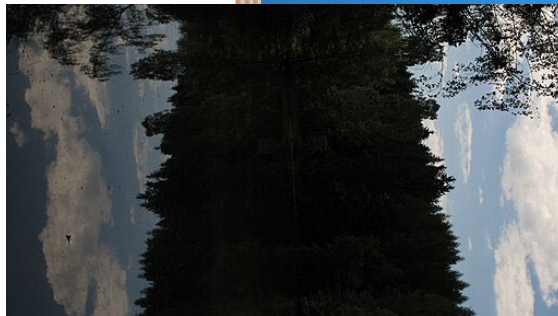


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Contents

- Impact of Human Resource Information System Performance for Sustainable Health Sector in South Africa 01-17
Emmanuel Udekwe, Chux Gervase Iwu, Olusegun Samson Obadire
- The KLC Cultures' Synergy Power, Trust, and Tacit Knowledge for Organizational Intelligence 18-35
Wioleta Kucharska, Denise Bedford
- Reshaping Knowledge Flow: The Impact of E-collaboration Platforms in IT-Project Knowledge Transfer 36-49
Rita Stampfl, Michael Prodinger, Silke Palkovits-Rauter
- Using Personas in Human Capital Management: A Novel Concept Affected by Legal, Ethical and Technological Considerations 50-62
Anastasiia Mikhlin, Juha Saukkonen
- Factors Influencing Knowledge-Sharing Intention in Virtual Waste Management Community: A Systematic Review and AHP Analysis 63-81
Yekti Wirani, Dana Indra Sensuse, Imairi Eitiveni, Deden Sumirat Hidayat, Sofiyanti Indriasari, Yudho Giri Sucahyo

Impact of Human Resource Information System Performance for Sustainable Health Sector in South Africa

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Abstract: The search for significance in the constantly changing health sector environment has led many organisations/sectors to consider numerous strategies, such as the introduction of information systems in human resource management. Thus, the utilisation of human resource information systems (HRIS) for sustainable healthcare workforce performance to realise substantial study interest without proportionate consideration of how HRIS can impact the healthcare sector for sustainable development growth in South Africa (SA). A mixed-method research design was employed; four public hospitals were selected in the Western Cape Provincial Department of Health and Wellness (WCPDHW) of SA. A pragmatic paradigm with an abductive approach was initiated. Psychometric properties testing was carried out to assess the reliability and validity of the data instrument. The participants were selected purposively from the four hospitals. Forty-six questionnaires and forty-one interviews were collated for the study. It was realised that the lack of effective HRIS does not bode well for healthcare workforce performance management due to reasons such as insufficient computers and information systems, lack of teamwork and staff participation, lack of sophisticated systems, lack of confidentiality of information, continuous use of manual HR processes, lack of government support and commitment. These reasons do not support sectors such as healthcare that should add to the country's growth and sustainable strategy. The respondents argue that the effectiveness of information systems is sustained if a suitable intervention of how it can be improved to achieve better healthcare performance in the sector is introduced. It was found that the lack of upgrades to the system in use does create negativity among healthcare workers regarding the impact of HRIS on their performance in the healthcare sector. The study recommends sustainable technological structures and the elimination of manual HR processes. It further recommends effective guidelines for effective HRIS utilisation to sustain workforce performance in SA's health sector. Future research directions are signalled in the study.

Keywords: Human resource information system, HRIS, Sustainable healthcare, Workforce performance, Service delivery

1. Introduction

The adoption of the resolve to achieve an end to poverty, safeguard the earth, and ensure that by 2030 all people experience peace and prosperity has been documented in the United Nations Sustainable Development Goals (SDG). SDGs specifically address health and well-being for people of all ages. The drive to realise good health and well-being for any nation relies also on the effective functioning of the accessible public healthcare sector. For some time now, the public healthcare sector in developing nations has yet to live up to its promises of good healthcare services. For example, Lema (2018) and Mabaso (2020) decried the state of public hospitals in South Africa (SA) and Ethiopia. Equally, Grobler, Wörnich and Mokobane (2018) and Matimbwa and Masue (2019) mentioned the lack of qualified personnel to manage public healthcare facilities. Reports that suggest the gross state of disrepair of government hospitals have made the rounds and a need to identify the impact of HRIS in the healthcare sector for sustainable development in SA (Sireesha and Ganapavarapu, 2015; Randle, Coleman and Kekwaletswe, 2017).

HRIS is a "systematic procedure for maintaining, collecting, storing, retrieving, and validating information belonging to an organisation. Such information can relate to the organisations' HR, personnel activities, and organisational characteristics" (Kovach and Cathcart, 1999. p.276). It is also considered a "system that is used to acquire, store, manipulate, analyse, retrieve, and distribute human resource information" (Kavanagh, Gueutal and Tannenbaum, 1990. p.13). Nonetheless, the use of IS in managing HR to improve performance lies in their capacity to reduce its intricacies because, on its own, managing workers can be a perplexing task (Hanif et al., 2014; Valcik, Sabharwal and Benavides, 2021). The use of HRIS by organisations in healthcare to support performance can, therefore, be a momentous exercise in an emergent economy. The need for such IS to be in

place could strengthen the delivery of reliable healthcare services (Dilu, Gebreslassie and Kebede, 2017; Dey and Saha, 2020).

The healthcare sector is deemed one of the most important sectors in any country due to its prominence in the sustenance of human lives and the improvement in the health and well-being of society (Iwu, 2013; Rispel et al., 2019). Some authors (such as Erdem and Lucey, 2021; Bianchi, Tuzovic and Kuppelwieser, 2022) have argued that it is also regarded as a sector that advances economic progress and development through the prioritization of human lives in its growth strategy. An effective HRIS can be used by the healthcare sector to take actions relating to the standing of the healthcare workers in a country, which signifies the relevance of HRIS in the healthcare sector of a sustaining economy (Dida, 2021; Menant, Gilbert and Sauvezon, 2021; Sikira and Misheal, 2024). Appropriate incentives and financial support in the use of HRIS should be viewed as an imperative factor in the consciousness of an efficient and effective health workforce in general (Udekwe, Iwu, de la Harpe and Daramola, 2021b; Arakelian et al., 2022). Perhaps the healthcare sector is a substantial provider of the socio-economic enhancement and well-being of a nation, and the deployment of HRIS in the healthcare sector will help do away with the obsolete approach to managing healthcare workers and improve the health and well-being of the country's population.

The need to conduct a study on how the healthcare sector can apply HRIS to identify capable talent performance and to restructure HR is essential for social and environmental sustainability (Maruru, 2014; Rahman, Islam and Qi, 2017; Masum, Beh, Azad and Hoque, 2018). This will assist in determining the effect of healthcare workforce management and resource allocation in the sector. Maruru (2014) and Lema (2018) are of the opinion that there has been minor research on the impact of HRIS on workforce performance for a sustainable healthcare sector. This will require further investigation to identify ways to improve healthcare performance through HRIS for social and environmental sustainability in the sector.

According to Alam, Masum, Beh and Hong (2016), more research is necessary to identify additional factors that constrain the successful use of HRIS and its influence on the healthcare industry. This, according to Chakraborty and Khan (2019) as well as Mohammed (2021), may assist in determining the potential of HRIS towards contributing to the SDG of realising healthy lives and the promotion of well-being for people of the world. The study sought to explore the impact of HRIS on the performance of healthcare employees in SA. In doing this, four public hospitals in the Western Cape Provincial Department of Health and Wellness (WCPDHW) of SA were involved in the study. The objective of the study is to identify the impact of HRIS on the performance of workers for healthcare sustainability in SA.

2. Literature Review

Numerous research has been conducted concerning the impact of HRIS on the performance of workers in the healthcare sector (Al Shikhy et al., 2019; Arakelian et al., 2022; Sikira and Mishael, 2024). However, a review of selected African research showed the trend and the established results. Mansour et al. (2022) recognised a reduction in healthcare workers due to a lack of effective systems to regulate, maintain and monitor how HR functions are performed in a sustainable economy, then proposed suitable policies and regulations for effective HRIS to support good health and well-being of a nation. Conversely, Rameshbabu (2018), as well as Rees, Quispe and Scotter (2021), highlighted the lack of suitable ISs to assist in tracking and identifying competent talents, identifying skill gaps, and engaging people in the right discipline for sustainable health systems in place. Udekwe (2022) emphasised the importance of guardianship of accurate, confidential, and secured information about healthcare workers in a single platform database is essential for the easy identification of competent and sustainable workers. Essentially, Qadir and Agrawal (2016) seemed to contend that, for an effective policy to be in place in assisting to identify capable talents to be placed in the right position in the healthcare sector, the system must be contained by management and government support for workforce performance and also in capturing, recording and retrieval of healthcare workers details for sustainable and dependable healthcare delivery.

Studies conducted by Das and Barman (2018), as well as Mabaso (2020) on ways to introduce an HRIS that has fully assimilated HR mechanisms that can be used in the effectiveness of organisations' performance, are essential. This perhaps could deprive some organisations not able to make use of ISs such as HRIS to ascertain workers that are due for incentives for their additional effort be rewarded accordingly. Perhaps there is a need for an HRIS that assists in regulating the healthcare sector in developing, planning, and managing the workforce and rewards for their effort in the organisation. Furthermore, Manyasa, Sahay, Braa and Shisia (2018), Gichuki (2021), and Hassan (2021) highlighted the effect of a devolved health system in Africa and the negative effect of flagging the lack of effective ISs by the authorities which results in a lack of management support. There is

contention regarding the lack of prioritising spending on the upgrade of ISs such as HRIS for an effective health system. This argument seemed to fit the narrative which according to Matimbwa, Shillingi and Masue (2021), who found that the enthusiasm for the effective usage of HRIS is very low owing to several challenges such as insufficient funds, incapable healthcare workers, and deprived dedication by the authorities to support HRIS usage for a sustainable healthcare sector. Interestingly, these challenges are part of the major reasons why HRIS has not been able to prove its efficiency in the performance of the healthcare sector (Maruru, 2014; Lema, 2018; Singh and Bakshi, 2018; Ali, Sharhan and Alsaedi, 2021; Udekwe et al., 2021b).

