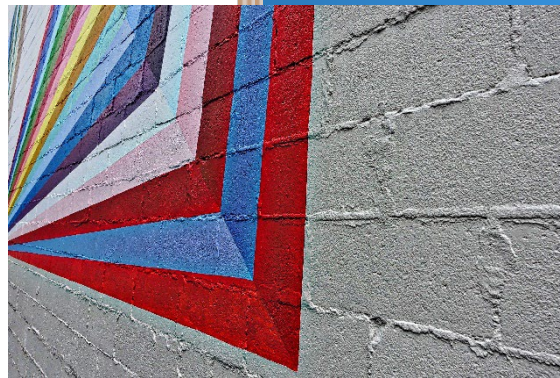


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Knowledge Repositories for Managing Knowledge in Learning Organizations

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Abstract: Learning organizations create a phenomenal amount of scholarly knowledge as part of their academic discourse and research activities. This scholarly knowledge must be preserved and made accessible to other members. The absence of tools and strategies to facilitate the storage and accessibility of knowledge and information resources poses lots of challenges for the growth of learning organizations, particularly, learning organizations in Ghana. This study, therefore, sought to assess the deployment of knowledge repositories in learning organizations toward effective knowledge creation, use, sharing, retention, and retrieval. The study employed the triangulation design and online survey research. The triangulation helped in the collection of quantitative data followed by qualitative instruments (interviews) to find answers to pertinent questions and issues that were insufficiently addressed in the questionnaire responses. Nine (9) learning organizations in Ghana participated in this study. The study established that knowledge repositories and technology played critical roles in managing knowledge in learning organizations. However, the knowledge repositories were not user-friendly and fully utilized or accessible for knowledge management practices at the learning organizations. Also, the absence of fully integrated ICT Tools and Infrastructure inhibited the effective promotion of knowledge management initiatives at the learning organizations. The study concludes by developing a knowledge repository architecture for knowledge management in learning organizations.

Keywords: Knowledge, Knowledge management, Knowledge repository, Organisational Learning, Learning organizations, Knowledge management technology

1. Introduction

One aspect of knowledge management (KM) is the implementation of a central repository or system to manage the local contents and memories of the organization (Alstete and Meyer, 2020), rather than leaving it to chance (Frost, 2015). Critical and relevant enterprise and proprietary knowledge, as well as memories of organizations, must be stored in a location, systems, and repositories, and in a format that can be easily accessed by users (Dei, 2017). Repositories are implemented in organizations to enable them to capture data, information, and knowledge (Dingsøyr, 2019; Frost 2018) or its intellectual assets, in any form and to improve at all levels or departments (Frost, 2015).

Knowledge repositories (KRs) serve as key systems used to manage the knowledge assets, organizational memories, and scholarly knowledge of members of organizations. KRs connect members of their communities locally and globally via databases. KRs provide a central location to collect, create, share, and retain knowledge assets and learning resources for use in instructional design and content development for both traditional and non-traditional learning environments and learning organizations (LO). KRs have become an integral part of LOs knowledge management (KM) activities and a valuable stimulant of teaching, research, and learning (Dei and van der Walt 2020; Dei, 2017).

KRs have become important in scholarly communication, institutional visibility, university ranking, and the feasible foundation of institutional KM (Kakai, 2018). LOs create a phenomenal amount of scholarly knowledge as part of their academic discourse and research activities. The knowledge created is published through various vehicles of scholarly communication such as journals, conference and symposium proceedings, books, case materials, patents, etc. LOs also produce a great deal of knowledge in the form of ephemeral and unpublished materials such as working papers, technical reports, courseware, classroom presentations, lecture notes, etc. Similarly, KRs consist of all electronic publications such as thesis, journals, books, and conference papers (Nunda and Elia, 2019; Adeyemo and Jamogha, 2021).

In LOs, KRs are used for scholarly communication; storing learning materials and courseware; electronic publishing; managing collections of research documents; preserving digital materials for the long term; adding to the institutions' prestige by showcasing its academic research; knowledge management; research assessment; and encouraging open access to scholarly research. Furthermore, KRs in LOs provide services to faculties, researchers, and administrators who want to archive research findings, reports, books, publications, and creative materials, among others, in any form. According to Dei and van der Walt (2018), it has always been a practice, in LOs, to store all relevant documents contributed by in-house resources in the knowledge repository or database. The implemented systems in LOs allow staff to deposit the content and explicit knowledge. Depositing and storing knowledge in repositories is expected from the staff of LOs and allows them to utilize the knowledge generated within the community.

This, therefore, means that LOs in Ghana need to invest and deploy tools and strategies to facilitate the deployment of KR toward the management of knowledge and information resources. Thus, the availability of KRs in LOs in Ghana should be able to enable them (LOs) to effectively embark on scholarly communication, records management, and manage their contents (theses, conference materials, journals, books, etc.).

There have been several studies on institutional repositories (Fadel and Durcikova, 2014; de Brito et al., 2016) and knowledge repositories (Gray and Durcikova, 2006; Semertzaki, 2011; Sugumaran, 2016). However, there is a lack of empirical research that seeks to investigate the role of KRs in managing knowledge in LOs, specifically, within the Ghanaian context. The absence of empirical literature has resulted in the absence of KR tools and strategies for the management of knowledge in the LOs despite the roles of the LOs in creating and generating knowledge. It is against this background that this study seeks to assess the deployment of KRs and the roles KRs play in LOs toward effective knowledge creation, use, sharing, retention, and retrieval.

2. Literature Review

2.1 Learning Organisation

Organizations consist of individuals or groups of individuals working towards a common goal or culture (Felipe, Roldán, and Leal-Rodríguez, 2017). Consequently, it takes time to foster a new culture among the members of organizations (Chen et al., 2018; Felipe, Roldán and Leal-Rodríguez, 2017) such as LOs (Šedžiuvienė, 2017). LOs for that matter organizational learning is a concept (or phenomenon) that is not easily defined. Questions such as “are there any true learning organizations?” and “are there any organizations that are not learning?” (Örtenblad, 2018). Örtenblad (2007) further posits that the phrase “learning organization” emerged from two distinct developmental processes: organized learning and organizational learning. Organized learning refers to the structuring of certain learning activities, particularly in the fields of pedagogy and educational science (Hofstetter, 1967), as well as management and organization studies (Huczynski and Boddy, 1979; Örtenblad, 2018; Örtenblad, 2007). Organizational learning was transformed into the term “learning organization” as part of the other evolving process for the term (Dery, 1982; Örtenblad, 2018; Örtenblad, 2007).

Senge (1990) went ahead to define LOs as “organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together.” Garvin (1993) also posit that LOs are “organizations skilled at creating, acquiring and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights”. In the opinion of Pedler and Burgoyne (2017) and Pedler, Burgoyne, and Boydell (1997), LOs are organizations that facilitate the learning of all their members and continuously transform themselves in order to meet their strategic goals. Continuous learning with transformation as the goal is a recurrent, stated promise in the definition. There is also an implicit promise that organizations will learn to adapt to their surroundings (Doyle and Johnson, 2019; Jensen, 2005; Song et al., 2013). In this regard, Neelen (2017) posits that LOs are good at individual learning (IL) and organizational learning (OL). Individual learning focuses on increasing knowledge and skills to do a better job (Odor, 2018) while organizational learning is about ‘solving problems on the organization’s behalf (which doesn’t necessarily lead to learning, so perhaps we should call it ‘organizational problem-solving instead) (Voolaid and Ehrlich, 2019; Alles, Seidel, and Gröschner, 2019) and ensures that individual learning is enriched and enhanced in organizations (Odor, 2018).

In LOs, the group of people works together collectively to enhance their capacities to create results they care about (Odor, 2018) and enhance learning (Šedžiuvienė, 2017). The process of learning must ultimately be made part of the culture, not just be a solution to a given problem (Šedžiuvienė, 2017). LOs have a culture that supports learning and innovations both by individuals and by the organization itself (Tan, 2019). LOs depend on the

cognitive process of the individual in the organization (Antunes and Pinheiro, 2020). The environment promotes a culture of learning, a community of learners (Voolaid and Ehrlich, 2019; Alles, Seidel, and Gröschner, 2019), and it ensures that individual learning enriches and enhances the organization as a whole (Odor, 2018).

The concept of LO regards the organization as an entity and focuses on the characteristics that encourage its members may learn. LOs are places where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole (reality) together." (Senge, 2017; 1990). LOs encourage ingenuity, independent thinking, and teamwork building and encourage and facilitate learning to continually transform itself not just to survive but also to excel in a swiftly changing business environment (Salleh and Huang, 2011).

In LOs, work processes must integrate attention to every aspect of knowledge. The processes and culture must enable knowledge creation, processing, storage, and dissemination (Antunes and Pinheiro, 2020). Organizational knowledge is knowledge independent of specific members in the organization, e.g. knowledge in knowledge repositories, and knowledge embedded in policies, and routines (Antunes and Pinheiro, 2020; Serrat, 2017). Members in LOs share ideas and both are concerned with processes for acquiring information, interpreting data, developing knowledge, and sustaining learning (Antunes and Pinheiro, 2020; Park and Kim, 2018). LOs also create opportunities for their member to share their ideas and insights without fear of being judged, expand their knowledge, and work together to achieve common goals (Su, 2017).

According to Senge (2017) and Goh (2020), the core of LOs work is based upon five "learning disciplines", each providing a true dimension in building an organization that can truly learn: Senge's five disciplines are integral components in LOs, providing tools and methods that are applicable and useful in the process of learning. The 5 disciplines are

1. System's thinking (collaborative learning culture): every LOs is supported by a culture of learning and every individual in the LOs plays a vital role in the learning and KM process.
2. Personal mastery (lifelong learning mindset): LOs require a forward-thinking mindset. Members must develop lifelong learning and KM practice where they value and understand the importance of continual growth.
3. Mental models (room for innovation): the members must be able to evaluate and assess their cognitive standing in the way of progress.
4. Team learning (knowledge sharing): collaboration is key in LOs. Every member must be aware of the objectives and outcome of the LOs and work towards it/them.
5. Shared vision (forward-thinking leadership): finally, LOs must look for forward-thinking leaders with vision, enthusiasm, and dedication to promote KM initiatives.

2.2 Knowledge Management

An effective organizational environment and the implementation of KM processes should increase the quality and quantity of both explicit and tacit knowledge of individuals, teams, and the whole organization (Omotayo, 2015). Davenport (1994) succinctly defined KM as "the process of capturing, distributing, and effectively using knowledge." Alosaimi (2018) further opines that KM is the systematic management of all activities and processes referred to generation and development, codification and storage, transferring and sharing, and utilization of knowledge for an organization's competitive edge. KM as a process in this study is seen as any practice or process of acquiring, creating, sharing, capturing, and using knowledge, wherever it resides, to enhance organizations learning and performance (Asiedu, Abah, & Dei, 2022). Its goal is to leverage and improve the organization's knowledge assets to effectuate better knowledge practices, improved organizational behaviors, better decisions, and improved organizational performance" (Dei and van der Walt, 2020; Dei, 2017).

The ability to create new knowledge is often at the heart of organizations competitive advantage (De-Graft, 2019; Frost, 2014). Knowledge creation is the process of making available and amplifying knowledge produced or generated by individuals or groups as well as crystallizing and connecting it to an organization's database or system (Valmohammadi and Ahmadi, 2015). Knowledge creation expands the reasons and practical ways to support it, which allows consistent creation within an organization (Hajric, 2018). Knowledge creation in this study is seen as the process of developing and obtaining insights, skills, and relationships either from internal sources (tapping into the knowledge of its staff, learning from experiences, and implementing continuous process improvements) or from external sources (best practices and benchmarking information from other organizations and collaborating with other organizations (Dei and van der Walt, 2020; Dei, 2017).

Knowledge created must be retained (Dei, 2017; Anduvare, 2015). The most effective approach to retaining knowledge in LOs is by implementing strategies such as education, training, communities of practice, and professional networks, documenting the processes, and use of advanced technology to capture work processes (Wamundila and Ngulube, 2011; APQC, 2015), mentoring and apprenticeship, greater access to subject matter experts, storytelling and leveraging retirees (Chigada, 2014; Frost, 2014). Other strategies include the support of formal and informal knowledge networks (social areas, social media, meetings, company functions, knowledge fairs, expertise locators, etc.), and changing the organization's culture (Frost, 2014; APQC, 2015). Knowledge retention is thus seen as all the activities, databases, and repositories that capture, preserve, and archive knowledge of organizations (Dei, 2017). Knowledge can exist or be retained in repositories of organizations and these knowledge repositories mainly consist of individuals, culture, transformations (procedures and formalized systems), structures (formal and informal networks), and external activities (Dei and van der Walt, 2020; Dei, 2017).

The operational objective of KM is to ensure that the right knowledge is available to the right person(s), at the right time, to aid the execution of their knowledge activities (Omotayo, 2015; Ramohlale, 2014). The concept of knowledge sharing in this study is viewed as the process through which one unit is affected by the experience of another and is manifested through changes in the knowledge or performance of the recipient units and can be demonstrated by measuring changes in performance and enabling the exploitation and application of existing knowledge for the organization's purposes (Dei and van der Walt, 2020; Dei, 2017)

2.3 Knowledge Repositories

Repositories are systems where information or scholarly works of members of a particular institution are deposited for safekeeping, access, use, and dissemination (Shajitha and KC, 2019). They are information technology-based systems set up to capture, store, index, and redistribute information and knowledge (Moscato-Zea et al., 2019). Repositories are essentially being used for the acquisition, preservation, and dissemination of locally generated scholarly information. Repositories are increasingly becoming podiums for publishing original and peer-reviewed content in an open-access environment (Saini, 2018).

Repositories are set up to manage the knowledge assets of LOs (Joo, Hofman, and Kim, 2019). KR is thus seen as A database that systematically captures, organizes, and categorizes knowledge-based information about institutions (Mahmoodpour and Lobov, 2019). Knowledge is codified and stored in a repository under the assumption that it will be transferable and useful to others within an organization and the organization as a whole (Ahmed, Salloum, and Shaalan, 2021). KRs serve as key systems used by LOs to manage knowledge assets and organizational memories and to connect members of their communities locally and globally via databases (Nurdin and Yusuf, 2020). KRs provide a central location to collect, create, share, and retain knowledge assets and learning resources for use (Nair and Munusami, 2020) in instructional design and content development for both traditional and non-traditional learning environments of Los (Akella, 2023). KRs have become an integral part of LOs KM activities (Khalil and Khalil, 2020) and a valuable stimulant of teaching, research, and learning (Sahlin-Andersson and Engwall, 2002).

KRs are designed to capture, store, and disseminate relevant knowledge throughout an organization (Singh and Gupta, 2014; Davenport, 2013; Knoco, 2015), and are often used to disseminate best practices among workers (Fadel and Durcikova, 2014). Accordingly, KRs are expected to improve organizational efficiency that is organizations' productivity, flexibility, and innovativeness by enabling organizational members to share, integrate and reuse knowledge more effectively (Bansler and Havn, 2004). Productivity is made possible by using ICT technologies to provide best practices and build a shared knowledge base (Sugumaran, 2016; Semertzaki, 2011; Smith and Brooks (2012). According to Passerini and Wu (2008), ICT empowers experts and professionals in various domains to contribute their knowledge effectively and efficiently. Repositories are enabled by ICT. Good ICT systems (infrastructure, hardware, networks, software) can aid access, production storage, and dissemination of information and knowledge resources considerably more rapidly and powerfully with the help of good ICT infrastructure (Dei and van der Walt, 2018; Ghosh and Ghosh, 2009). Minina and Mabrouk (2019) further posit that ICTs facilitate access to electronic documents, email, network resources, and digitization services to support researchers, academic personnel, and other staff of LOs.

3. Methodology

The triangulation design was applied in this research since it increases the perceived quality of the research, especially when the qualitative study follows the quantitative one and provides validation for the findings (Santos et al., 2020). The quantitative aspect enabled the researchers to gather quantifiable data from the respondents. The qualitative enabled the researchers to gather qualitative or descriptive data from the

respondents. The respondents were able to express themselves in words and the researchers were also able to gather in-depth insight and understanding of the concepts under study. The purpose of triangulation in this study is to use both qualitative and quantitative data sources and methodologies for the same phenomena in order to maximize the validity and reliability of the findings. Triangulation gave a more thorough knowledge of the study topic or aim and helped offset the drawbacks of employing a single data source or approach.

The researchers made use of survey research since the study involved a geographically dispersed population. The researchers started with the collection of quantitative data using the questionnaire and then used qualitative instruments (interviews) to find answers to pertinent questions and issues that were insufficiently addressed in the responses to the questionnaires. The selected participants were considered, however, as one unit for analysis. The use of the survey strategy in this study enabled the researchers to gather data using the opinions of sampled respondents about the implementation and use of KRs in the LOs.

The selection of cases for this study went through three stages. The first involves the identification and categorization of the LOs. The researchers categorized the LO into nine (9) groups/categories based on individual learning and organizational learning. Nine (9) categories of LOs identified include education and research institutions; law firms; IT firms; health organizations; employment and consulting agencies; finance, banking, and account; construction and engineering firms; hospitality; and energy firms. The second stage involves the selection of organizations or firms from each category of LOs identified in the first stage. The third stage involves the selection of respondents from the selected organizations. From each organization, the researchers purposively selected five (5) respondents who are key stakeholders of knowledge management activities in the organization and same-time management members of the organizations. Therefore, forty-five (45) people served as the respondents for the study.

For this study, the researchers chose an online survey as a principal means of collecting quantitative data from the respondents (Keusch, 2015). According to Usability.gov (2020), an online survey is a “structured questionnaire that your target audience completes over the internet generally through a filling out a form”. The collected data was stored in a database. The survey tool or application used to produce the online survey provided an automatic analysis of data for the researchers. In addition, the researchers adopted the telephone interview to elicit qualitative data from respondents who were unable to respond to the online survey. The telephone interview followed the structured format of the online survey for conformity.

4. Findings

By the end of the data collection, a total of forty-five sampled respondents, forty-one (41) of them successfully filled out the online survey and responded to the telephone interview. This represents a 91.11% response rate. The presentation of the survey responses was based on the thematic areas of the outlined objectives for the study.

4.1 Understanding KM and LOs

The study first sought to determine the respondents' level of understanding of the concept of KM, KRs, and LOs. Further to this, it sought to find out whether or not the respondents see their organization as an LO. The study established that most of the respondents understand the concepts of KRs as 24 (58.54%) of the respondents gave a positive response that they understand the concept of KRs. Also, 60.98% of the respondents said they understood the concept of KM. This is shown in Figure 1 below.

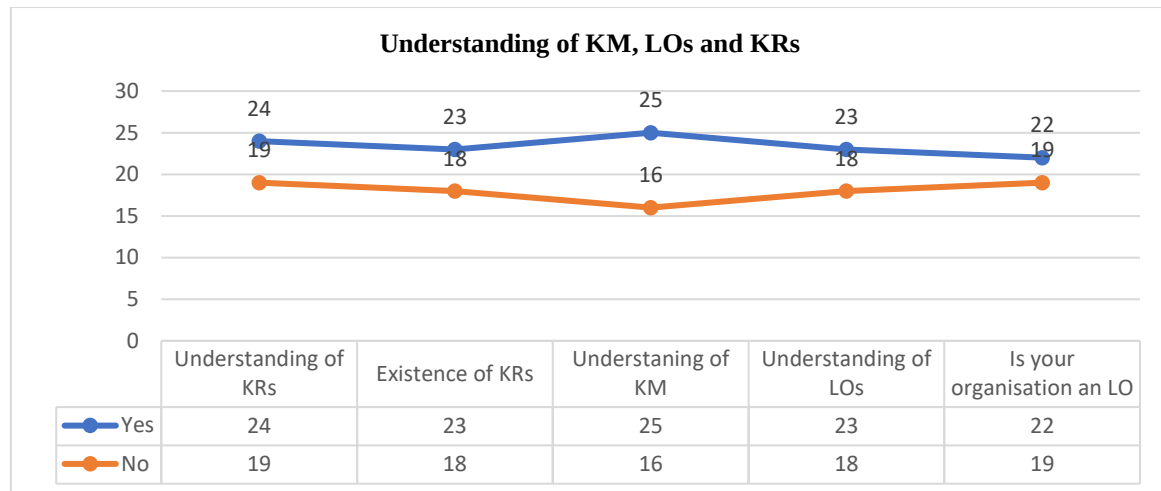


Figure 1: Understanding of KM, LOs, and KRs

Thus, the researchers sought to find out if the LOs have deployed repositories to facilitate the capturing and storage of knowledge assets of the organizations. The study established that 56.10% of the respondents believe there exist KRs in their organizations while 43.90% had contrary views. This shows that the LOs have not fully deployed or implemented repositories as 43.90% are either unaware or do not see their existence at the LOs. This could be a result of their lack of understanding of the concept of KRs as 41.46% said they don't understand the concept of KRs. Some of the respondents outline the following as their definition and understanding of KRs

- KRs are the storage platform for our content.
- KRs are the central place for keeping our knowledge and information products
- Devices for depositing the data and information of the organization
- They are our databases
- The servers that serve as the central location for our data and information.

These responses clearly show that the concept of KRs is not new to the respondents and that they understand KRs. Key to their responses is the acknowledgment of the fact that KRs are systems deployed by their organizations to manage the information and knowledge assets of their organizations.

