision to hide knowledge can also be influenced by various internal and external factors, making it situational behaviour (Anand, Centobelli & Cerchione, 2020).

Knowledge-hiding behaviours like evasive hiding, rationalised hiding, and playing dumb can significantly hinder academic innovation (Donate et al., 2022; Duan et al., 2022; Gustina, Indartono & Darmawati, 2023). While the successful implementation of open innovation relies on the motivation of individuals, most research in this field primarily concentrates on the organizational level rather than the individual level, so overlooking the significance of people's motivation in open innovation (Ismail et al., 2023). These behaviours create a climate of distrust and suspicion. Academics encountering misinformation through evasive hiding or resistance to sharing (rationalised hiding) become less likely to seek knowledge from colleagues or collaborate on research projects. The fear of being misled or needing help accessing information discourages them from engaging in inbound open innovation. Outbound open innovation also suffers. Academics might hesitate to share their valuable findings externally because they fear exploiting or using their ideas without proper credit (evasive hiding, playing dumb). Additionally, rationalised hiding, where academics downplay the value of sharing knowledge, can make them less likely to see the broader benefits of open collaboration.

Social exchange theory (SET) serves as a lens through which we can comprehend the underlying aspects of knowledge hiding in organizations and its consequences on innovation processes. SET suggests that social actions result from an exchange process to optimise dividends and costs. Employees who partake in knowledge hiding have the ability to disturb the reciprocal relationships necessary for effective innovation. Such actions set in motion a phenomenon that creates an environment of distrust, cynicism, and unwillingness to share knowledge, which only worsens the situation of knowledge hiding, resulting in both outbound and inbound innovation efforts being suppressed (Arain et al., 2020; Guo, Brown & Zhang, 2022).

Outbound innovation relies on external collaborations and is particularly sensitive to knowledge-hiding behaviours. This occurs mainly because when an employee decides to hide a piece of information, they not only reduce their input but also diminish the organizational capability to use any potential external information sources. This lack of openness can result in missed opportunities for learning and adaptation, ultimately leading to stagnation in innovative potential (Guo, Brown & Zhang, 2022; Wang, Feng & Li, 2021). By fostering an environment where knowledge sharing is encouraged and rewarded, organizations can mitigate the negative impacts of knowledge hiding and enhance their innovative capabilities (Babič et al., 2019; Fong et al., 2018).

The knowledge-hiding phenomenon also influences inbound innovation as barriers within the organization make it hard to incorporate useful external knowledge. This unwillingness to share information is often caused by perceived competition from within or lack of trust towards one's colleagues, one of the most important aspects of social exchange theory (Riaz, Xu & Hussain, 2019). More importantly, employees can adopt a self-defeating view in which sharing knowledge is seen as a threat to their own standing in the organization, and this leads to a protective posture that damages an organization’s collective learning and adaptive capabilities (Bogilović et al., 2017). Therefore, analyzing knowledge hiding practices from the perspective of SET is vital for achieving innovative performance, as trust and other reciprocal relations are the basis for the free flow of ideas and information (Weng et al., 2020; Zhao et al., 2019).

Overall, these behaviours stifle the free flow of knowledge, a crucial element for open innovation. A less receptive environment for external ideas (inbound) and a reluctance to share their work (outbound) ultimately hinder progress and innovation within the academic field. Previous studies have found that knowledge hiding is a huge detriment to open innovation processes as it creates barriers that harm both outbound and inbound innovation. Rationalized hiding, playing dumb, and evasive hiding are all three types of knowledge hiding, which sub-serve this effect differently. Rationalized hiding is associated negatively with employee well-being, creating distrust that inhibits creativity and innovation (Khoreva & Wechtler, 2020). Particular types of evasive hiding

include intentionally not sharing knowledge, blocking the exchange of vital information required for working collaboration and limiting innovation capabilities within organizations (Mubarak, Khan & Osmadi, 2022). This behaviour limits the possibility of the emergence of new ideas and fosters an environment for less knowledge sharing, which adds to the difficulties in dealing with innovation in open contexts (Černe et al., 2017). Thus, the last hypothesis of this research was:

H2a: Evasive hiding behaviour negatively influences inbound open innovation orientation.

H2b: Rationalized hiding behaviour negatively influences inbound open innovation orientation.

H2c: Playing dumb hiding behaviour negatively influences inbound open innovation orientation.

H3d: Evasive hiding behaviour negatively influences outbound open innovation orientation.

H2e: Rationalized hiding behaviour negatively influences outbound open innovation orientation.

H2f: Playing dumb hiding behaviour negatively influences outbound open innovation orientation.

The summary of the model proposed in this research can be seen in Figure 1.

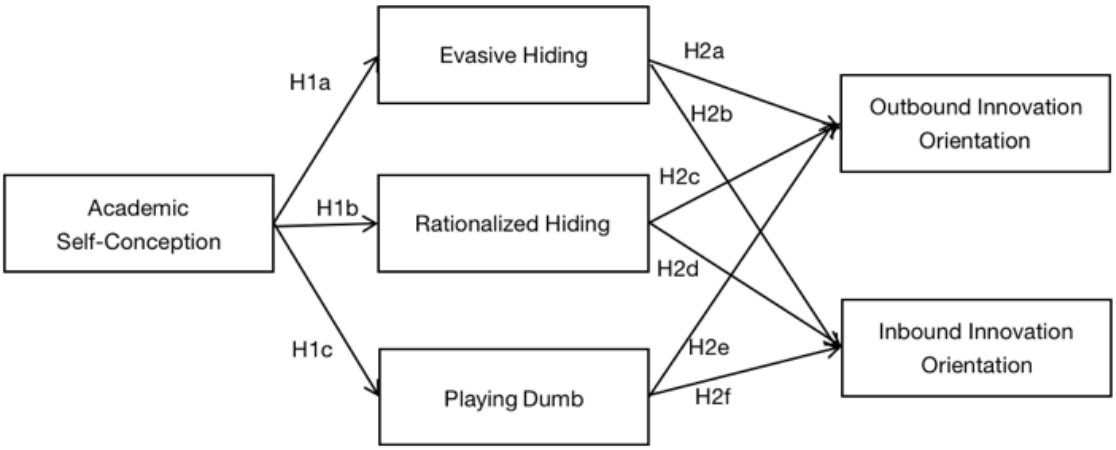

Figure 1: Research Model

3. Method

3.1 Measurement

This study builds on existing research to explore the relationships between variables. To measure these concepts, we used established scales. Open innovation orientation was measured using eight-scale questionnaires by Sun, Liu & Ding (2020), knowledge hiding was measured using 12 items developed by Connelly et al. (2012), and academic self-conception was assessed with 22 items questionnaires by Goñi et al.,2011). All these scales relied on a 7-point Likert scale, where respondents indicated their level of agreement with statements related to each concept. The study participants were academics from Indonesia. The questionnaire was first translated into Indonesian and then translated back to capture the meaning of the items accurately. The collection of data was done using online platforms. After receiving the answers to the questionnaire, the items were coded, and the instrument and hypothesis tests were performed. Following the research model in Figure 1, the study analyses the effect of academic self-conception on knowledge hiding (evasive hiding, rationalized hiding and playing dumb). Knowledge-hiding is then examined in relation to open innovation, which comprises inbound open innovation and outbound innovation. Finally, a statistical technique called partial least squares structural equation modelling (PLS-SEM) was used to analyse the data and test the proposed relationships.

3.2 Reliability and Validity

The internal consistency of these items is computed using Cronbach's alpha coefficient and the validity assessment. Confirmatory factor analysis was performed to fit the model and ensure that the variables under consideration were distinct. The reliability test is adequate when the value of Cronbach's alpha is greater than 0.70, while the validity test is conducted on a loading factor and AVE value greater than 0.50 (Hair et al., 2017;

Hair & Brunsveld, 2019). Table 1 exemplifies the validity of the scale data based on convergent and reliability criteria. The average variance extracted (AVE) value for each construct is reported to be more than 0.5. A subsequent step in the analysis consisted of omitting values of the loading factor, which were less than 0.7, as these were not included in the calculation. The detailed results of the questions item are included in table 1, alongside reliability and validity tests.

4. Result and Discussion

4.1 Respondent Demographic Profile

The sample from this research consisted of 262 respondents. The sample comprised 46.90% male (n=123) and 51.10% female (n=139). According to tenure, 34.73% (n=91) have been working under five years, 29.38% (n=77) have worked for six to ten years, 24.04% (n=63) have been working for 11 to 15 years, and 11.83% (n=31) have been worked more than 16 years.

4.2 Result

This research was carried out by assessing the validity and reliability of the measuring instrument, and afterwards, it proceeded to hypothesis testing. The loading factor and AVE score measure the validity of the test. On the other hand, the HTMT and Cronbach alpha indices are used to measure the reliability of this study. In this validity test, those values of loading factor below 0.7 are not accepted and, therefore, excluded from this study. This study's latent variables have Cronbach's alpha and composite reliability values greater than 0.7. The figures for outer loading and average variance extraction in this investigation met the criteria. The heterotrait monotrait ratio (HTMT) is used to measure discriminant validity. Table 2 shows that all research variables are genuine; no HTMT values surpass 0.9 (Hair et al., 2017). Table 3 shows the R-squared and adjusted R-squared values. The partial least squares (PLS) analysis results demonstrated that seven out of nine hypotheses are supported (see Table 4).

Table 1: Validity and Reliability Test

Variables	Dimension	Item	Code	Factor Loading	Cronbach's alpha	AVE
Knowledge Hiding	Evasive Hiding	In a specific situation, I agreed to help my colleague but never really intended to	KH1	0.810	0.813	0.727
		In a specific situation, I agreed to help my colleague but instead give them information that different from they wanted	KH2	0.872		
		In a specific situation, I told my colleague I would help them later but stalled as much as possible	KH3	0.875		
		In a specific situation, I offered information instead of what they really wanted	KH4	0,626		
	Playing Dumb	In a specific situation, I pretend that I didn't know the information	KH5	0.989	0.892	0.826
		In a specific situation, I said that I did not know, even though I did	KH6	0.989		
		In a specific situation, I pretend I didn't know what my colleague talking about	KH7	0,693		
		In a specific situation, I said that I was not very knowledgeable about the topic	KH8	0.975		
	Rationalized Hiding	In a specific situation, I explained that I would like to tell to my colleague, but was not supposed to	KH9	0.952	0.984	0.970
		In a specific situation, I explained that the information is confidential and only available to the people on the particular project	KH10	0.826		
		In a specific situation, I told my colleague that my boss would not let anyone share this knowledge	KH11	0.944		

Variables	Dimension	Item	Code	Factor Loading	Cronbach's alpha	AVE
		In a specific situation, I said that I would not answer my colleague questions	KH12	0,621		
Academic Open Innovation	Outbound-Innovation	I often sells licenses, such as patents, copyrights, or trademarks, to external partners to better benefit from our innovation efforts	OI1	0.794	0.899	0.765
		I often offers royalty agreements to other firms to better benefit from our innovation efforts	OI2	0.894		
		I strengthens every possible use of our own intellectual properties to better benefit our firm	OI3	0.910		
		I founds spin-offs to better benefit from our innovation efforts	OI4	0.896		
	Inbound-Innovation	External partners are directly involved in all our projects	OI5	0.632	0.798	0.630
		All our innovation projects are highly dependent upon the contribution of external partners	OI6	0.822		
		My university often buys R&D related products from external partners	OI7	0.855		
		My university often buys intellectual property, such as patents, copyrights, or trademarks, belonging from external partners to be used in our innovative projects	OI8	0.845		
Self-Conception	Self-Fulfilment	I am satisfied with what I am achieving in my life	SC1	0,551	0.924	0.541
		So far, I have achieved every important goal I have set myself	SC2	0.832		
		I have yet to achieve anything I consider to be important in my life	SC3	0,601		
		I have always overcome any difficulties I have encountered in my life	SC4	0.835		
		If I could start my life over again, I would not change very much	SC5	0.809		
		I feel proud of how I am managing my life	SC6	0.898		
	Honesty	I am a trustworthy person	SC7	0.807		
		I am a man/woman of my word	SC8	0,569		
		My promises are sacred	SC9	0.810		
		I am a decent, honest person	SC10	0,281		
		I try not to do anything that might hurt others	SC11	0,079		
	Autonomy	I depend on other people more than the majority of those I know	SC12	0.448		
		In order to do anything, I first need other people's approval	SC13	0.817		
		I find it hard to embark on anything without other people's support	SC14	0.022		
		When taking a decision, I depend too much on other people's opinions	SC15	0.852		
		I find it difficult to take decisions on my own	SC16	0.795		
	Emotional Adjustment	If I'm feeling down, I find it hard to snap out of it	SC17	0.780		
		I consider myself to be a very uptight and highly strung person	SC18	0,859		

Variables	Dimension	Item	Code	Factor Loading	Cronbach's alpha	AVE
		I am more sensitive than the majority of people	SC19	0,706		
		I am an emotionally strong person	SC20	0.880		
		I suffer too much when something goes wrong	SC21	0.764		
		I know how to look after myself so as not to suffer	SC22	0,291		

Table 2: HTMT

	Evasive Hiding	Rationalized	Playing Dumb	Outbound	Inbound
Rationalized	0.669				
Playing Dumb	0.776	0.757			
Outbound	0.107	0.269	0.060		
Inbound	0.139	0.190	0.164	0.770	
Self-Conception	0.451	0.299	0.407	0.111	0.112

Table 3: R-Square and R-Square adjusted

	R-square	R-square adjusted
Evasive Hiding	0.163	0.160
Rationalized Hiding	0.095	0.092
Playing Dumb	0.152	0.149
Inbound	0.134	0.124
Outbound	0.123	0.112

Table 4: Hypothesis Testing Result

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
SC -> Evasive	0.404	0.412	0.063	6.437	0.000
SC -> Playing Dumb	0.390	0.395	0.067	5.790	0.000
SC -> Rationalized	0.308	0.315	0.062	4.978	0.000
Evasive -> Inbound	-0.007	-0.012	0.074	0.096	0.924
Evasive -> Outbound	0.018	0.014	0.073	0.254	0.800
Rationalized -> Inbound	-0.495	-0.503	0.082	6.064	0.000
Rationalized -> Outbound	-0.501	-0.505	0.082	6.141	0.000
Playing Dumb -> Inbound	0.465	0.474	0.094	4.966	0.000
Playing Dumb -> Outbound	0.322	0.328	0.098	3.291	0.001

5. Discussion

This study confirms the social exchange theory (SET). Firstly, based on the statistical result, individuals with a high academic self-conception may engage in evasive hiding to protect their perceived status or reputation within their educational community. According to Zhang et al. 2018), individuals use the SET technique to make decisions based on predicted economic benefits and self-efficacy. Self-efficacy refers to belief in one's ability to manage future problems (Bandura, 2010). According to self-concept motivation theories, individuals desire, seek, and attempt to establish positive reflected assessments, favourable social comparisons, and self-perceptions that attest to competence and morality. In the case of academics, maintaining a high academic self-conception is often associated with being perceived as knowledgeable and competent in their field (Varshney &

Varshney, 2023). Thus, individuals may engage in evasive hiding by avoiding sharing certain information or expertise with others to uphold their perceived superiority or competitive advantage. This behaviour is driven by the desire to protect their status within the academic community, as sharing specific knowledge may diminish their perceived expertise.

Secondly, based on the result, rationalised hiding can also be influenced by academic self-conception within the framework of SET. Schlegel et al. (2011) defined self-concept as a reflection of one's desires that are influenced by feelings of self-worth. Self-conception was found to be related to counterproductive work behaviour (Varshney & Varshney, 2023). Individuals with a high academic self-conception may rationalise their hiding behaviour by justifying it as necessary for their advancement or success. According to SET, an individual transfers resources with another individual because they want to receive something through interaction (Yan et al., 2016). In the case of rationalised hiding, individuals may perceive the benefits of withholding specific knowledge as outweighing the potential costs. For instance, individuals may rationalise hiding by arguing that sharing specific knowledge could undermine their research projects or career prospects. Thus, their positive academic self-conception may lead them to justify hiding particular knowledge as a strategic decision to further their interests within academia.

Finally, academic self-conception can also influence playing dumb as a form of knowledge hiding. Playing dumb involves pretending to lack knowledge or expertise in specific areas to avoid sharing information with others. Individuals with a positive academic self-conception may play dumb to protect their perceived status or reputation within the educational community. By pretending to lack knowledge in certain areas, individuals may avoid situations where others could question or challenge their expertise, thus maintaining their perceived status within academia.

Based on the statistical analysis, four of six from the second hypothesis were supported. Evasive hiding involves individuals avoiding sharing certain information or expertise (Garg et al., 2021). This research was conducted among Indonesian scholars. The cultural attributes of Indonesia provide one of the most probable explanations regarding the insignificance result of evasive hiding on open innovation. Culture in Indonesia is usually described as collectivistic, whereby group sustainability and cooperation are of great importance (Ghasemaghaei & Turel, 2021). Indonesian communication styles can be more indirect. Consequently, people in such settings might be less motivated to use evasive hiding techniques because these techniques may negatively affect their relationship with the group and its collaborative efforts. Second, the nature of the knowledge-hiding behaviours may also explain the absence of a notable effect of evasive hiding on open innovation. Evidence shows that evasive hiding is considered less socially acceptable than other techniques of knowledge hiding, for instance, feigning ignorance (Arain et al., 2024). This phenomenon of preferring less severe ways of hiding knowledge or even not hiding knowledge at all leads to the conclusion that this behaviour is beneficial. The absence of a negative influence on a grey area of innovation that allows for some restricted behavioural evasion supports the notion that there is little to no impact on open innovation.