Effective HRIS is critical in the performance of healthcare workers, which is one of the identified reasons crippling the healthcare system of countries such as SA. Moussa (2014), David, Shukla and Gupta (2015), and Grobler, Wörnich and Mokobane (2018) also revealed that due to ineffective ISs, such as HRIS for accurate recording and retrieving of healthcare workers' details, contribute to a shortage of healthcare personnel, which creates a circumstance where inexperienced medical practitioners are taking over the healthcare functions. Perhaps there is a need to conduct studies on the impact of unqualified healthcare workers and HRIS usage as it impacts negatively on the sustainability of healthcare delivery services. Thus, ascertaining how HRIS can assist in identifying the capable workers to be employed and do away with the unskilled workers (Malindadi, 2016; Dilu, Gebreslassie and Kebede, 2017; Dlamini, Zogli and Muzanhenamo, 2021; Salah et al., 2022). The lack of effective HRIS in identifying and employing capable workers against unskilled workers could position the health and well-being of the country's population in a perilous situation.

Scott, Dinginto and Xapile (2015) and Salah et al. (2022) believe that there are several reasons why the impact of HRIS on organisational performance has not been substantiated enough, such as i), low level of efficiency to heighten competitive advantage, ii), poor HR planning, iii), poor HR-related data collection, iv), poor HR monitoring activities, v), ineffective promotion decisions, vi), defective employee performance results, vii), defective employee remunerations, and viii), rewards structures. However, Alam et al. (2016) believe that effective HRIS could assist in better organisational performance through effective policies and programmes and enabling decisions to support employees' sustenance for healthcare delivery. Jayabalan, Makhbul, Selvanathan and Subramaniam (2020) and Okolo and Iruo (2021) consider that effective HRIS could assist the Human Resource Department (HRD) in covering various undertakings which include reward practices and incentives at the workplace to achieve sustainable development strategy.

Hosain, Arefin and Hossin (2020), emphasise the need for suitable communication structures to be supported by effective HRIS to improve teamwork, and passion in organisations. Jarrar (2022) also believes that HRIS strategies need to be achieved through performance autonomy, engagement, teamwork, and compensation to assist in placing competent and motivated personnel. Thus, the absence of appropriate collaboration and staff involvement among HRIS users does have an undesirable impact on the expected benefits of the system usage (Sireesha and Ganapavarapu, 2015; Udekwe, Iwu, de la Harpe and Daramola, 2021a). Valcik, Sabharwal and Benavides (2021) are also of the opinion that effective HRIS can result in improved efficiency and morale; a dedicated worker will be able to perform effectively which warrants the need for a self-service system to enhance teamwork, and job performance in an organisation.

HRIS privacy and safety is a pertinent area of concern in organisations. With the increase in demand for effective HRIS implementation, the safety of workforce details is critically important; they need to be conscious of managing workers' details (Zafar, 2013; Udekwe, Iwu and de la Harpe, 2023). Davarpanah and Mohamed (2020) think that employees are more pleased with the HRIS when assured that it has satisfactory precautions to keep their performance records confidential. Thus, confidentiality ensures that the workers' information is kept in a safe environment from unauthorised individuals. However, HRIS integrity will be required to ensure that systems and services are secured in a system through a complex healthcare environment. Perhaps there is a need to develop and document procedures to protect data privacy and integrity through HRIS (Mavuso, 2016; Sarma and Barua, 2018).

3. Methodology

The investigators conducted the study using a mixed method through the inclusion of both quantitative and qualitative methods of data collection (Saunders, Lewis and Thornhill, 2019). The mixed method allows for better data triangulation and interpretation (Gibson, 2017). An abductive approach with a pragmatic paradigm was portrayed (Saunders et al., 2019; Hayton, Botma and Heyns, 2021). The data were collated from four (4) selected public hospitals in Cape Town, SA, using questionnaires and interviews. The data were analysed using Atlas-ti (qualitative) and SPSS (quantitative), respectively (Quesada, 2010; Smit, 2021).

Descriptive and exploratory research design was followed to support the methodology selected, which corresponds with Ruparel and Modi (2016), and Lekgela (2017). This was concerning HRIS-related research in various disciplines/organisations (Masum, 2015; Muhammad, Shah and Azhar, 2021; Al-Saidi and Matar, 2022; Sikira and Mishael, 2024). The descriptive and exploratory research design assisted in gaining new insight into the sensation of HRIS usage to assist in workforce performance in the South African healthcare sector. Multiple cases and survey research strategies were followed. Forty-six questionnaires and forty-one interviews were collated, totalling, eighty-seven people who participated in the study. Both methods were used to gain much insight into the impact of ineffective HRIS on the performance of the healthcare sector.

A pilot study was conducted, using four (4) senior staff of each hospital to complete the questionnaires for pre-testing to accommodate all the participants' thoughts (Leedy and Ormrod 2010). Psychometric properties testing was carried out to assess the reliability and validity and to ensure that the survey instruments scale is authenticated (Golafshani, 2003). This process was initiated by testing the questionnaire and applying a similar procedure repeatedly to confirm the similarity of the result (Babbie, 2014).

3.1 Description of the Selected Hospitals

The SA public hospitals are categorised into; Regional, District, Teaching, Specialist, Community, and Primary Healthcare (Udekwe, 2022. p.62). Hospital 'E' is a district hospital, with an average of over 250 workers, has an HRD, and technologically advanced. Hospitals F, G, and H are community hospitals with an average of 100 workers, do not have an HRD, and not as technologically advanced as the district hospital.

3.2 Reason for Selecting the Hospitals

The investigators anticipated the participation of 10 hospitals, unfortunately, only four hospitals indicated their interest to participate in the study. The hospitals' enthusiasm, and readiness to participate, influenced their selection. In that regard, the selected hospitals became the unit of analysis for the study. Furthermore, participation may have been limited by the timing of the study, which was during the COVID-19 epidemic.

3.3 Reason for Adopting Mixed Model Research Methods

In the beginning, 230 questionnaires were distributed among the four hospitals, and only 46 were completed and returned. This made the investigators initiate a second process through interviews to make up for the questionnaire's low response and to have sufficient data to analyse the study. The interview was also significant to assist in clarifying rigorous research problem areas that require attention (Rubin and Babbie 2014). Essentially, the mixed model research supplemented/supported the study process (Tashakkori and Teddlie, 2003) considering that the qualitative method extended the inquiry that made use of the quantitative approach.

A triangulation method is used in mixed model research for multiple sources of data collection either serially or concurrently for the accuracy of results and to capture wider and more detailed information (Tashakkori and Teddlie, 2003; Gibson, 2017). This study adopted the triangulation method by simultaneously combining the data and information from both methods in the discussion section to yield quality and trusted results of the analysis.

3.4 Reason for Selected Questions

Terre Blanche, Durrheim and Painter (2009) highlighted that the reason for developing questions is to collect data to capture sensible and quality information that can be interpreted into credible answers to research questions. The questionnaire and interview questions were selected to identify the impact of HRIS usage on the sustenance of skilled workers and their performance in the sector. However, several research papers (such as Beadles II, Lowery and Johns, 2005; Malindadi, 2016; Mavuso, 2016; Udekwe, 2016; Kolatshi, 2017; Jayabalan et al., 2020; Ali, Sharhan and Alsaedi, 2021) focusing on the impact of HRIS and E-HRM in various sectors were reviewed. The investigators had to identify the questions from the gaps in the literature, to select a comprehensive list of questions that relate to the impact on HRIS performance in the healthcare sector. Table 1 below shows the categories of the participants, and Table 2 shows the code's identification of the interviewed participants and their hospitals:

Table 1: Study participants

S/N	Category of participants	Interview response	Questionnaire response	Cumulative total
1	Hospital Administrators	2	2	4
2	IT/HR/ADMIN staff	8	5	13
3	Doctors	5	6	11
4	Nurses	15	14	29
5	Pharmacists	4	10	14
6	Radiographers	3	2	5
7	Other healthcare staff	4	7	11
	TOTAL	41	46	87

Table 1 shows that nurses were the most participants in the study (29), followed by pharmacists (14). Next is IT/HR/ADMIN (13), followed by doctors and other healthcare workers (11) respectively. The next is radiographers (5) and the last is hospital administrators (4).

Table 2: Codes representation of the interviewed participants and hospitals

S/N	Designated hospitals	Participants codes	Frequency	Percentage	Cumulative percentage
1	Hospital E	E01 – E09	9	22.0	22.0
2	Hospital F	F01 – F15	15	36.6	58.5
3	Hospital G	G01 – G13	13	31.7	90.2
4	Hospital H	H01 – H04	4	9.8	100.0
	TOTAL		41	100	

Table 2 illustrates the four hospitals that indicated their interest to participate in the study with the codes representing the interviewed participants in the various hospitals. Hospital F has the highest number of interviewed participants (15), followed by Hospital G (13). The next is Hospital E (9), and the last is Hospital H (4).