In relation to understanding the concept of LOs, 56.10% of the respondents understand the concept of LOs while 43.90% of the respondents think otherwise. Similarly, 53.66% of the respondents think their organization can be classified as LOs while 46.34% gave a contrary response to the effect that their organizations cannot be classified as LOs. Some of the respondents outlined the following as their understanding of LOs

- The organization that facilitates the learning of its members and continuously transforms it
- Organizations that learn from its processes.
- LOs are organizations that ensure that the staff are allowed to learn and share knowledge freely
- LOs are organizations that seek to constantly improve themselves and their performance based on their experience and accumulated knowledge
- Organizations that keep learning
- An organization that has developed the capacity to learn, adapt, and change.

Additionally, the respondents indicated that they think their organizations can be classified as LOs because:

- Members of the organization freely share knowledge
- Learning is key to the organization
- Knowledge creation and sharing is fundamental in the organization
- The organization has deployed systems to facilitate continued learning by the members and staff of the organization
- There are learning centers in the organization
- We have an officer in charge of learning
- The organization has made provision for capacity building
- Training and development are part of the organizational culture

From the responses outlined by the respondents, it can be concluded that they understood the concept of LOs.

4.2 Knowledge Repositories

KRs are designed to capture, store, and disseminate relevant knowledge throughout an organization, and are often used to disseminate best practices among workers. They are expected to improve organizational efficiency. The study assessed KRs deployment from five main perspectives, namely, KRs in support of a culture of learning; capturing of content in the KRs; storage of content in the KRs; user-friendliness of the KRs; easy access and usage of the KRs; KRs supporting effective knowledge sharing; and using the KRs for collaborations. The responses are summarized in Figure 2 below.

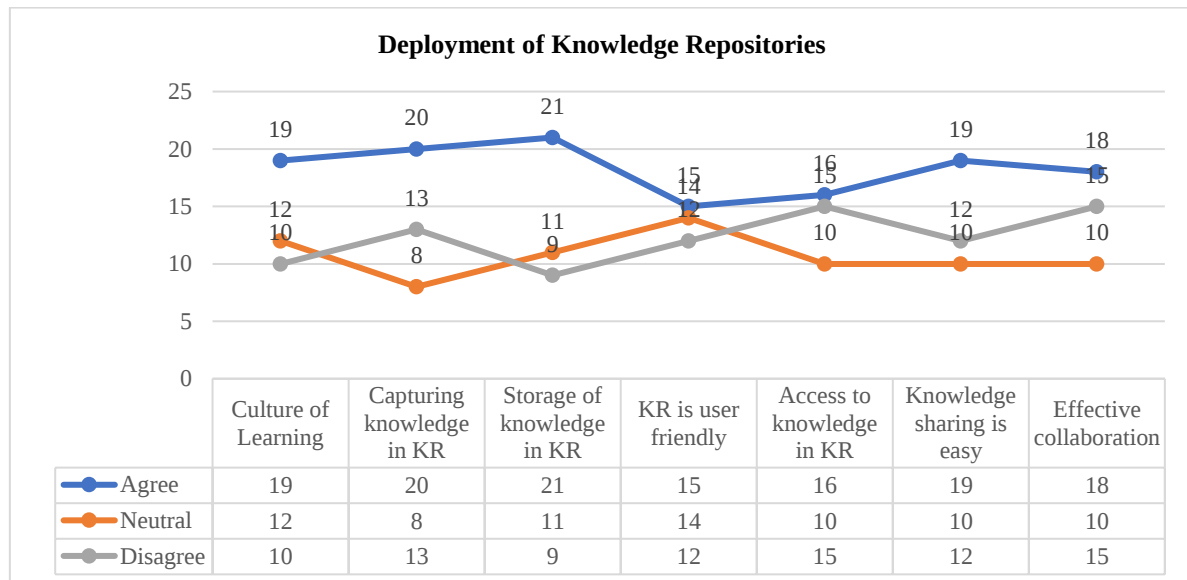


Figure 2: Deployment of Knowledge Repositories

A culture of learning is a fundamental factor in KM practice. It was established that the culture of learning which is a key component was not present and practiced at the LOs with a rate of 46.34%. A culture of learning promotes the creation and sharing of knowledge, and it is vital because it allows LOs to create new knowledge from shared and existing knowledge.

The creation of repositories is to facilitate the capturing and storage of data, information, and knowledge. The study established that despite the acknowledgment by some of the respondents of the existence of KR, capturing of knowledge in the repositories was not encouraging as only 48.78% of the staff think knowledge is captured in the repositories of the LOs. Again, the study revealed that only 51.22% positively think the knowledge created or captured is stored in the KR of the LOs. The lack of awareness or the non-existence of KRs by 31.72% of the respondents at the LOs could be attributed to why a reasonable 48.78% of the respondents said knowledge created at the LOs was not captured and stored in a KR.

It was again requested that the respondents indicate whether the KRs were user-friendly or not and whether there was easy access to knowledge from the KRs. The responses showed that only 36.59% of the respondents agreed that the KRs are user-friendly while 63.41% (34.15% neutral and 29.27% disagreed) expressed a contrary view indicating either they are unaware or disagreed. Concerning accessing knowledge in the KRs, 39.02% of the respondents agreed that they can access knowledge in the KRs while 60.98% expressed a contrary view indicating that they are unable to access knowledge in the KRs.

When asked if the KRs make knowledge sharing easy at the LOs, it was discovered that only 46.34% of the respondents think the KRs make knowledge sharing at the LOs easy. Conversely, 24.39% of the respondents were neutral and 29.27% disagreed, implying the KRs at the LOs do not support knowledge sharing.

On whether the KRs helped members to be able to collaborate with each other, 18 (43.90%) of the respondents agreed, 10 (24.39%) were neutral and 13 (31.71%) disagreed. These results showed that only a marginal portion believed the KRs provided prospects for collaboration.

4.3 ICT Tools and Infrastructure

The researchers sought to find out the existence of ICT tools and infrastructure at the LOs; whether the ICT tools facilitate easy access to knowledge content; and the availability of tools such as an intranet, portals, groupware, and weblogs for knowledge creation and sharing at the LOs.

Some of the systems and platforms available for knowledge sharing and collaboration at the LOs include the Internet, intranet, email, SMS, WhatsApp, LinkedIn, Facebook, YouTube, ZOOM, teleconferencing, Google Meet, and website. Figure 3 shows that only an average of 48.06% of the respondents affirmed that their LOs have proper ICT infrastructure that can support the KRs and KM processes. The findings suggest the limited availability of infrastructure and deployment of the same to support the KRs and facilitate KM practices at the LOs. On the specific infrastructure, the intranet and portal recorded technological support with a rate of 39.02% for KM practices.

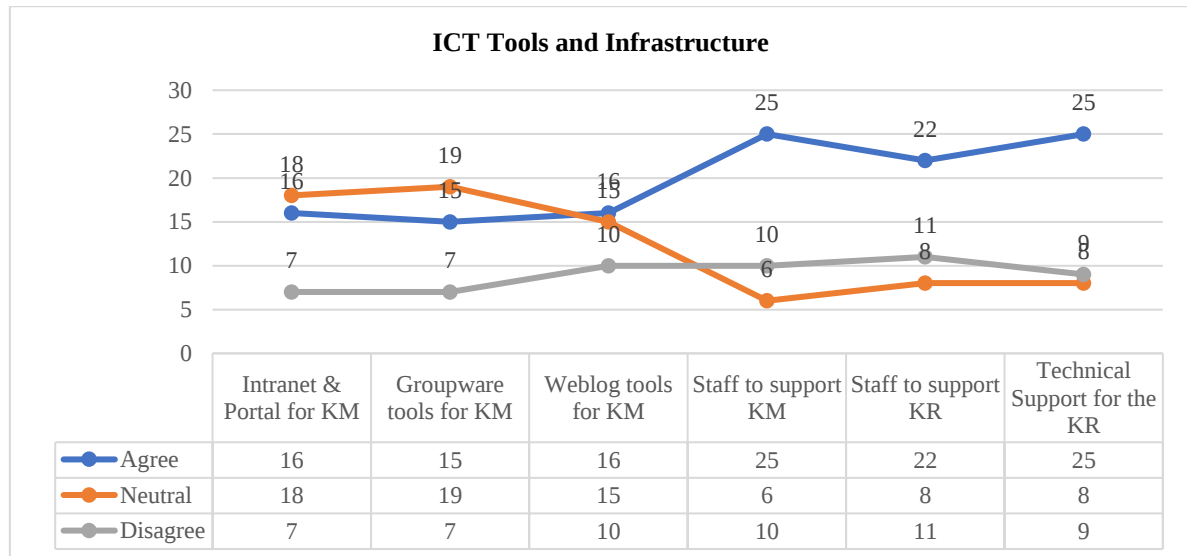


Figure 3: ICT Tools and Infrastructure

Furthermore, the viability of groupware tools in support of knowledge sharing and ultimately KM at the LOs was not encouraging as a minimal positivity rate of 36.59% while 65.41% (46.34% neutral and 17.07% disagreed) of the respondents expressed a contrary view to the existence of groupware tools to support KM. These results showed that the majority of respondents were either unaware or knew that groupware was not used to facilitate KM.

As with groupware, the researchers wanted to establish the viability of weblog tools in support of knowledge sharing and KM. The responses from the field showed that the use of weblogs for managing knowledge in the LOs was not intensely used as only 39.02% of the respondents responded positively while 36.59% and 24.39% of the respondents indicated they were neutral or disagreed. These results showed that the majority of respondents chose to be neutral and disagreed, which could mean that they are not aware of the existence of weblogs or they knew of its existence, but do not know if it is used for KM.

The researchers further wanted to establish the viability of weblogs in support of knowledge sharing and ultimately KM. The results reveal that the majority of staff (60.98%) do not use weblogs for knowledge creation and sharing. This means that the LOs need to promote the use of Weblogs, as it was revealed that only 39.02% of the respondents appreciate the usage of Weblogs in the LOs.

5. Discussion

Firstly, the researchers sought to find out the respondents' level of understanding and appreciation of the concept of LOs and KRs. The study established that most of the respondents understand the concepts of KRs and LOs. This gave a positive sign since the respondents are staff of LOs and LOs consist of a group of people who work collectively to enhance their capacities to create results they care about and enhance learning. Understanding the concept of LOs helps to create an environment that promotes a culture of learning, a

community of learners (Voolaid and Ehrlich, 2019; Alles, Seidel, and Gröschner, 2019), and ensures that individual learning is enriched and enhanced in organizations (Odor, 2018).

Despite the understanding of KRs, the study revealed that the LOs have not fully deployed or implemented KRs although some of the LOs have deployed KRs. The lack of KRs in some of the LOs could be attributed to a lack of understanding of the concept of KRs as 41.46% said they don't understand the concept of KRs. The creation of repositories with information and knowledge content is key for KM practices in every organization. Key to their responses is the acknowledgment of the fact that KRs are systems deployed by their organizations to manage the information and knowledge assets of their organizations.

A principal attribute of LOs is the culture of learning. It was established that the culture of learning which is a key component was not present and practiced at the LOs with a rate of 46.34%. again, this could be attributed to the lack of understanding of the concept of LOs and KRs by the respondents. This then could lead to a low culture of learning at the LOs although LOs should have an environment that is characterized by a culture of learning. A culture of learning promotes the creation and sharing of knowledge and it is vital because it allows LOs to create new knowledge from shared and existing knowledge.

KRs facilitate the capturing and storage of data, information, and knowledge. The study established that knowledge capturing in the KRs of the LOs was not encouraging as only 48.78% of the staff think knowledge is captured in the repositories of the LOs. This could be attributed to the absence of KRs in most of the LOs. These findings contradict the findings of Dei (2017) and Anduvare (2015) who established that the majority of knowledge in organizations is captured and stored. It is important to bear in mind that a vast amount of knowledge is in the heads of "experts" (Dei, 2017) and these must be captured in the KRs of the LOs. Such knowledge could remain unused if not tapped. KRs are designed to capture, store, and disseminate relevant knowledge throughout an organization, and are often used to disseminate best practices among workers. They are expected to improve organizational efficiency. The LOs should therefore deploy mechanisms to facilitate the capturing, storing, and sharing of knowledge.

The study further revealed that only 51.22% positively think the knowledge created or captured is stored in the KR of the LOs. The lack of awareness or the non-existence of KRs by 31.72% of the respondents at the LOs could be attributed to why a reasonable 48.78% of the respondents said knowledge created at the LOs was not captured and stored in a KR. According to Dei and van der Walt (2018), it has always been a practice, in almost all LOs, to store all relevant documents contributed by in-house resources in the KRs or database. It is therefore important LOs to deploy strategies to facilitate the capturing of knowledge into the KRs. These findings contradict Sugumaran (2016), Semertzaki (2011), and Smith and Brooks (2012) who established that systems and knowledge repositories deployed in organizations are to facilitate the capturing of knowledge created and generated in organizations. Similarly, Dei (2017) found that the deployment of knowledge management systems in learning organizations such as universities facilitated the capturing of both formal and informal knowledge at the universities.

The availability of KRs should facilitate collaboration and easy access to knowledge for every staff member of an organization. The study revealed that the KRs are not user-friendly. Similarly, it was revealed that the KRs are not easily accessible and the knowledge is not easily sharable. The lack of awareness or the non-existence of repositories at the LOs could again be attributed to this result. Frost (2018), Levallet and Chan. (2019), Chhim, Somers, and Chinnam (2017), and Al-Busaidi and Olfman (2017) established that KRs and systems deployed to manage knowledge in organizations should be user-friendly and accessible. The user-friendliness and accessibility lead to the usage and application of the knowledge captured and stored in the KRs. Omotayo (2015) also articulates that creating and sharing knowledge is essential for the survival of almost all organizations.

The study also established that only a marginal portion believed the KRs provided prospects for collaboration. These results could be attributed to a lack of willingness to collaborate at Jurišević Brčić and Mihelič (2015) indicate that willingness significantly influences knowledge sharing, communication, and collaboration. Chigada and Ngulube (2015) also indicate that collaboration, teamwork, and socialization are the surest ways to promote and enhance knowledge sharing in organizations. Collaboration between staff enhances KM and organizational learning, it assumes a basic level of organizational skills such as teamwork (APQC, 2015).

Technology has long been an enabler for KM such as collaborative computing tools, internet, intranet, knowledge servers, groupware, knowledge portals, document and content management systems, knowledge harvesting tools as well as search engines are critical enablers of KM (Singh and Gupta, 2014; Davenport, 2013; Knoco, 2015). The study showed that some of the systems and platforms available for knowledge sharing and

collaboration at the LOs include the Internet, intranet, email, SMS, WhatsApp, LinkedIn, Facebook, YouTube, ZOOM, Google Meet, website, and teleconferencing. However, the findings suggest the limited availability of infrastructure and deployment of the same to support the KRs and facilitate KM practices at the LOs.

Furthermore, the results showed that the majority of respondents were either unaware or knew that groupware was not used to facilitate KM. It is therefore important for groupware to be deployed in the LOs. Groupware fulfills a number of specific roles in relation to KM in organizations. It enables both communication and group memory; facilitates and provides a forum for organizational communication, it collects and stores this communication as well.

The researchers further suggest a framework based on the findings. The framework consists of three (3) main elements. These are ICT Tools/Infrastructure, Knowledge Management, and Knowledge Repositories. The framework established a relationship between the elements and how they interact to generate knowledge as shown in Figure 4 below

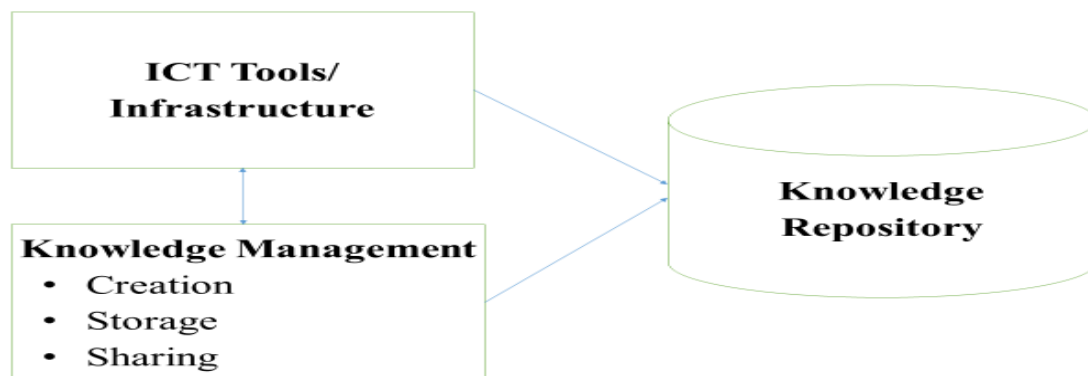


Figure 4: Proposed KR architecture for LOs

The framework suggests three building blocks/elements: KM, KRs, and ICT tools/infrastructure. From this perspective, knowledge is considered as an object that can be created, used, retained, and/or shared among members within or aligned to the LOs and 'is transferable from one place to another with less appropriation. The knowledge can be codified, indexed, and stored in the repository. When knowledge is created, it is either used instantly, shared among members of the LOs, or deposited in the KR for storage, archiving, and indexing, making it possible for others to easily access or retrieve the knowledge for use and reuse.

The ICT tools and infrastructure consist of hardware, software, and peopleware (the roles played by people in facilitating the creation, use, sharing, and storage of knowledge) and serve as an enabler of knowledge creation, use, sharing, and storage in LOs. They help in building knowledge capital in organizations. The ICT Tools/Infrastructure similarly serve as an enabler for the KRs. Thus, the backbone of the KRs of the organizations.

The KR is the storage system for all knowledge created or generated at the LOs. In this contest, the KR is seen as the database that systematically captures, organizes, and categorizes knowledge-based information of the LOs. Knowledge is codified, indexed, and stored in the KR with the aid of information technology under the assumption that it can be retrieved, used, transferable, and useful to other members of the LOs and the LOs as a whole. The KR serves as a key system used by the LOs to manage the knowledge assets and organizational memories and to connect members of their communities locally and globally via databases. The KRs provides a central location to collect, create, share, and retain knowledge assets and learning resources for use in instructional design and content development for both traditional and non-traditional learning environment of LOs.

6. Conclusion and Recommendation

The study sought to assess the role of KRs in managing knowledge in LOs, specifically, within the Ghanaian context. Based on the analyzed data, it was realized that despite the acknowledgment by some of the respondents of the existence and understanding of KR, capturing and storage of knowledge in the repositories was not encouraging while accessibility to the KRs for use and KM was minimal at the LOs which resulted in the absence of a culture of learning. Generally, the LOs did not have proper ICT Tools and infrastructure that could support the KRs and KM processes although the Intranet and portal recorded minimal technological support for KM at the LOs. The viability of groupware tools and weblog tools in support of knowledge sharing and ultimately

KM at the LOs was not encouraging. Again, the KRs were not user-friendly, did not make knowledge sharing easy at the LOs, and did not facilitate effective collaboration.

The study, concludes that despite the high level of appreciation and understanding of the concept of KM, KRs, and LOs; and the acknowledgment that KRs play critical roles in managing knowledge in LOs, the KRs were not user-friendly and fully utilized or accessible for KM practices at the LOs. In addition, the absence of fully integrated ICT Tools and Infrastructure failed to effectively promote proper KM initiatives at the LOs.

Based on the findings and conclusion, it is recommended that

- The LOs should intensify the deployment and integration of ICT tools such as an intranet, portals, groupware, and weblog that can support the KRs and KM processes
- There should be more collaboration for effective KM practices at the LOs
- Systems and procedures should be put in place to encourage the capturing and storage of knowledge into the KRs of the LOs.
- the KRs should be re-structured to be user-friendly, accessible, and usable

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Human Capital Dimensions Influencing Knowledge Hiding in the Public Sector: Evidence from Italy

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Abstract: The aim of the current study is to investigate the influence of human capital dimensions on knowledge hiding behaviour of public sector employees. A simple random sampling technique was used, and data were collected through a survey from 336 individuals working in different companies within the Italian public sector. The results show that, in most cases, the influence of human capital dimensions on knowledge hiding behaviour was significant. Furthermore, these findings contribute to identifying and highlighting how gender also plays a significant role in the way people hide their knowledge. The work is novel in the context of investigating the factors that may influence knowledge hiding behaviour in the public sector and seeks to contribute to the development of knowledge risks strand and, more generally, to the research on knowledge management in public sector organisations. It also encourages managers to consider the potentially harmful effects of this practice.