Based on the result, rationalised hiding negatively influences outbound and inbound innovation orientation. Rationalised hiding among scholars involves justifying their hiding behaviour as necessary for their advancement or success (Gustina & Sitalaksmi, 2023) within academia. Scholars may rationalise hiding in the context of outbound innovation by arguing that sharing specific knowledge could undermine their research projects or career prospects. Similarly, in the context of inbound innovation, scholars may rationalise hiding information from external collaborators to protect their perceived status or competitive advantage. From a SET perspective, rationalised hiding reflects individuals' motivations to maximise their benefits in social exchanges, even if it negatively impacts innovation outcomes by limiting collaboration and knowledge exchange.

Finally, the last hypothesis, which stated that playing dumb negatively influences outbound and inbound open innovation orientation, was not supported but interestingly showed the contrary result, where playing dumb positively influences outbound and inbound open innovation orientation. Playing dumb can be a strategic behaviour adopted by scholars with a self-conception that, in turn, enhances collaboration and promotes innovation. Playing dumb happens when someone pretends not to know about the requested knowledge (Garg et al., 2021). They tend to pretend to play dumb and engage in collaboration to protect their stand. Individuals may encourage sharing information and expertise from external sources by pretending to lack knowledge or expertise in certain areas. Scholars may signal openness to collaboration and knowledge exchange with external stakeholders by pretending to lack knowledge or expertise in certain regions.

By intentionally withholding certain knowledge, individuals may create opportunities for others to explore alternative solutions or ideas, stimulating creativity and innovation. Moreover, playing dumb may also be a

coping mechanism in environments characterized by high interpersonal conflict or competition. Research indicates that when individuals experience conflict, they may resort to knowledge-hiding behaviours, including playing dumb, as a way to manage stress and navigate complex social dynamics (Venz & Nesher Shoshan, 2022). Thus, playing dumb creates room for discussion. By creating space for others to contribute ideas, playing dumb can inadvertently enhance the collective innovation efforts of a team. Playing dumb is often perceived as less deceptive and more socially acceptable, reducing the potential for conflict and fostering a more collaborative atmosphere (Burmeister, Fasbender & Gerpott, 2019). Playing dumb might not be perceived as a complete refusal to share but rather as a way to encourage further discussion or negotiation. This indirectness could leave room for eventual knowledge exchange despite the initial knowledge-hiding behaviour.

From a SET perspective, playing dumb reflects individuals' motivations to maximise the benefits of social exchanges by fostering collaboration and knowledge exchange with external sources. In outbound innovation, playing dumb can encourage scholars to seek external expertise or knowledge outside their academic institution, enhancing their organisation's innovation capabilities. In outbound innovation, playing dumb can foster collaboration with external experts or partners, facilitating the development and commercialisation of innovative products or services. Similarly, in the context of inbound innovation, playing dumb can attract external knowledge or technology by signalling openness to new ideas and expertise.

6. Theoretical Implication

Our study contributes to developing SET by demonstrating its applicability in understanding knowledge-hiding behaviours within academic contexts. We enhance our understanding of the social dynamics of knowledge hiding processes by elucidating how academic self-conception influences knowledge-hiding tendencies. We extend the literature on open innovation by highlighting the significance of individual-level factors, such as academic self-conception, in shaping knowledge-related behaviours and their impact on innovation outcomes. This underscores the importance of considering individual characteristics alongside organisational factors in studies of open innovation processes.

7. Practical Contribution

Our research results explain the crucial aspects of knowledge-hiding behaviour and its impact on the suppressive open innovation culture in academia. First, the negative effects of academic self-perception on knowledge-hiding behaviour suggest that, as a first step, institutions need to promote a stronger sense of community and social identity for their academic staff. Institutions need to establish a culture that fosters shared goals to lessen the desire for self-protective knowledge concealment behaviours. Second, the adverse issues created by rationalized hiding on open innovation clearly indicate that institutions need to understand the rationales around knowledge concealment by some faculty. Training programs focusing on knowledge sharing and the consequences of rationalized hiding can help deter faculty from problematic communication and foster more open relations. Moreover, the non-significant effect of evasive hiding on open innovation implies that this kind of behaviour is not as detrimental as others, but it may lend support to the more entrenched concerns of distrust or alienation.

8. Implications for Future Studies

Our study's results pose numerous possibilities for further inquiries that would help reveal additional findings surrounding knowledge hiding and its impact on open innovation in the academic context. First, examining the indirect and conditional effects of particular psychological factors in the link between knowledge-hiding behaviours and open innovation results is crucial. For instance, the role of psychological disengagement, as highlighted in studies examining playing dumb behaviours, could provide insights into how such behaviours influence innovation performance (Xie et al., 2022). Secondly, further exploration of the contextual factors that influence knowledge-hiding behaviours is warranted. Research indicates that cultural and organizational contexts significantly shape knowledge-sharing and hiding dynamics (Guo, Brown & Zhang, 2022; He et al., 2021). Future studies could examine how different organizational cultures, leadership styles, and team dynamics impact the prevalence and consequences of knowledge-hiding behaviours, particularly in diverse academic settings. Moreover, future research should consider the implications of knowledge-hiding behaviours on team dynamics and creativity. Given that playing dumb has been shown to have a nuanced influence on open innovation, it would be interesting to explore how this behaviour interacts with team interdependence and collaborative processes (Fong et al., 2018). Investigating the conditions under which playing dumb can stimulate creativity and innovation instead of hindering it could provide practical insights for fostering a more innovative academic environment.

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The Impact of Knowledge Complexity, Distrust, Psychological Ownership on Knowledge Hiding Behavior

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Abstract: Knowledge hiding behavior can lead to adverse consequences for both individuals and organizations. However, research on knowledge hiding remains insufficient. The objective of this study is to examine the relationship between knowledge complexity, distrust, psychological ownership, and knowledge hiding behavior among employees in knowledge-intensive sectors such as banking. Data were collected through surveys of bank employees, and hypotheses were tested using Partial Least Squares (PLS). The results indicate that knowledge complexity directly affects knowledge hiding behavior, distrust, and psychological ownership. Additionally, distrust and psychological ownership mediate the relationship between knowledge complexity and knowledge hiding behavior. This study makes significant contributions by revealing that knowledge complexity can increase psychological ownership and distrust, which in turn exacerbate employees' likelihood of hiding knowledge. These findings also provide a basis for managers to reduce knowledge hiding by minimizing distrust, psychological ownership, and knowledge complexity.

Keywords: Knowledge hiding, Banking, Psychological ownership, Distrust, Complexity

1. Introduction

Knowledge is considered one of the most important assets of organizations, particularly in knowledge-intensive sectors such as banking. Therefore, knowledge sharing activities play a crucial role in enhancing competitiveness and fostering organizational growth (Iqbal et al., 2020; Fauzi, 2023). However, knowledge is not always shared widely and effectively among employees; it can often be concealed. Knowledge hiding is a common phenomenon in which employees deliberately withhold information or knowledge instead of sharing it with colleagues (Connelly & Zweig, 2015). This behavior may arise from various reasons, such as personal gain or the desire to maintain status or power in the workplace (Connelly et al., 2012; Connelly & Zweig, 2015; Sulistiawan et al., 2022). In the banking sector, where knowledge plays a critical role, decision-making demands accuracy and speed based on a strong knowledge foundation. Consequently, knowledge hiding can lead to significant losses in both individual and organizational performance and efficiency.

In recent years, numerous studies have examined the antecedents of knowledge sharing behavior (Babic et al., 2019; Abubakar et al., 2019; Kumar, Kang and Kishore, 2020; Inegbedion et al., 2023; Nguyen & Nguyen, 2024). However, knowledge sharing is not entirely the opposite of knowledge hiding (Singh, 2019; Banagou et al., 2021; Skerlavaj et al., 2023; Nguyễn & Nguyễn, 2024). Knowledge hiding is considered a counterproductive behavior as it can harm both individuals and organizations (Venz & Nesher Shoshan, 2022). Research on knowledge hiding has shown that, despite the significant benefits of knowledge sharing for organizations, employees tend to hide knowledge to protect personal interests (Sulistiawan et al., 2022). This behavior hinders organizational development, particularly in the banking sector, where competition is intensifying, and high flexibility in knowledge management is required. Therefore, finding ways to limit knowledge hiding behavior remains a topic of ongoing exploration among researchers. El-Kassar et al. (2022) also noted that although knowledge hiding has garnered research attention, the body of information surrounding this issue is still in its early stages and lacks empirical evidence. Existing literature indicates that knowledge hiding is prevalent in the service sector and poses significant barriers to knowledge exchange (Zhao et al., 2016). However, studies investigating the causes of knowledge hiding remain limited (Sulistiawan et al., 2022).

Recent studies have attempted to explain knowledge hiding behavior through various theoretical frameworks such as social exchange theory, psychological ownership theory. It is essential to integrate these foundational theories to gain deeper insights. This research proposes a combination of social exchange theory, psychological ownership theory, and and the norm of reciprocity to explain the relationship between knowledge complexity,

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distrust, psychological ownership, and employees' knowledge hiding behavior. The banking sector is considered a knowledge-intensive field where knowledge hiding has become more prevalent (Fong et al., 2018; Abubakar et al., 2019; Gürlek, 2020). In this field, acquiring knowledge is highly valuable, as it can offer individuals greater benefits such as higher salaries and promotions. Moreover, in the context of Vietnam, knowledge hiding behavior has not yet been fully explored.

This study offers several important theoretical and practical contributions to the field of knowledge management. First, the research reveals that knowledge complexity not only directly increases the likelihood of knowledge hiding, as found in previous studies (Peng, Wang and Chen, 2019), but also heightens distrust (Yuan et al., 2021) and psychological ownership. In turn, distrust and psychological ownership further increase the likelihood of knowledge hiding. In other words, distrust and psychological ownership partially mediate the relationship between knowledge complexity and knowledge hiding behavior. This finding makes a significant theoretical contribution by explaining employee knowledge hiding behavior within organizations. The results also provide important practical insights for knowledge management in knowledge-intensive organizations. In such organizations, knowledge is often complex, which strengthens psychological ownership over knowledge and consequently increases the likelihood of knowledge hiding. To achieve the research objectives, a survey was conducted among employees in the banking sector, a knowledge-intensive industry with a high level of knowledge complexity, making it suitable for analyzing knowledge hiding behavior. The study employed Smart PLS to analyze the data. The research is structured into the following sections: introduction, theoretical framework, research methodology, research findings and discussion, conclusion, and future research directions.

2. Literature Review

Social exchange theory (Blau, 1964) and the norm of reciprocity (Gouldner, 1960) help explain the exchange of knowledge among employees. An act of knowledge hiding by one employee may be reciprocated by similar behavior from others, which ultimately harms the knowledge hider, as noted by Černe et al. (2014). When an employee hides knowledge, they are less likely to receive knowledge in return from their colleagues, negatively impacting their ability to perform their tasks (Singh, 2019). Knowledge hiding worsens relationships among colleagues in the workplace (Skerlavaj et al., 2023), as it creates a negative spiral based on the reciprocity principle.

Grounded in psychological ownership theory, researchers argue that employees develop a deep sense of ownership over the knowledge they acquire through the investment of time and effort (Pierce, Kostova, and Dirks, 2001; Duan et al., 2022). Consequently, they actively establish protective mechanisms to hide that knowledge (Li et al., 2015; Duan et al., 2022), which hinders non-uniform knowledge-sharing activities and erodes trust among team members (Connelly et al., 2012; Černe et al., 2014; Duan et al., 2022). This study integrates psychological ownership theory, social exchange theory, and the norm of reciprocity to examine the relationship between knowledge complexity, distrust, psychological ownership, and knowledge hiding behavior among employees in knowledge-intensive sectors such as banking.

2.1 Hypotheses Development

2.1.1 Knowledge complexity and distrust

Knowledge is a valuable asset that is comprehensively formed through independent learning and accumulated experience (Yuan et al., 2021). Individuals who possess complex knowledge gain more advantages compared to others. Evans, Hendron and Oldroyd (2014) also assert that knowledge is a key factor that helps individuals maintain their status and influence within an organization, enabling them to increase performance and gain more opportunities for advancement. Employees often invest significant time and financial resources to acquire complex knowledge, which leads them to frequently hide the knowledge they possess. Additionally, Yuan et al. (2021) argue that the complexity of knowledge also makes it easier for employees to engage in knowledge hiding from their colleagues.

Based on social exchange theory, individuals typically engage in knowledge sharing and transfer within organizations according to the principle of maximizing personal benefits. Following the norm of reciprocity, the sharing and exchange of knowledge between colleagues is based on the expectation of receiving an equivalent response. Conversely, one person's knowledge hiding behavior may be reciprocated by knowledge hiding from others, following the norm of reciprocity, which results in inefficient social interaction. As Blau (2017) noted, distrust between individuals is a key factor leading to ineffective social interactions. Ultimately, this increases distrust among individuals, leading to a decline in knowledge exchanges and exacerbating distrust in

relationships (Yuan et al., 2021). When transferring complex knowledge, the giver often expects to receive a response equivalent to the knowledge transferred. However, the fear of losing valuable knowledge without appropriate reciprocation can heighten distrust for the knowledge sharer, thus further intensifying distrust among employees. Therefore, based on this reasoning, the study proposes the following hypothesis:

Hypothesis H1: *Knowledge complexity positively affects distrust.*

2.1.2 Knowledge complexity and psychological ownership

Psychological ownership theory suggests that employees are likely to develop a sense of ownership over the knowledge they have invested time, effort, and financial resources to acquire (Yuan et al., 2021; Alnaimi & Rjoub, 2021; Sulistiawan et al., 2022). This means that the knowledge employees possess is perceived as their own, and they feel they have ownership over it. In the context of the banking sector, a knowledge-intensive industry, employees must invest more resources to acquire and accumulate complex knowledge. Clearly, the more complex the knowledge, the more challenging it is to acquire. Alnaimi & Rjoub (2021) also argue that in the banking sector, individuals often invest money, time, and mental energy to gain knowledge through education, training, and experience. As a result, when knowledge is complex, it increases the feeling that the knowledge they possess is the result of their own learning efforts and personal investment. This outcome enhances the sense of psychological ownership of knowledge for each individual. Therefore, the following hypothesis is proposed:

Hypothesis H2: *Knowledge complexity positively affects psychological ownership.*

2.1.3 Knowledge complexity and knowledge hiding

The complexity of knowledge can influence employees' knowledge hiding behaviors (Connelly et al., 2012; Connelly & Zweig, 2015; Scuotto et al., 2022). According to Sulistiawan et al. (2022), employees invest time and effort to acquire complex knowledge with the aim of advancing their careers and improving job performance, leading them to view such knowledge as a valuable asset. When colleagues request to share this knowledge, access becomes more difficult as the holders of complex knowledge tend to withhold it to protect their personal competitive advantage. As knowledge complexity increases, the bond between the holder and the knowledge deepens, making it less likely to be shared due to concerns about losing control and advantage (Sulistiawan et al., 2022). Peng et al. (2019) emphasized that knowledge complexity is a key factor in determining employees' knowledge hiding behaviors. Connelly and Zweig (2015) indicated that individuals are more inclined to hide knowledge, especially when that knowledge is highly complex. Kumar Jha and Varkkey (2018) confirmed that knowledge hiding strategies differ between simple and complex knowledge. Findings from prior research, such as Yuan et al. (2021) and Sulistiawan et al. (2022), have shown that knowledge complexity positively affects knowledge hiding behavior. Therefore, the following hypothesis is proposed:

Hypothesis H3: *Knowledge complexity positively affects knowledge hiding behavior.*

2.1.4 Distrust and knowledge hiding behavior

Distrust is understood as a subjective lack of confidence in others during interpersonal interactions, based on the belief that others will harm them by exploiting their vulnerabilities (Sulistiawan et al., 2022). Based on social exchange, Sulistiawan et al. (2022) suggest that to maintain a competitive advantage in social relationships with other employees within the organization, individuals may refuse to transfer or share knowledge with their colleagues. When it comes to valuable knowledge, individuals tend to hide it to avoid losing their knowledge advantage (Connelly & Zweig, 2015; Sulistiawan et al., 2022). From the perspective of social exchange, an act of knowledge hiding by a colleague erodes the trust of other colleagues, thereby undermining trust among employees. When distrust arises among employees, the likelihood of engaging in knowledge hiding behavior increases. Recent findings from Skerlavaj, Černe and Batistič (2023) also suggest that when individuals do not trust a colleague, they are more likely to withhold information that the colleague needs. Evidence from prior research indicates that the higher the level of distrust among employees, the greater the likelihood of knowledge hiding. Therefore, this study proposes the following hypothesis:

Hypothesis H4: *Distrust positively affects knowledge hiding behavior.*

2.1.5 Psychological ownership and knowledge hiding behavior

Psychological ownership stems from the theory of psychological ownership. When performing tasks, employees use their knowledge through the process of acquiring or creating it, and thus they have control over that

knowledge (Peng, 2013). In the process of acquiring and generating new knowledge to apply to their work, employees invest significant effort and time. This leads to the potential development of a sense of ownership over the work-related knowledge they hold (Peng, 2013). In knowledge-intensive fields such as banking, employees with a high sense of psychological ownership are more likely to engage in knowledge hiding (Weng & Ma, 2021). To acquire knowledge, employees must bear certain costs, such as money and time, through learning processes. Therefore, sharing knowledge also means transferring ownership of that knowledge to others (Alnaimi & Rjoub, 2021; Weng & Ma, 2021). Hence, individuals with a high sense of psychological ownership of their knowledge—meaning they consider it their own—are more likely to engage in knowledge hiding behavior. Therefore, the next hypothesis is proposed as follows:

Hypothesis H5: *Psychological ownership positively affects knowledge hiding behavior.*

The research model is constructed as shown in Figure 1.