3.5 Ethics

Zikmund, Babin, Carr and Griffin (2010) acknowledge that ethics is a communal arrangement between investigators and the participants on issues concerning harm to the participants, informed consent, right to privacy, voluntary participation, confidentiality, beneficence, deception, justice, and anonymity. The investigators were optimistic that the above ethical considerations were strictly observed (Boatright, 2000; Udekwe and de la Harpe, 2017). Ethical clearance and study approvals were granted to the investigators by the Cape Peninsula University of Technology and the WCPDHW of SA. The information collection processes were undesirably affected by the COVID-19 pandemic infections lockdown. Most of the purposively selected participants declined their participation.

4. Findings

The study aimed to identify the impact of HRIS on workforce performance and sustainability in the South African healthcare sector. From below, Figure 1 offers the quantitative data analysis in percentages; Figure 2 provides the qualitative data collated in frequency codes, while Figure 3 presents the qualitative data summary in themes.

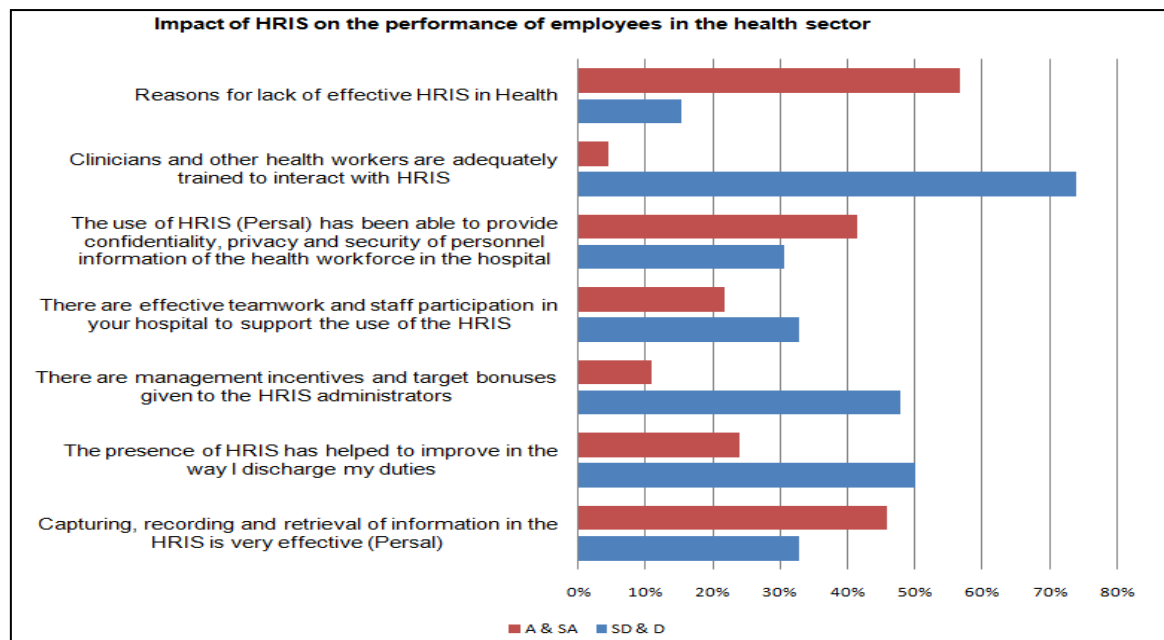


Figure 1: Quantitative findings on the impact of HRIS on the performance and sustainability in the healthcare sector

Abbreviations: A & SA = Agree & Strongly Agree, SD & D = Strongly Disagree & Disagree

4.1 Quantitative Analysis

In Figure 1, there is a significant margin of 74% of respondents disagreeing with the availability of training for healthcare workers on how to interact with HRIS. Also, 48% responded negatively to the availability of management incentives for HRIS usage. These negative responses could be attributed to the lack of support structures on how HRIS can assist in improving healthcare workers' performance. Thus, an average perception of 50% responded that HRIS does not contribute to the enhancement of healthcare workforce performance. This could also be attributed to the lack of improvement in the current HRIS to assist healthcare workers in improving their work performance and less worried about HR-related problems. Although a small number (24%) agreed that HRIS assists in improving the way healthcare workers perform their duties, this group of people might not be familiar with the system and could not identify how HRIS could impact their work performance.

However, concerning teamwork to support the usage of HRIS in the health sector, 33% responded that there is no teamwork and staff participation to support effective HRIS usage in the healthcare sector. The unfamiliarity could also be a reason that most workers are not concerned about HRIS and indicated that they do not have any reason to team up on the sustenance of effective HRIS in the sector.

Surprisingly, 46% responded positively that the current HRIS is effective in capturing, recording, and retrieving healthcare workers' details. 41% also specified that the HRIS used provides privacy, security, and confidentiality of healthcare workers' information. These positive responses could be a result of an existing system being better than the manual HR system and the fact that they never had cyber-attacks on the system. However, 33% and 30% disagreed with capturing, recording, and retrieving, as well as privacy, security, and confidentiality of workers' details in the system. This disagreement signifies the outdatedness of HRIS does not support improvement in the system for effective capturing and accessing of healthcare workers' performance improvement in the sector.

However, 57% gave a positive response that the South African healthcare sector is still lagging in the effectiveness of HRIS to compete with developing nations, and a need to upgrade the system is pertinent for the effective performance of the sector. In summary, it arises from the observations that despite responses signifying that HRIS has information security, confidentiality, and capturing, recording, and retrieving workforce details, there were issues of HRIS not assisting in improving healthcare workers' performance. Also, the lack of training on how to interact with HRIS and the lack of adequate incentives to motivate access were problems that needed some attention for effective workforce performance in a sustainable healthcare sector.

	Count	% Codes	Cases	% Cases	Nb Words	% Words
 Capturing, recording and retrieval of information in HRIS						
 Effective capturing and recording	21	8.8%	21	51.2%	304	0.3%
 Use of computers not comfortable	2	0.8%	2	4.9%	26	0.0%
 Poor computer skills leading to ineffective capturing and recording of data	6	2.5%	6	14.6%	156	0.2%
 Ineffective capturing and recording	6	2.5%	6	14.6%	140	0.2%
 Lacks knowledge of capturing , recording and retrieval of data using HRIS	8	3.3%	8	19.5%	153	0.2%
 Improving performance						
 Ineffective - errors and mistakes delay performance	8	3.3%	8	19.5%	141	0.2%
 Effective in improving performance than paper	19	7.9%	19	46.3%	317	0.4%
 Indifferent	12	5.0%	12	29.3%	143	0.2%
 Incentives for HRIS use						
 No knowledge of HRIS use incentives	36	15.1%	35	85.4%	176	0.2%
 Beliefs there is some HRIS use incentives	5	2.1%	5	12.2%	78	0.1%
 Team work and staff participation in HRIS use						
 No effective team work and staff participation in HRIS use	10	4.2%	10	24.4%	99	0.1%
 There is a team to facilitate HRIS	12	5.0%	12	29.3%	90	0.1%
 Not aware of any team	16	6.7%	16	39.0%	127	0.1%
 Confidentiality and security in HRIS use						
 Passwords ensure security	5	2.1%	5	12.2%	30	0.0%
 It seems there is security	29	12.1%	29	70.7%	202	0.2%
 There is no security	6	2.5%	6	14.6%	159	0.2%
 Reasons depriving HRIS use in the Health sector						
 Negative attitudes towards computer use	18	7.5%	17	41.5%	283	0.3%
 Ineffective training	6	2.5%	6	14.6%	81	0.1%
 Poor HRIS structuration	9	3.8%	9	22.0%	241	0.3%
 Auditing its effectiveness	1	0.4%	1	2.4%	40	0.0%
 Government is not committed to HRIS use	2	0.8%	2	4.9%	60	0.1%
 Data insecurities	2	0.8%	2	4.9%	68	0.1%

Figure 2: The impact of HRIS code frequency chart output for qualitative data analysis

4.2 Qualitative Analysis

4.2.1 Capture, record, and retrieve information

In Figure 2, capturing, recording, and retrieving of information in HRIS were identified, with 20% of the respondents indicating their lack of knowledge of capture, record, and retrieval of data in the HRIS. This was endorsed by their unfamiliarity with what exists in HRIS. Thus, 5% responded to not being comfortable with the use of computers for non-medical functions. This is in accordance with 15% responding to the ineffectiveness of capturing and recording as well as poor computer knowledge leading to an ineffective system in place. On this basis, **Respondent F11** mentioned that “the current HRIS is not effective, and most health workers are not comfortable using computers at work.” Surprisingly, 51% responded positively that capturing, recording, and retrieving information in HRIS is effective; the lack of upgrades is the problem. **Respondent H04** thinks that “HRIS effectiveness would be in the training of people on how to access the system to capture their HR-related information.” **Respondent E04** is also of the opinion that “capturing and recording might not be a problem, but when there are too many people logged into the system at the same time can slow down the network connections and other ISs processes, which is a major problem.” The opinions of respondents F11, H04, and E04 show that the capturing and recording in HRIS can be effective, but the lack of upgrades to the latest technology and the fact that some healthcare workers might not be comfortable making use of computers for HR-related work, due to extra workload is a problem.