Keywords: Knowledge hiding, Organisational behaviour, Human capital, Gender, Public sector

1. Introduction

Recognized as a component of the intellectual capital construct together with structural, relational, and social capital (Brennan and Connell, 2000; Edvinsson and Malone, 1997; Scafarto, V., Ricci and Scafarto, F., 2016), human capital (HC) is “anything but physical capital such as properties, equipment and financial capital” (Pasban and Nojehdeh, 2016, p. 250), and refers to the accumulation of knowledge, skills and experiences of individuals, which organisations employ to achieve and maintain a competitive advantage, and which they must use and develop optimally to prevent it from diminishing in value (Islam and Amin, 2022). The link between HC, knowledge, and knowledge management (KM) already appears clear from its definition, and has been extensively explored in various research studies. Dar and Mishra (2021), investigating the role of HC in the internationalization of SMEs, highlighted that knowledge is a key constituent of HC both in its explicit form, where it is easily incorporated into the organisation, and in its tacit form, where it is more difficult to codify. In Palacios-Marques, Gil-Pechuán and Lim (2011), the relationship between HC and KM was studied by relating KM practices to each human capital dimensions (HCDs), and it was found that introducing KM practices positively influences HC improvement. Birasnav and Rangnekar (2010) developed a KM hierarchical structure for HC development through a KM tactical process and problem-solving approach, communication-oriented culture, and innovation-supportive culture. Alnoor (2020), using data from a sample of owners of SMEs in Iraq, demonstrated the mediating role of KM on the relationship between HCDs and firm’s survival. Considering the existing link between HC, knowledge, and KM, as confirmed by the literature, we believe it is appropriate to also consider the relationship between HC, its dimensions, and knowledge-related risks, namely, knowledge risks. Knowledge risks have been defined as “a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can affect the functioning of an organisation on any level” (Durst and Zieba, 2019, p.2). Durst and Zieba (2019) classified them into technological, operational, and human knowledge risks based on their origin. Human knowledge risks refer to personal, social, and psychological aspects and occur in the context of interactions between organisational members (Durst and Zieba, 2019). Technological knowledge risks concern the relationship of organisations with technology, which can show technology’s risky side as in the case of cyber-attacks (Durst and Zieba, 2019) or when employees use obsolete technologies, especially when working from home (Borgia et al., 2022). Operational knowledge risks are instead connected to the management of knowledge in the day-to-day operations of organisations, as well as in extraordinary events, as in the case of mergers and acquisitions (Durst and Zieba, 2019). Knowledge hiding (KH)

is a human knowledge risk referring to “intentional attempts to withhold or conceal knowledge from another individual” (Connelly et al. 2012, p. 65), and has been recognized as a risk capable of harming the ability of organisations to be competitive and innovative (Butt and Ahmad, 2021). In public sector organisations, knowledge sharing is very important given the role of such organisations in the community (Abbasi et al., 2021; Torfing, 2019); thus, KHB prevention and mitigation become paramount. The relationship between HCDs and risk has been widely investigated in the literature (Adeleke et al., 2018; Isaac, 1995; Zheng et al., 2018), while research on knowledge risks is still developing (Durst, 2019), also regarding its relation to HCDs, especially in the public sector.

The present paper seeks to fill this gap by considering knowledge hiding behaviour (KHB) of public sector employees and by analyzing the effects of HCDs on such behaviour. The influence of gender on KHB is also analyzed, representing a gap in the knowledge risk literature that was a recommended topic to be investigated in knowledge hiding studies (Anand, A., Offergelt and Anand, P., 2022). A study that relates human capital to knowledge hiding behaviour could contribute to research on knowledge management in organisations, in particular, on the risks associated with knowledge management. Investigating knowledge hiding determinants and whether they may be related to human capital may be crucial for organisations wishing to maintain satisfactory and durable levels of performance.

The paper continues in the following sections with the literature review and hypothesis development (Section 2), with an explanation of the methodology used in the analysis (Section 3), and with the presentation of the results (Section 4). The discussion and conclusions close the paper (Section 5 and Section 6).

2. Literature Review and Hypothesis Development

Traditional HC measures are still subject to limitations due to the scarce amount of consideration given to the main qualitative characteristics of HC, which essentially means that it is the result of a combination of individuals' features (Mubarik, Chandran and Devadason, 2018). Based on Alnoor's research (2020), in this work, items considered to measure HCDs were education (EDU), experience (EXP), health (HLT), personal attributes (PA), skills (SKI), and training (TRA). Hypothesis 1 was formulated with regard to the relationship between HC and KHB. Hypothesis 2 was formulated based on the influence of gender on KHB. Both the hypotheses of the present work are based on previous studies, which support their formulation.

2.1 Human Capital Dimensions and Knowledge-Hiding Behaviour

2.1.1 Education and knowledge-hiding behaviour

HCDs were found to be in correlation with KHB in several studies. Considering the level of EDU, it was found that it can have both positive and negative effects on KHB, but also be non-significantly related to KHB. The findings from Zhang et al. (2022) showed that employees with better EDU engaged in KHB more rationally rather than evasively, reducing the harmful effects of KH. Pan and Zhag (2014) verified that graduate students hide knowledge, identifying the complexity of knowledge as the main cause of hiding. Dodokh (2020), analyzing data collected from 270 employees in the telecommunications and information technology sector in Jordan, found that education is positively related to workplace knowledge-hiding behavior, finding that higher-educated employees hide information more than their counterparts. In other studies, such as that of Zhang, Yao, Qunchao, and Tsai (2022), it was found that the educational background of employees has no significant effect on KH.

Based on the above, the following hypothesis was created:

Hypothesis 1 (H1a). *The level of education (EDU) has positive effect on knowledge-hiding behaviour (KHB).*

2.1.2 Experience and knowledge-hiding behaviour

Scholars demonstrated that EXP is positively related to KHB. Serenko and Bontis (2016), according to Peng (2013) and Li et al. (2015), pointed out that employees consider knowledge accumulated from past work experiences as a property, and when they are in their current organisation, the sense of psychological ownership of that knowledge drives them to hide it from their colleagues. Considering the above, the following hypothesis was drawn:

Hypothesis 1 (H1b). *Work experience (EXP1) has positive effect on knowledge-hiding behaviour (KHB).*

Hypothesis 1 (H1c) *Similar industry experience (EXP2) has positive effect on knowledge-hiding behaviour (KHB).*

2.1.3 Health and knowledge-hiding behaviour

HLT as a dimension of HC was negatively correlated with KHB, in particular mental health, having been shown, in several studies, that poor mental health, particularly due to working environment conditions, lead employees to withhold knowledge. Zhao and Jiang (2021) demonstrated that role stress, as a core element of emotional exhaustion, positively relates to KHB, and in another study, employees were found to choose KHB in response to psychological stress provoked by high interpersonal conflicts in the workplace (Losada-Otálora, Peña-García, and Sanchez, . 2020). Furthermore, in Rubbab (2022), it was found that organisational dehumanization, causing psychological distress, induces employees to KHB. Given the foregoing, the hypothesis relating to HLT dimension is posed:

Hypothesis 1 (H1_a). *Health conditions (HLT) have negative effect on knowledge-hiding behaviour (KHB).*

2.1.4 Personal attributes and knowledge-hiding behaviour

Referring to personality characteristics and abilities (Wood 1989), PA have been related to KHB in several researches. Considering personality characteristics, de Geofroy and Evans (2017) found that high emotional intelligence has a negative impact on KHB, which results in mitigation. Abilities were defined as personal attributes capable of influencing work performance, such as creativity or problem sensitivity (Carnevale and Smith 2013), which researchers found negatively correlated to KHB, as in the case of employee creativity (Bogilović et al. 2017; Malik et al. 2019), professional commitment (Butt 2021), and extroversion (Demirkasimoglu 2016; Iqbal et al. 2020). In contrast to these studies, Akhlaghimofrad and Farmanesh (2021) found that a PA such as cynicism has no significant impact on KHB, and rather acts as a mediating variable. Thus, the hypothesis about PA size is stated below:

Hypothesis 1 (H1_b). *Personal attributes (PA) have negative effect on knowledge-hiding behaviour (KHB).*

2.1.5 Skills and knowledge-hiding behaviour

Scholars investigated the effects of SKI on KHB as well. In particular, employees' political skills were found to be helpful in diminishing the occurrence of KHB (Ain et al. 2022; Kaur and Kang 2022; Offergelt and Venz 2023). Hence, the hypothesis about SKI effects on KHB is drawn:

Hypothesis 1 (H1_f). *Skills (SKI), in particular employees' political skills, have negative effect on knowledge-hiding behaviour (KHB).*

2.1.6 Professional training and knowledge-hiding behaviour

With reference to the effects of TRA on KHB, Labafi et al. (2022) studied the factors triggering KHB in IT services of Iran, and found that the learning ability of the knowledge seeker is one of the most influential factors. This implies that organisations need to implement the learning capacity of knowledge seekers through training mechanisms aimed at promoting knowledge sharing. Lanke (2023), on the other hand, using an integrative review technique, found that compassion training, by helping to develop empathy, improves interpersonal relationships consequently reducing KHB. Thus, the hypothesis of this study regarding TRA dimension:

Hypothesis 1 (H1_g). *Professional training (TRA) has negative effect on knowledge-hiding behaviour (KHB).*

2.2 Gender and Knowledge-Hiding Behaviour

Whether and how gender can influence risk perception and behaviour has been widely covered in the literature thus far. Savage (1993) studied the influence of demographics on the perception of very different types of risk, finding that women have more dread related to hazards. In other studies, the perception of risk of tourists during the COVID-19 pandemic was explored, and gender was also considered as an influencing factor (O'Connor and Assaker 2021; Perić, Damićanin and Conić, 2021; Zhan et al. 2022). In Forsythe and Shi's research (2003), the risk profile of an internet shopper was provided, where the influence of gender was considered among selected demographics. Regarding gender and risk behaviour, considerable scientific studies have been carried out as well. Jackman et al. (2021) investigated differences in suicidality based on gender identity, and Ghahremani et al. (2019) analyzed the relationship between demographics and high-risk behaviour. Furthermore, La Greca et al. (2022) investigated mothers' health-risk behaviour, and other studies analyzed the gender differences in risky driving behaviour (Măirean and Diaconu-Gherasim 2021; Granie et al. 2021).

With specific reference to KHB, Demikasimoglu showed that female academics are more likely to engage in evasive knowledge hiding behaviour (Demirkasimoglu 2016), while Andreeva and Zappa (2023) reported that men were more likely to hide their knowledge from colleagues. The role of gender was also considered in research focused on the relationship between ethical leadership and KH (Koay and Lim, 2021), and between expert power and referent power regarding KH (Issac et al. 2022). In the study by Koay and Lim, gender was included as a control variable because it was thought to influence employees' propensity to share knowledge, while Issac found that men were more likely to retaliate against their abusive supervisors by hiding knowledge from other shop workers. After considering this researches, the following hypothesis was formulated:

Hypothesis 2 (H2). *Gender affects knowledge-hiding behaviour (KHB). Women hide knowledge more than their male counterparts.*

The conceptual framework shown in Figure 1 represents the various hypotheses that are presented in this study. HC (with its subscales) and gender are independent variables, whereas KHB1 is dependent.

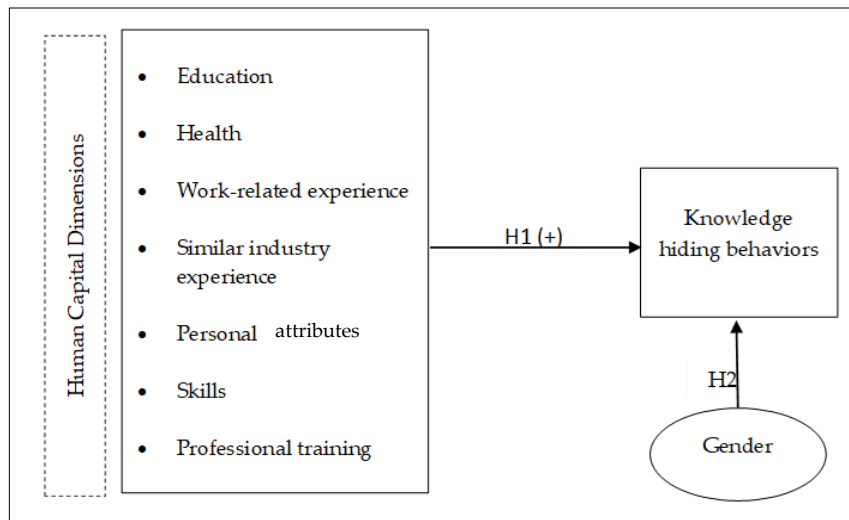


Figure 1: The conceptual framework. Source: authors' conceptualization

3. Research Methodology

3.1 Sampling and Data Collection

To examine the research model presented in Figure 1, and to achieve the study objectives, a quantitative approach was followed, two non-probabilistic sampling methods (i.e., convenience sampling and self-selection sampling) to gather data from the participants through circulating the questionnaire link to faculty members via their emails as well as distributing hard copies of the questionnaires on their work-related sites. As a result, the questionnaire has been distributed via two ways (online questionnaire and on-site).

From June 2022 to September 2022 a total of 336 responses (117 online + 219 self-administered) were collected and regarded as valid for further analysis.

3.2 Questionnaire and Measures

The study utilized two non-probabilistic sampling methods to gather data from the participants. These methods were used to gather information from the individuals through the distribution of the questionnaire link via email, and hard copies of the questionnaire were also made available on the work-related sites of the participants. The study's pre-test was conducted to determine the minimum amount of time that it would take for the participants to complete the questionnaire. It showed that some of the participants may not have taken the survey seriously. To minimize the error variance that might occur due to a low number of participants who took the survey seriously, the cutoff for the analysis was set at 2.2 minutes. The questionnaire's final form featured two main sections. One of these asked about the respondents' demographic features, such as their gender, marital status, educational qualifications, and work position. The other asked about the constructs of KHB and HC. Previous studies also used an applied response scale, where 1 was strongly disagree and 5 was strongly agree. The results of the survey were then sent to the responders in Italian. For HCDs, reference was made to the dimensions

proposed by Alnoor (2020), namely education, experience, health, personal attributes (EDU, EXP1, EXP2, HLT, PA, SKI1, SKI2, and TRA), which were related to the various aspects of an employee's experience. HCDs were measured using eight items thanks to previous studies (Mubarik, 2016; Mubarik, Chandran and Devadason, 2016; 2018, Alnoor 2020; Han, Lin and Chen, 2008). As in the study by Nguyen, Malik and Budhwar (2022) KHB was measured using a scale developed by Peng (2012), which included a limited number of items derived from Connelly's scale (2012) (Table 1).

Table 1: Constructs' items

Latent variables/ items	References
Human Capital Dimensions (HCD) EDU My level of education helps me perform my job duties professionally and productively EXP1 Work related experience allows me to perform my work duties effectively and efficiently. EXP2 Similar industry experience allows me to perform my job duties effectively and efficiently. HLT My health conditions allow me not to be absent from work frequently. PA My personal attributes support me in carrying out my work duties and in managing the relationship with colleagues in the best possible way. SKI1 My skills allow me to carry out technically complex tasks. SKI2 My skills allow me to solve problems related to my work. TRA Professional training, even on-the-job, has provided me with the soft and technical skills necessary to perform my work duties effectively and efficiently.	Mubarik (2016) Mubarik, Chandran and Devadason. (2016, 2018) Alnoor (2020) Han, Lin and Chen, 2008
Knowledge Hiding Behaviour (KHB) KHB1 I don't want to transfer my personal knowledge and experience to others. KHB2 I voluntarily hide useful information or knowledge from others because I believe they can use it to their advantage and to my detriment. KHB3 I find difficult to transform my valuable skills and competences into organisational knowledge.	Nguyen, Malik & Budhwar (2022)

3.3 Statistical Techniques

Descriptive statistical analysis was conducted by first using central tendency and variability indexes for quantitative variables and frequency tables for qualitative variables. We used an independent t-test to compare the mean values of "I don't want to transfer my personal knowledge and experience to others." (KHB1), "I voluntarily hide useful information or knowledge from others because I believe they can use it to their advantage and to my detriment" (KHB2), and "I find difficult to transform my valuable skills and competences into organisational knowledge" (KHB3) between men and women. Finally, a multiple linear regression was used with KHB1 (I don't want to transfer my personal knowledge and experience to others) as a dependent variable and EDU, EXP1, EXP2, HLT, PA, SKI, TRA and Gender as independent variables. The variable SKI was obtained by calculating the mean value between SKI1 and SKI2, as both variables measured the same factor. KHB1 was chosen as the dependent variable since we consider it an item that underlies the most emblematic KHB. The R^2 index, F statistic of the final model, and VIF values were used to evaluate the overall goodness of fit of the model. A significance level of 0.05 was chosen for all considered analyses. All analyses were conducted in SPSS Statistics version 28.

4. Study Findings

4.1 Demographic Characteristics

Table 2 shows the demographic characteristics of the participants. The sample was 47.2% male and 52.8% female. Of the respondents, about 75% were more than 50 years old, 67.6% of the participants had a bachelor's

degree, the vast majority of participants were employees (90.8%), and 77.7% of the sample had work seniority having been at their organisation for more than 15 years. In addition, 67.3% of the sample was married.

Table 2: Demographic characteristics

Variables	Categories	Absolute frequencies (n)	Relative frequencies (%)
Gender	Man	148	44.0
	Woman	188	56.0
Marital status	Married	226	67.3
	Widower	10	3.0
	Divorced, Separated	41	12.1
	Never married	59	7.6
Work Position	Manager	31	9.2
	Employee	305	90.8
Age	22-30	5	1.5
	31-40	24	7.1
	41-50	80	23.8
	>50	227	67.6
	>50	227	67.6
Educational qualification	Diploma	92	27.4
	Degree	227	67.6
	Master's	17	5.0
Work seniority (years)	6-10	20	6.0
	11-15	55	16.3
	>15	261	77.7

4.2 Formulated Hypotheses

The descriptive statistics of the scales presented in Table 3 indicate that the means of the organisational factors were quite high, considering that the Likert scales had values between 1 (strongly disagree) and 5 (strongly agree). The variable with the highest mean value was KHB3 ($\bar{x} = 3.83$, $\sigma = 0.607$), while the lowest value was for KHB1 ($\bar{x} = 1.51$, $\sigma = 0.593$). Assuming that the distribution of a Likert scale can be approximated as a continuous distribution, the normality condition was investigated via the skewness and kurtosis indexes, and all the values presented in Table 2 indicate that these values were within the threshold of ± 3 (Ghasemi & Zahediasl, 2012).

Table 3: Descriptive statistics

Variables	Mean	St. Dev.	Skewness	Kurtosis
EDU	3.74	0.507	-0.331	-0.348
EXP1	3.79	0.612	0.150	-0.507
EXP2	3.44	0.591	-0.522	-0.641
HLT	3.83	0.607	0.1	-0.416
PA	3.79	0.612	0.150	-0.507
SKI1	3.85	0.607	0.085	-0.387
SKI2	3.85	0.603	0.073	-0.353
TRA	2.63	0.483	-0.545	-1.713
KHB1	1.51	0.593	0.698	-0.473
KHB2	1.58	0.588	0.438	-0.689
KHB3	3.83	0.607	0.1	-0.416

An independent samples t-test was performed to verify if there is a statistically significant difference between the means of the variables KHB1, KHB2, and KHB3 in the two subgroups of the gender variable (Table 4). Before the t-test, the Levene test was performed to test the null hypothesis of equal variances in the two subgroups: in the case of Levene's test being significant, a robust t-test was applied. There was a significant difference in KHB1 between men ($\bar{x} = 1.34$, $\sigma = 0.544$) and women ($\bar{x} = 1.64$, $\sigma = 0.6$) ($t_{(327.5)} = -4.695$, $p = <0.001$). There was not a significant difference in KHB2 between men ($\bar{x} = 1.6$, $\sigma = 0.556$) and women ($\bar{x} = 1.56$, $\sigma = 0.613$) ($t_{(334)} = 0.580$, $p = 0.562$). There was a significant difference, but only a 0.10 level of significance, in KHB3 between men ($\bar{x} = 3.76$, $\sigma = 0.621$) and women ($\bar{x} = 3.88$, $\sigma = 0.591$) ($t_{(308.28)} = -1.787$, $p = 0.075$).

Table 4: Independent samples t-test

Variable		Mean	St. D.	Levene p	Levene F	T-test t	T-test p
KHB1	Man	1.34	0.544	,016	-4,640	-4.695	<0.001
	Woman	1.64	0.600				
KHB2	Man	1.60	0.556	3,325	,069	.580	0.562
	Woman	1.56	0.613				
KHB3	Man	3.76	0.621	4,885	,028	-1.787	0.075
	Woman	3.88	0.591				

For the outcome of KHB1, a multiple linear regression was developed to determine which factors have a statistically significant impact. We obtained a statistically significant final model ($F_{(8,327)}=19,912$, $p < 0.001$) with a good R^2 value of 0.328. No collinearity problems emerged when observing the VIF values for independent variables. The results of the multiple linear regression are presented in Table 5. The variables EXP1, EXP2, HLT, and SKI were found to have a statistically significant impact on KHB1 (p -value $<0,05$); specifically, EXP1 and HLT have a positive impact, while EXP2 and SKI have a negative impact. Furthermore, being a man compared to being a woman results in a decrease of 0.275 in KHB. Observing the standardized coefficients, it is possible to conclude that, compared to other independent variables, SKI has the strongest impact on KHB1 (Beta= -0,431). Decisions on the assumptions made are summarised in Table 6.

Table 5: Results of multiple linear regression^a

Independent Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2,828	,539		5,251	<,001		
EDU	-,063	,058	-,054	-1,091	,276	,851	1,176
EXP1	,093	,046	,096	1,998	,047	,898	1,114
EXP2	-,140	,047	-,140	-2,971	,003	,932	1,073
HLT	,149	,046	,152	3,245	,001	,936	1,068
PA	,042	,049	,043	,851	,396	,801	1,249
SKI	-,430	,048	-,431	-9,029	<,001	,904	1,106
TRA	,037	,059	,030	,626	,532	,888	1,127

Gender	-.275	,063	-.231	-4,342	<,001	,728	1,374
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a. Dependent variable: KHB1.