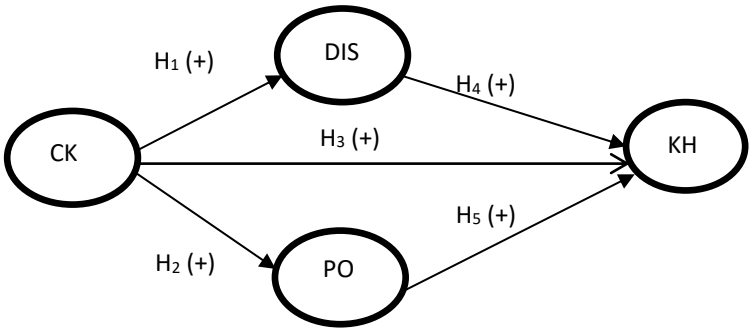

Figure 1: Conceptual model

Note:CK=Complexity of Knowledge; DIS=Distrust; PO=Ppsychological Ownership;KH=Knowledge Hiding

3. Research Methods

3.1 Sample and Data Collection

The data was collected using questionnaires through direct and online surveys of employees working in commercial banks in Vietnam. A qualitative study was conducted to refine the measurement scales. To ensure the validity and reliability of the scales, the items were pre-tested on six bank employees before being finalized into the official questionnaire. This study gathered 273 survey responses. After excluding incomplete surveys, the final sample consisted of 216 valid responses, which were used for the main study. The sample characteristics are detailed in Table 1.

Table 1: Descriptive statistics

Variables	Classifications	Frequency	Percentage
Gender	Male	87	40.3
	Female	129	59.7
Age	Under 27	55	25.5
	27-45	104	48.1
	Over 45	57	26.4
Education	Bachelor	123	56.9
	Masters	93	43.1

3.2 Measures

The constructs in this study were derived from previous research. To ensure the validity and reliability of the measurement items, the study reused items from earlier studies. Specifically, the “Distrust” scale consists of 4 items, the “Psychological Ownership” scale consists of 3 items, the “Complexity of Knowledge” scale consists of

4 items, and the "Knowledge Hiding" behavioral scale consists of 4 items, all adapted from studies by Anaza and Nowlin (2017), Lin (2007), Sulistiawan (2022), Peng (2012), and Nguyen, Malik and Budhwar (2022) (See Appendix). The items were evaluated using a 5-point Likert scale, ranging from 1 being "strongly disagree" to 5 being "strongly agree." The Cronbach's alpha (α) for the scales was as follows: CK scale, 0.884; DIS scale, 0.882; PO scale, 0.856; and KH behavioral scale, 0.850. Therefore, the measurement scales in the proposed research model demonstrate a high level of reliability, with Cronbach's alpha ranging from 0.850 to 0.884 (Table 2).

Table 2: The validity and reliability results

Variables	Source	Code	Outer Loading	CR	AVE	α
Complexity of Knowledge (CK)	Sulistiawan (2022)	CK1	0.886	0.920	0.743	0.884
		CK2	0.869			
		CK3	0.850			
		CK4	0.841			
Distrust (DIS)	Sulistiawan (2022)	DIS1	0.879	0.919	0.739	0.882
		DIS2	0.848			
		DIS3	0.835			
		DIS4	0.875			
Ppsychological Ownership (PO)	Peng (2012)	PO1	0.885	0.899	0.691	0.856
		PO2	0.887			
		PO3	0.872			
Knowledge Hiding (KH)	Nguyen, Malik and Budhwar (2022)	KH1	0.856	0.913	0.777	0.850
		KH2	0.893			
		KH3	0.859			
		KH4	0.704			

Note: Cronbach's alpha (α); Average Variance Extract (AVE); Composite Reliability (CR)

4. Results and Discussion

4.1 Results

This study employed Smart PLS3 to analyze the data. PLS-SEM analysis was conducted in two steps. First, the study assessed the measurement model using indicators such as Cronbach's alpha, composite reliability (CR), outer loadings of the factors, and the average variance extracted (AVE). The analysis results showed that all indicators met the requirements based on the standards of Hair et al. (2014). Specifically, Table 2 indicates that Cronbach's alpha values in this study were all above 0.8 (the lowest being 0.850), exceeding the recommended minimum of 0.7; the composite reliability (CR) of the scales all surpassed 0.8 (the lowest being 0.899), significantly above the recommended threshold of 0.7; the outer loadings of the factors were all above the 0.7 threshold; and the AVE values of the scales far exceeded the minimum threshold of 0.5 (the lowest being 0.691).

The discriminant validity of the model was measured using two specific methods: the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio analysis. The Fornell & Larcker (1981) criterion was employed to assess the discriminant validity between constructs. According to the Fornell-Larcker correlation matrix, discriminant validity is achieved when the AVE of a construct is greater than the square of the correlations between that construct and other constructs. In other words, discriminant validity is met if the diagonal values (the square root of the AVE) are greater than the off-diagonal values in the same row or column. The results in Table 4 show that the square roots of the AVE on the diagonal are all greater than the corresponding off-diagonal values, confirming that the discriminant validity of the constructs meets the Fornell & Larcker (1981) criterion. Table 3 shows that all HTMT ratios are below 0.85, further confirming the model's discriminant validity. The variance inflation factor (VIF) was also assessed to check for multicollinearity issues in the data. All VIF values were below 3, indicating no multicollinearity issues. Therefore, this measurement model is fully qualified for further analysis.

Table 3: HTMT ratio

	KH	DIS	PO	CK
KH				
DIS	0.647			
PO	0.621	0.383		
CK	0.559	0.398	0.430	

Note:CK=Complexity of Knowledge; DIS=Distrust; PO=Ppsychological Ownership;KH=Knowledge Hiding

Table 4: The Fornell–Larcker Criterion

	KH	DIS	PO	CK
KH	0.831			
DIS	0.568	0.860		
PO	0.533	0.334	0.881	
CK	0.490	0.353	0.376	0.862

Note:CK=Complexity of Knowledge; DIS=Distrust; PO=Ppsychological Ownership;KH=Knowledge Hiding; The diagonal values in bold are the square root of AVE.

After successfully assessing the measurement model, the study proceeded to the second step, which involved estimating the structural model through path coefficients and the coefficient of determination. The bootstrapping technique was applied with 5,000 resamples with replacement to test the hypotheses and their validity. The detailed results of the hypothesis testing are presented in Table 5.

Table 5: The results of hypothesis testing

Paths	O	M	P-value	Results
CK -> DIS (H1)	0.353	0.358	0.000	Accepted
CK -> PO (H2)	0.376	0.379	0.000	Accepted
CK -> KH (H3)	0.238	0.238	0.000	Accepted
DIS -> KH (H4)	0.378	0.377	0.000	Accepted
PO -> KH (H5)	0.318	0.318	0.000	Accepted
CK -> DIS->KH	0.133	0.134	0.000	Accepted
CK -> PO->KH	0.119	0.120	0.000	Accepted

Note:CK=Complexity of Knowledge; DIS=Distrust; PO=Ppsychological Ownership;KH=Knowledge Hiding; O=Original sample; M=Sample mean

This study proposed five hypotheses, all of which were accepted (Figure 2). Specifically, Hypothesis H1 proposed a positive relationship between CK and DIS, and the results showed β = 0.353 and p = 0.000, leading to the acceptance of H1. Hypothesis H2 proposed a positive relationship between CK and PO, with the analysis revealing β = 0.376 and p = 0.000, resulting in the acceptance of H2. Hypothesis H3 suggested a positive relationship between CK and KH, and H3 was accepted with β = 0.238 and p = 0.000. Similarly, Hypothesis H4 proposed a positive relationship between DIS and KH, and the results showed β = 0.378 and p = 0.000, confirming the acceptance of H4. Finally, Hypothesis H5 suggested a positive relationship between PO and KH, and the results indicated β = 0.318 and p = 0.000, leading to the acceptance of H5. The evaluation of the mediating effects of DIS and PO showed that CK indirectly affects KH through the mediating roles of DIS (β = 0.133 and p = 0.000) and PO (β = 0.119 and p = 0.000).

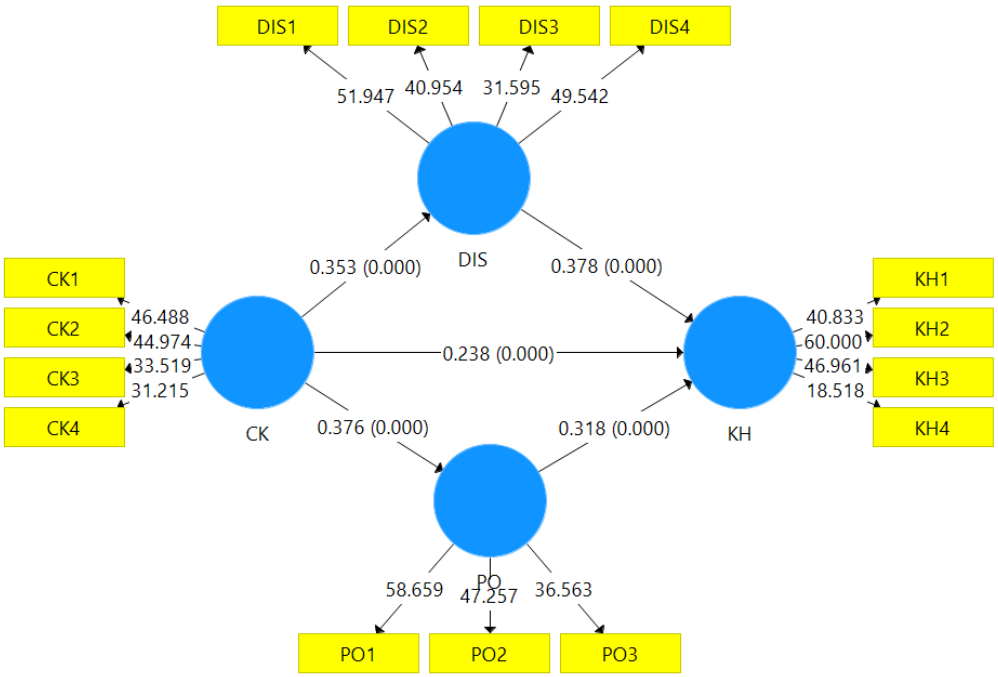

Figure 2: PLS Structural Path

Note:CK=Complexity of Knowledge; DIS=Distrust; PO=Ppsychological Ownership;KH=Knowledge Hiding

4.2 Discussion

The complexity of knowledge positively influences distrust (H1 is accepted) among employees, a result that aligns with the findings of Yuan et al. (2021), who argued that complex knowledge is a valuable resource because it requires significant time and financial investment to acquire. Therefore, when asked to share their knowledge, individuals often tend to avoid sharing it with the requester. As a result, the requester perceives knowledge-hiding behavior, which damages the positive emotions between colleagues (Connelly & Zweig, 2015). From the perspective of social exchange theory, this behavior leads to a reciprocal negative relationship between parties, ultimately increasing mutual distrust. Similarly, knowledge complexity also heightens the perception of psychological ownership over the knowledge. The more complex the knowledge, the stronger the individual's sense of ownership, as they have personally invested time and money to acquire it. This result is consistent with the knowledge-based psychological ownership theory.

The relationship between knowledge complexity and knowledge-hiding behavior is also accepted in this study, as evidenced by the acceptance of Hypothesis H3. The findings support the link between knowledge complexity and knowledge-hiding behavior, which aligns with previous studies such as Yuan et al. (2021). The level of knowledge complexity is considered an important factor in determining why employees hide their knowledge (Sulistiawan et al., 2022). When knowledge is highly complex, employees tend to hide it because this type of knowledge requires significant time and effort to acquire, thereby reducing the time available for employees to complete their tasks (Connelly & Zweig, 2015). This leads to a reluctance to share knowledge, as knowledge-hiding is viewed as a defensive mechanism to prevent the loss of valuable resources (Sulistiawan et al., 2022).

The research results also reveal a positive relationship between distrust and knowledge-hiding behavior. This means that when employees lack trust in their colleagues within the organization, they are more likely to engage in knowledge-hiding behaviors. This relationship has been identified in previous studies such as Connelly et al. (2012), Yuan et al. (2021), and Sulistiawan et al. (2022). Mutual distrust among colleagues is a basis for ineffective social interactions (Blau, 2017). When employees are asked to share their knowledge, they often hide it due to distrust towards their colleagues, which harms positive emotions between them, thus exacerbating knowledge-hiding behavior (Connelly & Zweig, 2015; Yuan et al., 2021). Therefore, this finding is consistent with previous research.

The results of this study also support Hypothesis H5, which proposed a positive relationship between psychological ownership of knowledge and knowledge-hiding behavior. This suggests that when employees feel a high level of psychological ownership over their knowledge, they are more likely to engage in knowledge-

hiding behavior. The study by Alnaimi & Rjoub (2021) also supports this relationship. The findings indicate that employees' psychological ownership of knowledge reflects a desire to acquire and preserve their knowledge to maintain control, especially when they are not adequately rewarded or recognized for their achievements. Alnaimi & Rjoub (2021) also noted that psychological entitlement is often linked to negative outcomes. Individuals with a strong sense of entitlement are more likely to prioritize their own needs over those of others in the organization. Entitlement serves as a moral license that drives employees to engage in both interpersonal and organizational deviant behaviors (Yam et al., 2017), such as knowledge-hiding behavior. Therefore, individuals with high psychological ownership of knowledge are more likely to act selfishly and show a lack of respect for others (Alnaimi & Rjoub, 2021).

Additionally, distrust and psychological ownership based on knowledge serve as mediators in the relationship between knowledge complexity and knowledge-hiding behavior. Previous research by Yuan et al. (2021) also confirmed the mediating role of distrust. In addition to distrust, this study further reveals the mediating role of psychological ownership. Thus, when knowledge is highly complex, it can directly increase the likelihood of knowledge-hiding, a relationship that has already been identified in several studies, such as Khalid, Gulzar and Khan (2020) and Weng & Ma (2021). Moreover, knowledge complexity can also heighten distrust and psychological ownership, which indirectly leads to an increase in employees' knowledge-hiding behavior (Yuan et al., 2021). In other words, distrust and psychological ownership based on individual knowledge amplify the effect of knowledge complexity on employees' knowledge-hiding behavior.

5. Conclusion, Contributions and Limitations

5.1 Conclusion and Contributions

This study examines the impact of knowledge complexity on knowledge-hiding behavior through the mediating roles of distrust and psychological ownership among employees in knowledge-intensive sectors such as banking. Data were collected via a survey using a convenience sampling method. Subsequently, the data were analyzed using Smart PLS. The measurement model was evaluated through indicators such as reliability, validity, and discriminant validity. Path analysis was employed to test the research hypotheses. The analysis results indicate that all five proposed hypotheses were accepted. Specifically, knowledge complexity has a direct positive effect on knowledge-hiding behavior and an indirect positive effect through the mediating roles of distrust and psychological ownership based on knowledge. This research contributes significantly both theoretically and practically.

First, from a theoretical perspective, this study makes a significant contribution to explaining employees' knowledge-hiding behavior by identifying the mediating role of distrust in the relationship between knowledge complexity and knowledge-hiding behavior. This relationship was previously examined by Yuan et al. (2021), thus this study provides additional evidence to enrich the theoretical framework explaining employees' knowledge-hiding behavior. A notable contribution of this research is the mediating role of employees' psychological ownership based on knowledge in the relationship between knowledge complexity and knowledge-hiding behavior, a relationship that has been scarcely addressed in empirical studies within knowledge-intensive sectors like banking.

The findings of this study also have important practical implications for managers in knowledge-intensive fields such as banking. Knowledge complexity may increase employees' propensity to engage in knowledge-hiding behaviors. The banking sector is characterized by a substantial amount of complex knowledge. Therefore, managers need to implement measures to mitigate this issue. Additionally, distrust among employees, as well as psychological ownership, exacerbates mutual knowledge-hiding among staff. This highlights a critical implication for practitioners in organizational knowledge management.

5.2 Limitations and Future Directions

This study also has certain limitations. First, it examines knowledge-hiding behavior as a unidimensional concept. Therefore, future research should consider this concept in a multidimensional framework, as classified by Connelly et al. (2012), or in terms of tacit and explicit knowledge. Second, this research employed a convenience sampling method within the banking sector in the context of Vietnam. Consequently, future studies should expand to other sectors and countries to provide stronger evidence for the proposed hypotheses. Third, knowledge hiding behavior may be influenced by various factors that this study has not addressed. Therefore, future research can incorporate additional factors beyond those examined in this study.

Ethical Statement: This research was conducted in accordance with all applicable ethical guidelines.

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.