4.2.2 Improve performance

The usage of HRIS to measure performance improvement in the healthcare sector was in Figure 2, dominated by 46% responding that the current HRIS is better than the manual/paper-based HR system. However, 29% indicated an insignificant difference between manual and current HRIS because most South African healthcare sectors are dependent on manual HR systems. **Respondent G12** made it known that “they do not make use of HRIS in their hospital and do not have access to computers. HR functions are performed manually in their hospital.” 20% also responded that the current HRIS is defective due to frequent errors, mistakes, and delays in responding to HR queries. On this basis, **Respondent F10** believes that “the manual HR process creates an avenue of inconvenience where people had to travel to HRD in substructure to resolve their HR-related problems.” **Respondent G08** also expressed their frustration on “how they submit HR documents manually, and it gets lost on the way to the substructure or not received and captured at the right time, affects their work plans.” Respondents F10, G08, and G12 seem to advocate that due to a lack of computers, most government hospitals in SA perform HR functions manually and send the documents to the substructure for capturing. This warrants that documents that could be misplaced or not captured on the system are frustrating and could influence the performance of healthcare personnel and the sector.

4.2.3 Incentives

This category was critical in finding out if there are incentives for HRIS usage in the healthcare sector. In Figure 2, 12% of the respondents believed that there could be an incentive bonus given to HRIS users but did not attest to it. However, 85% responded that they do not know about such incentives existing in the South African healthcare sector. Could this be a result of a lack of awareness of HRIS among healthcare workers? Thus, **respondent G06** contemplates that “they do not have an idea of specific incentives for HRIS access; they only have general incentives for everyone, yet such incentives are not reliable.” **Respondent G02** also contends that “the annual incentives are supposedly for everyone, but only a few people get the incentives.” Respondents G02 and G06 appear to propose that most people do not have an idea of special incentives for HRIS access, but they do have incentives for the entire workers, which is also not effective. Not everyone gets the incentives in the South African healthcare sector.

4.2.4 Teamwork and staff participation

Teamwork and staff participation have raised eyebrows on how they impact the use of HRIS in the health sector. In Figure 2, 29% responded to the existence of teamwork in the use of HRIS among the users, where they assist one another in navigating through the system. However, 39% responded that they are not aware of any form of teamwork in the use of HRIS because they are not familiar with the system and how it works. According to **respondent E03**, “In the substructure, someone does the capturing and someone else does the approval of what is captured in HRIS, but in terms of teamwork, I don’t know if it exists.” Remarkably, 24% responded that there is no effective teamwork present in the use of HRIS because not all the workers have access, and the system is still outdated. Thus, **respondent F15** made it known that “HRIS is centralised and does not empower healthcare workers to have access to capture their HR information themselves, which does not inspire teamwork.” **Respondent F09** also mentioned that “in their hospital, HR functions are manually conducted by one, a mostly inexperienced person who might not guarantee teamwork.” Respondents F09 and F15 believe that the healthcare sector makes use of outdated HRIS and does not allow healthcare workers access, also making use of manual HR processes to support HRIS. This defeats the reason for defective systems in place. It is also characterised by the fact that most health workers are not aware of what goes on in HRIS.

4.2.5 Confidential and secured

In Figure 2, 71% responded positively to the existence of security of HR information using HRIS, and 12% also supported the use of passwords to access the system. On this basis, **respondent E04** is of the view that “everyone in the HRD did sign a confidentiality clause not to disclose any HR information without authorisation.” **Respondent F03** also mentioned that “they have a secured HRIS system where no one can access without a password.” However, 15% disagreed with the existence of security in the use of current HRIS due to frequent payroll omissions caused by human error and manual HR processes. Thus, **respondent F01** indicates that “in their hospital, HR functions are still done manually, and the fact that they submit their leave and other HR-related documents by hand, and it gets sent to the substructure is a confidential bridge to people’s details.” Based on the responses, they highlighted the presence of confidentiality, privacy, and security of information in HRIS. However, the use of manual HR processes in most government hospitals in SA is because of the absence of advanced systems; confidential documents could easily be accessed by anyone or misplaced in the process.

4.2.6 Other reasons for ineffective system

Reasons that deprive the effective use of HRIS were considered critical in the performance of the healthcare workers and the sector. In Figure 2, 42% responded with a negative attitude towards the use of computers due to resistance to change by the healthcare workers. Coincidentally, 22% and 15% pointed out that poor HRIS saturation, as well as ineffective training to equip the users, were part of the reasons that deprived the effective performance of HRIS usage in the healthcare sector of SA. Thus, a fraction (5%) of the respondents mentioned that the government is not committed to supporting the effective use of HRIS to improve performance in the healthcare sector due to a lack of sufficient budget allocation for IS acquisition/upgrades. Also, 5% and 2% pointed to data insecurity as well as lack of HRIS audit as other reasons that deprive the effective performance of HRIS in the South African healthcare sector.

4.3 Summary of the Findings

Figure 3 below shows a summary of the qualitative outputs from the data.

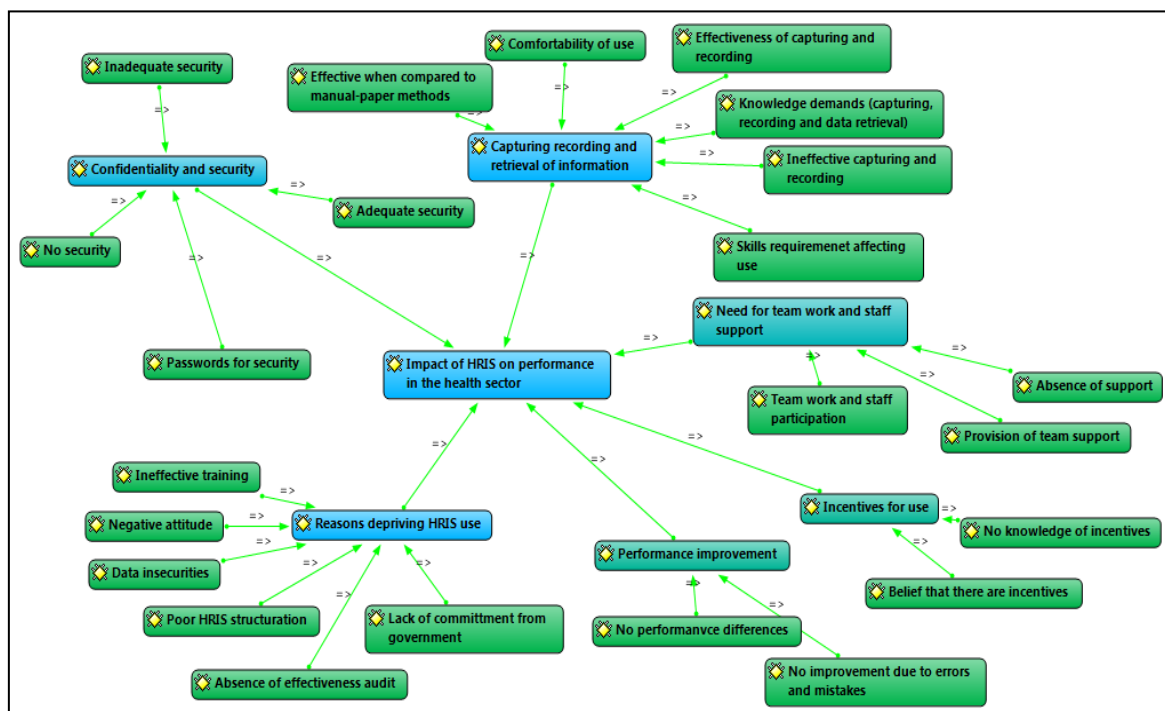


Figure 3: Summary of HRIS impact on the performance of the health sector

Figure 3 shows a summary of the qualitative data analysed above, which indicates that several reasons impact negatively on the use of HRIS to assist in the performance of the healthcare sector, which include ineffective training, data insecurity, lack of teamwork, absence of an effective audit, lack of incentives, capturing and recording issues, lack of effective skills, lack of government commitment, absence of support system, and poor HRIS saturation.

5. Discussion

On the issue relating to HRIS in the capture, record, and retrieval of workforce information in the healthcare sector. In Figure 2, 51%, as well as 46% in Figure 1, of the respondents indicated effective capturing and recording in HRIS. These agreements are due to IS usage being more effective than manual system usage. However, in Figure 2, most of the respondents 55% (5%, 15%, 15%, and 20%) gave several undesirable responses to the effective capturing, recording, and retrieving of information in HRIS due to reasons such as poor computer expertise, people not comfortable with using computers at work, and lack of acquaintance of data captured in HRIS to name a few. This also corresponds with the response of 33% disagreement in Figure 1. These disagreements are embraced by the lack of system sophistication. This argument corresponds with David et al. (2015. p.116), who indicated that effective performance of HRIS can assist organisations in recording and storing employees' documents and information, such as employee personal and qualification documents, for accuracy of data and information that can be easily accessed whenever they are needed. For effective HRIS performance,

the accuracy and confidence in HRIS information need to be singled out to measure the benefits to be accomplished.

The improvement in healthcare workers' performance through HRIS usage was pointed out. In Figure 2, 46% agreed the use of the current HRIS is much better than the manual HR system; however, most government hospitals in SA still conduct manual HR-related processes, which is still a challenge. Perhaps, HRIS is still not as efficient to improve their work performance due to its outdatedness. Coincidentally, in Figure 2, 29% and 20% of the respondents specified insignificant as well as ineffective differences between the current HRIS and manual HR systems because the South African healthcare sector is highly dependent on manual HR functions to support HRIS. Also in Figure 1, 50% of the respondents opposed the effectiveness of HRIS in the improvement of work performance in the sector due to a substantial rate of manual HR dependence. This warrants frequent errors, mistakes, and misplacement of documents sent to the substructure. This study corresponds with Scott et al. (2015), who mentioned that in some organisations, the leave and other HR information retrieved from HRIS are sometimes not updated, and that makes the HR information furnished to the management unreliable and untrustworthy. Inaccurate record-keeping caused by ineffective ISs such as HRIS can lead to service failure and poor performance, which can be attributed to a high level of paper-based, no proper filing system, poor HR planning, poor HR supervision and lack of experienced workers (Marutha, 2011).