Table 6: Hypothesis decision

Hypothesis	Result	Effect
(H1 _a) EDU -> KHB1	Rejected	-
(H1 _b) EXP1 -> KHB1	Not Rejected	As EXP1 increases, KHB1 increases
(H1 _c) EXP2 -> KHB1	Not Rejected	As EXP2 increases, KHB1 decreases
(H1 _d) HLT -> KHB1	Not Rejected	As HLT increases, KHB1 increases
(H1 _e) PA -> KHB1	Rejected	-
(H1 _f) SKI -> KHB1	Not Rejected	As SKI increases, KHB1 decreases
(H1 _g) TRA -> KHB1	Rejected	-
(H2) Gender-> KHB1	Not Rejected	Men have lower KHB1 scores than women

5. Discussion

Although the literature revealed that some organisational factors such as HCDs can influence employees' risk behaviour (Adeleke et al. 2018; Isaac 1995; Zheng et al. 2018), research examining the impact of these factors on KHB is still scattered and almost always scarce. This paper attempts to bridge this research gap. The model used was developed basing on early studies in this field. Our findings reveal that HC has a significant effect on KHB (H1). Almost all of the results related to Hypothesis one and its sub-hypotheses are in line with previous empirical studies, showing the significant effect of HCDs on KHB.

Regarding H1a, the results showed a non-significant correlation between EDU and KHB, this led to reject the hypothesis, but it is however a result in line with those studies that have not found EDU to have a significant effect on KHB (Zhang et al 2022).

The hypotheses related to EXP on KHB were supported by the results, which showed the positive effects of EXP1 on KHB, as found in previous researches (Li et al., 2015; Peng, 2013; Serenko and Bontis 2016;).

Furthermore, this study hypothesized a negative effect of HLT on KHB (H1d). This assumption was not supported by the results, which revealed a positive effect of employee health conditions on KHB. This result could be due to the fact that this variable is complex and correlated to individual elements of judgment on personal health conditions. According to H1e, PA have negative effect on KHB. This hypothesis was not supported by the results, which instead revealed the non-significance of the correlation, a result however comforted by a part of the literature (Akhlaghimofrad and Farmanesh 2021). SKI has been hypothesized to have negative effects on KHB (H1f). This was confirmed by the results of the present analysis, and is in line with previous research (Ain et al. 2022; Kaur and Kang 2022; Offergelt and Venz 2023). Finally, H1g was rejected as the results showed a non-significant relationship between TRA and KHB.

Our findings related to the second hypothesis (H2) indicate that gender exerts influence over KHB. This result concurs with other previous studies that demonstrated the influence of gender on KHB (Demirkasimoglu 2016; Koay and Lim, 2021; Issac et al. 2022; ; Zutshi et al. 2021).

Both theoretical and practical implications can be drawn from this study. By analysing the relationship between HC and KHB in the public sector and considering the possible influence of gender on KHB (Anand, 2022), this paper adds to the underdeveloped research on knowledge risk (Durst, 2019; Durst and Henschel, 2020). Furthermore, this research could encourage public sector managers and governments to develop those innate or acquired HC traits that are more likely to induce knowledge sharing behaviour and reduce KHB. Thus, the current research is considered necessary for the HR staff of an organisation, especially those in top management, who are trying to understand the phenomenon of knowledge-hiding behaviour and the ways to reduce it. The data collected here show that the study-suggested model clarifies and predicts satisfactory levels of individual behaviour in the workplace, confirming the usefulness of the study's theoretical model.

6. Conclusions

6.1 Theoretical and Managerial Implications

The aim of this work was to investigate the relationship between human capital dimensions and knowledge hiding behaviour in the public sector. Data were gathered from public sector establishments in South Italy through a structured questionnaire. A research model was developed to determine the relationships between variables, and the hypothesized relationships were analyzed by employing a structural model analysis. The findings show that HC affects KHB, although some HCDs were found to have a non-significant effect. Additionally, we found that gender affects the KHB of public employees. Thus, the present research contains numerous theoretical and intellectual contributions that may be of great interest to academics and researchers in this field. This study adds to our understanding of a variety of variables related to organisational behavior and human resources. It provides a deeper understanding of the impact of some pivotal implications, indicating the significance of HCDs and gender on KHB; additionally, this study is one of the few carried out in Italy, and specifically in South Italy, so it is expected that this study will help to bridge the research and knowledge gap in this field. This study is also significant because there are few studies in the literature that indicate the existence of or propose a comprehensive model containing organisational factors affecting knowledge-hiding behaviour.

Furthermore, the study may help influence knowledge-hiding behavior policies. To be more specific, this work is considered one of the few studies conducted to assess how HCDs and gender can influence KHB from the perspective of public sector employees in South Italy.

This study has several management implications and can help define a set of practical recommendations for decisionmakers, policymakers, and organisations to prepare public managers on the organisational factors that contribute to employee knowledge-hiding behaviour in the public sector. Through the results of this study, it was found that there are two organisational factors that lead to employees partaking in KHB in the work environment. These two factors are HCDs and gender. Therefore, organisation managers must develop appropriate policies and implement measures in a timely manner to limit KHB and related practices. This can be accomplished by improving communication and knowledge-sharing practices that facilitate direct interaction channels between employees and senior management, which may allow for direct interaction, reduce knowledge-hiding behaviour, and create a work environment that encourages participation and the expression of opinions.

Practically, managers of organisations and companies must consider all factors that lead to organisational isolation within the organisation. This can result from an organisation's failure to listen. Improvements can be achieved by providing management with the necessary support to motivate employees and encourage them to feel connected to the organisation in which they work, as well as make them feel that the work they provide, whatever it is, has value and meaning. This can also be accomplished by increasing employees' ideas and opinions. Preparing external workshops that improve confidence in establishing relationships and breaking down isolation barriers through training will ultimately help improve teamwork in the work environment and consolidate relationships between employees within the organisation. Establishing organisation policies that are developed and implemented clearly can help to ensure employee rights for both men and women. This also provides employees reassurance on their rights and stability regarding their future in the organisation by providing them with opportunities to achieve their own goals (for example, involving them in development programs that aim to improve performance) so that they feel a sense of accomplishment or achievement, reducing knowledge-hiding behaviour that occur when they do not achieve personal goals.

6.2 Limitations and Future Research Directions

Despite the importance of this research, which may help organisations make modifications in their procedures and processes, this study has some limitations. Firstly, the study participants were from public sector establishments in South Italy, and thus, external validity may be a concern. Hence, future research may include private sector organisations as well, and may conduct a comparative study between these two sectors. Secondly, the results of this study are not longitudinal, and this may cause a problem in establishing causal relationships. Moreover, the current study relies on self-report measures of individuals' behavior, which could cause the possibility of a method bias. Thirdly, the study was restricted to HCDs; therefore, future research may include other organisational factors such as organisational deviation, organisational hypocrisy, and organisational injustice and explore their effects on other variables such as stress in the workplace. The goal of future studies should be to analyze the various factors that influence the performance of employees. These include the psychological empowerment of staff members, the establishment of high-performing teams, and the relationship between managers and employees.

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Critical Aspects of a Higher Education Reform for Continuous Lifelong Learning Opportunities in a Digital Era

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Abstract: In the knowledge society today, there is a strong need for providing continuous lifelong learning opportunities. Recently, the Covid-19 pandemic has acted as a catalyst for technology enhanced learning, involving new challenges for higher education. The main focus for this study has been the ongoing reform of higher education for providing lifelong learning opportunities. This study is the second phase of a Delphi study on higher education reform. Data were gathered by email interviews with an expert panel, where all respondents have genuine knowledge in the field of technology enhanced lifelong learning. The interview answers were analysed according to the Grounded Theory concepts of open coding and axial coding. The central main category for the axial coding was 'Higher education reform for the provision of lifelong learning opportunities'. This category was later found to be dependent on 'Infrastructure', 'Multimodal delivery', 'Pedagogical change', 'Financial aspects', and 'Quality and organisation', 'Digital literacy', 'Accessibility', and 'Equity, diversity and inclusion'.

Keywords: Lifelong learning, Higher education, Higher education reform, Technology enhanced learning, Inclusive education, Accessibility

1. Introduction

Following the outbreak of the Covid-19 pandemic, the provision of lifelong learning opportunities has increasingly become a topic of discussion in higher education (Rashid and Yadav, 2020; Atchoarena, 2021; Nuankaew and Nuankaew, 2021). For many educational institutions, the pandemic also involved an increased application of digital technologies to support learning (Rashid and Yadav, 2020; Ivenicki, 2021). Nevertheless, the pandemic as a driving force for higher education development is just a recent driver for change (Atchoarena, 2021). The digitalisation of society and the sector has been going on for decades and is part of what some scholars call the learning society (e.g., Jarvis, 2007) and some call the knowledge society (e.g., Peters and Romero, 2019). This ongoing shift to a knowledge society requires professional development of higher education teachers and reskilling and upskilling that preferably should be technology-enabled (Matheos and Cleveland-Innes, 2018). Providing lifelong learning opportunities and its role in the higher education system needs to be rethought, including new forms or educational designs adapted to a digital era (Zgaga, et al., 2019). These new forms of educational designs have been introduced over time and often include formal, non-formal and informal aspects of lifelong learning from a life-wide perspective (Roche, 2015; Burbules, Fan and Repp, 2020).

The provision of lifelong learning opportunities has also been linked to societal development. This has resulted in countries all over the world, as well as transnational organisations, involving supporting the development of lifelong learning initiatives in their higher education policy documents (Volles, 2016; Bostrom, 2017; Lee and Jan, 2018). Jaldemark (2021), for example, reports various motives for the inclusion of the urge to develop lifelong learning initiatives in these policy documents such as social development, increased employability, global competition, and sometimes also the aspect of personal development. Schuetze and Slowey (2020) report that the reform of the current higher education system appears to be in focus in most policy documents, which aim to open up new opportunities for developing lifelong learning initiatives. For example, the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) suggests a wider and broader approach: "the right to education needs to be broadened to be lifelong and encompass the right to information, culture, science and connectivity" (UNESCO, 2021, p. 4).

From the higher educational perspective, digitalisation changes the conditions for educational design, teaching, learning and communication between humans. Therefore, ongoing reforms with policy development connects

to yet another global societal trend, i.e. the rapidly emerging digitalisation. Digitalisation can also be said to intersect with the new stronger focus on providing lifelong learning opportunities. Therefore, the new conditions provided by digitalisation enable lifelong learning opportunities through new innovative ways of considering the combination of places and time modes to facilitate the idea of anyplace and anytime learning (Cook and Grant-Davis, 2020; Varghese and Mandal, 2020). Thus, digitalisation has a strong impact on educational systems in general, particularly in higher education. The creation of innovative and transformative lifelong learning opportunities supports and enables both asynchronous and synchronous teaching and learning activities in formal, informal, and non-formal educational settings (Jaldemark, 2021; Matheos and Cleveland-Innes, 2018).

In the ongoing discussion of the reform of higher education, digitalisation and the provision of lifelong learning opportunities are common themes. Policies are one approach to supporting this reform. Here, policies highlight the need to be up-to-date with regard to the impact of digitalisation on working life. The role of Higher Education (HE) is also important in societies in change. This change has brought forward ideas for reforming the role of higher education both in national educational systems and on a global level. Recently, the Covid-19 pandemic has further accentuated the need for fully online solutions and, therefore, a richer technology enhancement of higher education (Carius, 2020; Mozelius, 2020). This educational shift requires new pedagogical ideas and collaborative learning approaches to support learning and lifelong learning processes. A stronger emphasis on lifelong learning initiatives in policies and emerging digitalisation creates new conditions for providing lifelong learning opportunities for 21st-century citizens.

In light of the rising emphasis on providing lifelong learning opportunities and digitalisation, this paper aims to explore and analyse the ongoing reform of higher education. The following research question was posed: *What are the critical aspects of higher education reform for the provision of lifelong learning opportunities in a digital era?*

2. The Reform of Higher Education and the Provision of Lifelong Learning Opportunities

To update and reform higher education and providing lifelong learning opportunities is a global ongoing process, with a need for adapting to both new pedagogies (Alt and Raichel, 2022), as well as to new digital technologies (Rawas, 2023). Moreover, the stronger emphasis on providing lifelong learning opportunities as a task for higher education also implies preparing students at regular university programs to be lifelong learners, including capabilities to meet the demands of changes in their future lives and a meta-cognitive capacity to understand their own learning process (e.g., Blaschke, 2021; Lock, et al., 2021). However, reforming higher education by emphasising lifelong learning opportunities also includes adapting activities to groups other than the full-time students at regular university programs. For example, triple helix collaborative activities with organisations in the surrounding society (e.g., Vivar-Simon et al, 2022) or by offering flexible courses adapted to students that combine studies and work. In effect, continuous lifelong learning opportunities in different forms for those who already have an academic degree. These opportunities go beyond regular university programs and reach out to former higher education students and the organisations they belong to. Here, higher education initiatives to provide lifelong learning opportunities can contribute to organisational development through reskilling and upskilling workers. These higher education lifelong learning opportunities are sometimes also discussed in terms of professional development (e.g., Amhag, Hellström and Stigmar, 2019; Russell, et al., 2022) or participating in continuous education (e.g., Longhini, Rossettini and Palese, 2021).

At the same time, the concept of lifelong learning has a long and interesting history involving different narratives (Field, 2011; Kitto, 2022). In the late 18th century, Condorcet (1992/2003) introduced the notion of lifelong learning by building on Plato's (n.a.) idea of supporting learning through the lifespan and Comenius's (1657/1896) idea of education for all. Condorcet emphasised that education should expand beyond formal education, be for all ages and all citizens and go beyond the social position in society and educational background. It should educate people for both practical and professional purposes. This democratic and humanistic perspective of lifelong learning emphasises lifelong learning as an emancipatory process that should strengthen human beings and their capacities and participation in a democratic society (e.g., Jaldemark, 2023; United Nations Educational, Scientific, and Cultural Organisation, 2021). In the 20th century, global organisations and nations emphasised an economic perspective, including the emergence of the provision of lifelong learning opportunities for the masses. This economic perspective focuses on taking positions and being competitive in the global market. Therefore, lifelong learning initiatives and policies from an economic perspective aim at making citizens employable and available to the working market (e.g., Jaldemark, 2023; Organisation for Economic Co-operation and Development, 2021).

The link between higher education, digitalisation and the provision of lifelong learning opportunities is an ongoing process that was established before society was hugely infused by digital technologies (e.g., Jaldemark, 2021; Knapper, 1988). The reform of higher education with digital technologies has its roots, at least in technological development initiated in the early 19th century. To bridge time and place, analogue technologies have been included in educational designs to reform higher education, making higher education accessible to more students. In the 19th century, postcards and letters were included in higher education designs – called *correspondence teaching* – to bridge time and space and enable learning from a life-wide and lifelong perspective (Holmberg, 1960; Pittman, 2003). Later, mass media technology such as radio and television were added as tools to enable participation in higher education based on the idea of providing lifelong learning opportunities (McIsaac and Gunawardena, 1996). However, the addition of these technologies had some communicative pitfalls. Support for providing lifelong learning opportunities and fast two-way communication between teachers and learners were not ideal while these technologies were either slow, asynchronous two-way technologies such as letters or fast inflexible one-way synchronous technologies. The addition of internet-based digital technologies to reform higher education settings at the end of the 20th century provides opportunities for lifelong learning by affording flexible two-way synchronous and asynchronous communication.

3. Methods and Materials

This study was the second step in a larger, three-step Delphi study about the contemporary reform of higher education capacity to initiate and provide lifelong learning opportunities. The Delphi study design was inspired by the method outlined by Brady (2015), and involved a panel of informants (N=8) with expertise in the field of lifelong learning. In the first step, the members of the Delphi expert panel answered an online survey with five-graded Likert-scale questions. A summary of the survey results was used to create email interviews compromised of open-ended questions on the topics of lifelong learning, higher education reform, technology enhanced learning, instructional design, and pedagogy.

3.1 Reading Assignment

The first phase of the research, a literature study, is described in detail in Håkansson Lindqvist et al. (2020). This phase was carried out as a systematic review of foundational and currently published literature on higher education reform for lifelong learning. Out of a first result set of 26 articles, five articles were selected by the authors. This selection was the result of reducing the number of articles with similar themes in order to offer as a knowledge base for the experts. The five articles are listed in Table 1 here below.

Table 1: Selected publications and their main themes.

Publication and authors	Main themes
Santos, L., Bago, J., Baptista, A. V., Ambrósio, S., Fonseca, H. M., and Quintas, H. (2016). Academic success of mature students in higher education: a Portuguese case study. <i>European journal for Research on the Education and Learning of Adults</i> , 7(1), 57-73.	Presents European lifelong learning policy for economic development, personal development, social inclusiveness and democratic understanding
Kasworm, C. (2020). Adult Workers as Learners in the USA Higher Education Landscape. In <i>Inequality, innovation and reform in higher education</i> (pp. 221-235). Springer, Cham.	Discusses a rethinking of the mission of higher education with a specific focus on adult undergraduate students who more often are both workers and students
Boyadjieva, P., and Ilieva-Trichkova, P. (2018). Lifelong learning as an emancipation process: A capability approach. In <i>The Palgrave international handbook on adult and lifelong education and learning</i> (pp. 267-288). Palgrave Macmillan, London.	Presents a theoretical outline of the heuristic potential of the capability approach in conceptualising lifelong learning and the capacity of this approach to guide empirical studies on lifelong learning
Weil, M., and Eugster, B. (2019). Thinking outside the box. De-structuring continuing and higher education. <i>Disciplinary Struggles in Education</i> .	Promotes a stronger relationship between higher education research and continuing education training (CET). More collaborative engagement between higher education and CET is necessary to include the importance of an applied, practitioner research in professional fields

Publication and authors	Main themes
Jamaludin, R., McKay E., and Ledger, S. (2020). Are we ready for Education 4.0 within ASEAN higher education institutions? Thriving for knowledge, industry and humanity in a dynamic higher education ecosystem?. <i>Journal of Applied Research in Higher Education</i> .	Presents challenges that have been identified in higher education and the need for a new dynamic higher education ecosystem. The concept of Education 4.0.

The five articles were sent to the experts for reading. Consistent with the Delphi research of Lock et al., (2021), “selected readings were chosen based on research accuracy, conceptual clarity, and citation records” (p. 1654). These articles provided a knowledge foundation as a point of preliminary reference from which experts would begin conceptual exploration of the topic. While the traditional Delphi method has “been useful in educational settings in forming guidelines, standards, and in predicting trends” (Green, 2014, p. 1), the complex nature of education reform has led to adjustments in the Delphi process. For example, in a study by Mirata et al. (2020), a four-step Delphi design was used and included a preliminary topic workshop as foundational knowledge for the Delphi experts involved.

After the completed reading, the experts were asked to complete an email interview on lifelong learning and higher education. A summary of the survey results was used to create email interviews with open ended questions on topics such as lifelong learning, higher education reform, technology enhanced learning, instructional design and pedagogy.

3.2 Data Collection

The data were gathered by email in which eight selected experts on lifelong learning answered a questionnaire with seven open ended questions. The experts were selected in a purposive expert sampling (Rai and Thapa, 2015) with informants that all have long and rich experience of research on lifelong learning. At the same time, the experts come from a wide geographical spread, representing five countries and three continents. This geographical spread contributed to variations in socio-cultural contexts. To inspire the experts, they were given a reading assignment with five articles that was the result from an earlier literature study on the provision of lifelong learning opportunities and higher education.

3.3 Data Analysis

An investigator triangulation approach to thematic analysis was the primary approach in the data analysis. The authors used 'triangulating analysis' to find relevant themes based on codes and subcodes identified in the interview answers. Investigator triangulation has been described by Patton (2002, p. 560), as ‘having two or more persons independently analyse the same qualitative data and compare their findings’. In the first analysis phase, two of the investigators conducted their separate analysis with the idea of open coding as described by Khandkar (2009). In the open coding phase, researchers fracture data into discrete parts and thoroughly examine the parts to identify data extracts, codes, and potential categories. In the second phase axial coding was used. The concept axial coding relates to ideas in Grounded Theory (GT) and is defined as: ‘coding that treats a category as an axis around which the analyst delineates relationships and specifies the dimensions of the category’ (Bryant and Charmaz, 2007, p. 603). In this study, the identified data was reassembled into more abstract conceptual categories with relationships between the categories.

4. Findings

In this section, the findings are presented. First, the process of open coding is presented. Thereafter, the axial coding process is presented. Examples are provided for illustration.

4.1 Open Coding

In the Open Coding process, the first step was to review the email interview answers, and to break them down in smaller pieces for close reading. This was done in order to compare relations, similarities, and dissimilarities. Relevant data extracts were colour coded and marked with appropriate labels to facilitate further analysis. In this first step that Khandkar (2009) refers to as ‘building concepts’ as depicted in Figure 1.

1) Based on the pandemic-based experience using technology in education please describe what you believe will be drivers for change post-pandemic?

I always teach online so my pandemic-based experience was little changed from normal. I have learned new uses and greater appreciation for real time video exchanges. I believe from what I have heard from colleagues and read in journals that faculty are starting to understand the importance of communicating social presence among instructors and students, something I have long studied. I also believe many faculty have new appreciation for the need to be familiar with a variety of technologies. Some have a new appreciation for online learning, and some, those who didn't learn about social presence in particular, had their poor opinions of online learning confirmed. I would guess that drivers for change post-pandemic will be mostly fiscal – administrators will try to save money by hiring more adjuncts to teach set courses and offering competency-based and adaptive learning systems, and/or they will use predictive analytics to increase enrollments and retain more students.

Figure 1: Colour coded data extracts or subcodes from the email interview answers

These colour coded data extracts or subcodes were then aligned to code labels as illustrated in Figure 2 below.