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Appendix

Variables	Source	Code	Items
Complexity of Knowledge (CK)	Sulistiawan (2022)	CK1	The knowledge used in my organization requires prior learning in other technologies and related knowledge.
		CK2	Description of the knowledge used in my organization requires a large amount of information.
		CK3	The knowledge used in my organization is technologically sophisticated and difficult to implement.
		CK4	The knowledge used in my organization is complex.
Distrust (DIS)	Sulistiawan (2022)	DIS1	I am cynical toward my colleagues.
		DIS2	I am wary of my colleagues.
		DIS3	I must remain vigilant when dealing with my colleagues.
		DIS4	I must remain watchful of my transactions with my colleagues.
Psychological Ownership (PO)	Peng (2012)	PO1	This is my knowledge
		PO2	I feel a very high degree of personal ownership of the knowledge
		PO3	I sense that this is my knowledge

Variables	Source	Code	Items
Knowledge Hiding (KH)	Nguyen, Malik and Budhwar (2022)	KH1	I do not want to transfer personal knowledge and experience to other
		KH2	I withhold helpful information or knowledge from others
		KH3	I do not want to transform valuable skills and expertise into organizational knowledge
		KH4	I do not want to share innovative achievements

From Tweets to Trends: Bibliometric Insights on Social Media and Knowledge Management

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Abstract: The junction of social media and knowledge management has developed into one of the main areas of study, representing the transformative power of digital communication both in organizational processes and knowledge-sharing practices. This study provides a comprehensive bibliometric analysis of the intersection between social media and knowledge management from 1999 to 2024. It explores the evolution of research trends, identifies key thematic clusters, and visualizes international collaborations in this field. Through co-citation and timeline network visualizations, we highlight 13 thematic clusters of research, each representing distinct aspects of social media's role in knowledge sharing and organizational learning. Notable clusters include Knowledge Management, Social Media, Internet Technologies, and Sustainability, among others. The study also maps out cross-national collaborations and their contribution to advancing this interdisciplinary field. The analysis reveals significant growth in publications and citation counts, with a notable shift toward exploring advanced technologies such as AI, big data, and machine learning in the context of knowledge management. This paper identifies critical research gaps, particularly the need for integrating emerging technologies and adopting interdisciplinary approaches. The findings offer practical insights for organizations seeking to enhance knowledge sharing through social media platforms and suggest directions for future research.

Keywords: Social media, Knowledge management, Bibliometric analysis, Biblioshiny, CiteSpace, VOSviewer

1. Introduction

Social media in this present digital era has structurally altered the manner of communication, cooperation, and information dissemination of people and organizations. In that respect, relying on social media has become fundamental and intrinsic to personal interaction and professional enterprise alike. Thanks to the growth of Facebook, Twitter, LinkedIn, and Instagram that had never been seen before, new opportunities for knowledge exchange and orchestrating connections among users from diverse backgrounds and competencies could be created (Vaidyanathan and Sudarsanam, 2017). This change in the dynamics of communications has made organizations take a wider look at their traditional knowledge management practices, including the use of social media as a tool for improving knowledge-sharing and collaboration.

Knowledge management encompasses generation, distribution, utilization, and management of knowledge and information within an organization. Integration of social media platforms in KM strategies permits the organization and exploitation of the collective intelligence of its internal workforce along with external stakeholders. Social media platforms make real-time communication and collaboration possible; hence, there is more dynamism than what emails or meetings conventionally can provide. This creates an ever-agile environment of knowledge sharing, deliberation, popping up ideas, spewing innovation, and improving decision-making processes (Razmerita, Kirchner and Nabeth, 2014).

Despite the numerous advantages of social media in knowledge management, organizations also face several challenges that must be addressed to maximize its benefits. Moreover, information overload, data security issues, and even the spreading of misinformation may blur the concept of effective knowledge management within organizations (Chugh and Joshi, 2020). Therefore, organizations have to consider how they will find strategies related to these challenges and take advantage of the benefits of social media (Ford and Mason, 2013b). Understanding the interplay of social media and knowledge management could allow organizations to create a more collaborative-informed culture, leading to enhanced organizational performance and a competitive advantage in the marketplace.

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This bibliometric analysis specifically focuses on examining how social media intersects with knowledge management across two key dimensions: within organizations and at a broader societal or international level. On one hand, the study investigates the role of social media in enhancing internal knowledge-sharing processes, collaboration, and innovation within organizational contexts. On the other hand, it reflects on how social media facilitates knowledge dissemination and coordination during large-scale societal events, such as crises or global initiatives. By addressing these dimensions, the research provides a holistic view of the evolving applications of social media in knowledge management, highlighting trends, challenges, and opportunities in both domains.

Bibliometric analysis is one of the potent quantitative methods to evaluate and explore the academic literature regarding publication patterns, citation impact, and key contributions in various fields (Joseph, Jose, *et al.*, 2024; Joseph, Thomas, *et al.*, 2024). This form of mapping supports researchers in underpinning the intellectual structure of disciplines so as to identify emerging trends, influential works, and key contributors. Besides, there are a number of highly accessible tools for bibliometric analysis (Agbo *et al.*, 2021; Abas *et al.*, 2023). Biblioshiny, a web user-friendly interface of the R package Bibliometrix, enables researchers-with no programming skills-to perform in-depth analysis and visualization through citation networks and network analysis of research collaborations (Joseph, Jose, John, *et al.*, 2023; Joseph, Jose, Jose, *et al.*, 2023; Thangavel and Chandra, 2023; Devaki, Ramganesh and Amutha, 2024). Another powerful tool is CiteSpace, which shows, through the time, the trends and developments of the scientific literature by emerging topic identification, research front tracking, and co-citation networks, keyword bursts, and cluster pattern analysis (Geng *et al.*, 2024; Sun *et al.*, 2024; Zhang, Quoquab and Mohammad, 2024). Its real strength is thus due to the strength it has in the detection of pivotal articles and tracking shifts in research activity over time. VOSviewer is intuitive software meant for creating and visualizing networks of co-authorship, co-citation, and keyword co-occurrence, which may turn out just perfect for mapping dense research landscapes and revealing relations among the different elements of academic research. The tools together provide deep insight into the evolution of scholarly domains (van Eck and Waltman, 2010; Arruda *et al.*, 2022).

The objective of this study is to conduct a comprehensive bibliometric analysis to understand the evolving intersection between social media and knowledge management (KM). Specifically, the research aims to identify key trends, influential authors, and prominent themes in the scholarly literature that focus on the use of social media as a tool for enhancing KM practices across various sectors. By utilizing data from Scopus and employing advanced bibliometric tools such as Biblioshiny, CiteSpace, and VOSviewer, the study seeks to map the intellectual landscape, revealing patterns of collaboration, citation impact, and thematic developments over time. The study also aims to explore how social media platforms have transformed organizational knowledge-sharing processes, particularly in addressing contemporary issues like crisis management and knowledge dissemination during global events. Ultimately, this research sets out to provide insights that pave the way for future investigations and practical applications in the dynamic and rapidly evolving field of social media and knowledge management.

In recent years, the intersection of social media and knowledge management (KM) has continued to evolve, driven by rapid advancements in digital technologies and the increasing reliance on social media platforms for communication and collaboration in organizational settings. While early studies in this domain primarily focused on basic social network dynamics, recent research has shifted toward exploring more sophisticated themes such as big data, sentiment analysis, artificial intelligence, and their role in enhancing organizational knowledge sharing. This study seeks to fill the gap in the literature by offering a comprehensive bibliometric analysis of the relationship between social media and KM from 1999 to 2024, a period marked by significant transformations in both fields. The central research question of this study is: How have social media platforms influenced the evolution of knowledge management practices across various organizational contexts? Sub-questions guiding this inquiry include: 1) What are the key thematic trends in the research on social media and KM? 2) How have collaborations between countries shaped the development of this research? 3) What emerging technologies, such as AI and big data, are influencing the future of KM in the context of social media? By answering these questions, this study aims to provide valuable insights into the contemporary role of social media in knowledge management and its ongoing significance in both academic and organizational settings.

2. Review of Literature

Social media refers to a collection of digital platforms and technologies that facilitate interactive communication, content sharing, and collaboration among users. In the context of knowledge management (KM), social media encompasses various tools such as social networking sites (e.g., Facebook, LinkedIn, Twitter), microblogging platforms (e.g., Twitter), wikis (e.g., Wikipedia, corporate knowledge bases), blogs, discussion forums, social

tagging systems (e.g., Delicious, Diigo), and enterprise social media (e.g., Slack, Microsoft Teams, Yammer). These technologies enable both explicit and tacit knowledge sharing, fostering organizational learning and innovation.

The fusion of social media and knowledge management, in particular, has become a Research Barker area over the last couple of years, as new social media platforms turn increasingly into tools for knowledge creation, sharing, and storage inside an organization. Social media facilitates the capture of both tacit and explicit knowledge by encouraging collaboration within and outside organizations. Social media technologies, such as blogging, wikis, and microblogging platforms like Twitter, create vibrant real-time knowledge-sharing environments. Such platforms enhance knowledge management by facilitating the dispersion of information faster and wider, thus enhancing collective intelligence and collaboration in organizations (Vaidyanathan and Sudarsanam, 2017). Additionally, it provides a bottom-up approach to KM because the individual contributions may be aggregated into collective organizational knowledge, thus supporting both personal and collective knowledge processes (Razmerita, Kirchner and Nabeth, 2014). Social media will also allow knowledge workers to make their contributions through "Enterprise 2.0" environments where tools like wikis and social tagging systems help in adding to the creation and management of knowledge. These platforms add value because decentralized, informal knowledge sharing will raise the level of organizational agility and responsiveness (Ford and Mason, 2013b).

While many scholars emphasize the transformative role of social media in knowledge management by fostering collaboration, accelerating knowledge dissemination, and enhancing organizational learning (Razmerita, Kirchner and Nabeth, 2014; Ali *et al.*, 2020), others highlight critical concerns that challenge its effectiveness. For instance, Ford and Mason (2013) argue that the use of social media in knowledge management can create tensions between openness and control, as organizations struggle to balance knowledge-sharing with the need to protect proprietary information (Ford and Mason, 2013b). Similarly, Chugh and Joshi (2020) warn that information overload and the rapid spread of misinformation can diminish the reliability of knowledge shared via social media, ultimately affecting decision-making processes (Chugh and Joshi, 2020). Additionally, while some studies suggest that social media democratizes knowledge-sharing by reducing hierarchical barriers (Scuotto, Giudice and Omeihe, 2017), others indicate that its use may reinforce existing power structures, as knowledge contribution often depends on user engagement and visibility (Leonardi, 2014). These conflicting perspectives underline the complexities of integrating social media into knowledge management frameworks, requiring organizations to adopt strategic approaches to mitigate risks while maximizing benefits.

The role of social media in KM is more than just information exchange. Through the absorptive capacity of teams, social media nurtures innovation leading to high performance and creativity levels among the teams (Ali *et al.*, 2020). Customer Knowledge Management (CKM) plays a critical role in leveraging social media for business decision-making by extracting valuable insights from user interactions and engagement patterns. Sites as Twitter and Facebook are capable of enabling CKM and thus helping the organization gain access to customer knowledge at a great speed alongside efficient dissemination and thereby enhancing business decision-making (Boateng, 2016). Meanwhile, by using the technological integration of Big Data, social media will afford the opportunity to the organization with handling and extracting knowledge coming out of large sets of data. This is significantly useful for business intelligence and competitive analytics (He, Wang and Akula, 2017).

Despite the benefits, the adoption of social media in KM poses challenges, including information overload and the potential loss of control over proprietary knowledge. Managers often struggle to balance the openness of social media with the need to protect intellectual property (Ford and Mason, 2013a) . These tensions are further exacerbated by the differing levels of control between individuals and groups within organizations, which can complicate the implementation of social media tools (Ford and Mason, 2013). In small and medium enterprises (SMEs), the adoption of social media for KM is often hindered by resource constraints. However, enterprise social media (ESM) platforms can serve as cost-effective solutions for facilitating collaboration and knowledge sharing in these settings (Soto-Acosta, Cegarra-Navarro and García-Pérez, 2017). ESM can also foster innovation by enabling mass collaborative KM practices that draw on the collective intelligence of employees (Scuotto, Giudice and Omeihe, 2017).

In professional service firms, social media has been shown to enhance the SECI model of knowledge creation, adding value to the socialization, externalization, combination, and internalization processes (Shah, Khan and Amjad, 2013). Social media tools also play a crucial role in sustaining KM practices by facilitating continuous learning and knowledge sharing in diverse fields such as healthcare, marketing, and politics. Social media has provided significant support for sustainable knowledge management practices, enabling responsible knowledge

sharing among stakeholders. Platforms like Facebook and Twitter have been shown to improve creativity, productivity, and trust-building in KM processes (Alghamdi, Pileggi and Sohaib, 2023). In addition, social media facilitates the integration of knowledge workers into more effective collaboration through transactive memory systems, thus improving team innovation performance (Ali *et al.*, 2020).

The ability of social media to support KM processes is also highlighted in the organizational context, where platforms offer dynamic alternatives to traditional KM systems. Unlike static knowledge repositories, social media tools promote collaboration, participation, and knowledge sharing across various hierarchical levels in organizations (Chedid and Teixeira, 2021). Social media fosters knowledge creation and sharing by creating communities where individuals contribute to collective intelligence. The "wisdom of the crowd" enables a collaborative environment for knowledge creation, facilitated through digital traces that leave behind reusable knowledge for future reference (Helms, Cranefield and Reijsen, 2020). Furthermore, social media tools have been instrumental in enhancing knowledge sharing across generations and within diverse workforces. Despite organizational reluctance in some cases, employees who have access to these tools demonstrate higher usage for knowledge-sharing purposes (Obermayer *et al.*, 2020). Despite the advantages, integrating social media into KM strategies poses significant challenges. One key issue is the speed at which knowledge can spread through social media, potentially leading to information overload and difficulties in managing proprietary knowledge. This is especially challenging for smaller companies, which may not have the resources to manage the vast amount of information generated through social media (Chugh and Joshi, 2020). In developing economies, the use of social media for customer knowledge management (CKM) is growing. However, uncertainty remains about the impact of social media on KM processes in these regions. Strategies that integrate engagement and business intelligence are crucial for overcoming these challenges and optimizing CKM (Ofori, 2020).

In the tourism industry, social media plays a crucial role in knowledge creation, sharing, and preservation. While prior research has focused on how social media is changing the industry, there is still limited exploration of its role in managing touristic knowledge, particularly in preserving it for future use (Agrifoglio and Metallo, 2021). Similarly, in the healthcare sector, social media is proving useful for health knowledge management. It helps overcome geographical barriers and supports public health education and decision-making processes. However, privacy concerns and ethical issues in managing sensitive health information are ongoing challenges (Ghalavand, Panahi and Sedghi, 2020). Social media provides a valuable platform for customer knowledge management, particularly in small and medium-sized enterprises (SMEs). By utilizing text mining and frameworks such as the Kano model, organizations can extract valuable insights from customer interactions on social media platforms. These insights can help businesses tailor their strategies and improve customer experiences (Zeng, Harncharnchai and Saeheaw, 2021). In addition, social media facilitates knowledge creation through collaborative environments. Platforms like Twitter and Facebook allow knowledge workers to generate and quantify actionable knowledge that informs business decisions. The use of sentiment analysis and topic mining further enhances the ability to extract meaningful insights from social media data (Ramesh and Weber, 2022). Social media has profoundly impacted KM by facilitating knowledge creation, sharing, and innovation. However, its integration into organizational KM practices comes with challenges related to information control and resource constraints. Despite these challenges, social media tools are valuable in enhancing both personal and collective KM processes, particularly in innovation-driven and customer-focused industries.

A critical aspect of understanding the role of social media in knowledge management lies in exploring the varied definitions and frameworks of knowledge management (KM) that intersect with social media practices. Scholars have proposed different typologies of knowledge management that influence how social media tools are integrated within organizational settings. For instance, Nonaka's SECI model, which emphasizes the conversion of tacit knowledge into explicit knowledge, is often cited in discussions around the role of social media in facilitating knowledge sharing (Nonaka and Takeuchi, 1995). In contrast, the knowledge management system (KMS) approach focuses on the technological infrastructure that supports organizational knowledge, where social media serves as a collaborative tool within a larger knowledge-sharing ecosystem (Davenport and Prusak, 1998). A more nuanced understanding of these models would highlight how social media, from platforms like Facebook and Twitter to specialized tools like Slack and Microsoft Teams, supports both knowledge creation and dissemination. Furthermore, social media tools themselves exhibit diverse functionalities and are deployed in different organizational contexts, making it essential to categorize them according to their purpose—such as for communication, content sharing, or collaboration (Leonardi, 2017). This typology of social media tools can provide clarity on how they contribute to specific KM strategies, enhancing the understanding of their varying impacts across organizational landscapes. Therefore, future research should examine how different KM

definitions align with specific social media platforms and consider the nuances in their application to further strengthen the theoretical framework in this area.

3. Results

3.1 Materials and Methods

In this research, Scopus was chosen as the primary source for bibliographic information due to its comprehensive coverage of high-quality journals, which offers a broader selection compared to other databases. The publications were gathered using the keywords "Social Media" and "Knowledge Management," with no restrictions on language. The search query was carefully constructed by combining the keywords "Social Media" and "Knowledge Management" using the logical AND operator. This ensured that only articles addressing the intersection of both fields were included in the search results, as opposed to those focusing on either topic individually. The search was limited to academic publications from the years 1999 to 2024, and the query was further refined to include peer-reviewed journal articles, conference papers, and book chapters to maintain relevance. The inclusion of both keywords ensures that the selected studies specifically explore the relationship between social media and knowledge management. A total of 1,579 documents were obtained from 708 unique sources, spanning from 1999 to 2024. Figure 1 illustrates the PRISMA methodology applied in the bibliometric analysis, which followed a three-step process. The first step involved identifying and extracting pertinent data from the database. In the second step, materials such as reviews, editorials, letters, notes, books, and short surveys were excluded, refining the dataset to include only articles, book chapters, and conference papers. The data was then exported as a CSV file, and the bibliometric analysis was performed using VOSviewer, CiteSpace, and Biblioshiny software.