Special incentives to access HRIS were also brought up in the study. In Figure 2, 85%, as well as 48% in Figure 1, responded that they do not know as well as disagreed with the existence of special incentives to access HRIS. The lack of incentives could be unfavourable and demoralising to healthcare workers, which could be attributed to resistance to change and lack of interest in accessing the system. Coincidentally in Figures 1, 11% and Figure 2, 12%, both believe that they do have incentives that are supposedly given to entire healthcare workers for doing their job and not to access HRIS. Unfortunately, only certain selected people are given such incentives, which also adds to the grievance among healthcare workers' performance. This supports the argument of Phahlane (2017) and Okolo and Iruo (2021), signifying that the conditions of service in the use of HRIS need to be improved through special incentives to inspire access to the system. Also, healthcare workers need to be given incentives as a motivation to improve their performance at work (Kumler, Verhoogen and Frías, 2013).

Teamwork and staff participation to support the usage of HRIS was portrayed in this study. In Figure 1, 22%, and Figure 2, 29% signalled the possibility of teamwork among HRIS users because only certain HR staff have access. Also in Figure 2, 39% indicated their unawareness of teamwork that exists in HRIS usage due to their unfamiliarity with the system. Subsequently, in Figure 1, 33% and 24% in Figure 2 gave an undesirable response to the existence of teamwork in the use of HRIS. These undesirable and unfamiliar responses were due to ignorance of HRIS in most of the government hospitals in SA. Also, the fact that those hospitals are operated in a centralised system, yet the high rate of ignorance of HR processes discourages teamwork in the sector. According to Udekwe et al. (2021b), the absence of effective teamwork and staff participation to access HRIS creates an undesirable impact on the expected achievements from using the system. Perhaps effective teamwork will assist in creating a conducive and cooperative work environment. This is in line with Valcik, Sabharwal and Benavides (2021) study; they mentioned that an effective HRIS could promote good morale and efficiency in an organisation. Ideally, a dedicated worker will be able to meet organisational objectives, which would warrant the need for a self-service system to enhance teamwork, job performance, and sufficient human capital in an organisation. Proper communication that is supported by HRIS can increase teamwork and motivation for effective performance and sustainable delivery service (Hosain, Arefin and Hossin, 2020).

Confidentiality, privacy, and security of healthcare workers' information in HRIS were also pointed out in this study. In Figure 1, 41%, and Figure 2, 71% of the respondents gave an affirmative remark that the current HRIS supports the confidentiality of their details. Also, 12% in Figure 1 supports confidentiality to the use of passwords to access HRIS as security features. The support of confidentiality is because the respondents have never had any complaints of security blunders of workers' data using the current HRIS. However, in Figure 1, 30% and Figure 2, 15% both disagreed with the security of workers' HR details because most government hospitals do not make use of HRIS and do not have HRD; they submit and send their HR documents manually to the substructure which might not be confidential and secured. The South African healthcare sectors need to provide HRIS that can be accessed by the entire healthcare workers and do away with manual HR submissions. Mugo (2017) made it known that the lack of integration of HRIS with other ISs to a single database can create confidentiality and privacy blunders in an organisation. The lack of reliable information from HRIS may lead to security-related consequences. This study corresponds with Zafar (2013), who mentioned that HRIS security is a pertinent area of concern; with the increase in the number of access, security and confidentiality of workers'

data should be of importance, and organisations should be cautious in managing workers' data. Perhaps, the security of workers' information should be an important subject of concern in modern day HR systems.

The issue of audit on HRIS was also highlighted in the study. In Figure 2, a fraction (2%) of the respondents emphasised the non-availability of system audits on HRIS, and the investigators had to identify the importance of system audits on HRIS as critical. The respondents highlighted the audit is only conducted on the reports and documents generated from HRIS and not on the system itself to identify the impact of the performance in the sector. This study is in line with Saleem and Akbar (2015), who mentioned the need to improve HR performance through the alliance of compliance and legal review with strong audits on ISs in organisations. Esanga et al. (2017) also emphasised the necessity of having an effective HRIS audit for workers' records and salaries to be accurate for assistance in characterising the healthcare workforce control in countries/continents.

The investigators observed some other reasons identified as crucial to the study. In Figure 1, 57% agreed that there are other reasons that also deprive the effective usage of HRIS on the performance in the healthcare sector. This observation was supported by 5% of respondents shown in Figure 2; they mentioned that lack of governmental support for the effective usage of HRIS was a reason. Also in Figure 2, 5% and 15% mentioned data insecurity as well as ineffective training for users as other reasons that deprive the effectiveness of HRIS. 22% in Figure 2 also pointed out that poor HRIS saturation was a reason for the lack of upgrades to the system. These observations made the current HRIS not enticing to the users and the healthcare workers. Furthermore, in Figure 2, 42% also specified that they do not need to perform additional functions outside their primary healthcare functions by accessing the HRIS through a system. They believe that accessing HRIS will create an additional workload to their existing workloads, which is another reason that deprives the usage of HRIS for effective performance in the healthcare sector. This study corresponds with Gray (2019. p.21), who indicated that unhappiness among health workers is a practice caused by poor working conditions, extreme workloads, and discrimination in the workplace. Antony and Balu (2018. p.122) are also of the opinion that workload is a crucial factor that creates an unsuitable working environment, which is caused by the complexity and complication of IS usage in the health sector. Perhaps, an effective HRIS for workforce access is needed for simplicity and workforce convenience for sustainable healthcare delivery.

6. Conclusion and Recommendations

6.1 Conclusion

The healthcare sectors are of the impression that the positive impact of HRIS could be an enabler for the adequate performance of healthcare workers for a sustainable health sector. This process will require a development plan to assist in aligning healthcare workers and the health sector's strategic performance using HRIS for data capturing, recording, and retrieving for judgements relating to healthcare workforce sustenance. The fact remains that the usage of ISs such as HRIS is much better than the manual HR functions, but due to lack of upgrades on HRIS to the latest technology, lack of HRIS supervision, lack of special incentives to motivate HRIS access, unreliable and inaccurate reports caused by the paper-based system, warrants a sophisticated HRIS to achieve quality healthcare performance.

Evidence from the study shows that HRIS does not assist the healthcare workers and the sector to improve their performance due to a lack of government commitment to support the maintenance of the system, data insecurity, lack of sufficient computers and other technological infrastructures, ineffective training, lack of HRIS audit, and poor HRIS saturation. For these reasons, the healthcare sector could not achieve the expected workforce performance for a sustainable sector. Furthermore, the lack of effective HRIS could be broadly observed by assessing the impending value of the system performance and how such performance could provide confidentiality, privacy, and security of healthcare workforce details, including teamwork and staff participation, to support an effective health sector. For an efficient healthcare sector in place, they need an upgraded HRIS that will assist in improving the way HR functions are conducted in hospitals for effective workforce performance for sustainable healthcare delivery in SA.

6.2 Recommendations

Capturing, recording, and retrieving healthcare workers' details were offered as key features of how to measure the impact of HRIS usage on worker productivity. Interestingly, some respondents indicated that the system's lack of current and insufficient access to ISs such as HRIS created the problem of ineffective recording and retrieval of workers' information in the sector. This was also attributed to data insecurity and a lack of government commitment to support the system (Mawaddah and Retnowardhani, 2023). The recommendation is that there should be support systems for acquaintance, availability of sufficient funds, computers, and other

technological infrastructures, upgrade of the system, and training on accessing ISs such as HRIS to the healthcare workers. All these will not be achieved without government and management support and commitment. This will also assist in eradicating ineffectiveness in the capture, record, and retrieval of healthcare workforce information and improve the performance of the sector.

It was also observed from the findings that the current HRIS used in the South African healthcare sector does pose reasonable confidentiality, privacy, and security of workers' details through passwords to have access. Also, the users sign a confidentiality agreement not to disclose HR information without authorisation. However, some respondents do not trust the system due to numerous errors, misplacements, and the manual process used to support HRIS. Also, a situation where inexperienced staff is employed to handle workers' HR documents is not confidential (Kagehi, 2015; Iwu, Bayari and Jaiyeola, 2019). The recommendation is that the healthcare sector should employ qualified and trained workers to handle the HR functions and allow healthcare workers access to HRIS to eliminate manual HR processes and reduce the workload in HR-related tasks. Confidentiality, privacy, and security of healthcare workers' information are priorities that can support and improve the performance of healthcare workers and promote social and environmental sustainability in the sector in general.

The findings also highlighted the need for knowledge of existing teamwork and staff participation in HRIS usage. This was attributed to the fact that most of the respondents are clinical workers who do not have access to HRIS and need to know what goes on in the HRD. However, some respondents mentioned that somehow, the users might be engaging among themselves through teamwork. The fact that the system is not accessible to the entire healthcare workers does not bode well for effective teamwork in the sector. The recommendation is that there should be equitable access to HRIS in the healthcare sector and that teamwork and staff participation should be encouraged for workforce performance.