- 1 Pedagogy / Instructional design/Content development
- 2 Economy / Financial aspects
- 3 Technology Enhanced Learning /Blended learning/(MOOC)
- 4 Transformation of Higher education / Lifelong learning/Definitions
- 5 Work-integrated learning / Collaboration with society
- 6 Assessment/ Learning outcomes/Capacity building (related to 1 & 3)
- 7 Aim/Outcomes Rewards/Certificates/Credits/ (related to 1 & 6)

Figure 2: Related codes colour coded for creating preliminary categories

In the second step, 'abstracting the concepts', the further analysis process is to group codes into relevant concepts or categories. The labelling can be decided either by the analyser or can be taken from the analysed content (Khandkar, 2009). Here, in the second step the authors discussed the two different analyses to compare the similarities, dissimilarities and relations which were found. Following this the two different Open Coding analyses were sent to a third investigator in the research team for further analysis involving comparison and merging. After this additional step of analysis, further discussions took place and the codes and subcodes were grouped into preliminary categories. One example is presented in Figure 3.

Pedagogical change Codes: <i>Pedagogy - Instructional design – Interaction - Social presence – Learner centred design</i>
Subcodes / Data extracts: Improved learning design based on affordances of digital technology/ digital interaction instead of converting f2f modes into digital pedagogy. have transformed their pedagogy to make it more focused on students' learning, by using in their course synchronous and asynchronous activities. They also were able to provide their students with the advantages described in the literature on blended and online courses: flexibility, accessibility, complementarity between synchronous and asynchronous activities using pedagogical approaches such as problem-based or project-based learning by integrating technologies and in particular Internet research. However, in some developing countries, these resources are weaker or even non-existent problem-based or project-based learning, emphasize the acquisition of skills and

Figure 3: Preliminary categories aggregated by codes and subcodes

In the conducted Open Coding process, codes initially emerge from the raw data, and that they later were grouped into conceptual categories or themes. As pointed out by Khandkar (2009, p. 8): “The goal is to build a descriptive, multi-dimensional preliminary framework for later analysis. As it builds directly from the raw data, its process itself ensures the validity of the work.” Regarding the later mentioned analysis, this was conducted as an Axial Coding outlined by Vollstedt and Rezat (2019).

4.2 Axial Coding

A characteristic of the GT approach is that data collection, data analysis, and theory development are not separate and successive steps in a research study, but rather intertwined and interdependent in an iterative process (Vollstedt and Rezat, 2019). As described by Strauss and Corbin (1990), axial coding is an analytic process to investigate the relationships between the categories that developed earlier in the open coding process. In other words, after that data were divided into separate categories in the open coding process, they are then joined together or assembled in a new way in the axial coding process aligned around respective central categories.

The focus of axial coding should be on one category (the phenomenon), with relations and dependencies to the other categories. Whether the research is about individuals, groups or collectives, there are always actions and interactions directed towards the phenomenon (Vollstedt and Rezat, 2019). The found phenomenon, and the central category in this study was ‘Higher education reform for the provision of lifelong learning opportunities’ with a dependency on the categories of ‘Infrastructure’, ‘Multimodal delivery’, ‘Pedagogical change’, ‘Financial aspects’, and ‘Quality and organisation’ on the general higher education level. On the individual level the important found categories, or aspects, were ‘Digital literacy’, ‘Accessibility’, and ‘Equity, diversity and inclusion (EDI)’ as depicted in Figure 4. Despite what appears to be a linearity in this process, the analysis, coding, and categorization was a dynamic, iterative, and nonlinear process.

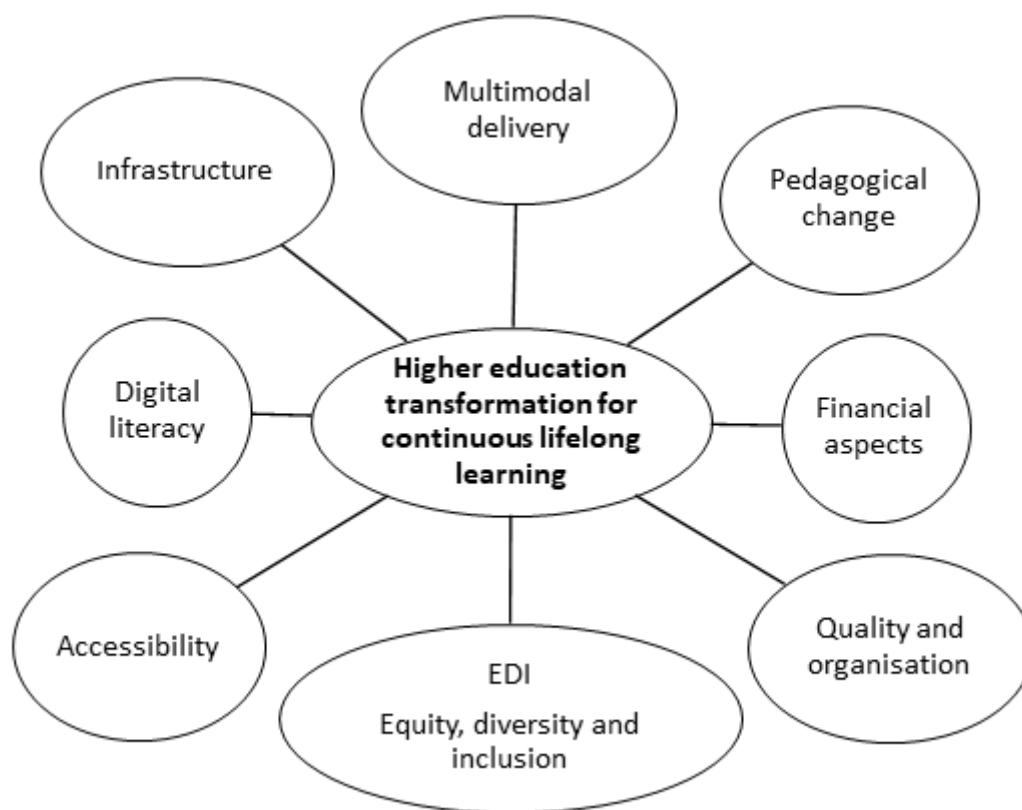


Figure 4: Critical aspects of Higher education reform for the provision of lifelong learning opportunities

The overarching theme referenced for the axial coding is ‘Higher education reform for the provision of lifelong learning opportunities’. This overarching theme or category is seen to be dependent on the following related themes or categories: ‘Infrastructure’, ‘Multimodal delivery’, ‘Pedagogical change’, ‘Financial aspects’, and ‘Quality and organisation’, ‘Digital literacy’, ‘Accessibility’, and ‘Equity, diversity and inclusion (EDI)’ which are all described in the discussion section.

5. Discussion

The identified categories are discussed in detail here below, starting with the central category 'Higher education reform for lifelong learning'.

5.1 Higher Education Reform for Providing Lifelong Learning Opportunities

The phenomenon, or the central category, that the axial coding focused on was Higher education reform for providing lifelong learning opportunities. This is a merge of the earlier category of 'lifelong learning' and the subcategory of 'Reform of higher education'. The earlier 'Infrastructure' part of Reform of higher education later became a category of its own. Many experts identified the pandemic as a catalyst for this transition, and as stated by one of the interviewees *"I think we have learned a number of important lessons during the pandemic, some of which provide insights about future drivers for change in HE"*.

Another transitional driver mentioned by the experts were the new demands of society and the labour market, with huge needs for reskilling and professional development. One of the experts highlights the need for a more demand driven provision of lifelong learning opportunities, and to "increase research-led education to focus on innovation, increase engagement, and focus on capability". Moreover, one expert brought up climate change as a driver that *"will continue to be a backdrop for many initiatives, policy shifts, et cetera"*. Another driver for transition is that higher education lifelong learning initiatives will use more of digital technology in the future, but as claimed by one of the experts:

"I don't think it's wise to say that technology is itself a driver. Better to say that improvements in the capabilities of affordable digital devices + enhancements to networking infrastructures are entangled with changing habits and expectations."

However, technology enhancement is an ongoing process. Another issue that emerged is enrichment of traditional education with other experiences such as project work, work-based experiences, and the idea of work integrated learning. Another trend is the request for shorter courses, modular degree structures or so-called micro credentials. There was also a remark on non-credit offerings and Massive Open Online Courses (MOOCs), that these phenomena already are pushing the boundaries between the academy and industry with the aim of 'job readiness'.

Recommendations in the interview answers included *"Be clear about the added value of education in the context and meaning of lifelong learning. Re-define what educational institutions are in the context of emerging corporate training and industry academies"*. Another suggestion was *"favoring the integration of practice into training, such as, internships in companies or in the industry, projects carried out in partnership with industry and joint supervision between university faculties and professionals"*, and to *"focus on both the development of the canonical knowledge required, for instance a set of occupational capacities, but also some variations of how that knowledge will be applied, for instance in a particular workplace setting."*

The discussions also suggested that opening up the university to a hybrid model where the professional development is built around the true and evolving needs in organisations and companies. An example of a constantly evolving field was healthcare, with a need for expanding the possibilities to be part of lifelong learning initiatives and the fact that *"healthcare workers must keep up to date with this new knowledge, and must quickly integrate it into their practices"*. The recommendation from one of the experts was to build around *"these kinds of activities that individuals face every day in their working life, and having the capacities to respond to them both those that are routine and those that are non-routine"*. The panel experts pointed out many challenges in the transition to lifelong learning opportunities in higher education, however, there are positive expectations in the spirit of *"the deeper structures and values of lifelong learning as well as the long history of how to do technology-enhanced learning in ways that foster human flourishing, learning fulfilment and worth-while fusions of academic and professional development"*.

To foster human development, one of the experts suggested that *"we involve both lifelong education for employability and lifelong learning for personal development."* This should be *"thought about in ways that encompass the whole life course"*, and with the idea of enriching daily life and to empower learners. The two aspects should better be combined, and as expressed by an expert: *"on the one hand, functional lifelong learning in the form of upskilling with a focus on socio-economic value, and, on the other hand, personal lifelong learning in the form of 'life-world becoming'"*. Several experts raised the idea of human centred lifelong learning opportunities, where one of them recommends:

"Putting human flourishing before efficient or smart tech set-ups, worth-while learning before technological upskilling of the workforce the deeper purpose of lifelong learning before the construction of massive technology-enhanced lifelong learning courses."

5.2 Infrastructure

The reform of higher education for providing lifelong learning opportunities is clearly dependent on the reform of infrastructure to establish an *"open learning environment where new formats, forms and formations emerge"*. One expert suggested *"Hybridizing learning experiences and interactions through opening up learning environments for the public"*, with lifelong learners *"participating in courses with people in different roles, contexts and localities or having institutions that are open to all and offer valuable knowledge or products for the public"*. This transition has already started at many universities, even if educators still meet *"the idiotic but often repeated claims that university education hasn't changed since the middle-ages"*. The attitudes are of course different in different parts of the world, and many politicians and policy makers would not agree with what was occurring *"in Australia, we had a prime minister asserting that only face-to-face classes really 'count' as education; 'screen time' is wasted time"*. There are certainly advantages with technology enhanced learning with global aspects such as *"educational provision for international students interacts in an interesting way with use of online/blended learning"*.

Other opportunities with a thoughtful and technology enhanced redesign of the infrastructure might be the *"development of a computed curriculum and further automation of the delivery of education"* and that this would *"likely further increase in the area of educational consumption and supply driven individualised learning pathways"*. However, the aim must be to combine individualisation with new forms of collaborative learning support for *"technological systems and tools to technology-enhanced learning communities. The question is here how to foster technology-enhanced places for lifelong learning that 'vibrates' and make learners flourish"*. Several experts mention that technology and the general digitalisation of society will change the way higher education learning is practised and produced. One interview answer brings up the Economic Co-operation and Development (OECD) vision from 2020 for education systems in the future, a vision that involves four alternative scenarios: schooling extended, education outsourced, schools as learning hubs, and learn-as-you-go. Each of these scenarios would require infrastructural changes, where:

"The first two scenarios would require less reform of the school system, while the latter two would require greater change in how we design and deliver education — and unless institutions are able to adapt agilely to this change, other providers will step in to fill the gap."

5.3 Multimodal Delivery

What could be seen as an extension of the previous category of Infrastructure is a multimodal delivery that further supports the idea of helping learners flourish. Technology-enhanced learning requires content development, instructional design, and rich media tools that facilitates what one of the panel experts summarises as *"feasible e-learning activities in both fully online and blended models"*. The Covid-19 pandemic has been a catalyst, and as described by another expert:

"To me, the experience gained using digital technologies will further boost and improve the learning experience of existing trends. Where education was relatively slow to adapt and embrace digital technology, the pandemic made sure they (had to) catch up."

Recommended was the idea that *"technologies should be ubiquitous in higher education"*, to support various modalities in teaching and learning activities. Multimodality is brought up in two different ways by the panel experts. First, with the idea of combining modalities such as text, sound, and images in content development and instructional design and to use rich media tools for synchronous collaborative online activities. Several experts mention the importance of *"familiarity with web-based videoconferencing"*, and positive experiences such as *"I have learned new uses and greater appreciation for real time video exchanges web-based videoconferencing"*. Secondly, the use of different modalities appears, as in:

"The use of blended and online courses, higher education institutions will continue to use these modalities, perhaps not to the same extent as during the pandemic, but should increase their use as compared to the period before the pandemic"

The interview data show expectations such as *"that technology-enhanced lifelong learning will be a disruptive technology"*, and *"course modalities allowing better accessibility of higher education to students, especially for those living outside big centers"*. Moreover, a multimodal delivery could involve reflective learner activities such

as "knowledge acquisition by the means of e-portfolios". Finally, another extension of the infrastructure category and another is the concept of a hybridised networked learning. As with many other suggestions for higher education to provide reinforced technology-enhanced lifelong learning (TELL) opportunities this would, as one of the experts states, require "a (re)opening of TELL as process, practice and learning environment".

5.4 Pedagogical Change

The suggestions for a new technology-enhanced and multimodal instructional design in the previous category leads to a need for a new adapted pedagogical design. This category was aggregated from the found themes: Instructional design, Learner centred design, Interaction, and Social presence. Other concepts found in the experts' interview answers were *"using pedagogical approaches such as problem-based or project-based learning by integrating technologies and in particular Internet research"*. Problem-based or project-based learning are concepts that seem suitable for providing lifelong and work-integrated learning opportunities while they *"emphasize the acquisition of skills and competencies (rather than knowledge) and permit students to "learn to learn" throughout their lives"*.

Several experts highlight the importance of a learner centred design, and to avoid the *"reproduced/recycled misconceptions about higher education practices, including by assuming/asserting/implying that lectures are the main/only form of teaching and that teaching-learning is mainly a matter of transmission"*. Another expert encourages higher education institutions *"to rethink not only their delivery of teaching and learning, but also their design of that teaching, shifting to more learner-directed, learner-entered forms of education"*. This debate is not new, and many higher education institutions:

"have transformed their pedagogy to make it more focused on students' learning, by using in their course synchronous and asynchronous activities. They also were able to provide their students with the advantages described in the literature on blended and online courses: flexibility, accessibility, complementarity between synchronous and asynchronous activities".

To create synchronous and asynchronous learning activities of quality requires an *"increased competence creating and validating digital products and increased capacity for assessing validity of digital resources"*, with a *"need for learning designers to help faculty with existing and emergence online learning"*. On one hand, it was pointed out that *"providing an accessible medium in some ways, is also restricted in its pedagogical capacities"*, on the other hand an expert believed *"that good pedagogies, good teachers, will set learners on a path to lifelong learning regardless of technologies"*. The themes of Social presence and Interaction matter in the design of virtual learning environments, and one recommendation was that *"It's never too early to start learning how to configure your own learning environment"*. Others suggested to address this challenge by *"communicating social presence among instructors and students"*, and to develop an *"improved learning design based on affordances of digital technology/ digital interaction instead of converting f2f modes into digital pedagogy"*.

5.5 Financial Aspects

Many of the interesting and creative ideas that can be found in the categories above need funding. One expert claimed that *"learning that is accessible anytime/anywhere increases access and can reduce cost of formal education"*. Courses could be given at a reduced cost, but high-quality education must initially invest in the creation and alignment of quality content, and a structured course design. In reference to course content, the same expert recommends an *"increased production and distribution of open education resources (OERs) and research articles that are licensed under Creative Commons licenses"*. Another expert describes a future where:

"Administrators will try to save money by hiring more adjuncts to teach set courses and offering competency-based and adaptive learning systems, and/or they will use predictive analytics to increase enrolments and retain more students"

The experts in the Delphi panel live in different countries on three continents. Their concerns regarding financial aspects show differences from remarks such as *"The neo-liberal motivated cuts to government support to higher education are forcing ever increasing tuition rates"*, to answers without comments on the topic. While the European experts show less concern, the situation in Australia seems to be different:

"Australian universities have acted very swiftly to cut their cost base (e.g. by 'letting go' many thousands of casually-employed teaching staff) and are revising projections about future revenue".

Another, more international threat that was mentioned in this answer concerned *"the rapacious appetites of venture capitalists, the naiveté of the CEOs of ed tech startups"*.

A theme emerging from the data identifies internationalisation and export of online courses as a way to finance course development and the transition to provide lifelong learning opportunities. One of the experts depicts the problem in a different way: *"to exclude universities from economic stimulus measures; has castigated universities for being so 'reliant' on international students (a strange way to talk about a successful export industry)"*. Different conditions exist in different countries, but share the global idea that the *"growth of international student numbers (and revenues) has been an important element in university planning and finances"*. Finally, some remarks on the student perspective are that *"Our students will be the biggest drivers of change"*, and that:

"Students live and study in one of the country's 10 or so large cities – usually the city in which they've grown up – and that many of them, for financial reasons, continue to live with their parents, and engage in many hours per week of paid work".

Thus, the student perspective was considered as a driver of change.

5.6 Quality and Organisation

Several aspects of quality and organisation were found in the answers. From the learner perspective, two trending concepts emerged: micro credentialing and experiential learning. Older, full-time working target groups require education built around learning by doing, learners' earlier knowledge, and a reduction of standard 7.5 ECTS courses into smaller chunks. A recommendation from one panel expert was to use *"learning analytics and AI modelling to support learners"* and to create learning profiles. This expert continued by saying that change would require new models for assessment and evaluation *"by turning away from three to four major assessment points throughout the year, into following learning gains on a much more regular and finer grained basis"*. Another expert suggestion was non-credit offerings implemented as MOOCs, and that *"these are already pushing the boundaries between the academy and industry"*.

A criticism of MOOCs that links to the category EDI is that the *"MOOC use is largely not from those who have been denied opportunity for continuing formal education, but rather most often used by already educated"*. There are also recommendations that MOOCs and their digital content needs evaluation and quality assurances, and that the OERs that were part of the previous category might be useful here. From the teacher perspective, a suggestion that might not be embraced by all academics is that *"reward and promotion for academics needs to shift less on publication to quality of teaching and especially online teaching"*. The theme of internationalisation was mentioned as a risk, but also with the possibility that *"programs in a different country or cultural context can be seen as being powerful and exposing the learner to new and diverse experiences"*.

A theme found in several interview answers is work-integrated learning. According to one expert, we must *"take a realistic view of HE reform – one which acknowledges that universities are real work-places with real workforces whose actions are consequential"*. At the same time, there are comments about the labour market's need for upskilling should be complemented with a *"focus on the human flourishing, social cohesion, development of citizenship and individual fulfillment"*. There are different views and organisational modes to consider. One of the panel experts listed three modes. The first mode is described as an older, linear model, as *"a quality or excellence that is approved by hierarchically established peers"*. This model may not contribute to industry or the knowledge economy and is sometimes described as the *"the ivory tower model"*. The second mode is seen as *"context-driven, problem-focused and interdisciplinary research"*. This knowledge is produced in *"the context of application social accountability and quality control"* and is often described as the *"the competence factory"* which values the employability and the production of a relevant future workforce. Finally, the third mode *"emphasizes the coexistence and co-development of diverse knowledge and innovation modes"*, offering interdisciplinary and transdisciplinary knowledge. In this networked mode, according to this expert, higher education institutions and society are in dialogue and create new forms of knowledge and interconnected modes of knowledge production. According to this expert the third mode aspires to *"create deeper connections between the sectors, while respecting each sector."*

5.7 Equity, Diversity and Inclusion (EDI)

As one of the experts stated *"Student population will further diversify"* in the future, and that the provision of lifelong learning opportunities also will be more lifelong, and with a larger age span - from what an expert described as *"caring for children being 'home-schooled'"* to what another expert referred to as *"the elderly and especially those older citizens with less formal education and less funding to access quality tools and"*

connectivity". It is a crucial challenge to reach these new groups and also the ones that suffer from what an expert mention as citizens suffering from *"effects of social and economic disadvantage"*.

One identified global phenomenon is that the percentage of older adults is increasing at a time when work-life needs more upskilling and reskilling than earlier. For one expert, the provision of lifelong learning *opportunities "has the potential to span all age groups and educational contexts if it is mindful of and tailored to the deeper educational purposes of the context"*. Another expert highlighted that *"older individuals have benefited little in the past from these new approaches to learning and the extensive use of technology"*. There are, of course, many other target groups to include, where one of the experts depicts a vision of:

"Movements around climate action, women's rights, gender equality and Black Lives Matter (and more) - will carry this conviction into higher education and demand an education that helps them to change the world. (We saw versions of this in the late 60s/early 70s.) If such demands meet a positive response from academics who are weary of the corrosive effects of neoliberalism, then we may see alliances that will promote various forms of educational innovation and provision for more expansive forms of lifelong learning"

As this expert noted alliances, or collaboration, will provide possibilities for education innovation and expansive forms of lifelong learning initiatives.