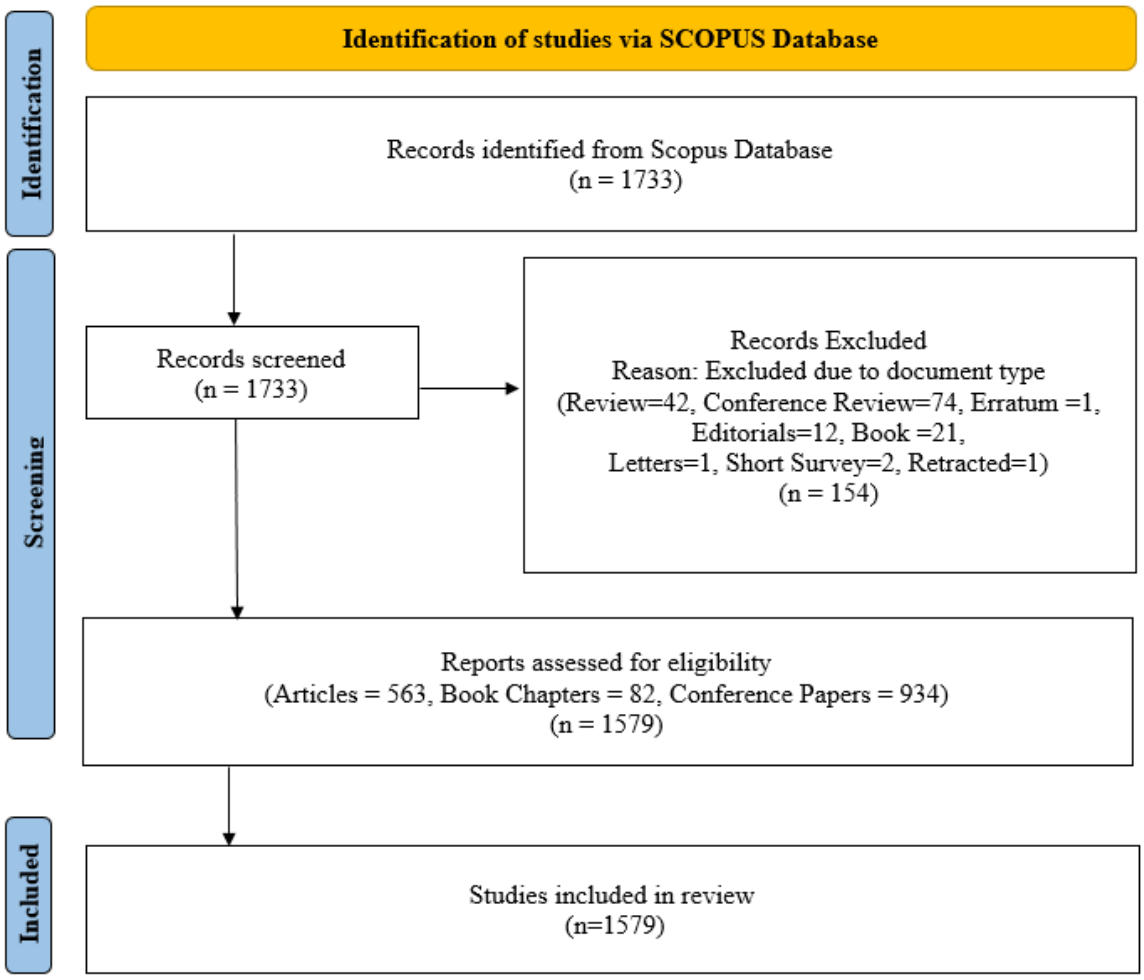


Figure 1: PRISMA Approach

Table 1 presents a detailed summary of the key findings from the investigation, highlighting various aspects of the data collected between 1999 and 2024. The study encompasses a total of 1,579 documents sourced from 708 distinct journals, books, and other publications, reflecting a substantial annual growth rate of 18.59%. The average age of the documents is approximately 6.91 years, with an impressive average citation rate of 18.88 per document, indicating their relevance and impact in the field. Notably, the dataset contains 57,359 references and a rich set of keywords, with 6,769 identified through "Keywords Plus" and 3,763 via authors' keywords. The author contributions are significant, with a total of 4,032 authors and 177 producing single-authored documents. Collaboration is also prominent, as indicated by the average of 3.25 co-authors per document and a 23.18% rate of international co-authorships. In terms of document types, the majority consists of conference papers (934), followed by articles (563) and book chapters (82), showcasing a diverse range of scholarly outputs in the context of social media and knowledge management.

Table 1: Main information of the investigation

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1999:2024
Sources (Journals, Books, etc)	708
Documents	1579
Annual Growth Rate %	18.59
Document Average Age	6.91
Average citations per doc	18.88
References	57359
DOCUMENT CONTENTS	
Keywords Plus (ID)	6769
Author's Keywords (DE)	3763
AUTHORS	
Authors	4032
Authors of single-authored docs	177
AUTHORS COLLABORATION	
Single-authored docs	204
Co-Authors per Doc	3.25
International co-authorships %	23.18
DOCUMENT TYPES	
article	563
book chapter	82
conference paper	934

3.2 Annual Scientific Production

Figure 2 Annual scientific production on the study theme of social media and knowledge management, according to the Scopus database. The period of coverage is from 1999 to 2024. It follows that there is a significant increase in the total number of articles published throughout the years under coverage, with an important inflection from approximately 2011. This function could reveal greater interest and investment in research within this area of analysis. The peak years-the years of highest numbers of production-point to a movement toward increased academic involvement with social media as an important factor in knowledge management processes. Yet, this graph also shows that the number of articles fluctuates over the course of a number of years, which may be evidence that research or funding priorities have shifted elsewhere. By and large, this underlines the ever-shifting world that exists for scholarly enterprise at the juncture of social media and knowledge management.

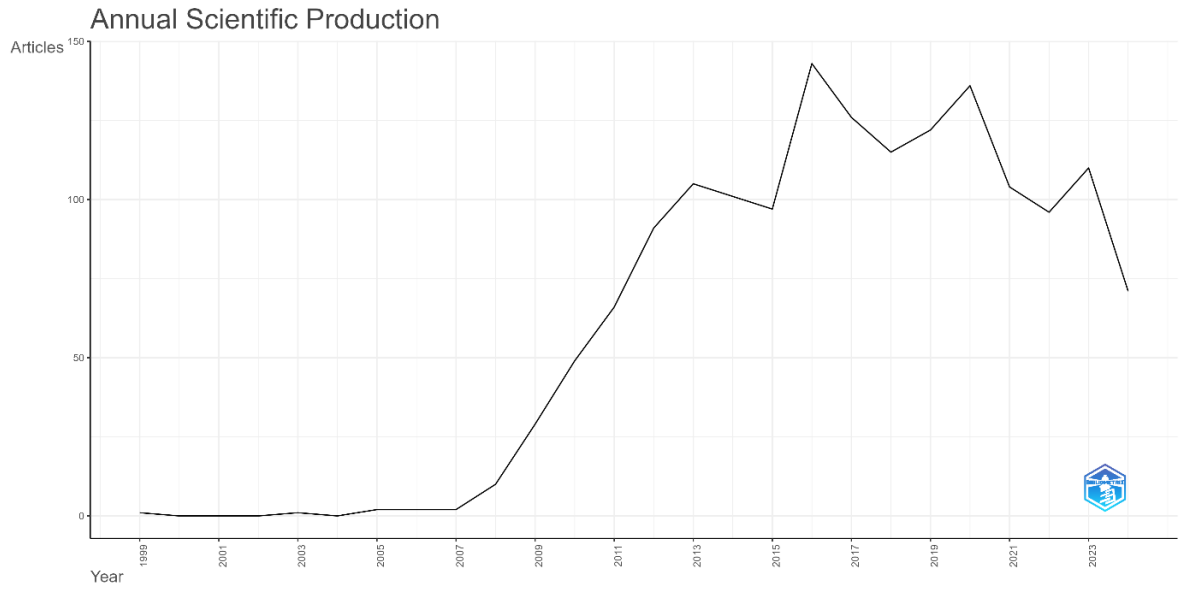


Figure 2: Annual Scientific Production

3.3 Most Relevant Authors

Table 2 lists the most productive authors in the field of social media and knowledge management. The leading authors in this table are Liu H and Zhang Y, with 22 articles each. These two are indeed prolific writers influencing the field. Third is Caverlee J, with 13 articles, which itself is a good contribution to the discussion. Other prominent contributors are Wang H, who contributed with as many as 10 articles, and Li X with 9 articles, both of whom provide considerable support. Further down the list, Bolisani E, Li J, Tang J, Zhang X, and Zhou X, having published 8 articles apiece, also turn out to be active in contributing to the knowledge development herein. This table underlines the very collaborative character of research in this domain, as these authors come together to contribute a wealth of knowledge for enrichment of the academic landscape on social media and knowledge management.

Table 2: Most Relevant Authors

Authors	Articles
Liu H	22
Zhang Y	22
Caverlee J	13
Wang H	10
Li X	9
Bolisani E	8
Li J	8
Tang J	8
Zhang X	8
Zhou X	8

3.4 Most Relevant Sources

Most relevant sources contributing to the research of social media for knowledge management are outlined in Table 3, reflecting that this important work is being published within a diverse range of venues. The International Conference on Information and Knowledge Management, Proceedings leads with 186 articles, showing that it is a central location to publish such relevant works. Next, the ACM International Conference Proceeding Series and Lecture Notes in Computer Science, including subseries, each add 53 articles to attest to their standing in the field of computer science and information management. It is also represented by the 51-article strong Proceedings of the European Conference on Knowledge Management, ECKM, which in turn serves to further

emphasize that discourse on knowledge management is truly global. Other great sources are Communications in Computer and Information Science with 31 articles, CEUR Workshop Proceedings with 29 articles, and the Proceedings of Annual Hawaii International Conference on System Sciences with 25, adding further to the rich landscape of scholarly output. Following this trend, the Journal of Knowledge Management and Computers in Human Behavior have 16 and 14, respectively, because their attention might fall upon knowledge-related matters within social media contexts. This table illustrates the broad range of studies published through various platforms; once more, it proves that there is actually a very interesting and active scholarly community engaged in discussing how knowledge management and social media may relate to one another.

Table 3: Most Relevant Sources

Sources	Articles
International Conference on Information and Knowledge Management, Proceedings	186
ACM International Conference Proceeding Series	53
Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	53
Proceedings of the European Conference on Knowledge Management, ECKM	51
Communications in Computer and Information Science	31
CEUR Workshop Proceedings	29
Proceedings of the Annual Hawaii International Conference on System Sciences	25
CIKM 2014 - Proceedings of the 2014 ACM International Conference on Information and Knowledge Management	20
Journal of Knowledge Management	16
Computers in Human Behavior	14

3.5 Trend Topics

Figure 3 indicates the time-oriented trend topics of the research on social media and knowledge management, representing developing focus areas between 2004 and 2024. The size of each circle in Figure 3 is based on term frequency, which suggests the relative importance of the terms within the literature. Of these, early topics such as user-generated content, mobile, and social networks exhibit their importance during the mid-2000s. As time passed, big data, sentiment analytics, and social media analytics are some of the relatively newer trends that start to take over the research landscape post-2010.

It is rather easy to notice that such terms as artificial intelligence, deep learning, and natural language processing have recently become the most attractive objects of interest and therefore denote an increasingly complex integration of high technologies into the process of social media analysis and knowledge management. Other topics that discuss issues like covid-19 and fake news detection also emerge, thus reflecting the challenges that happen in global contemporary life and their impact on research priorities. It could be observed from this graph that the area has extended the base of foundational concepts of social networks to more complex technological-driven areas. This shows the continuous evolution of the themes of research, as the society and technology modifications happen.

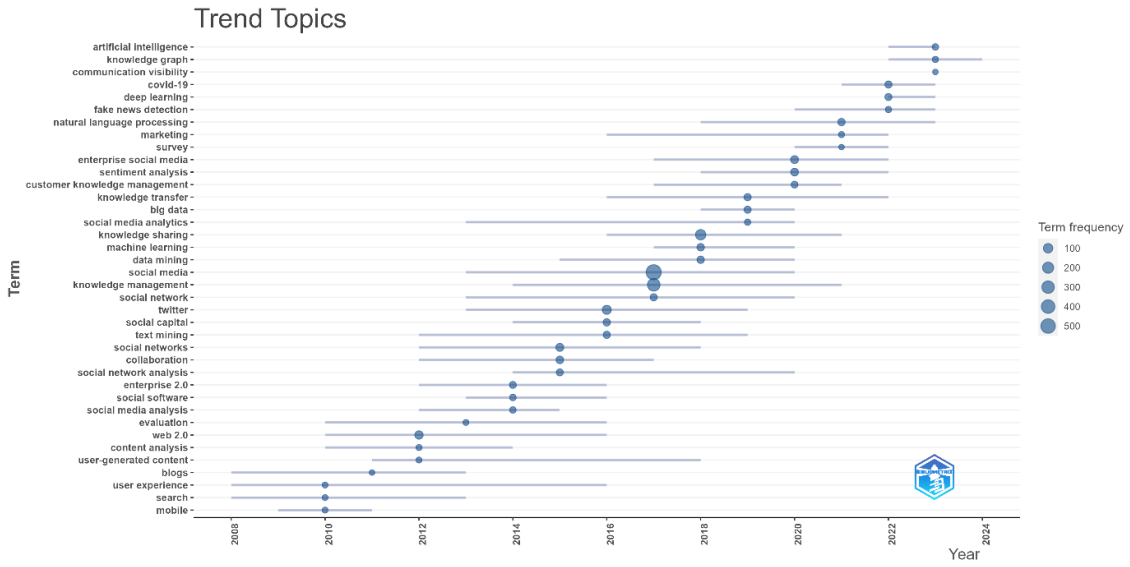


Figure 3: Trend Topics

3.6 Thematic Map

Figure 4 is the thematic map of research topics of the field of Social Media and Knowledge Management; positioning of themes according to relevance centrality and degree of development density. The four quadrants of the map refer to different types of themes according to their role and maturity in the thematic structure of research.

Within the Niche Themes quadrant, we can identify those topics that are very specialized but are of lower centrality for the overall set. For instance, personal knowledge management is very highly developed yet more isolated. This would suggest that serious research has been conducted in the area; however, it nonetheless maintains a somewhat peripheral relation to the mainstream sets of discussions within social media and knowledge management, indicating relevance to a more focused group of scholars or niche applications.

The top right quadrant, Motor Themes, shows those topics that are both central and highly developed in the field; the level of development gives them the role of critical drivers of research. Example key themes falling within this area include sentiment analysis, Twitter, machine learning, and social network analysis. This kind of theme is not only well-studied but also very important for the advance of knowledge in the intersection between social media and knowledge management and can be expected to influence future research directions and innovations.

The quadrant on Basic Themes brings us themes central but less developed in terms of research density. Examples that fall into this category are social media, knowledge management, and knowledge sharing. That therefore reflects their importance at the very core of the subjects involved. Although not as deeply explored as other topics, they set the very basic blocks for the study of the impact of social media on knowledge processes.

Finally, the quadrant for the Emerging or Declining Themes, which is bottom left, highlights social media analysis and fake news. These themes are in either an early stage of development or already losing ground in the research landscape. Their positioning in this quadrant may indicate that they are gaining momentum as emerging areas of interest or are falling from centrality as research evolves. The thematic map provides a general overview of what the priorities and specific foci have evolved into in the study of social media and knowledge management.

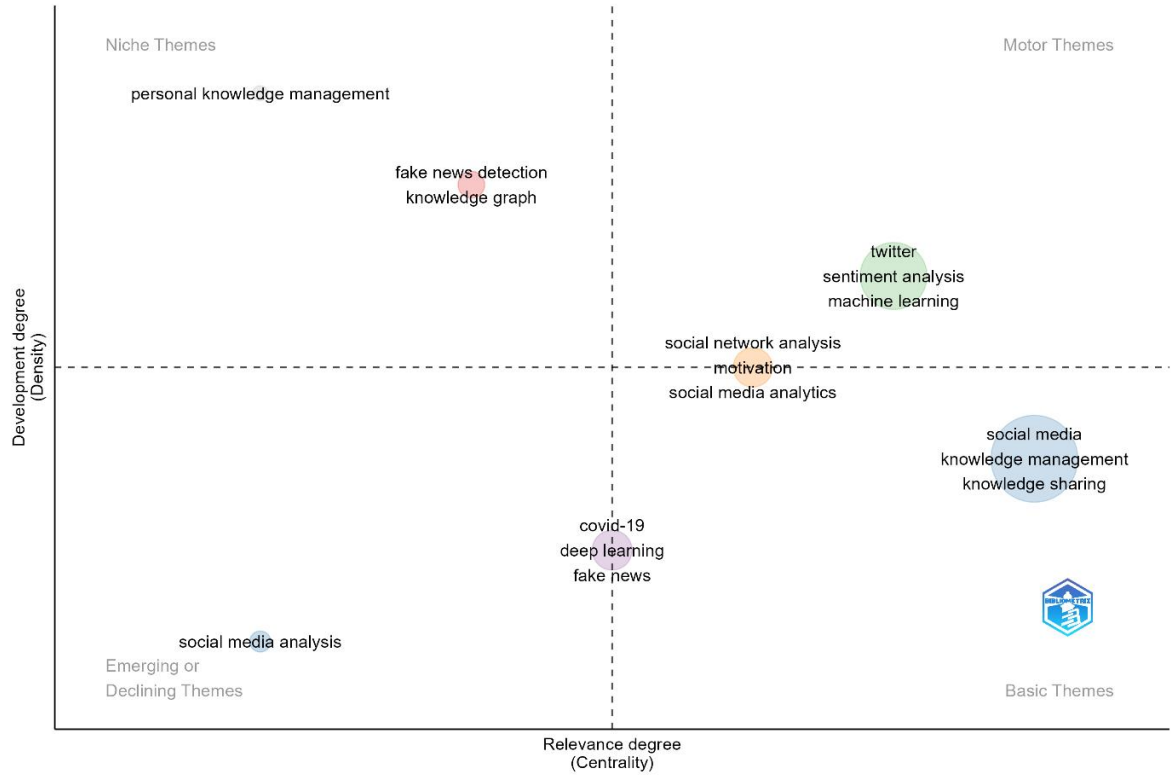


Figure 4: Thematic Map

3.7 Three Field Plot

Figure 5 is the three-field plot of the relationships between keywords, authors, and publication sources in the area of social media and knowledge management research. The plot has visualized how certain keywords are associated with certain authors and the journals or conference proceedings where their work was published. This plot represents how the keywords being placed on the left side, like social media, sentiment analysis, and data mining, reflect core drives into the research area. The size and prominence of such keywords represent occurrence rate and importance within the literature of interest. Then, the contributors, as authors, are connected to those keywords while moving toward the plot center. Note the recurrence of certain authors, such as Liu H, Caverlee J, and Zhang Y, which shows that they are contributing frequently to the development of these important topics. On the right-hand side, the publication sources give an indication of the influential works that have been published in journals and conference proceedings like the International Conference on Information and Knowledge Management, Communications in Computer and Information Science, and Lecture Notes in Computer Science. The relationships this plot identifies can be used further in understanding the collaborative nature of research at social media and knowledge management-more precisely, how given themes are considered by different authors through various esteemed sources. Overall, this visualization enhances our understanding of the interrelationships of this research domain, revealing the networks of ideas and contributions that have come to define the field.