Public health facilities serve the vast majority of the country's population (Udekwe, Iwu, Daramola and de la Harpe, 2023). This arguably results in a burdensome workload for the workers. A motivation strategy to include HRIS access in the health sector's work function is recommended (Smaldone, 2017; Papac, Pejanović-Škobić and Bošnjak, 2020). The general incentives should be across the board to give the healthcare workers motivation to remain at work and also improve their performance in the workplace (Abuya et al., 2021; Grabner and Martin, 2021; Okereke et al., 2021; Young, 2022). When people do not receive special incentives for their extra efforts, it can drive them towards looking for other job opportunities.

The analysis also highlighted that the South African healthcare sector does not conduct system audits on HRIS. Some respondents emphasised that audits are only conducted on the reports generated from HRIS, which is inappropriate. Malpractices might be evident in the HRIS technology, which might not be easily noticed in the reports generated (Marutha, 2011; Mong'eri, 2014; Fashoto et al., 2018; Koech, 2022). Such technological malpractices may only be identified in the long term which might be too late to act upon. Furthermore, such technological malpractices might not be easily identified and might go on for an extended period. These malpractices can include ghost workers' salaries, double salary payments, allowances, leave, and wrong records of availability of leave days, amongst others. Sometimes, it can be an error, and sometimes it can be an intentional act by the system users (Kumler, Verhoogen and Frías, 2013; Matimbwa and Masue, 2019). The recommendation is that there should be periodic system audits on HRIS to ensure that such malpractices and mistakes are identified before the reports are generated and sent to the authorities for decisions.

Conflict of interest: The investigators declare no potential conflict of interest concerning the publication of this work. In addition, the investigators have completely witnessed ethical issues which include plagiarism, misconduct, informed consent, data fabrication and, or falsification, double publication and, or submission, and redundancy.

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The KLC Cultures' Synergy Power, Trust, and Tacit Knowledge for Organizational Intelligence

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Abstract: This paper examines the impact of knowledge, learning, and collaboration cultures synergy (the KLC approach) on organizational adaptability. The SEM analysis method was applied to verify the critical assumption of this paper: that the KLC approach and trust support knowledge-sharing processes (tacit and explicit) and are critical for organizational intelligence activation. Specifically, the empirical evidence, based on a 640-case sample composed of Polish knowledge workers, revealed that knowledge sharing, organizational intelligence, and innovativeness are vital benefits of the KLC cultures' synergy. It also highlighted that trust among workmates is critical to sustaining tacit knowledge sharing in an organization. Tacit knowledge, which is knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it, is clearly identified as a key component of change adaptability, which is viewed as a measure of organizational intelligence. Moreover, the acceptance of mistakes as a learning source - a learning culture component that supports trial-error learning, was found to be tremendous for knowledge-sharing processes, organizational intelligence (change adaptability), and innovativeness. This study proved that knowledge sharing, organizational intelligence, and innovativeness are vital benefits of the synergy that offers the KLC cultures. Trust strengthens this effect. So, to gain these benefits, knowledge-driven organizations should employ trusted managers who trust others and, in addition to their professional credentials, exhibit strong habits of respecting knowledge, learning, and collaboration.

Keywords: Knowledge culture, Learning culture, Collaborative culture, KLC cultures, Knowledge sharing, Tacit knowledge, Explicit knowledge, Collective intelligence, Trust, Change adaptability, Innovations, Knowledge workers

1. Introduction

Company culture is an intangible asset that requires design, implementation, and management to leverage the company knowledge strategy. If company culture and knowledge strategy are misaligned, there is no chance for successful knowledge management from a long-run perspective. The long-run perspective management requires organizational innovativeness and collective intelligence development. Therefore, this study aims to explore the meaning of knowledge, learning, and collaboration (KLC—cultures) synergy for the long-run perspective, which requires a focus on change adaptability and innovativeness development in more depth.

The essence of the KLC culture's synergy idea is the simultaneous implementation of functional cultures of knowledge, learning, and collaboration to grow knowledge-driven organizations (Kucharska and Bedford, 2023a). Authors claim that these cultures support and strengthen one another to develop favorable conditions for new knowledge creation and utilization, which impacts the organizational ability to adapt to externally induced changes. This organizational change adaptability is rooted in collective organizational intelligence, which simultaneously is potent to internally dedicated changes oriented to organizational efficacy improvements. The KLC culture's synergy is assumed to be extremely powerful for strengthening the tacit knowledge-sharing behaviors (Kucharska and Bedford, 2023a) that are focal for human and relational capital development, and this is also true for organizational intelligence. Since tacit knowledge cannot be shared or acquired without trust (Holste and Fields, 2009), knowledge management efforts to support organizational innovativeness and adaptability may depend on trust among co-workers. According to a study by Capestro et al. (2024), cognitive trust influences tacit knowledge sharing more than affective trust. Company culture absorption is a cognitive process (Burnes and James, 1995). If so, then company culture might be the focal management tool that can support trust-building behaviors in the company. This study aims to empirically verify whether the KLC approach dedicated to knowledge-driven organizations is efficient and, consequently, whether trust is included in the investigation.

Understanding company culture's contribution to its performance is particularly critical in today's hyperdynamic knowledge economy. Culture will always dominate strategy (Kucharska and Bedford, 2023a). However, it can play an even more significant role in the knowledge economy, where knowledge is the primary form of capital and the most critical intellectual production factor. To thrive and survive in the knowledge economy, managers must "see" their company culture's power to shape the company's course and learn to gain and sustain knowledge, learning, and collaboration cultures synergy. Nowadays, hyperdynamic business reality requires intelligent actions. When managers "see" their cultures as assets, they can shape and use them for the company's best (Kucharska and Bedford, 2023a). This study aims to empirically prove that company culture based on knowledge, learning, and collaboration matters for growth in knowledge-driven organizations and that trust among co-workers is critical for this process. Kucharska and Bedford (2023a) suggested this before based on proxy, but empirical evidence is still required. So, this study aims to deliver it.

2. Conceptual Framework

Company culture is a critical asset that determines a business's capability. The vital source of a company's competitive advantage is tacit knowledge, which is produced thanks to personal experience and social interactions (Kucharska and Erickson, 2023a-b; Olaisen and Revang, 2018; Polanyi, 1966) and stored in the human minds, so tacit knowledge can be shared only as an act of free will. So, it cannot be forced by any procedures or rules. Its sharing depends on trust among workmates and company culture that can stimulate learning, sharing knowledge, and collaboration (Koskinen, Pihlanto and Vanharanta, 2003; Kucharska and Bedford, 2023b; Olaisen and Revang, 2018; Senge, 2006). Contrary to tacit knowledge, explicit knowledge can easily be formalized, transferred, and managed (Faccin et al., 2019; Nonaka and Takeuchi, 1995; Santhos and Lawrence, 2023). Company culture is seen as a powerful asset that impacts the above policies, procedures, and rules (Bajaj, Bradley and Sun, 2024; Cegarra-Navarro, Jimenez-Jimenez and Garcia-Perez, 2021; Kotter and Heskett, 2008; Kucharska and Bedford, 2019; Yoon and Park, 2023). Culture strongly determines individuals' and entities' understanding, motivations, and full capabilities. Unsurprisingly, organizations are increasingly aware of culture's role in supporting or impeding strategies. Peter's Drucker adage – culture eats strategy for breakfast every day – indicates that even the most brilliant strategy will fail if it is not aligned with the company culture. KLC cultures' approach is dedicated to companies whose management systems are rooted in knowledge. Therefore, this study explores the assumed KLC culture's powerful impact on knowledge-driven organizations' ability to create knowledge (explicit and tacit) thanks to trust among employees, which is expected to matter for organizational intelligence and innovativeness development.

KLC cultures

The focal point to clarify the KLC culture approach to knowledge-driven organizational culture introduced by (Kucharska and Bedford, 2023a) is the clarification of the key characteristics of each of them and the exposition of their relations.

The KLC cultures approach promotes the view that the priority of knowledge-driven organizations today is to adapt to hyperdynamic reality smoothly to keep competitiveness and, therefore, to support the company's strategy; company culture must be composed of many functional types of culture supporting these organizational functions that are critical for company's sustainable development: KLC cultures. Therefore, the synergy of these critical for the particular business context functional sub-cultures finally shapes the whole culture of a specific knowledge-driven organization today. The synergy of knowledge, learning, and collaboration cultures (KLC approach) is vital for knowledge-driven companies' sustainable development. These cultures are not as influential separately as they are if united.

A culture of knowledge dominates in knowledge-oriented organizations that focus more on static knowledge exploitation (Kucharska and Bedford, 2023a; Van Wijk et al., 2012), whereas learning culture dominates in organizations that focus more on dynamic, constantly breaking 'the status quo.' Furthermore, knowledge culture is a base for learning culture. It is easy to predict that if any organization is stuck in the knowledge-orientation stage, it exists in a reality where static exploitation of knowledge and control dominates over exploration. New knowledge is usually rejected in such conditions (new knowledge is considered risky for the existing order). In such organizations, old, proven action methods are cultivated and appreciated more than new solutions sought. New methods are seen as risky and are rejected to avoid mistakes. Organizations based chiefly on proven knowledge secure their "comfort zone." Therefore, they often prefer to "keep things as they are"; this way, "safe, well-known routines" and a control-oriented organizational attitude might block these organizations' development.