5.8 Accessibility

Technology is a double-edged sword that, as one expert wrote, facilitates *"learning that is accessible anytime/anywhere increases"*. On the other hand, *"without access to these digital technologies, students can not have access to knowledge accessible through the web and must therefore rely on their teachers"*. Another expert commented that *"technology-enhanced lifelong learning will be a disruptive technology"*. As in other technology dependent educational contexts, there will certainly be a digital divide between those who have access, and those who do not have access. Moreover, there are two different digital divides, the external between developed countries and less developed countries, and the internal digital divide inside a country or a region (Peiris et al., 2015). For example:

"Access to these technologies is not guaranteed for everyone. Indeed, in developed countries, higher education institutions have infrastructures that allow students to have access to these technologies, which is not the case for developing countries. In addition, Internet accessibility could vary, depending on whether students are in large urban centers or in remote areas".

Most frequently mentioned is the divide between younger and older lifelong learners.

How long is the current life of the learner? One expert points out that *"the elderly and especially those older citizens with less formal education and less funding to access quality tools and connectivity"* will have specific needs. Another emphasises that *"older individuals have benefited little in the past from these new approaches to learning and the extensive use of technology"*. On the other hand, an expert mentions we must look carefully at the differences:

"I have noticed that while younger students are often more comfortable using technology in teaching and learning, older students are more creative in their uses. It is also the case that being able to use technology well does not necessarily mean that one is able to use it to support learning."

5.9 Digital Literacy

Without digital literacy, most of the earlier features would fail. As one of the panel experts emphasised, *"technology-enhanced learning will continue to increase in importance across all age groups, educational contexts"*. It was also pointed out that *"how actively the individual engages with the experiences afforded and made sense of"* will impact outcomes. This category is closely aligned to accessibility. Both digital literacy and accessibility are bottlenecks: *"students (who) cannot have access to knowledge accessible through the web and must therefore rely on their teachers"*.

Digital literacy is close to what one of the experts referred to as readiness in:

"An essential educational concept is that of readiness. That is, the level of knowledge individuals has to engage with what they encounter or experience. Consequently, readiness associated with engaging in technology-enhanced learning may well be a key mediating factor in terms of its efficacy".

On the other hand, the digitalisation of lifelong learning initiatives could be seen as opening opportunities and that "technology has many affordances that support development of lifelong learning skills, specifically in making education accessible and available and in connecting learners around the globe". Suggestions for a way forward were "to strive toward using technology to support learning rather than to drive it. Learning and the learner must always be centre stage", and "then access to technologies and training in their use in terms of functionality might be useful so that such learners can look for similar functionality in the technologies of the future". Finally:

"The focus in 'technology-enhanced' is not on 'high tech' workers but on 'professional human flourishing' with and through technologies. It is 'technology-enhanced professional identities' and a life-world becoming as a professional with and through technologies, more than the learning of new technological tools, systems or skills".

Thus, this expert saw professional identities and becoming through the use of technologies.

6. Conclusion

In the light of the rising emphasis on the provision of lifelong learning opportunities and digitalisation, the aim of this study was to explore and analyse expert perspectives the required reform of higher education. The following research question was posed: What are the critical aspects of higher education reform for the provision of lifelong learning opportunities in a digital era? A panel of experts in the field of lifelong learning answered email interviews with open ended questions on topics such as lifelong learning, higher education reform, technology enhanced learning, instructional design, and pedagogy. The main categories that emerged in the axial coding are 'Infrastructure', 'Multimodal delivery', 'Pedagogical change', 'Financial aspects', 'Quality and organisation', 'Digital literacy', 'Accessibility', and 'Equity, diversity and inclusion (EDI)'. With the grounded theory idea of iterative cycles of data collection and analysis, the next step should be selective or confirmative coding. To develop hypotheses and theory, the results from the axial coding should be further elaborated and validated. This will be carried out in an analysis that compares the results from this study with results from two focus group interviews with the selected Delphi expert panel. There is obviously a dependency between the categories that should be revised and refined in the next step of this Delphi process.

Declarations

Conflict of interests Authors declare that they have no competing interests. The data that supported the findings of this study are available from the corresponding author upon request.

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A Systematic Literature Review on University Collaboration in Open Innovation: Trends, Technologies, and Frameworks

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Abstract: Open innovation is a concept of collaboration of ideas, knowledge, and resources that originates from within the organization and involves external organizations. University-industry collaboration is a factor driving innovation and competitiveness. Most research on interactions between universities and industry concentrated on the industrial side meanwhile, universities, as knowledge producers, play a vital role in creating an open innovation ecosystem that encourages realizing innovations that benefit society. Therefore, the problem raised in this research is how university collaboration can support open innovation. This research aims to identify research trends, the latest technologies, and inter-university collaboration frameworks that can support open innovation. The methodology used is Kitchenham's Systematic Literature Review (SLR) and bibliometric. SLR consists of Identification Study, Selection Studies, Quality Assessment, Data Extraction and Study Synthesis. From the SLR stages, 21 papers published between 2019 and 2023 were obtained. Synthesis and additional literature review were carried out to identify trends, technologies, and frameworks related to the topic comprehensively. In terms of trend, based on the application bibliometric, it was found that there was an increase in the number of publications and the top list of open innovation journals. University collaboration in open innovation more frequently takes place in the UK, and the industries mostly involved are small-medium enterprises. Quantitative research methodology and data analyses, comprising of hypothesis test, regression test, and descriptive statistics, are mostly preferred. Meanwhile, descriptive data analysis is the most common means of qualitative data analysis. Numerous suggestions on topics for future research were also identified. In addition, data analysis using machine learning survival data is identified as a novelty among data analysis methods. Technology transfer and the use of digital platforms may support open innovation processes, and the use of blockchain technology may promote digital platforms development. Seven domains form the framework for university collaboration in open innovation, namely Social Behavior, People, Process, Organization, Environment, Technology, and Performance. The findings of trends, technologies, and frameworks in this research may serve as a foundation for research on similar topics, and the identified framework domains could serve as framework components that might be used by universities to collaborate with partners in implementing open innovation processes. The research have contributes to knowledge management theoretically and practically. Theoretically, open innovation can expand the knowledge base by supporting the concept that knowledge and expertise can be found outside organizational boundaries. Practically, it can enrich knowledge management practices by emphasizing the importance of utilizing digital platform technology in supporting knowledge management sourced from external knowledge and collaboration services in the open innovation process.

Keywords: University collaboration, Open innovation, Trends, Technology, Framework

1. Introduction

Open innovation involving collaboration between universities and industry is increasing (Johnston, 2022). Such collaboration may provide great support for companies in responding to the challenges of today's highly competitive environment. Collaboration with universities can increase the industrial knowledge base through access to new knowledge, expert ideas, scientific results owned by universities, and consulting services that universities can provide (CF Băban & Băban, 2022). Universities as research partners for industry to access new technological and scientific capabilities (Gerdri and Manotungvorapun, 2022). However, innovation problems that often occur in the innovation process in universities based on literature studies include universities needing help getting funding for research, differences in scientific disciplines that can hinder the integration of knowledge, and the downstream of research not yet optimal. One solution is to carry out university-industry collaboration. University-industry collaboration is believed to be a decisive factor that encourages innovation and competitiveness. The mechanisms through which this collaboration occurs have generated increasing interest among academics and the business sector (Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020). Most

research on the interaction between universities and industry is still concentrated on the industrial side (Bürger and Fiates, 2021), with some research gaps focused on the university side. Figure 1 shows a gap in the number of collaborative research topics on open innovation between universities and industry. The numbers were obtained by searching twice, the first using the keywords "University collaboration" AND "open innovation" and the second using the keywords "industry collaboration" and "open innovation" on three scientific databases, namely Scopus, ScienceDirect, and Emerald Insight.

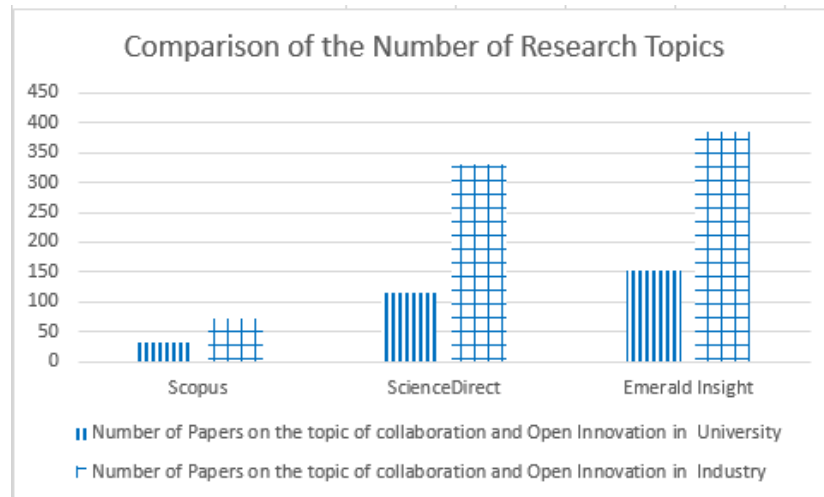


Figure 1: Comparison of the Number of Research Topic

Therefore, it is necessary to identify the latest trends in university collaborative research on open innovation to keep our knowledge and understanding of the development of open innovation updated. The objective of identifying research trends is to identify the number of publications each year, open innovation journals, countries and industries that conduct open innovation, methodology, data analysis methods, and future research in each selected literature.

Open Innovation is an innovation process that is distributed, directed, and based on the flow of knowledge across organizational and jurisdictional boundaries (Osorno-Hinojosa, Koria and Ramírez-Vázquez, 2022). It is a way to produce a product that has an added value. Using technology as a tool can support the open innovation process more effectively. Within this framework, the SLR attempts to identify what technologies are used in open innovation practices.

The success of implementing open innovation is not only based on the technology domain, but there are roles from other domains, such as people, processes, and organizations to name a few (Johnston, 2022; Arvaniti et al., 2022). This research also attempts to identify the strategic domains in developing a model or framework that may serve as a reference for organizations intending to implement open innovation.

This research was conducted using procedures of the systematic literature review (SLR) from Kitchenham et al. Then, the SLR results are synthesized to describe the trends, technologies, and frameworks. The findings could be used to assist research on the topic of university collaboration in open innovation, and the identified framework domains may serve as components that can be used by universities to collaborate with partners in implementing open innovation processes. This study's open innovation research trends are seen in 2019-2023. These findings can assist research on university collaboration in open innovation. Knowing the latest technology can provide insight into current technological developments supporting university collaboration to facilitate open innovation. The identified domains of the framework can serve as components that universities can use to collaborate with partners in implementing open innovation processes.

The research questions formulated in this study are:

RQ1. How have research trends on the topic of university collaboration to support open innovation in 2019-2023?

RQ2. What are the latest technologies used in university collaboration frameworks to facilitate open innovation?

RQ3. What domains have been used by universities to create university collaboration frameworks that can support open innovation?

This paper is divided into seven sections, namely Introduction, Literature Review, Research Methodology, Result, Discussion, Conclusion and Implications, Limitations, Future Research

2. Literature Review

Literature regarding university collaboration and open innovation is the main topic used in this research, including research from (Johnston, 2022) , which found that effective collaboration between small and medium enterprises (SMEs) and universities to encourage innovation in science is ' Proximity Matrix,' namely evaluating similarities between actors through evaluating their closeness in terms of distance, network membership, knowledge base, and working practice. Research from (Ponce, Polasko and Molina, 2021)proposes a new concept for open innovation laboratories at universities based on four overlapping innovation facilities capable of changing according to product needs. Research from (Koria *et al.*, 2022) examines how intermediary organizations that encourage innovation can encourage and enable the diffusion and adaptation of local knowledge, open innovation practices, and collaboration between universities, companies, and social innovators.

One application of technology to support the open innovation service process is to build a website-based digital platform that can be accessed by university partners for collaboration or by utilizing social media/networks; this is in line with the opinion of previous research (Szromek *et al.*, 2023)stating that coordination, information and communication functions, carried out in social networks and online platforms. Digital media can be used to obtain creative ideas, innovate products and services, and maintain contact with key stakeholders (Santoro, Ferraris and Winteler, 2019). One example (Koria *et al.*, 2022)creates an innovation platform that focuses on developing new products and services and research (Johnston, 2022) regarding the Gateway to Research website, which provides information in the form of details of all publicly funded research projects in the UK.

Several studies show that the term technology transfer in open innovation refers to sharing knowledge, technology, processes, or innovative solutions between organizations, companies, research institutions, or individuals. Technology transfer to accelerate innovation and development of new products through collaboration and utilization of external and internal resources. (Băban and Băban, 2022)found that the presence of universities near an industry can provide high-quality resources for research and innovation activities as well as support for the transfer of knowledge and technology, including in the context of open innovation

Previous research has shown that the successful implementation of open innovation in organizations does not only emphasize one dimension but must pay attention to other dimensions. Leavitt's socio-technical theory views organizations as complex systems with four dimensions: people, structure, tasks, and technology, which influence each other. People include individuals and groups working within an organization. Structure refers to the formal and informal work organization, including hierarchies, workflows, procedures, and policies. Task refers to work or activities that must be carried out to achieve organizational goals. Technology includes the tools, techniques, and methods to complete tasks (Leavitt, 2013). The following research from (Kobicheva, Baranova and Tokareva, 2020) is mapped into socio-technical—task components- Research processes, and activities related to interaction mechanisms that drive the innovation process. Apart from internal interactions within its departments, the university also conducts external interactions with the business world and government through living laboratories and a network of business incubators on open innovation online platforms. Components of society - groups involved in innovation activities are universities, the business world, and the government. The university has three departments: technical, economics, and humanities. Structural component- relationships between parties are based on the concept of open innovation, characterized by exchanging knowledge and ideas and working on potential projects in the future. The technology-platform component produced in this research is a web-based digital platform called the open innovation online platform. This technology facilitates living laboratories and Network Business Incubators.

Another example is research (Johnston, 2021), which emphasizes three factors that influence the formation of relationships between universities and industry, namely Organizational Proximity, Spatial Proximity, and Technological Proximity. Organizational Proximity: The existence of ties between actors, such as previous experience working with the company or collaborating with other companies in the sector, has been identified as the most influential factor in forming UI relationships. Spatial Proximity: The physical proximity of university partners to companies has been proven to influence the formation of UI relationships positively. Technological Proximity: The relevance of the partner university's knowledge and expertise to the food sector has been identified as an essential determinant in forming UI relationships, highlighting the importance of technological proximity. Gender factors in the people dimension also influence open innovation activities, as shown by two previous studies on gender in open innovation activities. The first study is research (Weerasinghe and Dedunu,

2021) This study found that academic staff collaboration in joint research activities and human resource mobility still need to be improved in Sri Lanka. Male academic staff have a more significant role in academic participation than women. Knowledge exchange occurs in joint research and training. Institutional factors significantly moderate the university-industry relationship, and the quality of academic work is the only individual factor that significantly moderates the relationship. The second study is research which found that gender positively affects open innovation activities in institutions. The presence of women in the top management team (TMT) has been proven to increase open innovation. Female executives are essential in moderating the relationship between TMT gender diversity and open innovation. Research shows that the influence of TMT gender diversity on open innovation increases when female executives have greater power to influence and when institutional conditions support it.

3. Method

The methods used in this research are systematic literature review (SLR), kitchenham, and bibliometric. SLR is used to obtain a collection of appropriate literature to answer the research question. In contrast, bibliometric is used to answer research question 1 regarding research trends on university collaboration topics to support open innovation.

The SLR stages use the Kitchenham procedure, consisting of:

1. Identification Study. At this stage, research questions are formulated using Population, Intervention, Comparison, Outcome, and Context (PICOC).
2. Selection Studies. There are two stages of selection conducted. The first stage of selection is based on the title and abstract, while the second stage is full-text selection. Both selections are carried out based on "inclusion" and "exclusion" criteria.
3. Quality Assessment. This stage involves assessing the methodological quality and reliability of the studies that have been selected.
4. Data Extraction. Once papers are selected and evaluated, relevant data are extracted by labeling papers based on relevant topics.
5. Study Synthesis. At this stage, analysis and synthesis are carried out based on the data resulting from the previous extraction, which is then used as a foundation for the research question.

Minimizing bias and limitations in research can be addressed through methodological steps at the study selection and quality assessment stages. At the study selection stage, the process is carried out in two steps: first, title and abstract selection, which must include key terms according to the research question, namely collaboration, university, and open innovation. In the second step, full-text selection is carried out by understanding the contents of the paper to determine whether there are key terms that can answer the research question. The final stage to avoid bias is to conduct a quality assessment of each paper, where the quality of the paper is assessed based on ten criteria, including clear research objectives, significant research contributions, and appropriate research methodology. Complete details can be seen in Table 10.

3.1 Study Identification

At this stage, a research question is formulated based on Population, Intervention, Comparison, Outcome, and Context (PICOC). The PICOC table can be seen in Table 1, and the research questions are shown in Table 2.

Table 1: PICOC

Population	University collaboration, technology, open innovation
Intervention	collaboration, universities, technology, digital platforms, applications, open innovation, knowledge
Comparison	Open Innovation in Industry
Outcome	Trends, technologies, and frameworks
Context	study at university

Table 2: Formulated research questions

RQ 1	How have research trends on the topic of university collaboration to support open innovation in 2019-2024?
RQ 2	What are the latest technologies used in university collaboration frameworks to facilitate open innovation?
RQ 3	What domains have been used by universities to create university collaboration frameworks that can support open innovation?

The next stage, to find relevant papers, is carried out through a Boolean string search in five scientific databases: Scopus, ScienceDirect, Emerald, ProQuest, and Sage. This database was selected based on its extensive coverage of the literature on the research topic of open innovation and the ease of accessing literature relevant to the research questions. The selection of keywords is based on key concepts in the research question, such as university collaboration, open innovation, technology or digital platforms or applications, models or frameworks, and knowledge. The keywords 'model' or 'framework' are used to facilitate the identification of the domains involved in establishing the framework. The Boolean String format can be seen in Table 3 below.

Table 3: Boolean search string

Scientific Databases	Boolean Search String
Scopus	<i>TITLE-ABS-KEY ("university collaboration" AND "open innovation" OR (model OR framework) AND (technology OR "digital platforms" OR applications) OR knowledge)</i>
ScienceDirect	Title, abstract, or author-specified keywords: <i>TITLE-ABS-KEY ("university collaboration" AND "open innovation" OR (model OR framework) AND (technology OR "digital platforms" OR applications) AND knowledge)</i>
Emerald	<i>TITLE-ABS-KEY ("university collaboration" AND "open innovation" AND (model OR framework) AND (technology OR "digital platforms" OR applications) AND knowledge)</i>
ProQuest	<i>("university collaboration" AND "open innovation" AND (model OR framework) AND (technology OR "digital platforms" OR applications) AND knowledge)</i>
Sage	<i>("university collaboration" AND "open innovation" AND (model OR framework) AND (technology OR "digital platforms" OR applications) AND knowledge)</i>

The inclusion and exclusion criteria at this stage can be seen in Table 4 below.

Table 4: Inclusion and exclusion criteria at the initiation stage

Stages	Inclusion Criteria	Exclusion Criteria
Initiation Stage	• In accordance with the searched keyword • Written in English • Published in 2019-2023 • Article • Selecting journals that suit the topic to filter databases resulting in thousands of papers.	• Written in languages other than English • Publication year beyond 2019-2023

Based on an initial search using a Boolean search string in five databases, 466 articles were obtained with the following details: Scopus 52 articles, ScienceDirect 222 articles, Sage Journal 8 articles, ProQuest 107 articles, and Emerald 77 articles.

3.2 Study Selection

At this stage, two stages of selection were carried out. The first stage of selection was based on the title and abstract, while the second stage was full-text selection. The inclusion and exclusion criteria for these two stages are shown in Table 5. The first stage and the second stage resulted in 193 articles and 21 articles respectively.

Table 5: Table of study selection criteria

Stages	Inclusion Criteria	Exclusion Criteria
Stage 1 (Selection of Title and abstract)	• Containing the term "collaboration" • Containing the terms related to university stakeholders, such as "government", • "industry", and "society"	• Other than open innovation

Stages	Inclusion Criteria	Exclusion Criteria
	Containing the term "open innovation"	
Stage 2 (Full-Text Selection)	- Containing open innovation-related processes - There is collaboration between universities and stakeholders - There is the use of technology <i>Open access papers</i>	- Not containing open innovation-related processes - There is no collaboration between the university and stakeholders - Papers whose full text cannot be accessed - Paper Review

3.3 Quality Assessment

At this stage, a quality assessment was carried out for the 21 articles obtained in the previous stage. Article quality assessment can be seen in Table 6

Table 6: Quality assessment

Check the list	Question Checklist
C1	Does the paper explain the research objectives clearly?
C2	Does the paper include a literature review, background, and research context?
C3	Does the paper show a different contribution from previous research?
C4	Does the paper show the proposed architecture or methodology used?
C5	Does the paper present the university collaboration?
C6	Does the paper use technology as a collaboration medium?
C7	Does the paper describe the concept of open innovation clearly?
C8	Does the paper describe the domain of a digital platform-based PT collaboration framework that can support open innovation?
C9	Does the paper have research results and conclusions relevant to the research problems?
C10	Does the paper recommend future work?

For each checklist, a five-point scale is given, namely 0 (very poor), 0.25 (poor), 0.5 (fair), 0.75 (good) and 1 (excellent). The maximum value for each article will be 10 points. Selected articles are those that get 6 points and above.

3.4 Data Extraction

Data extraction was carried out to identify the main contributions of the selected studies. The results are presented in the Results section later in this paper.