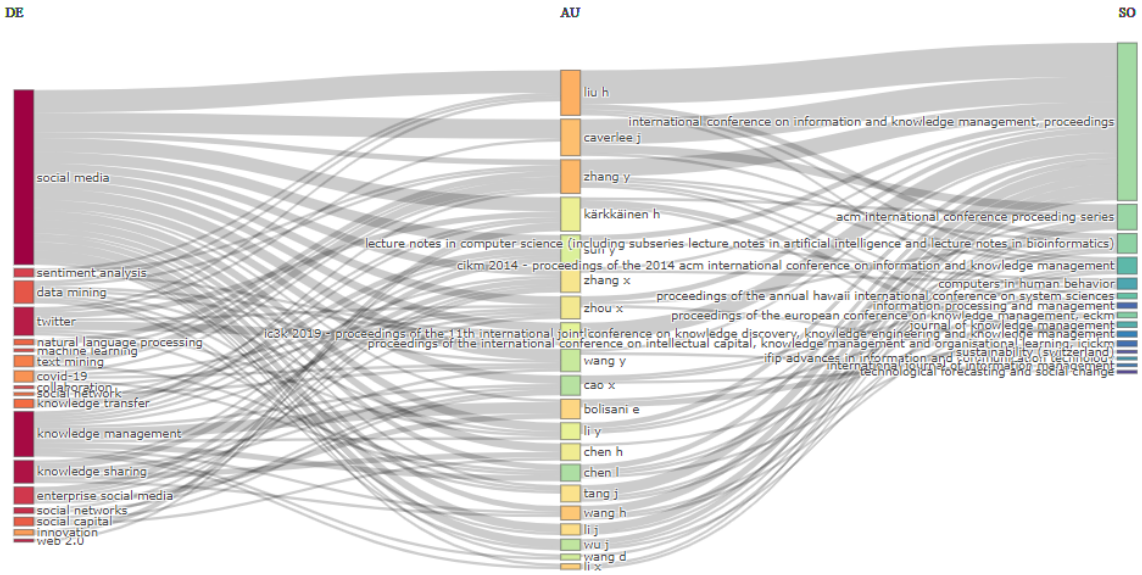


Figure 5: Three-field plot showing the connections between keywords, authors, and publication sources.

3.8 Most Cited Documents

Overview of highly cited documents on social media and knowledge management are given in Table 4, hence indicating influential research shaping the academic discussion in the area. The highest number of citations in the retrieved data is a paper by Yates et al., "Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake, with 762 citations. This therefore brings into perspective the critical role social media plays in managing knowledge in the Haitian earthquake and insight into the impact that is accruable when digital platforms are used in crisis situations. This is closely followed by Majchrzak et al. (2013), with 704 citations for its work entitled "The Contradictory Influence of Social Media Affordances on Online Communal Knowledge Sharing, published in the Journal of Computer-Mediated Communication.". This paper looks at the complex influences of features of social media on communal knowledge-sharing practices. Leonardi adds to the knowledge of how social media could enhance the visibility of communications for knowledge sharing and innovation. To date, his work titled "Social Media, Knowledge Sharing, and Innovation: Toward a Theory of Communication Visibility" has received 608 citations. Other milestone works have come from Ma et al. (2015), with 545 citations for the work "Detecting rumors using time series of social context information on microblogging websites, and Rao et al. (2010) with 437 citations for "Classifying latent user attributes in Twitter." These papers have stood as testimony to the ever-increasing scholarly interest in attempts to handle misinformation using social media and understanding user behavior on Twitter. Furthermore, Leonardi (2015), Wu (2023), and Kwak and Ma (2016, 2014) have contributed greatly to the discourse on knowledge sharing, enterprise social media, and the uses of social media in organizational learning and innovation. Based on this, highly cited papers reflect the wide range and influence that research at the intersection of social media and knowledge management has had-from crisis management to enterprise collaboration and innovation.

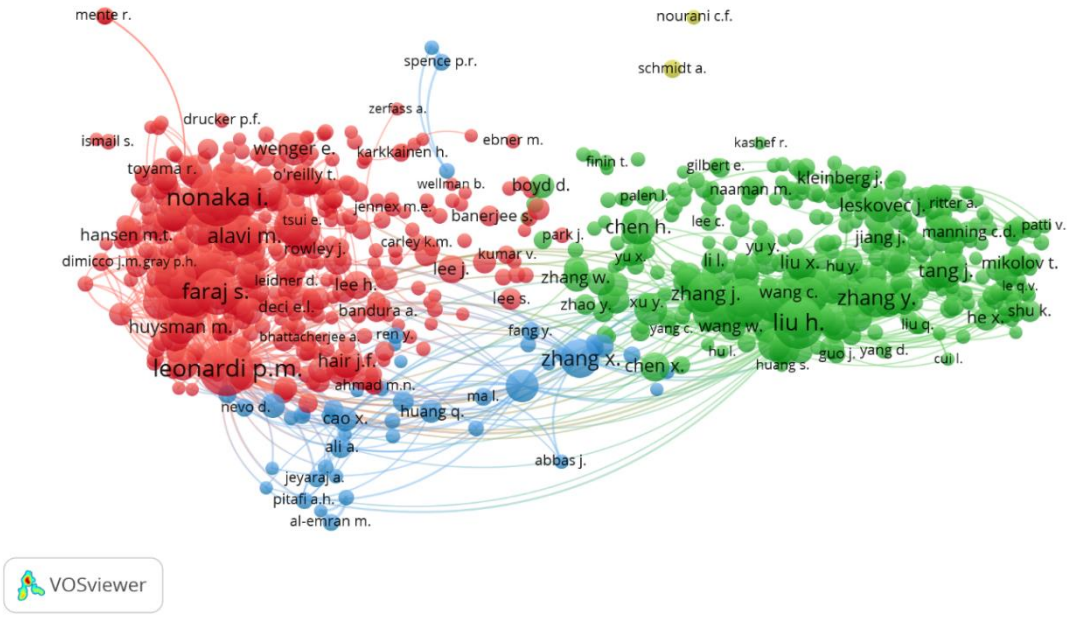
Table 4: Most Cited Documents

Title	Total Citations
Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake (Yates and Paquette, 2011)	762
The Contradictory Influence of Social Media Affordances on Online Communal Knowledge Sharing (Majchrzak *et al.*, 2013)	704
Social Media, Knowledge Sharing, and Innovation: Toward a Theory of Communication Visibility (Leonardi, 2014)	608
Detect Rumors Using Time Series of Social Context Information on Microblogging Websites (Ma *et al.*, 2015)	545
Classifying latent user attributes in twitter (Rao *et al.*, 2010)	437
How do programmers ask and answer questions on the web? (NIER track) (Treude, Barzilay and Storey, 2011)	343

Title	Total Citations
Ambient Awareness and Knowledge Acquisition: Using Social Media to Learn "Who Knows What" and "Who Knows Whom" (Leonardi, 2015)	336
Assessing the role of competitive intelligence and practices of dynamic capabilities in business accommodation of SMEs (Wu, Yan and Umair, 2023)	310
The effects of network sharing on knowledge-sharing activities and job performance in enterprise social media environments (Kwahk and Park, 2016)	273
Knowledge sharing and social media: Altruism, perceived online attachment motivation, and perceived online relationship commitment (Ma and Chan, 2014)	272

3.9 Co-Citation of Cited Authors

Figure 6 is the Co-citation network among cited authors in the domain of social media and knowledge management. The following visualization depicts how often various authors are cited together in academic literature, therefore giving a better overview of the collaborative research themes and the intellectual linkage among scholars. In the map, the nodes or circles represent individual authors. We also see that the size of the nodes corresponds to the size of the citations-the more co-citations a cited author has received, the greater his node. These are proxies for the influence and prominence. Colors represent clusters: on the left is a red cluster, and on the right is a green cluster. Such a division therefore signals that different research trajectories or thematic foci are at play within the overarching realm of social media and knowledge management. Keeping such topics in mind, one notices that prominent contemporary authors such as Leonardi P.M. and Faraj S. figure dominantly within the red cluster, presumably as contributors of major works to discussions of how social media impact knowledge sharing and its management. In quite another direction, the green cluster shows people like Chen H. and Zhang X., whose work appears to be directed at related but perhaps different aspects of social media in knowledge management. Links among nodes depict co-citation relationships, hence showing how pairs of authors are cited together. This may reflect their collaboration or sharing an interest in a particular area of research. In general, this co-citation analysis provides a good overview of the academic landscape, pointing at key players and interconnections of their contributions to this evolving field.



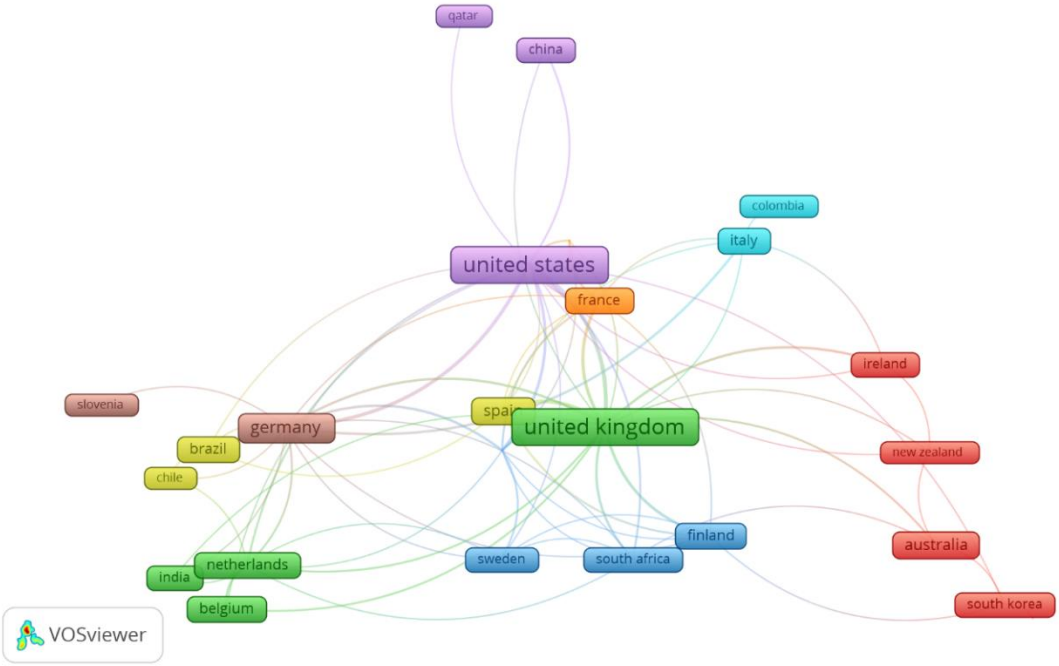


Figure 6: Co-Citation of Cited Authors

3.10 Co-occurrence of Keywords

Figure 7 presents the Co-occurrence network of important concepts and their relationships in Social Media and Knowledge Management The map, created in VOSviewer, visualizes the number of co-occurrences of various keywords in the titles and abstracts of the publications, showing the common research themes and trends in the literature. The core of the map is "Knowledge Management", which is the most central and dominant term, symbolizing that knowledge management is at the heart of the discussion circle when it comes to social media. The size of the "Knowledge Management" node suggests a high recurrence in the literature, showing that it is often the main topic of interest in relation to studies over social media. This central node is connected with several clusters, each standing for different yet related themes in knowledge management research. One of the key clusters is "Social Media Platforms", which are closely connected with such keywords as "information dissemination", "knowledge sharing", and "collaboration". This cluster indicates the social media as a means of spreading information and sharing the knowledge among the users. The presence of terms like "students", "learning", and "education" within this cluster would point to increased attention being paid to social media platforms in the ways they go about serving in educational contexts for both formal and informal knowledge sharing. Another key cluster is "Sentiment Analysis"/ "Natural Language Processing". Hence, this would indicate that one fruitful research focus is the use of data from social media in the measurement of public sentiment and the analysis of language patterns, particularly in the domain of analytics on social media. The terms "neural networks", "algorithms", and "machine learning" that appear in this cluster perhaps hint that superior computational techniques are in common use to process and understand Big Data emanating from social media. Other clusters are "knowledge dissemination", "higher education", and "virtual reality"-all reflecting the different kinds of research undertaken in knowledge management. These represent the cross-roads where knowledge management cuts across, including different fields such as academia, technology, and health, among other fields, while terms such as "mental health", "COVID-19", and "information processing" are reflective of recent trends, especially the influence of the pandemic on information sharing in the digital space. In a nutshell, this co-occurrence map visualizes connected research areas within the broad scope of social media and knowledge management issues, highlighting the multi-dimensional nature of the field. Both the core ideas of knowledge management and equally the developing application within varied disciplines are driven by the growing interest in digital and social media technologies.

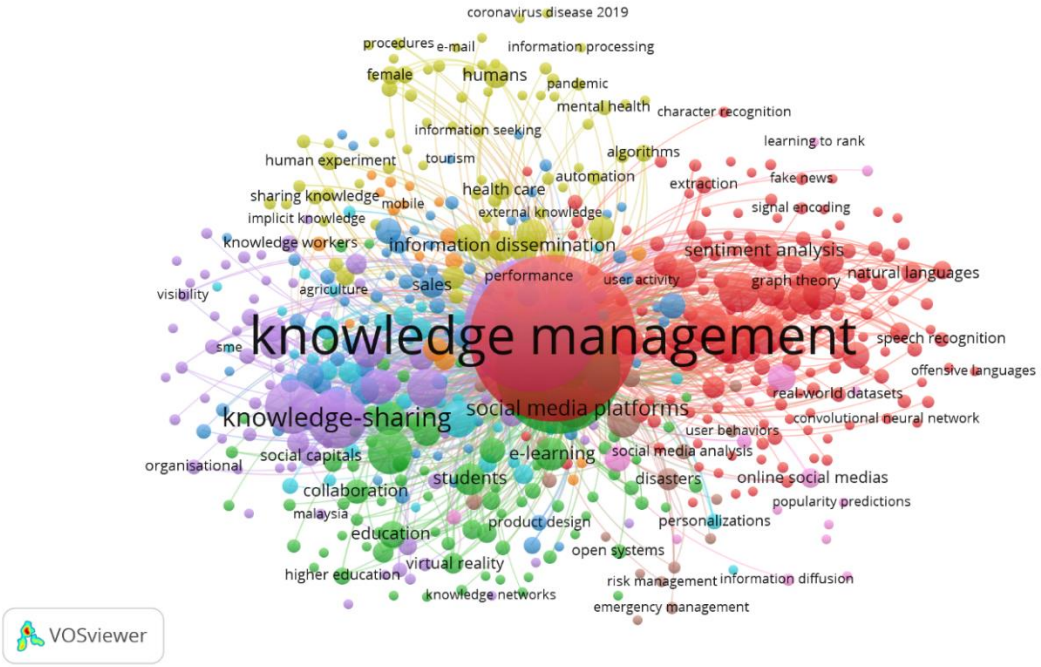


Figure 7: Co-occurrence of keywords

3.11 Network Visualization of Co-citation of Cited Reference

Figure 8 shows the visualization of a cited references co-citation network in social media and knowledge management research divided into this complex research landscape of 12 clusters. Currently, each cluster is dealing with a specific thematic area showing the intersection between social media and knowledge management. The largest cluster, Cluster #0 (Case Study), has 97 members with a silhouette value of 0.881, showing that the structure is well defined. This cluster is on the case studies of how organizations are using social media to manage knowledge. Some representative works within this cluster include Kaplan's 2010 highly cited article entitled "Users of the World Unite!" with 26 citations that discusses challenges and opportunities of social media, and Kietzmann's 2011 "Social Media? Get Serious!" with 13 citations, which details the functional building blocks of social media in organizations.

Cluster #1, with a membership of 92 and a silhouette value of 0.797, is the second biggest cluster. It deals with social media's role in promoting creative performance within organizations. This cluster characterizes how social media enables knowledge sharing and collaboration, hence creating an environment of creativity and innovation. The representative works in this cluster include Bharati 2015 about how social media enhance organizational knowledge management with 17 citations, and Sigala 2015 about the effects of social media on employee creativity with 17 citations. Cluster #2 is Social Media, with 58 members and a very high silhouette value of 0.939, showing great thematic coherence.