In contrast, a learning culture leads to active knowledge exploration through constant, dynamic knowledge acquisition provoked by “intelligence in action” (Erickson and Rothberg, 2012). A pervasive and persistent learning culture is essential to the development and growth of learning organizations in the current economic climate of continuous change (Maes and Van Hootegem, 2019; Rass et al., 2023). An organizational learning culture can facilitate the creation and sharing of tacit knowledge and discourage hoarding or hiding it (Weinzimmer and Esken, 2017). By itself, a knowledge culture does not cause such an effect, though it is a basis for fostering curiosity and exposing knowledge gaps that lead to learning. This elaborated differentiation idea is consistent with the research of Webster and Pearce (2008), who highlighted the importance of situational learning, which is essential to active and contextual learning. Situational learning is aligned with the current context. Contextual learning is vital for tacit knowledge acquisition. Tacit knowledge is a tremendous source of innovation. So, the aim of constant learning culture implementation is especially relevant today in a dynamic and rapidly changing business environment. Acting in such a dynamic and unpredictable business environment is a kind of experimentation that might be risky and naturally bring some mistakes that, if they occur, should not be wasted. So, the culture of learning sees mistakes not as a stigma of negligence but as an unintended effect of action that can be a source of precious lessons. The essence of this component is not acceptance of negligence at work but taking the complete lesson of the mistake event and capturing the new, contextual knowledge. Therefore, the lack of mistakes acceptance component of a learning culture can block learning from mistakes at the organizational level, which can be a waste. If a mistake occurs, then make it a lesson at least. A learning culture without developed mistakes’ acceptance component is an illusion of learning culture. So, an efficient learning culture should comprise the learning climate component and the component of acceptance of mistakes as a source of potential learning (Kucharska and Bedford, 2020). It is about Based on the above elaboration, the hypotheses are given below:

H1a: Knowledge culture positively influences the learning climate component of a learning culture.

H1b: Knowledge culture negatively influences the mistakes acceptance (as a source of learning) component of a learning culture.

A culture of learning is seen as an organization’s ability to create, acquire, and exchange knowledge, modify its behaviors and choices, and integrate that new knowledge and insights into its organizational knowledge (Garvin, 1993). Learning culture facilitates all organizational learning processes that influence dynamic capabilities, innovativeness, and sustainability (Klein, 2022; Romme and van Witteloostuijn, 1999). So, company culture matters in innovativeness and development studies (Dabrowska and Savitskaya, 2013; Warrick, 2017). The KLC cultures approach is dedicated to knowledge-driven organizations’ understanding that they can achieve sustainability thanks to innovations. Innovation generation comes from knowledge, critical thinking, learning, taking risks, and collaboration – as Kucharska and Bedford (2023a) stated. According to them, learning culture contains vital learning process components such as learning climate and mistake acceptance that significantly affect organizational change adaptability and intelligence development. Moreover, contrary to knowledge-oriented organizations’ culture, which focuses more on static knowledge exploitation, the learning culture supports a dynamic, constantly breaking status quo with a shared state of mind open to constant improvement. The continuous learning culture facilitates all the learning that happens in organizations. Briefly, there is no growth without learning. So, the organizational learning climate acts as an organizational learning stimulus, thanks to which the organization takes lessons from each event, both positive and negative, including mistakes. Therefore, the hypothesis is added as below:

H1c: The learning climate component of learning culture positively influences the mistakes acceptance (as a learning source) component.

Moreover, suppose an organization is seen as a group of people coordinated to achieve the aim none of them can achieve alone. In that case, collaborative culture is the essence of any organization's existence (Kucharska and Bedford, 2023a). Organizational learning requires collaboration. Collaboration supports learning, which is a source of new knowledge (Kucharska and Bedford, 2020; Nugroho, 2018). Collaboration is then the core competency that enables knowledge organizations to create relational knowledge capital. Based on this, the hypothesis is given below:

H1d: Collaborative culture positively influences the learning climate component of a learning culture.

H1e: Collaborative culture positively influences the acceptance of the mistakes (as a source of learning) component of a learning culture.

Based on Kucharska and Bedford (2023b), it is empirically proved that knowledge culture and collaborative culture are correlated and foster knowledge sharing, especially tacit. Therefore, the hypothesis is added:

H1f: Knowledge culture and collaborative culture are correlated.

Moreover, Alavi, Kayworth and Leidner (2005); Kucharska (2017); Kucharska, Kowalczyk and Kucharski (2017); and Yang (2007) studies indicated that knowledge sharing is motivated by collaborative culture; therefore, the additional hypothesis is formulated below:

H2: Collaborative culture influences positively explicit knowledge sharing.

Knowledge sharing

Knowledge is recognized today as the most critical company resource that can provide organizations with a sustainable competitive advantage (Barney, 1991). Therefore, sharing among workmates is equally critical for creating and implementing this competitive advantage. Both forms of knowledge - tacit and explicit matter for organizational innovativeness and development (Islam and Chadee, 2023). Tacit knowledge, in contrast to explicit, is enormously personal. Tacit knowledge can be challenging to express directly in words, and often, the only ways of presenting it are through drawings, metaphors, analogies, and different methods of expression that do not require a formal use of language (Koskinen et al., 2003). Thanks to experimentation and learning through interactions and collaborations, its acquisition enables its awareness and, as a result, also sharing, which in more and more remote-work-dominated business environments is often supported by technology and IT competency of the workforce (Kucharska and Erickson, 2023a-b). The culture of learning supports knowledge dissemination (tacit and explicit) across the company (Lucas, 2006; Schmitz et al. 2014; Kucharska and Bedford, 2023a-b). Therefore, the hypotheses are formulated below:

H3a Mistakes acceptance component of learning culture influences positively explicit knowledge sharing.

H3b: Mistakes acceptance component of learning culture positively influences tacit knowledge sharing.

H3c: Learning climate component of learning culture positively influences tacit knowledge sharing.

H3d: Learning climate component of learning culture positively influences explicit knowledge sharing.

Moreover, following Islam, Jasimuddin and Hasan's (2015) statement that knowledge culture supports the flow of knowledge throughout the organization and relying on Kucharska's (2021a) empirical evidence, it is assumed that knowledge culture might motivate knowledge workers to share their newly discovered thoughts and ideas. Thus, the following hypothesis is formulated:

H4: Knowledge culture influences tacit knowledge sharing positively.

Tacit knowledge acquisition and sharing is strongly contextual. It is acquired thanks to intelligence, and intelligence is growing thanks to tacit knowledge acquisition. So, tacit knowledge is precious. It is a critical ingredient of the explicit knowledge creation (Nonaka and Takeuchi, 1995). All the knowledge is rooted in tacit knowledge, as Polanyi (1966) stated. Based on this, the hypothesis is given below:

H5: Tacit knowledge sharing fosters explicit knowledge sharing.

Organizational development

Modern markets require organizations to learn and constantly adapt to sustain their competitive advantage through systematic improvements. The KLC cultures approach promotes the view that the priority of knowledge-driven organizations today is to adapt to hyperdynamic reality smoothly to keep competitiveness. Change is a characteristic of the current economy and requires organizations to adapt constantly. Existing in a fast-changing environment requires making change a part of daily organizational routines. In the knowledge economy, organizations and individuals create and adapt to change, thanks to up-to-date knowledge, which they can acquire and transform into value propositions relevant to market needs (Rass et al., 2023). How organizations deal with the need for adaptability and respond to surrounding change determines their survival and development. To improve innovation and business performance, developing a robust knowledge management (KM) strategy is a pivotal step for many firms today (Lai et al., 2022). This strategy is focused on identifying sources of desired, new knowledge, acquiring this knowledge (tacit), transforming it into explicit form through socialization, and externalizing this knowledge through its application to new solutions and new value propositions creation. So, the essence is organizational learning and transforming tacit knowledge into explicit

knowledge to create innovative solutions needed to win the market. Based on this, the hypothesis is developed as it goes below:

H6 Explicit knowledge sharing fosters market innovations.

Knowledge is a vital asset of the current economy because it is essential to company intelligence development (Rothberg and Erickson, 2007). Feuerstein et al. (1979) defined intelligence as the ability to adapt to change. Following him, the organizational, collective capacity to adapt to change is seen as its intelligence. This collective capacity is more than the only sum of individual abilities. The essence of organizational intelligence is enhancing the ability to act and grow collectively as a community. This collective intelligence development pays back as collective, intelligent acting is needed to compete and win in any market. Tacit knowledge sharing among workmates fosters the creation of innovative ideas that drive adaptability to change (Kucharska and Rebelo, 2022). At the same time, explicit knowledge supports implementing this change procedurally. Therefore, hypotheses have been given as follows:

H7: Explicit knowledge sharing fosters organizational intelligence (change adaptability).

H8: Tacit knowledge sharing fosters organizational intelligence (change adaptability).

Organizational adaptability reflects how an organization responds to change by managing stress and uncertainty, exposing flexibility or resilience, and supporting those who tackle problems to face the change (Reupert, 2020). Martin et al. (2013, p. 1) defined adaptability as 'appropriate cognitive, behavioral and/or emotional adjustment in the face of uncertainty and novelty.' Change is a characteristic of today's economy that places companies in a permanent learning and development mode related to adjusting, gaining a market advantage, and creating value through constant innovativeness (Kucharska and Rebelo, 2022). Bearing in mind all of the above, the hypothesis is formulated below:

H9: Organizational intelligence (change adaptability) fosters market innovations.