3.5 Synthesis

At this stage, analysis and synthesis were carried out based on the data from previous extraction. An additional literature review was carried out to answer the research question comprehensively. Synthesis results can be seen in Subsection 4.

4. Results

This section presents the results of the analysis of the systematic literature review in three sub-sections, namely research trends, use of technology in promoting open innovation, and framework domains for higher education collaboration.

4.1 Research Trends

This subsection displays research trends identified in 21 published papers selected based on SLR discussing about university collaboration in the context of open innovation. The papers were then analyzed using descriptive statistics to reveal research trends based on the distribution of papers by year, journal, country, industry, research methodology, and quantitative and qualitative data analysis methods. The distribution of publications by year can be seen in Figure 2. It can be seen that five publications are in 2020, 2022, and 2023 each, with three publications in 2019 and 2021.

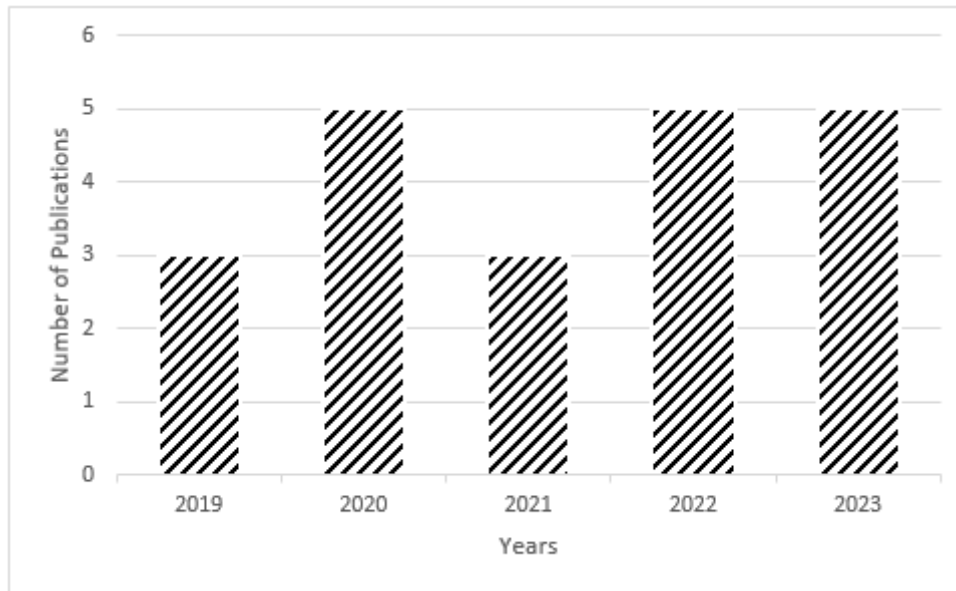


Figure 2: Distribution of Publications by Year

Most papers on the topic of university collaboration in open innovation were in the Journal of Open Innovation: Technology, Market, and Complexity reaching 19%, followed by the European Journal of Innovation Management and Mathematics with 14%. Next is the Journal of Technology Transfer at 10%, while the rest are 5% each. The detailed distributions of the journals can be seen in Table 7.

Table 7: Distribution of Publications by journal

Journal Name	Number of Publications
European Journal of Innovation Management	3
Mathematics	3
Science, Technology & Society	1
Industry and Innovation	1
EuroMed Journal of Business	1
International Journal of Innovation Science	1
The International Journal of Electrical Engineering & Education	1
Journal of Open Innovation: Technology, Markets, and Complexity	4
Technological Forecasting and Social Change	1
Asia Pacific Management Review	1
Sustainability	1
The Journal of Technology Transfer	2
Dimension Empresarial	1

The country with the most collaboration between industry and universities in open innovation is the UK at 23%, followed by 14% by Romania and Italy, 9% by America with the remaining 5% each. The number of publications of the countries is displayed in Figure 3.

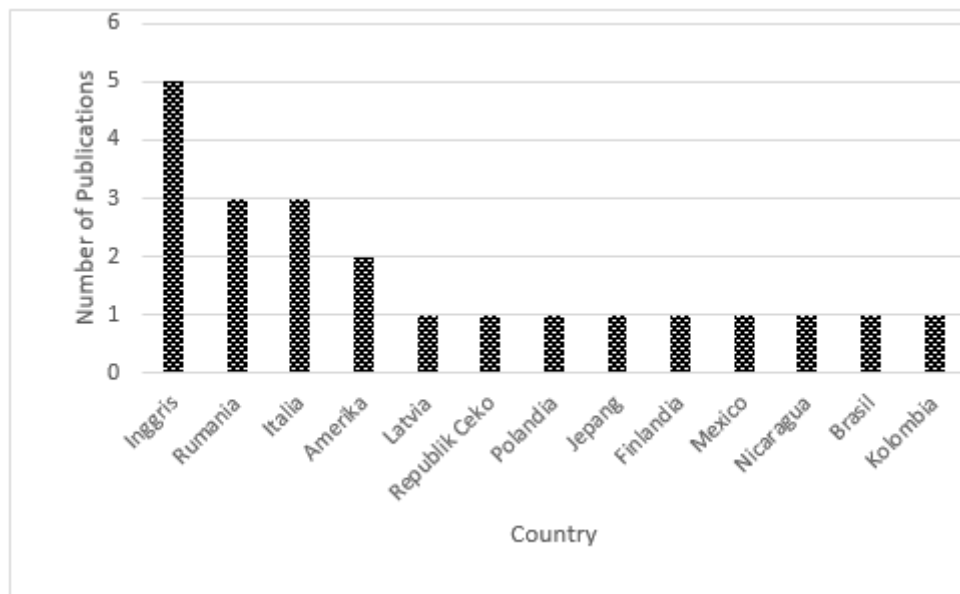


Figure 3: Distribution of Publications by Country Carrying Out Open Innovation

Meanwhile, a more detailed description of the role of industries in open innovation with universities can be seen in Figure 4. Small medium enterprises rank the highest, namely 26%, followed by startups, jewellery, automotive, electronics, and technology sectors each at 11 %, and the remaining 5% each in the food manufacturing industry, construction industry, tourism industry, and Sanitation Company.

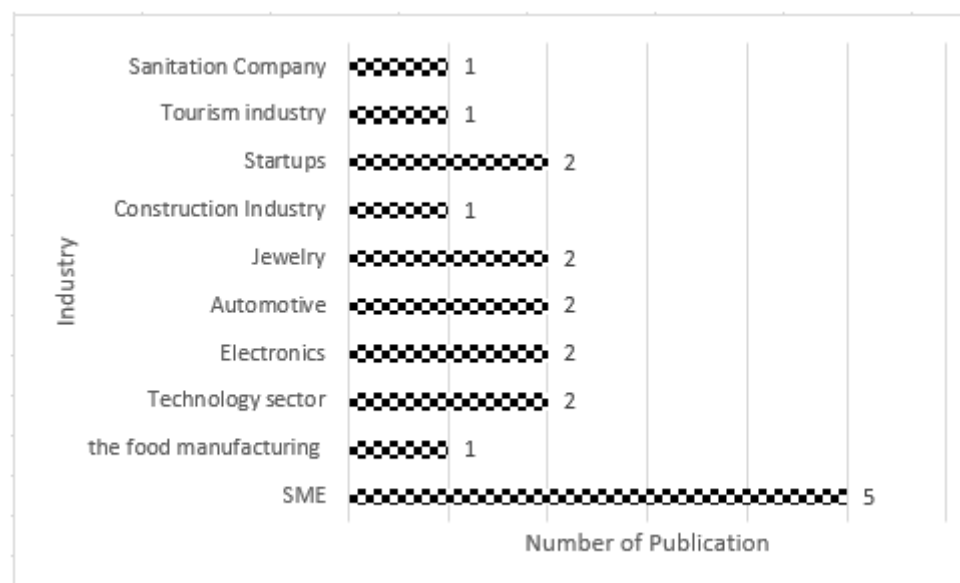


Figure 4: Distribution of Publications by industry collaborating with the University

Quantitative research methodology is the most common research approach in attempts to investigate the type of collaborative research for open innovation, taking 66%. This is followed by a qualitative approach at 24%, with the lowest the mix method, namely 10% (as seen in Figure 5).

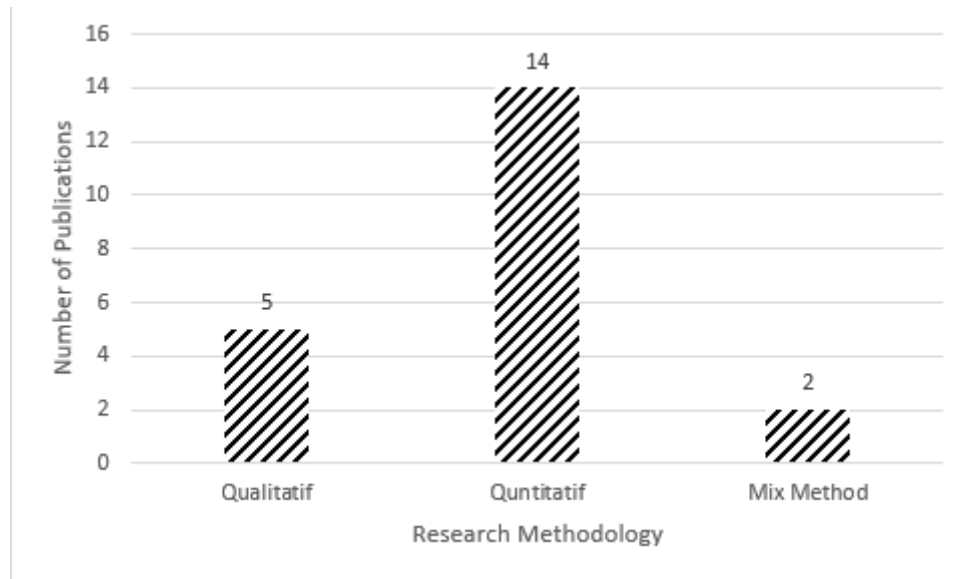


Figure 5: Distribution of Publications Based on Research Methodology

There are also differences in how data are analysed. In quantitative research, the Hypothesis Test is most commonly employed at 27%, followed by Regression Test at 15%, Descriptive Statistics at 12%, Artificial Neural Networks (ANN) at 9%, and Confirmatory Factor Analysis (CFA) and Correlation Test each at 6%. Adaptive Neuro-fuzzy Inference Systems, Data Envelopment Analysis (DEA), chi-square, Fisher's Exact Test, Fuzzy Logic, Generalized Method of Moments (GMM), Malmquist Productivity Index, and Social Network Analysis (SNA) are all 3% each. The data analysis methods used in quantitative research can be seen in Figure 6 below.

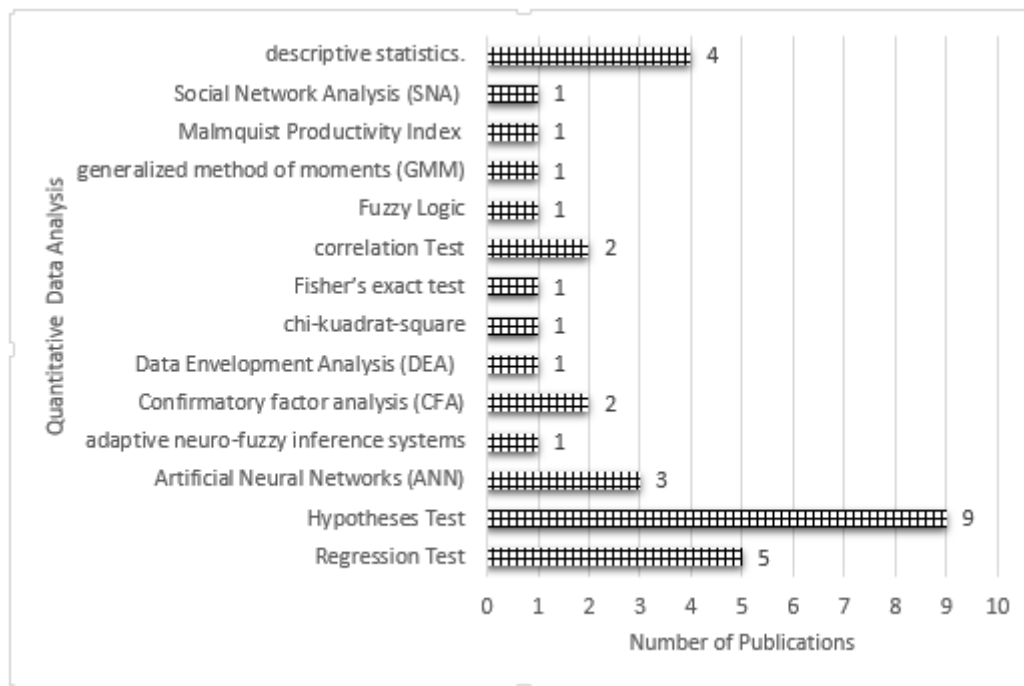


Figure 6: Distribution of Publications based on Quantitative Data Analysis

Whereas, qualitative data analysis mostly uses descriptive data analysis, as much as 40%, followed by narrative content analysis, multiple correspondence analysis (MCA), and content analysis method at 20% each (displayed in Figure 7).

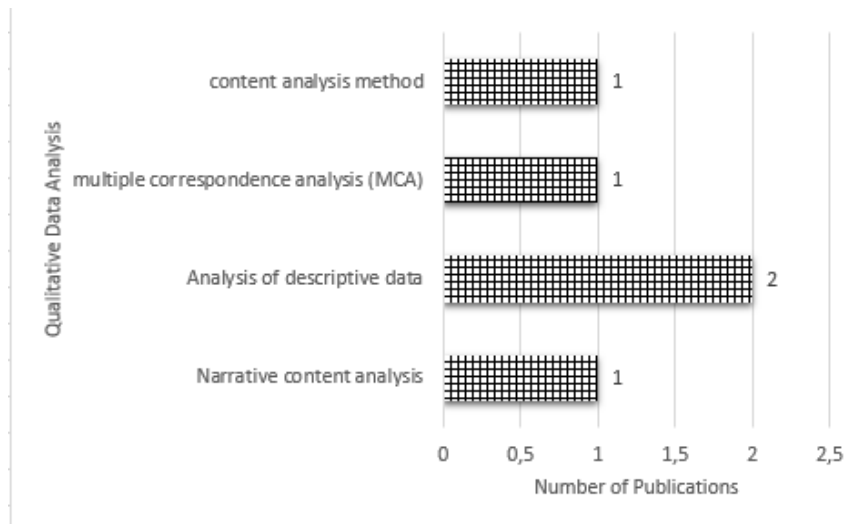


Figure 7: Distribution of Data Analysis Methods in Qualitative Research

Table 8 below depicts future research topics suggested by researchers of the selected papers.

Table 8: Future research topics

Suggested Future Research	Reference
Using similar methodology in different sectors and country contexts, to provide confirmatory evidence supporting the generalizability of the findings	(Johnston, 2021)
Conducting model validation, exploratory investigations with larger sample size surveys, and addressing nonlinearities between antecedent variables	(Călin, Băban and Rangone, 2022)
Validating the proposed variables through confirmatory and exploratory factor analysis	(Băban, Băban and Mitran, 2023)
Exploring the determining factors from the perspective of academics involved in the collaboration with industry to develop a methodology for implementing open environmental policies and procedures for innovation between industry and universities.	(Baban, Baban and Rangone, 2021b)
Presenting the impact of SMEs on universities by examining the extent to which these collaborations can support academic activity	(Johnston, 2022)
Taking the influences of other actors of innovation, for example, the quadruple/quintuple helix model, into account in promoting open innovation	(CF Băban & Băban, 2022)
Implementing an Open Innovation Patent (OIP) and an investigation is conducted into how to produce this type of patent	(Comai, 2020)
explains the role of universities as agents of innovation and entrepreneurship to support the economy	(Huggins, Prokop and Thompson, 2020)
Analyzing indicators for improving open innovation communities (OICs)	(Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020)

4.2 Use of Technology to Facilitate Open Innovation

The use of university collaboration technology in open innovation is displayed in Table 9.

Table 9: Technology in open innovation

Technology	Information	References
Technology Transfer	Resource exchange process	(CF Băban & Băban, 2022;) .
Platform/website/application	Digital-based platform	(Santoro et al., 2019) ; (Johnston, 2022)

There are different meanings when using "technology" in open innovation. The first understanding refers to technology transfer, which refers to transferring knowledge, skills, or technology from one partner to another. The partners include universities, industry, research organizations, and government. The second definition is an application used to help facilitate open innovation activities such as Knowledge Flow, Knowledge transfer, Knowledge management, Selection, Negotiations, Evaluation, and Commercialization. The application is, of course, website-based so that partners can access it.

4.3 Domain Framework for Higher Education Collaboration on Open Innovation

The domain grouping is based on a framework that is generally used to analyze the factors that influence the implementation of information system in an organization. The framework in question is PPT (People, Process, and Technology) and TOE (Technology, Organization, and Environment). However, in accordance with the conducted SLR, there are additional domains of Social Behavior and Performance. These domains are shown in Table 10 below.

Table 10: Domain Framework for Higher Education Collaboration in Open Innovation

No	Domain	Sub Domains	Description	References
1	Social Behaviour	Trust	Confidence or trust in the relationship between partners	(Johnston, 2022; Saeed et al., 2023; Santoro et al., 2019; Zhao, 2023; Ponce et al., 2021; Tomita, 2022; CF Băban & Băban, 2022; Campana et al., 2020)
		Communications	Communication between actors	(Johnston, 2021; Johnston, 2022; Zhao, 2023; Ponce et al., 2021; Rostoka et al., 2019; Tomita, 2022b)
		Collaboration	Each partner drives the other positively	(Johnston, 2021); (Călin, Băban and Rangone, 2022); (M. Băban et al., 2023) (Johnston, 2022) (Ponce, Polasko and Molina, 2021); (Audretsch et al., 2023); (Tomita, 2022); (de Araujo et al., 2020); (Campana et al., 2020)
		Commitment	Commitment from top management	(Santoro et al., 2019); (Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020)
2	People	University	Industry collaboration partner	(Johnston, 2021); (Baban, Baban and Rangone, 2021b)(Băban and Băban, 2022); (Băban, Băban and Mitran, 2023); (Johnston, 2022); (Santoro et al., 2019); (Zhao, 2023); (Han et al., 2019); (Ponce, Polasko and Molina, 2021); (Rostoka, Locovs and Gaile-Sarkane, 2019); (Audretsch et al., 2023); (Tomita, 2022); (Koria et al., 2022); (Comai, 2020); (de Araujo et al., 2020); (Huggins, Prokop and Thompson, 2020); (Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020); (Campana et al., 2020)
		Government	Policymakers and fund providers	(Ponce, Polasko and Molina, 2021); (Campana et al., 2020)
		Industry	University collaboration partners	(Johnston, 2021); (Baban, Baban and Rangone, 2021b)(Băban and Băban, 2022); (Băban, Băban and Mitran, 2023); (Johnston, 2022); (Santoro et al., 2019); (Zhao, 2023); (Han et al., 2019); (Ponce, Polasko and Molina, 2021); (Rostoka, Locovs and Gaile-Sarkane, 2019); (Audretsch et al., 2023); (Tomita, 2022); (Koria et al., 2022); (Comai, 2020); (de Araujo et al., 2020); (Huggins, Prokop and Thompson, 2020); (Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020); (Campana et al., 2020)

No	Domain	Sub Domains	Description	References
		Other Partners	Public/Citizen, Community, Research institutions, suppliers, customers	(Tomita, 2022); (Santoro <i>et al.</i> , 2019); (de Araujo <i>et al.</i> , 2020)
3	Process	Idea/Knowledge Flow	Internal and external knowledge flows	(Johnston, 2022); (Santoro <i>et al.</i> , 2019); (de Araujo <i>et al.</i> , 2020); (Campana <i>et al.</i> , 2020)
		Knowledge transfer	Sharing knowledge between partners	(Băban and Băban, 2022); (Băban, Băban and Mitran, 2023); (Johnston, 2022); (Szromek <i>et al.</i> , 2023); (Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020)
		Knowledge management	Knowledge management in open innovation processes	(Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020)
		Selection	Selection of the right collaboration partner	(Johnston, 2021); (Johnston, 2022); (Rostoka, Locovs and Gaile-Sarkane, 2019)
		Negotiations	Business negotiation	(Tomita, 2022)
		Evaluation	Measuring organizational achievements	(Ponce, Polasko and Molina, 2021)
		Commercialization	Innovative products enter the market	(Johnston, 2021); (Johnston, 2022); (Han <i>et al.</i> , 2019); (Ponce, Polasko and Molina, 2021); (Huggins, Prokop and Thompson, 2020)
4	Organization	Culture	Collaborative culture	(Santoro <i>et al.</i> , 2019); (Koria <i>et al.</i> , 2022); (Băban and Băban, 2022); (de Araujo <i>et al.</i> , 2020)
		Strategy	Innovation strategy	(Saeed, Ali and Riaz, 2023); (Han <i>et al.</i> , 2019); (Ponce, Polasko and Molina, 2021); (Tomita, 2022); (de Araujo <i>et al.</i> , 2020)
		Motives	The aim of collaborating	(Baban, Baban and Rangone, 2021b); (Băban and Băban, 2022); (Ponce, Polasko and Molina, 2021); (Rostoka, Locovs and Gaile-Sarkane, 2019)
5	Environment	Collaboration level selection	Levels of Collaboration	(Johnston, 2021); (Baban, Baban and Rangone, 2021b); (Băban and Băban, 2022); (Băban, Băban and Mitran, 2023); (Johnston, 2022); (Santoro <i>et al.</i> , 2019); (Zhao, 2023); (Han <i>et al.</i> , 2019); (Ponce, Polasko and Molina, 2021); (Rostoka, Locovs and Gaile-Sarkane, 2019); (Audretsch <i>et al.</i> , 2023); (Tomita, 2022); (Koria <i>et al.</i> , 2022); (de Araujo <i>et al.</i> , 2020); (Huggins, Prokop and Thompson, 2020); (Campana <i>et al.</i> , 2020)
		Policy	Open innovation policy	(Baban, Baban and Rangone, 2021b); (Johnston, 2022); (Szromek <i>et al.</i> , 2023); (de Araujo <i>et al.</i> , 2020)
6	Performance	Patents/Intellectual Property Rights	One of the results of the open innovation process	(Johnston, 2021); (Zhao, 2023); (Han <i>et al.</i> , 2019); (Ponce, Polasko and Molina, 2021); (Tomita, 2022)
7	Technology	Technology Transfer	Resource exchange process	(CF Băban & Băban, 2022); (Huggins, Prokop and Thompson, 2020)
		Platform/website /application	Digital-based platform	(Santoro <i>et al.</i> , 2019); (Johnston, 2022)

5. Discussion

This research uses Kitchenham's Systematic Literature Review (SLR) to answer three research questions, each to determine research trends, technology, and domain frameworks in higher education collaboration in open innovation. This section discusses the findings of the questions, provides an additional literature review to enrich the discussion, and summarizes the results to be used for potential stakeholders who may benefit from the research findings.