It highlights the role of social media in improving knowledge sharing, particularly in academic and organizational settings. Individual motivations for using social media platforms to facilitate knowledge dissemination are explored in this cluster. Recent publications that fall into this category include Ahmed's 2019 systematic review on social media for knowledge sharing, with 13 citations, and Hair's 2016 methodological guide on partial least squares structural equation modeling, with 5 citations. Cluster #5 is a small but extremely cohesive cluster with 24 members and an overall perfect silhouette value of 1. It will discuss the detection of offensive language and misinformation in social media, particularly Tamil YouTube comments. The study involves the adoption of some NLP tasks, such as BERT, for detecting and managing harmful content. Among them are highly cited works: Devlin's 2018 paper about BERT with 8 citations and Liu's sequel work from 2019 about RoBERTa, an optimized model of BERT, with 7 citations. Cluster #6, Emergency Management (n=22; silhouette value =0.941), describes how social media allow sharing and reusing of the knowledge in emergency situations.

This cluster is related to crisis management; here come works like Chua, who studied customer knowledge management through the use of social media in crisis situations, with 8 citations, and Majchrzak, who analyzed

how wikis improve the reuse of knowledge during the emergency, also with 8 citations. This study shows that social medias are of immense value for the spread of essential information when needed. Cluster #7: Utilization of Enterprise Social Networks by 20, with a silhouette value of 0.979. This is set out to determine how organizations can use ESNs to enhance knowledge management and collaboration. It will spindle how ESNs improve communication and foster collaboration across the different levels of the organization. Sample key works include Leonardi, 2013, on the definition and history of enterprise social media, with 21 citations, and Leftheriotis, 2014, on whether the use of social media in work improves productivity or just consumes time, with 7 citations. Cluster #9-Multipronged Approach can be made up of 18 members with a silhouette value of 0.973 in order to deal with the detection and management of fake news, hate speech, and misinformation in social media platforms.

These are multipronged methods toward fact-checking and removal of bias from online content. Some of the most frequently cited works in this cluster include the work of Vosoughi on the spread of true and false news online, with 8 citations, and that of Kipf on semi-supervised classification using graph convolutional networks, with 5 citations. Cluster #16, Team Knowledge Management Capabilities, gives insight into how social media allows the creation of team knowledge management capabilities and innovation performance, with a membership of 11. Its silhouette value is located at 0.986. This cluster investigates the role played by social media in systematically smoothing the process of knowledge transfer among teams. Important works within this cluster include the work by Cao on how social media affordances enhance team performance, which has 5 citations, and Leonardi's work on the use of social media and its influence on work efficiency, which has 3 citations. Cluster #21: Knowledge-Intensive Manufacturing SME - This cluster has 8 members with a silhouette value of .993. The focal point of this cluster is the use of social media within knowledge-intensive SMEs.

This cluster adapted a sociotechnical approach on how SMEs apply social media to improve innovation and knowledge sharing. Four of the key works in this cluster are one by Soto-Acosta on "Social Web Knowledge Sharing and Innovation Performance in SMES" with 7 citations, and Scuotto on "Mass Collaborative Knowledge Management in SME" with 3 citations. Cluster #23 Antecedent, with a cluster size of 8 and a silhouette value of 0.998, represents the antecedents/motivational factors of knowledge sharing in social networking platforms. This study investigates how social media tools foster knowledge-sharing practices in workplaces. The most significant ones are Pee's 2015 about intrinsic motivation for online knowledge sharing, with 2 citations, and the one by Muqadas 2017 about challenges of knowledge sharing at public sector universities, with 2 citations. Cluster #25 Online Attachment Motivation - is a small cluster with 7 members; its silhouette value is 0.991.

It examines how attachment to online communities impacts users' motivations to share knowledge and participate in the social media-enabled knowledge-sharing processes. Key publications emanating from the strand are those by Beck on knowledge exchange in social media-enabled networks of practice, which has 4 citations, and the one done by Ma on the role of altruism and online attachment motivation in knowledge sharing, also with 4 citations. Last not least, Cluster #47 is the smallest cluster containing 3 members with a silhouette value of 0.996. This cluster addresses the role of the enterprise resource planning system in regard to supporting business processes and knowledge management within organizations. Key contributions in this respect are the work of Leimeister 2009 on how to leverage crowdsourcing in ERP systems with 2 citations, and that of Adya 2011, who researched the impact of prolonged exposure to new technology on user acceptance, with 1 citation. This network visualization shows how social media cuts across knowledge management from a wide array of themes: creative performance, team collaboration, misinformation management, and emergency response. The selected clusters are distinctive and strongly thematically focused, thus providing a good overview of the topics studied on social media and knowledge management.

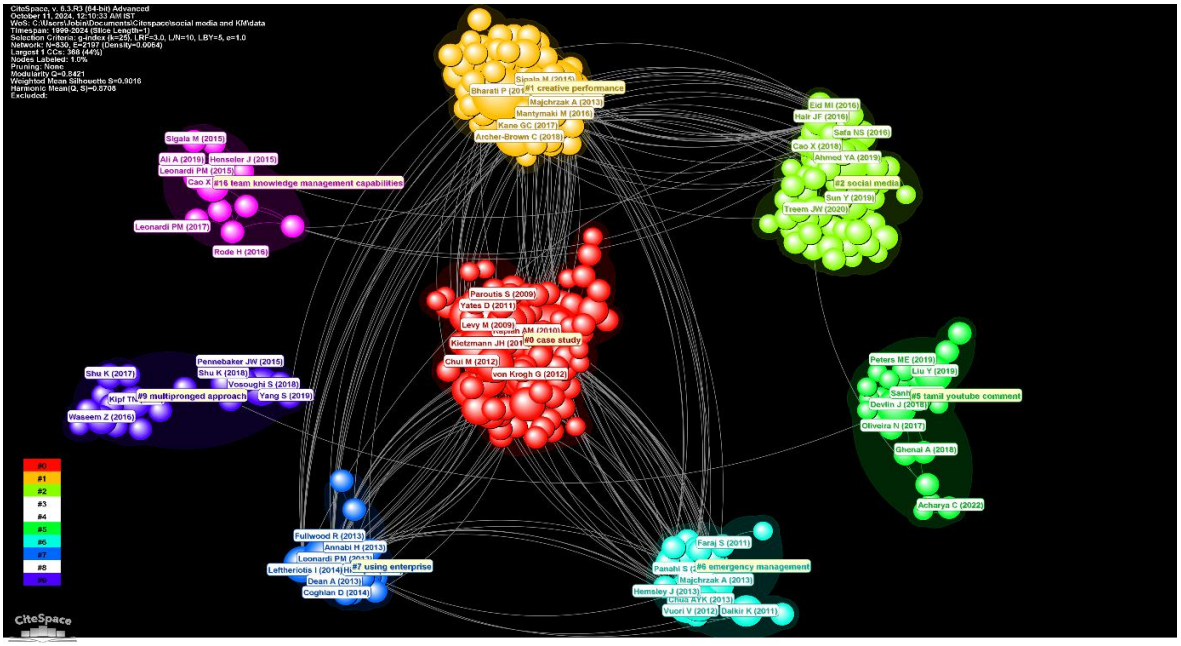


Figure 8: Network Visualization of Co-citation of cited reference

3.12 Timezone Network Visualization of Co-citation of Cited Journals

The timezone network visualization of co-citation of cited journals illustrated in Figure 9 reveals 13 distinct clusters, each highlighting different thematic focuses within these research domains. It organizes the clusters horizontally based on their thematic coherence and citation relationships. Each circle represents a journal, with its size reflecting the journal's total citation count in the network, and the color indicating the density of connections within its cluster. The layout's horizontal bars symbolize distinct time periods or thematic strata, helping identify how certain research topics or journals are interconnected over time. The arcs between circles illustrate co-citation links, revealing cross-cluster interactions and the interdisciplinary influence of journals across research domains. This approach provides a clear and visually intuitive representation of the dynamic interplay between journals and their citation networks, facilitating an in-depth understanding of the intellectual structure in the field. Cluster #0: Knowledge Management, the largest cluster with 119 members and a silhouette value of 0.91, centers on practical knowledge sharing in social media, particularly within instructional design and technology. Research in this cluster includes topics like Covid-19 fake news detection and fact-checking systems. Key journals in this cluster are IEEE Access and Technological Forecasting and Social Change, with 14 major citing articles each. Cluster #1: Social Media, consisting of 110 members with a silhouette value of 0.676, explores how social media enhances organizational performance through knowledge management. This cluster includes research on knowledge-sharing in enterprise social media platforms and the impact of big data on competitive advantage, particularly in the hospitality sector. The most-cited journals in this cluster include MIS Quarterly (263 citations), Organization Science (215 citations), and the Journal of Computer-Mediated Communication (174 citations).

Cluster #2: Internet Technologies has 80 members with a silhouette value of 0.619. This cluster focuses on the intersection of social media, internet technologies, and open innovation in IT organizations. Research here addresses the role of social media in fostering competitive advantage and customer knowledge sharing. Prominent journals in this cluster include International Journal of Information Management (200 citations) and Business Horizons (180 citations). Cluster #3: Global National is comprised of 71 members with a silhouette value of 0.839. This cluster focuses on global and national perspectives in social media and knowledge management, such as online knowledge-sharing mechanisms and sustainable knowledge management. Leading journals in this cluster are Sustainability (Switzerland) and Information Systems Frontiers, reflecting its international scope and environmental sustainability focus. Cluster #4: Knowledge Management, with 61 members and a silhouette value of 0.706, emphasizes the use of enterprise social networks for knowledge sharing in higher education. This research examines how networks and public crowdsourcing can be used for knowledge management. Key journals in this cluster include the Journal of Knowledge Management (318 citations) and Computers in Human Behavior (233 citations).

Cluster #5: Encouraging Participation, containing 34 members with a high silhouette value of 0.89, focuses on encouraging participation in virtual communities and using social media for knowledge sharing within organizations. The cluster examines how IT and social media platforms are leveraged to enhance collaboration and knowledge dissemination, with major journals such as Communications of the ACM (102 citations) and California Management Review (94 citations). Cluster #6: Conference Participant includes 28 members with a silhouette value of 0.757 and examines the role of social media in informal learning and knowledge sharing during conferences. Research in this area focuses on how social media platforms facilitate real-time collaboration and knowledge exchange among conference participants. The most-cited journals in this cluster are Computers & Education (64 citations) and the British Journal of Educational Technology (26 citations). Cluster #7: Learning Institution, with 26 members and a silhouette value of 0.836, explores knowledge sharing in higher education, specifically among academics. Research here looks at how academics engage in knowledge sharing to increase research productivity. Key journals in this cluster include the Journal of Marketing Research (77 citations) and Sustainability (62 citations), emphasizing both the marketing and environmental dimensions of knowledge management in educational institutions.

Cluster #8: Sharing Experience, containing 20 members with a high silhouette value of 0.968, examines how social media and mobile technologies enable experience sharing in professional and social contexts. This cluster focuses on virtual collaboration and knowledge exchange through mobile media. Key sources in this area include the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (39 citations) and AMCIS (3 citations). Cluster #10: Knowledge Management Behavior, with 16 members and a silhouette value of 0.994, explores how social media usage impacts employee creativity and knowledge management behavior in organizational settings. The research focuses on the role of social media platforms in enhancing creativity and decision-making processes. The most-cited journals in this cluster are Computers in Human Behavior and Journal of Business Research. Cluster #11: Fractal, consisting of 11 members and a perfect silhouette value of 1, focuses on the theoretical framework of knowledge workers as fractals within complex adaptive organizations. This cluster investigates the structures and organizational processes that promote knowledge sharing and adaptability. Key works in this area are found in Knowledge and Process Management and Journal of Management Inquiry.

Cluster #12: Creating Tag Hierarchies, with 8 members and a silhouette value of 0.993, discusses the development of tag hierarchies for social media navigation. Research in this cluster examines how effective navigation structures within social media platforms can enhance knowledge management. The most-cited journals here are Hypertext and Communications of the ACM (CACM). Finally, Cluster #16: Developmental Setting, the smallest cluster with 2 members and a silhouette value of 0.991, focuses on the application of knowledge management frameworks in developmental settings, specifically in smart agriculture. Key journals in this cluster include the Journal of Open Innovation: Technology and the Journal of Innovation & Knowledge.

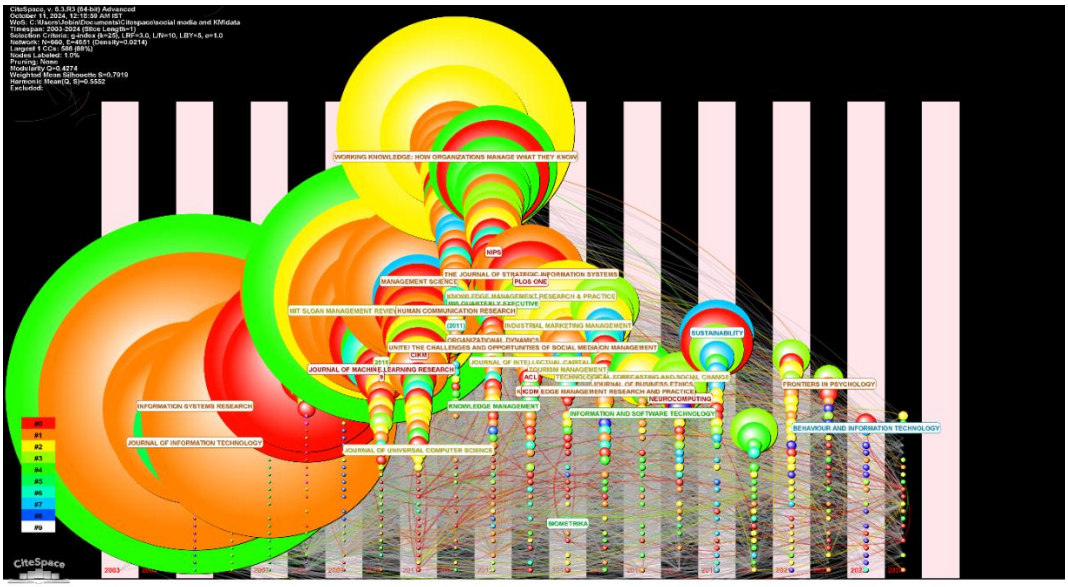


Figure 9: Timezone network visualization of Co-citation of cited journals

3.13 Timeline Network Visualization of Countries Collaborations

Figure 10 gives the visualize of the international research collaboration on a timeline, showing five key clusters with distinct themes and collaborations between nations. Cluster zero is the largest cluster, comprising twenty-six members with a silhouette value of 0.645. This cluster studies social connections, collaboration, and the role social media plays in academia and enterprise development. Individual nations also engage in the use of social networks for business optimization and learning innovation, as documented by Rust's analysis of farmers communicating with specialists in ecological management and Lytras's research on the impact of social networks on academic publishing. Supporting countries like Germany, Italy, and Spain create critical mass, as indicated by their citation counts of one hundred fourteen, sixty-two, and fifty-two respectively. Cluster one is the second largest cluster, including seventeen members at a silhouette value of 0.618. This cluster focuses mainly on the facilitation of knowledge on sustainability and corporate performance through social media. The collaborations here address issues like the detection of rumors at microblogging sites, transmission of know-how among employees, as seen in Sarkis's study of sustainable industry networks and Ma's research on exploiting time series to find the rumors in social platforms. The cluster leading is done by the United States, China, and Hong Kong because of the heavy involvement in exploring how social media influence the dissemination of data in both business and social settings; this is evidenced by their citation counts of three hundred sixty-two, two hundred five, and forty respectively.

Cluster #2: Advanced Systems includes 16 member countries and represents the incorporation of modern digital technologies, such as digital transformation, telehealth and online learning, into social networking sites. Members of this cluster include Australia, and many of the Southeast Asian countries that cooperate on research related to technological adoption of social media practices. The two most influential works cited include Talafidaryani's 2021 study on digital transformation and the study conducted by Salloum in 2020 on the acceptance of the e-learning system. Members most frequently cited include Australia, with 89 citations, Indonesia, with 45, and Malaysia, with 37, which indeed reflects the cluster focus on digital tools and their implications within society. Cluster #3: Intellectual Capital is made up of 16 members with a silhouette value of 0.821 focused on the role of intelligence assets in strengthening knowledge sharing-the expected occurrence for such cases as multinational businesses and higher education. The research in this cluster analyzed how intellectual capital and affordances of social media influence knowledge-sharing practices across organizations and communities. A seminal paper by Majchrzak in the year 2013 analyzed social media's contradictory impacts on communal knowledge sharing. Major countries participating in this cluster are India with 79 citations, Canada with 65, and Japan with 23 citations. All these countries are leading when it comes to exploring the use of brainpower via digital platforms to spread ideas far and wide.

Cluster #4: Educational Milieu discussed the deployment of social media and big data analytics in educational settings for small or medium-sized enterprises. It represents the most minor population with a silhouette value of 0.654 and only ten cluster members. This was an equally specialized cluster, showing international collaboration on how social networks and large-scale resources of data could assist in knowledge dissemination within educational systems, especially for small and medium enterprises. Perhaps the most important work in this effort to exploit knowledge management across firms was that of Scuotto, published in 2017. The countries with the greatest impact on discussing the use of social media platforms to enhance pedagogical and organizational learning across borders included the United Kingdom with 114 citations, the Russian Federation with 12 citations, and Nigeria with 7 citations. This temporal network map exposes cross-national collaborations underlying the global landscape of inquiries into the intersection between Social Connectedness and Information Exchange. While Cluster 0, with its focus on social ties, demonstrated substantial European participation, Cluster 1, on social media in the dissemination of expertise, had representatives mainly from the United States and China. Cluster 2, representing the new platforms, included major players from Australia and Southeast Asian countries. Cluster 3 dealt with intellectual assets wherein India and Canada had quite substantial contributions. Cluster 4 is about educational settings, wherein the UK and Russia have taken the lead to discuss the incorporation of social media into the pedagogical and enterprise environments. These clusters reflected the truly interdisciplinary and transnational character of scholarship in social media and knowledge management.