5.1 RQ 1. What are the research trends on the topic of university collaboration in open innovation?

To answer the question, Kitchenham's SLR stages were employed in evaluating published papers, starting from study identification, study selection, and quality assessment, resulting in 21 selected papers. The number of papers found is not so large because, at the study selection stage, one of the criteria for the paper selection is that each must contain the term "open innovation" in their title.

From the selected papers, trend analysis was carried out based on year, journal, country, industry, research methodology, data analysis methods, and future research suggestions. The results of the trend analysis by year show that university collaboration in open innovation is still a chosen topic of research every year, as seen in Figure 1. This topic is likely to be a research trend in the foreseeable future because most research on the interaction of universities and industry still mostly perceives it from the industrial perspective (Bürger and Fiates, 2021). Thus, there is still a research gap from the perspective of universities.

Research on university collaboration in open innovation is mostly found in the Journal of Open Innovation: Technology, Market, and Complexity. Based on Scimago Journal & Country Rank data, the journal is indexed by Scopus in Q1 with an H-Index of 38 (per November 2023).

It is also found that most of the collaborations between universities and their partners (industry, government, or community) on open innovation are conducted in the UK (see Figure 3). However, it should be noted that, based on the Global Innovation Index (GII) there are 130 countries involved in innovation ranking (World Intellectual Property Organization, 2022). The five countries with the highest rankings are shown in Figure 8 below.

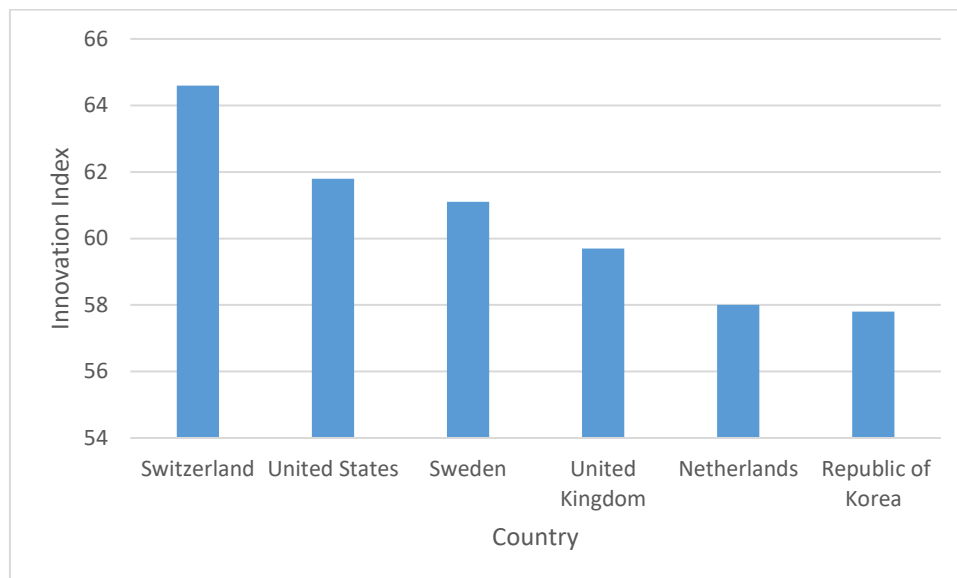


Figure 8: Innovation Index ranking by country

The score on the Innovation Index reflects how well a country innovates in various aspects of life. Some of the factors evaluated in this index include the number of patents filed, investment in research and development, industry-academic collaboration, and higher education capacity to name a few.

The industry that is most involved in university collaboration is small and medium enterprises (SMEs). One of the reasons for this is that SMEs often have limited knowledge, technology, and required resources. By carrying out open innovation, SMEs can collaborate with universities to overcome those limitations (Johnston, 2022; Vélez-Rolón, Méndez-Pinzón and Acevedo, 2020). For example, in research (Santoro, Ferraris and Winteler, 2019) based on the results of interviews conducted with UKM, state universities are seen as practical open

innovation that complements each other for UKM. For SMEs in the ICT sector, regular meetings with university partners are needed to balance relationships and avoid delays because ICT sector products/services quickly become obsolete.

The research methodology most widely used in university collaboration in open innovation is quantitative. This is because quantitative research is considered to be more objective as it uses numerical data. The mixed research methodology is rarely used in this research, making it a novelty in future research. For example, in research (Baban, Baban and Rangone, 2021a) conducted explanatory research by combining qualitative and quantitative approaches. Qualitative has been done with a literature review to determine the conceptual framework of industry-university determinants. Quantitative has been carried out with statistical analysis and a fuzzy logic approach. Statistical analysis was carried out on the questionnaire results data, including conducting a chi-square analysis to determine whether the Italian and Romanian populations tend to rank the importance of each questionnaire item differently. A fuzzy logic approach has been used to predict the impact of five determinants of Open Innovation on the perception of universities as a source of corporate Open Innovation activities. Research (Rostoka, Locovs and Gaile-Sarkane, 2019) uses an interpretative research paradigm by combining quantitative and qualitative approaches. Quantitative has been carried out using statistics to analyze demographic and economic data, labor costs, education, level of trust in state institutions, and distribution of European Union funds. Qualitative by interviewing industry and academic experts to evaluate employee turnover rates.

This novelty can also be implemented in qualitative and quantitative data analysis, where we can use data analysis other than those shown in Figure 6, for instance, the use of machine learning. Machine learning for survival analysis concerning the topic of university collaboration in open innovation could be used to predict the determinants of open innovation collaboration or to analyze the adaptation of higher education collaboration models to open innovation.

Future research suggestions (see Table 8) can be used to direct further research on related topics. For instance, research may add the determinants of collaboration from the perspective of academics involved in open innovation (Baban, Baban and Rangone, 2021b).

5.2 RQ 2. What are the latest technologies used in university collaboration frameworks to facilitate open innovation?

The term technology obtained from SLR results has two different meanings: the first as a technology transfer and the second as a digital-based platform. Technology transfer can be defined as the process of exchanging technology, production methods, or technical expertise between partners, as happens in a collaboration between universities and industry, where universities provide high-quality resources for open innovation processes (CF Băban & Băban, 2022;) (Huggins, Prokop and Thompson, 2020). For example, in research (Han *et al.*, 2019) under the OI paradigm, there is an essential flow of external knowledge into the organization that turns into projects through collaboration with external partners, leading to the purchase and incorporation of external technologies. Research (Baban, Baban and Rangone, 2021b) The presence of universities near industry provides high-quality resources for research and innovation activities and support for knowledge and technology transfer.

Technology as a digital platform provides benefits for companies to find opportunities from obtaining big data from external parties and developing an engaging open innovation collaboration with their partner via a digital ecosystem. In this way, SMEs can utilize e-collaboration tools, social media, and big data platforms, to obtain creative ideas to innovate their products and services and to maintain collaboration with university partners (Santoro *et al.*, 2019). Another example of a digital platform is the Gateway to Research website, which provides details of all publicly funded research projects in the UK (Johnston, 2022).

In addition, a new technology that can be utilized for university collaboration in open innovation is blockchain technology. Blockchain technology integrates artificial intelligence, cloud computing, and big data (Yang, 2019). This technology can be used to support the knowledge transfer process both internally and externally, especially in searching for ideas/knowledge in open innovation.

One of the critical success factors in sharing/transferring knowledge is trust (Al Hakim, Sensuse and Lestari, 2022). Trust plays a crucial role as an important facilitator in communication, which leads to good relationships, and, thus, people are more willing to engage in knowledge sharing (Azizi and Ahsan, 2023). Trust may be achieved by utilizing blockchain technology. Currently, blockchain has won much research recognition and public attention in the field of global innovation. "The Economist" compared blockchain to a "trust machine" and predicted that "the blockchain will redefine the world (Yang, 2019).

5.3 RQ 3. What domains have been used by universities to create a digital platform collaboration framework that can support open innovation?

The framework may serve as a foundation that can be used by universities to collaborate with partners in carrying out open innovation processes. The SLR on this research question came up with seven domains that form the framework. The seven domains are as follows: Social Behavior, People, Process, Organization, Environment, Technology, and Performance.

These findings group “trust”, “communication”, “commitment”, and “collaboration” as subdomains of Social Behavior. Previous research determines Social Behavior to be consisting of trust, communication, and commitment ((Santoro *et al.*, 2019). Collaboration in the social behavior domain may refer to cooperation between individuals or groups in social interactions. Collaboration that can be carried out in open innovation includes joint research (Johnston, 2021; Ponce *et al.*, 2021; Audretsch *et al.*, 2023; Tomita, 2022b) and collaboration technology (Comai, 2020; M. Băban *et al.*, 2023). One of the aims of such collaboration is to create intellectual property and achieve a competitive advantage (Campana *et al.*, 2020).

Trust is an important factor for success in collaboration, previous research found that partners are more likely to collaborate with universities they trust and have established good collaborative relationships (Johnston, 2022; Santoro *et al.*, 2019; Zhao, 2023). Greater partner trust can increase knowledge mobility, innovation feasibility, and performance of open innovation (Tomita, 2022b; CF Băban & Băban, 2022).

The People domain consists of sub-domains of “universities”, “industry”, “government” and other parties (public/citizens, community, research institutions, suppliers, and customers). Each has its role in the open innovation process. The role of universities includes being a source of knowledge and experts, a provider of access to research, a facilitator of the flow of knowledge, and a developer of new products and services (M. Băban *et al.*, 2023; Johnston, 2022; Zhao, 2023; Huggins *et al.*, 2020). The role of industry is to transfer knowledge to universities within its operating area, where they produce innovations (Băban and Băban, 2022). The role of government is to provide funds (Ponce *et al.*, 2021; Campana *et al.*, 2020) and to formulate policies on open innovation that involve collaboration between partners (Szromek *et al.*, 2023).

The Process domain consists of seven subdomains, namely “idea or knowledge flow”, “knowledge transfer”, “knowledge management”, “selection”, “negotiation”, “evaluation”, and “commercialization”. The idea or knowledge flow is the initial process where the ideas/knowledge originating from external parties combine with internal ideas/knowledge to produce innovative products or services (Johnston, 2022; de Araujo *et al.*, 2020; Campana *et al.*, 2020). Knowledge management is more about the process of managing internal knowledge and external knowledge. Knowledge transfer in open innovation may take the forms of publications, research collaborations, informal links and networks, consultations, or trainings (Băban and Băban, 2022). Selection is more about the process of selecting partners (Johnston, 2022). Negotiation is an interactive process in which two or more parties try to reach a mutually beneficial agreement. Evaluation is an important process for assessing the level of success of the open innovation process that has been carried out (Ponce, Polasko and Molina, 2021). While most academic research is concentrated on outputs related to the creation and commercialization of intellectual property, involving industrial partners will provide significant income for universities (Huggins, Prokop and Thompson, 2020).

The Organizational domain consists of “culture”, “strategy”, and “motive”. A collaboration culture is very important to promote open innovation (Koria *et al.*, 2022). There are several strategies to support open innovation, including joint ownership of patents as an organizational strategy to co-innovate (Saeed, Ali and Riaz, 2023), enriching the knowledge base by integrating partner knowledge (de Araujo *et al.*, 2020). University motives for carrying out open innovation include getting access to public funding through collaborative research projects, shortening product development time, sharing risks and access to research facilities (CF Băban & Băban, 2022), gaining knowledge that is useful for teaching and learning on campus, and seeking business opportunities (Rostoka, Locovs and Gaile-Sarkane, 2019).

The Environment domain consists of two subdomains, namely collaboration level selection and policy. Selecting the appropriate level of collaboration involves determining the extent to which the university wishes to be involved in collaboration, i.e. whether at the local, national, regional, or international level. The implementation of open innovation policies must involve all stakeholders (Baban, Baban and Rangone, 2021b). From a government perspective, policymakers need to review the role of state universities in society and concentrate on establishing an ideal organizational structure at the national and regional levels involving various interested parties (Szromek *et al.*, 2023).

The Technology domain consists of two subdomains, namely “technology transfer” and “digital platforms”. An explanation of the two subdomains can be seen in Sub-chapter 4.2. The Performance domain consists of the “patent/intellectual property rights” sub-domain. University patent stocks may still be considered an important opportunity for companies (Johnston, 2021). Eventually, open innovation processes may increase intellectual property (Zhao, 2023).

6. Conclusion

The literature used in this research comes from five reputable databases, namely Scopus, ScienceDirect, Emerald, ProQuest, and Sage. Through the Kitchenham SLR method, 21 articles were obtained. The article contains the keywords university collaboration and open innovation. Based on the results of the SLR, provide an overview of the current situation regarding the topic of university collaboration research and open innovation, technology that can be utilized to encourage open innovation, and a list of domains that form the framework for university collaboration in open innovation. The research trends presented in this study include information on the number of publications each year, a list of open innovation journals, countries, and industries undertaking open innovation, methodology, data analysis methods, and future research. The number of publications about "university collaboration" and 'open innovation' has increased in 2023. Three top journals accept papers on this topic, namely the Journal of Open Innovation: Technology, Markets, and Complexity and the European Journal of Innovation Management and Mathematics. From the 21 papers found, most research case studies on collaboration between universities and open innovation took place in the UK, with university collaboration partner companies most often being small and medium enterprises (SMEs).

This research carries out classifications related to methodology and data analysis. The study found that 14 articles used quantitative methods, five used qualitative methods, and two used mixed methods. Based on quantitative data analysis, hypothesis tests are often used, and analysis descriptive data are used in qualitative data analysis. Findings obtained from research trends can be used to discover and determine research novelty. For example, mixed methods research methodology is rarely used in collaboration. Therefore, this method may be new in future research. Some future research is also presented in this research, which can be used to develop subsequent research.

Regarding the term technology, this panel obtained two meanings, namely "technology transfer" and "digital platform." Based on the literature studies that have been conducted, Blockchain technology can be applied to collaborative digital platforms because this technology can support the search for ideas or knowledge to increase the opportunity to produce patents. The research has produced seven domains of a university collaboration framework in open innovation: Social Behavior, People, Process, Organization, Environment, Technology, and Performance. Universities can use this framework to create an open innovation ecosystem. Further research development will suggest using bibliometric software such as VOSviewer, CiteSpace, or Scopus Analysis tools to obtain more visualized research results.

7. Implications, Limitations, and Future Work

This research contributes to identifying research trends that may serve as the starting points for researchers who are interested in researching the topic of university collaboration in open innovation. Universities may implement appropriate technology to support the open innovation processes. Finally, the identified domain framework can be used as a guideline for conducting collaboration between universities and their prospective partners.

The limitation of this research is that the number of papers that resulted from the SLR stage was only 21 papers. This may result in research trends to be not very general. A possible way to overcome this problem is to do additional literature reviews to identify the latest data analysis and technology. In the future, research can be extended by changing the Boolean search string and the “inclusion and exclusion” criteria, so that a large number of papers can be obtained. Validation of domains and subdomains can also be carried out in future research.

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EJKM Editorial: 2024 State of the Journal

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After completing our first calendar year as editors-in-chief of the *Electronic Journal of Knowledge Management*, we thought it a good idea to look back at what we've learned. As everyone in our field knows, picking up the necessary knowledge to complete any task can take some time. We've experienced that sensation first-hand and are happy to report that we think we've learned how to coordinate effectively with our excellent administrative support at ACI (especially Karen Harris, who keeps everything running at the journal) and manage our work promptly.

EJKM received 84 submissions in 2023, similar to the 87 received in 2022. 14 submissions were accepted, slightly up from 2022's 9. And 74 submissions were declined, down from 81 in 2022. As submission, acceptance, or rejection of a given paper don't occur on a calendar-year basis, the numbers don't fully add up but are comparable across the years. Ultimately, the acceptance rate stayed relatively constant at 9%, versus 10% in 2022 and the long-term rate of 11%.

One positive trend is a substantial decline in days to decision, dropping by about 25% (70+ days for acceptances) and precipitously for rejections. Part of the reason for the latter was an increase in desk rejections but a decrease in rejections after review. We view these results as a good thing, earlier decisions on questionable submissions values the time and effort of both authors and reviewers, attaching these resources to the most promising manuscripts.

The journal published three issues in 2023. The articles covered a broad range of topics and methodologies. But one of the more interesting and satisfying outcomes was the geographical range and variety represented by contributors. Africa (Ghana, Kenya, South Africa) and Asia (Indonesia, Malaysia, Nepal) contributed five articles each. Others came from Europe (Cyprus, Slovakia), the Middle East (Jordan) and the US. Contributions continue to arrive from all over the world, and we welcome submissions from diverse locations.

Going forward, we've noticed a number of trends in this first year and can hopefully provide some guidance on creating submissions that will move successfully through the review process. Initially, make sure the paper has an explicit connection to knowledge and knowledge management. While topics such as human resources and customer communications are related to KM in several applications, they are separate and distinct topics. An HR paper focused primarily on HR theory and practice is probably better off in an HR journal. But if the connection is made to KM, and how that particular HR application is interesting in a KM context, then our journal is a good potential landing spot.

Given the spread of user-friendly structural equation modeling software, a number of SEM papers are being submitted on a consistent basis. SEM, of course, is an extremely useful methodology, and several SEM papers have successfully advanced through the review process. But remember that the models need to be fully justified and explained. SEM requires formal and detailed literature reviews in order to explain the variables chosen and the items gathered together to represent them. Authors make choices about which variables to use and how they are conceptualized, and those choices need to be explained and not just with a reference. SEM is always more convincing when the survey items have already been applied by a previous reference, but it is still up to the current author to explain why that conceptualization makes sense, why the components/items make sense according to the previous literature, and why this choice is best, given other options available. So be sure to tell a good story with SEM papers, including full information on the logic behind the model, not just the final metrics.

As is the case with other journals, we've also seen an increasing number of bibliometric studies. Bibliometric studies have their place, if well done, given their ability to identify and collect potentially massive numbers of references relating to an identified topic. But they can come off as armchair studies, without any real insight or contribution from the authors. In our case, thinking about the bibliometric studies we've seen over the past year, we're looking for contributions based on a solid conceptual foundation. The fact that a study is bibliometric does not remove the need for a deep and effective literature review. The authors need to establish that they

know the field and main literature, otherwise how can we trust their judgement on the correct keywords for the search or that they have the background necessary to analyze the contents of the identified sources. Descriptive statistics for bibliometric studies (what journals?, what countries?, what authors?) can be useful as background but should not be the main findings. Rather, the authors should be looking for trends and connections, discussions that have evolved over time, and other in-depth insights that can come from reviewing such a substantial sample of scholarship. That leads to conclusions about whether there is something new that has been added to existing knowledge.

One pattern that continued into 2023 was the receipt and publication of quality case studies and similar in-depth studies. We welcome these and other less-seen methodologies. There is room in the field for both quantitative and qualitative approaches. Just ensure that the qualitative studies take advantage of their strength, the ability to go into unusual detail in studying a specific application of KM and related concepts. Summary statistics or survey results don't mean as much in case studies as detailed descriptions, quotes, and similar opportunities for insights from a particular case or group of cases.

In terms of journal metrics, those change only slowly over time (e.g. ABDC), of course, but some do. The Scopus CiteScore for 2022 was 2.5, up from 2.3 (2021), 1.8 (2020), 1.2 (2019), and 0.8 (2018), a nice progression. None of that has anything to do with us, but it reflects a great job done by our predecessors. We hope to continue the positive trend. With that in mind, if there are opportunities to cite the journal's articles, please do so. That would obviously include any submissions to the journal but also consider doing so in other papers. We all benefit from a journal perceived as higher quality and that comes from all of us doing our part to keep improving journal submissions, published articles, and the factors contributing to journal metrics.

For 2024, we look forward to continuing to refine the review process, making it more efficient and productive for everyone involved, including more feedback for submissions moving forward or not. We also plan a special issue on KM in South and Central America, so keep your eyes open for that Call for Papers.

Thanks for your continued support of the journal. We look forward to working with everyone in 2024 and into the future.

Editors-In-Chief

Scott and Helen