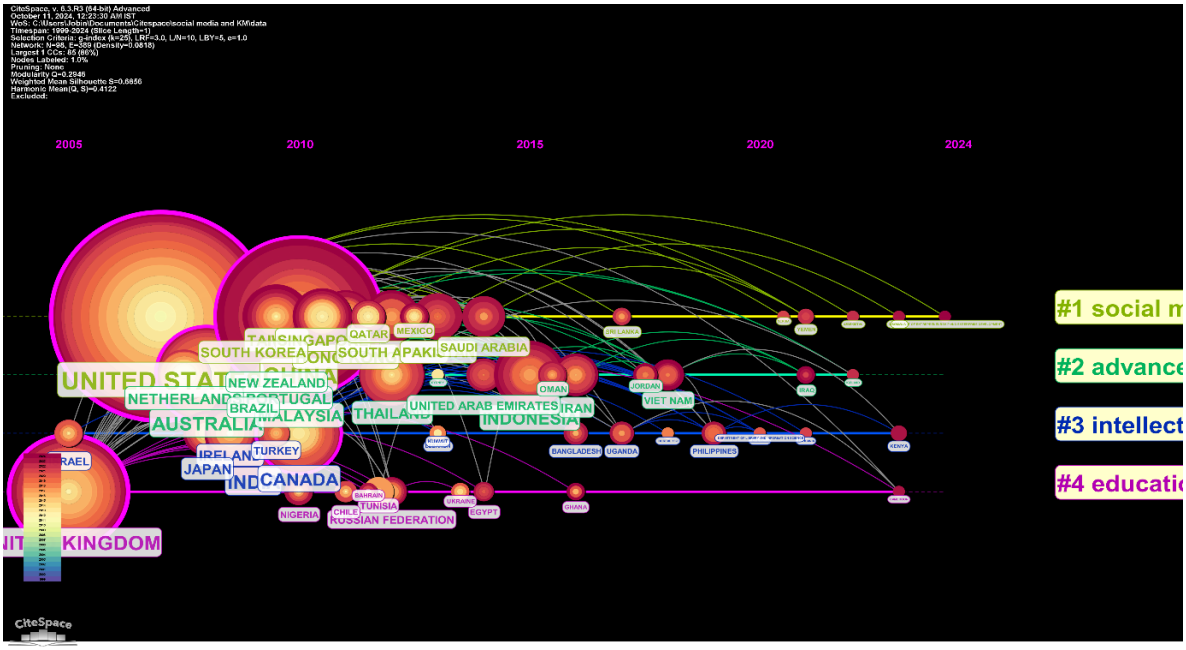


Figure 10: Timeline network visualization of Countries Collaborations

4. Discussion

This study provides a critical bibliometric review of the relationship between social media and knowledge management between 1999 and 2024. The findings underscore a growing academic interest in this intersection, reflected in an annual publication growth rate of 18.59% (Figure 2). This surge highlights the increasing relevance of social media in organizational knowledge management practices. The growth trajectory aligns with technological advancements, particularly in big data, artificial intelligence, and sentiment analysis, which have transformed the way knowledge is created, shared, and managed. Despite fluctuations in publication trends, the sustained interest in this domain signifies its evolving importance in academic and professional settings.

A key aspect of this study is the identification of thematic trends and emerging research priorities (Figure 3). Early studies primarily explored social networks and user-generated content, whereas contemporary research has shifted toward technologically advanced areas such as AI-driven knowledge systems, sentiment analysis, and misinformation detection. This transition signals a paradigm shift from traditional knowledge-sharing models to more data-driven and algorithmic approaches that leverage machine learning for automated knowledge extraction and dissemination. These evolving trends highlight the need for future research to explore how emerging technologies can enhance knowledge-sharing effectiveness while mitigating risks such as misinformation and data security concerns.

The thematic map of research clusters (Figure 4) further illustrates the intellectual structure of this field. Foundational topics such as Knowledge Management and Social Media remain at the core of academic discussions, while high-impact research areas, including machine learning, network analysis, and organizational knowledge-sharing models, drive innovation. The presence of fake news detection and misinformation management in the emerging themes quadrant suggests a growing awareness of the challenges posed by unverified information in social media-driven knowledge ecosystems. This thematic shift reflects a broader discourse on the reliability and authenticity of knowledge exchanged through digital platforms.

Beyond thematic trends, the co-citation analysis (Figure 6) reveals strong intellectual linkages among leading scholars in the field. The clustering of influential authors into distinct research communities suggests that knowledge management is increasingly viewed as an interdisciplinary field, integrating insights from computer science, business management, communication studies, and information systems. This finding underscores the necessity for cross-disciplinary collaboration to address complex knowledge management challenges in the digital era. Additionally, the co-occurrence network of keywords (Figure 7) highlights the growing convergence between knowledge management and AI-driven analytics, reinforcing the role of computational methodologies in advancing knowledge-sharing processes.

The study also uncovers significant international research collaborations (Figure 10). The visualization of country collaborations shows strong research partnerships between the United States, China, and leading European nations, reflecting their shared investment in technological advancements and digital transformation. However, developing economies remain underrepresented in this research domain, suggesting a potential gap in the literature regarding how social media-driven knowledge management unfolds in non-Western or resource-constrained contexts. Addressing this disparity through more inclusive global research efforts could provide a more comprehensive understanding of cultural and regional influences on knowledge-sharing behaviors.

Moreover, this study's most cited documents analysis (Table 4) provides valuable insights into key research contributions shaping this field. Highly cited studies emphasize topics such as crisis knowledge management, social media affordances, and enterprise knowledge-sharing frameworks. The predominance of research focusing on crisis response (e.g., knowledge management during natural disasters and pandemics) suggests that social media is increasingly seen as an essential tool for real-time information exchange in high-stakes scenarios. However, concerns regarding information overload, data privacy, and misinformation spread remain critical challenges, necessitating further research on strategies to enhance trust, transparency, and regulatory frameworks for social media-based knowledge systems.

These findings indicate that while social media has fundamentally transformed knowledge management practices, challenges persist in ensuring information reliability, security, and accessibility. The increasing reliance on AI, predictive analytics, and digital collaboration tools suggests a future in which automated knowledge extraction and AI-driven decision support systems play an even greater role in organizational strategies. However, as social media platforms continuously evolve, knowledge management frameworks must adapt to emerging risks and opportunities, ensuring that digital knowledge-sharing environments remain ethical, inclusive, and resilient.

5. Research Gaps

While such research has indeed pointed towards some robust growth pertaining to diversity in themes, there are a few key gaps that seem to raise an appeal for consideration. One such gap pertains to the lack of integration of emerging technologies, such as AI, ML, and NLP, in the knowledge management framework. Although these technologies have been acknowledged as having great potential, very few studies have been conducted that contest the ways in which these technologies could practically be applied in the improvement of knowledge-sharing with social media. This gap could well be filled in by future research focused on how these developments could serve to enhance the processes of organizational learning and knowledge management.

Another major gap exists in that no adequate interdisciplinary approach has thus far been taken towards understanding the relationship between social media and knowledge management. Much of the literature in these fields focuses too narrowly on some specific or isolated aspects of those fields, with little regard for what insights may be learned from viewing these aspects through the looking glasses of definite subjects such as information science, communication studies, and organizational behavior. The future research could move towards the development of a more holistic understanding of the complexities involved in leveraging social media for effective knowledge management by the adoption of interdisciplinary methodologies.

Another characteristic of the extant literature is the general lack of longitudinal studies tracing how social media influences knowledge management practices over time. Owing to rapid changes in the nature of platforms and user behavior, there is an urgent need for research into the long-term consequences of integrating social media within an organization. Such studies are more likely to be instructive with regard to the sustainability of knowledge-sharing practices and the evolving role of social media in organizational contexts.

Finally, most research so far has emphasized a certain region or industry; thus, the understanding of how cultural and contextual factors influence the nexus between social media and knowledge management is limited. Future research should therefore focus on cross-cultural studies to understand how different organizational environments shape knowledge-sharing behavior on social media. Such a broad approach may have the potential to enrich the literature by providing a more nuanced understanding of how different cultural factors affect knowledge management practices in different settings.

6. Practical Implications

Several actionable insights emerge from this study, relevant both for organizations and professionals who want to manage knowledge better through social media. First, organizations must learn that social media has now become an important tool for stimulating sharing and collaboration of knowledge within work groups. If carefully

integrated into the knowledge management strategies, social media platforms ensure finer communication, better communities, and fast-track information flow internally. Second, it is important for organizations to invest in broad training programs, considering that technologies such as AI and big data analytics are increasingly complex. These should alternatively equip the employees with the sets of skills necessary for comfortable use of social media with regards to knowledge management. In this way, such an investment in workforce development fosters a culture of continuous learning and adaptability, hence allowing organizations to maintain compatibility with the shifting technological environment. This study, on one hand, shows that policy and guidelines regarding the use of social media for knowledge management should be clear. In this light, frameworks demonstrating best practice on information sharing should be instituted by an organization, and employees should be informed of the possible implications for their activities online. Such guidelines have the potential to reduce risks such as information overload or miscommunication that may stem from unrestricted use of social media.

Finally, the study enumerates the role that has to be played by researchers, practitioners, and industry stakeholders in order to further knowledge management practices. A collaborative approach by the research fraternity, academia-industry partnerships for example, would facilitate the exchange of ideas and inspire innovation at the juncture where social media and knowledge management meet. Working jointly will also allow the various stakeholders to share their experiences in order to come up with better approaches to exploiting the full potential of social media within an organizational framework. While the study, therefore, established that there is an increasing interest in the role of social media in knowledge management, the gaps and practical considerations that underlined it did call for further investigation. Shutting these gaps would not only help advance academic discussions further but also provide organizations with the tools needed to negotiate clearly through the complexities associated with knowledge management in the digital era.

7. Conclusion

This study provides a comprehensive bibliometric review of the intersection between social media and knowledge management, based on a dataset of 1,579 publications from Scopus over the past 25 years. The analysis highlights several key trends, including an annual growth rate of 18.59% and a shift towards emerging topics like big data, sentiment analysis, and artificial intelligence within social media applications. This demonstrates the increasing relevance of social media in shaping knowledge management practices, offering valuable insights into how these technologies are transforming organizational knowledge processes. The study emphasizes the central role of social media in enhancing collaboration, knowledge sharing, and innovation within organizations. The thematic mapping and co-occurrence analysis reveal complex relationships between key concepts and trends in global research collaboration. Furthermore, recent studies focusing on issues like fake news detection and the impact of COVID-19 show how social media can address contemporary challenges in knowledge management. These findings reaffirm social media's adaptability and its growing importance in enabling dynamic, responsive knowledge management practices in a rapidly evolving technological landscape.

From a practical perspective, organizations must recognize the transformative potential of social media tools in fostering collaboration and enhancing communication across teams and departments. For this, investing in training programs is essential to ensure employees are equipped with the skills to effectively utilize social media platforms, especially as new technologies like AI and big data become integral to knowledge management. Additionally, it is important for organizations to establish clear policies and frameworks for social media use, to mitigate risks such as information overload and miscommunication, and to optimize the benefits of these tools for organizational learning. Looking ahead, this study highlights several future research directions. There is a significant need for ongoing exploration into the integration of emerging technologies, such as artificial intelligence, machine learning, and natural language processing, into knowledge management practices. Understanding how these technologies can enhance organizational learning and knowledge sharing will be crucial for advancing the field. Furthermore, there is a notable gap in interdisciplinary research that could provide a more holistic understanding of the complexities involved in leveraging social media for knowledge management. Longitudinal studies are also needed to examine the long-term effects of social media on knowledge management practices. Finally, future research should explore how cultural and contextual factors influence knowledge sharing on social media across different regions and industries, providing a deeper understanding of how organizational environments shape these processes. Overall, this research offers a solid foundation for future studies and provides valuable insights for scholars navigating the complexities of social media's role in knowledge management in the digital age.

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EJKM: 2025 State of the Journal

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Two-years in as editors-in-chief of the *Electronic Journal of Knowledge Management (EJKM)*, we continue to make progress in establishing the journal as a quality outlet for contemporary knowledge management research. We've seen some fine work published this year and believe we've made progress in improving the administrative processes as well.

Once again, thanks to everyone at ACI making the editing job easier, particularly Karen Harris who actually does most of the work. It's a pleasure to work in such an efficient, error-free environment.

The metrics show the journal received 189 submissions in 2024, up sharply from the 84 received in 2023. That's healthy but also a bit misleading as quite a number of these submissions were not really on topic and so were desk rejections. It's not entirely clear what's behind that trend but once misguided submissions are removed, the rate of submissions is still looking good and trending up.

EJKM accepted 13 submissions in 2014, on par with 2013's 14 acceptances. 170 submissions were declined. As always, submissions, acceptances, and rejections don't necessarily match up by calendar year, so the numbers don't add up to the 189 submissions. Also, as just noted, quite a number of submissions were desk rejections (160) with 10 others rejected after entering the reviewing process. The acceptance rate declined to 7% from 10%. As might be expected, the desk reject rate went up (72% to 89%) while the after-review reject rate went down (10% to 4%). The out-of-whack submission numbers make the results hard to evaluate precisely, but everything seems to be heading in the right direction. We were able to prioritize attention on the best submissions, allowing us to be respectful of reviewers' and authors' time. Days to accept declined markedly, from 259 days to 175 days, as did days to reject (37 days to 7 days). Only the latter should have been impacted by the large number of desk rejects.

The journal published two issues in 2024, down from three issues in 2023 but the first issue of 2025 is already rolling out. The difference is just a matter of timing when accepted articles are ready to publish, the difference does not indicate an overall drop in quality articles. *EJKM* continues to draw from a broad range of locations around the globe. Countries represented included not only Europe (Italy, Sweden, Poland, Austria, Finland) but also Asia (Indonesia twice, Vietnam), Africa (Ghana, South Africa), and North America (Canada, USA). And there are no formal numbers to support the feeling, but it seems from conversations with some authors that we might be publishing more articles from young scholars, completing or newly out of doctoral programs. If the work is good, we welcome it and hope so see more fine work in the future.

A couple of more opinionated comments again this year. We continue to see a good number of structural equation models (SEM) in submissions. As those are a focus of a lot of current work and the emphasis of many researchers' training, good SEM articles are always welcome. Authors looking to publish such methodologies, however, would save themselves and reviewers a lot of time if they take care to fully conceptualize their variables with specific references to the literature. SEM methods depend on scales which are combined into the concepts of interest. Often, the scales are sourced from the literature, showing they have already been successfully applied and reviewed. That's good. But too often, there is no theoretical development of the scales, just the reference to the previous study.

When putting together an SEM, the authors are making a choice on how to best conceptualize each of those variables. The scale used is one way to do it and contains specific items that the scale-maker drew from the literature (e.g. the tacit knowledge concept might be formed by items on learning-by-doing, sharing with colleagues, hands-on demonstrations, etc.). A full literature review would note that these types of items encompass what we know about tacit knowledge and so should be included in any conceptualization of the idea.

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The scale-maker presumably went to that trouble, the author borrowing the scale should at least acknowledge previous work on the concept to that degree. Further, the author has chosen that scale and that conceptualization. There are usually other options. So a full literature review and conceptualization encompasses acknowledging existing knowledge on what we know about the concepts and specifics on why the author chooses to represent it in this particular way for this particular study. A passing reference to a scale and a minimal literature review will not pass scrutiny in the reviewing process.

Relatedly, and we've seen a bit of discussion among reviewers this year, a question exists about the timeliness of sources. While submissions should be up-to-date, it's also important to recognize the scholars who originally established a concept or made a key finding. One should not be writing about tacit vs. explicit knowledge without mentioned Nonaka & Takeuchi or one of their connected papers. The fact that someone in a journal mentioned tacit knowledge last year is not a quality citation nor does it indicate the required deep understanding of the literature. At the same time, citing only the "classic" literature doesn't really get it done either. Scholars need to stay current (e.g. what has been published recently that has contributed to our understanding of tacit knowledge) so it is perfectly fair to ask for more recent citations if a paper is overly reliant on older literature. It's not one or the other, most quality literature reviews and conceptualizations will provide a balance between the originators of ideas and those who have made the most recent relevant contributions to our understanding.

External journal metrics show continuing improvement in our Scopus CiteScore, coming in at 3.0 for 2023, up from 2.5 in 2022. This level shows a positive, consistent trend from 0.8 in 2018. As always, please continue to read the journal and cite it when appropriate, especially in submissions. Everyone connected with the journal benefits from higher quality perceptions.

We look forward to continued growth in quality submissions. We welcome new reviewers, including those in or recently graduated from doctoral programs. More reviewers spread the work more widely, making everyone's life easier. If asked to review, it does help to let us know sooner rather than later about intentions to complete it (or not), and we always hope for a positive response. We do our best not to ask any more frequently than necessary, provide papers in areas of interest (if we know them), and to only put viable submissions out into the full review process.

Thanks for your continued support of the journal. We look forward to working with everyone in 2025 and into the future.

Editors-In-Chief

Helen & Scott