Trust as a control variable

TRUST reflects the belief in someone's reliability. Regarding organizations, Tan and Lim (2009) see trust in coworkers as the willingness of a person to be vulnerable to coworkers whose behavior and actions that person cannot control. TRUST strongly impacts knowledge sharing willingness among co-workers (Berraies, Hamza and Chtioui, 2020; Kmiecik, 2021; Rutten, Blaas-Franken and Martin, 2016). Sharing knowledge is like sharing a power. Trust among co-workers ensures successful collaboration and vice versa, reducing barriers to collaboration and knowledge-building across different parties (Handzic, Bratianu and Bolisani, 2021; Kucharska, 2017; Samuel and Koga, 2023). Trust increases knowledge sharing, team creativity, and performance (Andersson, Moen and Brett, 2020; Kucharska et al., 2017). At the same time, knowledge sharing supports trust-building among knowledge workers (Thomas et al., 2009). Therefore, TRUST is included in this study as a control variable (CV). CV imputation enables the inclusion of extraneous variables that are not the focal point of the thorough research but remain theoretically important (Carlson and Wu, 2012; Nielsen and Raswant, 2018). Sankowska (2013) presents the role of TRUST as a mechanism facilitating the transfer and creation of tacit into explicit knowledge within the company, making the organization much more innovative. Also, the former studies by Kucharska (2017) and Kucharska et al. (2017) exposed TRUST as a critical facilitator needed for tacit knowledge sharing. Based on this, the hypothesis is added below:

H_{cv}: TRUST positively impacts tacit knowledge sharing.

Based on the above, Figure 1 below visually summarizes the conceptual framework of the planned empirical research.

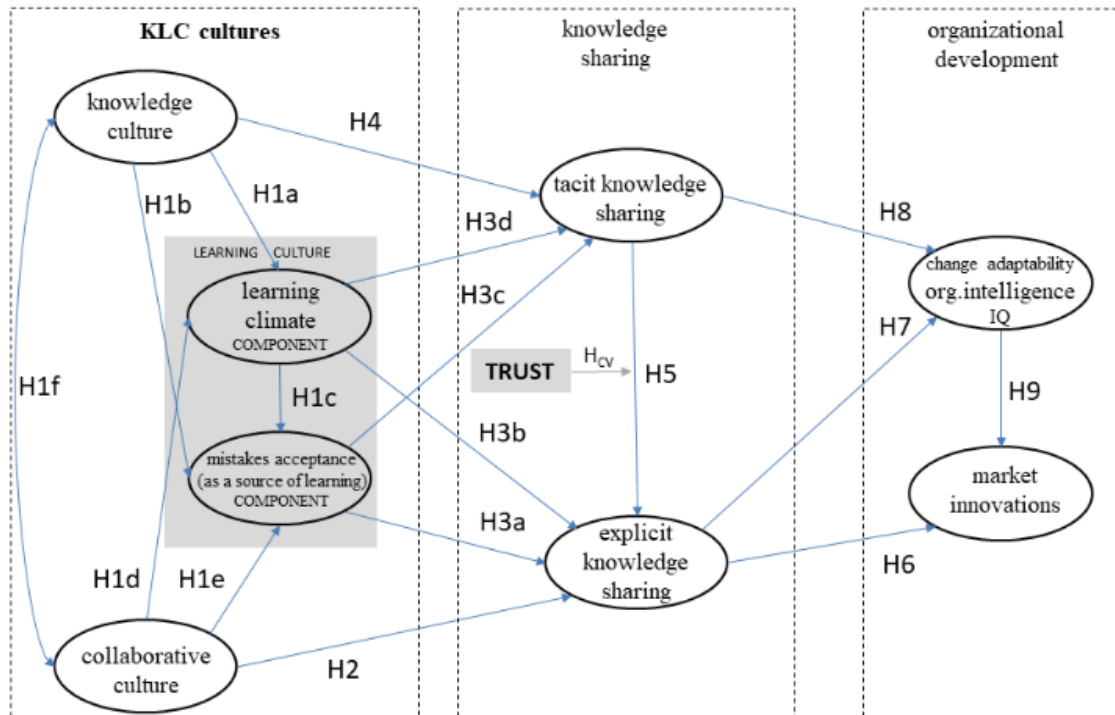


Figure 1: Conceptual framework

3. Methodology

Sampling procedure: This study targeted Polish knowledge workers; therefore, qualified respondents declared that their work's first input and output was knowledge. Moreover, to ensure the respondents' familiarity with their organizations' issues, we qualified only those who worked a minimum of one year for their current employer. The key definitions were provided to ensure the total understanding of the measured constructs. Data were collected in March 2023 by applying the CAWI method by Biostat® Poland.

Sample characteristics: The study sample was composed of 640 Polish knowledge workers: 306 specialists and 334 managers; 329 women and 311 men representing primarily private (77%) companies from different sectors to illustrate the general view on Poland (dominating sectors: production and knowledge services 19% each).

Measures: Following deVellis (2017, p. 2), "measurement is a fundamental activity of science." Social science measures focus on social constructs that are measured via scales. So, unobservable constructs are measured via observable indicators (loadings) reflected in statements. These statements align closely to a particular construct definition to reflect the meaning of a specific construct. Appendix 1 presents measured constructs scales (statements) and their sources. Respondents referred to the statements using a 7-point Likert scale. All measures reached the referenced values. The internal consistency of the constructs was assessed using Cronbach's alpha > 0.7 (Byrne, 2016; Hair et al., 2010) and average variance extracted (AVE) > 0.5 (Byrne, 2016; Hair et al., 2010). Further, composite reliability (CR) > 0.7 (Byrne, 2016; Hair et al., 2010) was used to justify the reliability of the scales. Next, discriminant validity was checked after the positively assessed statistical power of the chosen items (deVellis, 2017; Hu and Bentler, 1999). Detailed reliabilities are given in Table 1. Additionally, Appendix 2 presents the Cross-Loadings Matrix to verify if the scales used do not overlap and loadings do not supercharge one another.

Control variable (CV): TRUST was input into the model as CV; to do so, the composite variable was created based on the scale measures (Wang, 2022).

Method of analysis: Structural equation modeling (SEM) using SPSS Amos 26 software (Byrne, 2016); OLS regression using SPSS Process version 3.4.

Sample quality: Kaiser–Meyer–Olkin (KMO) test: .957, the total variance extracted: 75%, and Harman one factor test: 44% justify the good quality of the sample (Hair et al., 2010; Podsakoff and Organ, 1986).

Table 1: Basic statistics, obtained AVE root square, and correlations between constructs

	Mean	SD	AVE	CR	Cronbach alpha	T	CC	KC	LCc	LcM	TKS	EKS	IQ	InnE
T	3.59	2.01	.57	.79	.80	.753								
CC	3.68	2.09	.56	.86	.83	.677	.752							
KC	4.23	2.52	.71	.88	.88	.499	.657	.845						
LCc	3.74	2.15	.57	.79	.83	.586	.846	.693	.753					
LcM	3.12	1.7	.80	.94	.94	.437	.651	.398	.608	.894				
TKS	3.61	.07	.66	.85	.87	.637	.69	.606	.718	.543	.813			
EKS	3.56	1.98	.55	.79	.78	.668	.902	.642	.719	.692	.719	.742		
IQ	3.64	1.98	.59	.85	.85	.592	.75	.567	.708	.58	.786	.742	.765	
InnE	3.59	1.96	.54	.78	.77	.557	.738	.535	.678	.567	.697	.722	.758	.732

Note: n=640 KC-knowledge culture, LCc-learning culture climate component, LcM-Learning culture mistakes acceptance component (as a potential source of learning), CC-collaborative culture, TKS-tacit knowledge sharing, EKS-explicit knowledge sharing, T-TRUST, IQ- organizational change adaptability, InnE – market (external) innovations

After the positive assessment of the sample and applied scales reliability, the structural confirmatory factor analysis (CFA) model was developed to ensure that the scales performed appropriately. The evaluation of the model quality was initially conducted based on constructs' measurement consistency tests such as the average of variance extracted (AVE), composite reliability (CR), and Cronbach's alpha. AVE exceeded 0.54 for all constructs, which was acceptable (Hair et al., 2017). Cronbach's alpha test was used to confirm the consistency of the construct measurement model. The alpha coefficient was greater than 0.77 for all constructs, which was adequate (Hair et al. 2017, pp. 112). The CR was greater than 0.78 for all loadings, which was more than the required minimum of 0.7 (Hair et al., 2017). The square root of each construct's AVE exceeded the correlations between any pair of distinct constructs except CC-LCc and CC-EKS (bolded in Table 1). It means that there is a strong interdependency between collaborative culture, learning climate, and knowledge sharing in Poland. On the one hand, this interdependency may cause slight bias; on the other hand, it exposes how focal the collaborative culture is for knowledge spreading in Poland.

4. Results

Obtained results (Table 2a; Model A and B comparison) show that TRUST is next to the KLC culture's synergy, a focal company facilitator of knowledge-sharing processes in the knowledge-driven organization. The TRUST (CV) imputation strengthened the entire model's quality.

Moreover, results show that knowledge culture supports the learning climate component of a learning culture (H1a $\beta=.24^{***}$). Still, it is negatively related to the mistakes acceptance component (H1b $\beta=-.12^*$). The climate component supports the mistakes acceptance component (H1c $\beta=.26^{***}$) – as was indeed assumed by the KLC cultures approach by (Kucharska and Bedford, 2023a). On the contrary, collaborative cultures support both components of learning cultures (H1e $\beta=.51^{***}$; H1f $\beta=.66^{***}$). That next supports knowledge sharing except that the hat learning climate (H3b $\beta=.01(.899)$) is insufficient for explicit knowledge sharing. It might be that it is mediated by tacit knowledge sharing or by mistakes acceptance component of the learning culture. These assumptions require further profound verification.

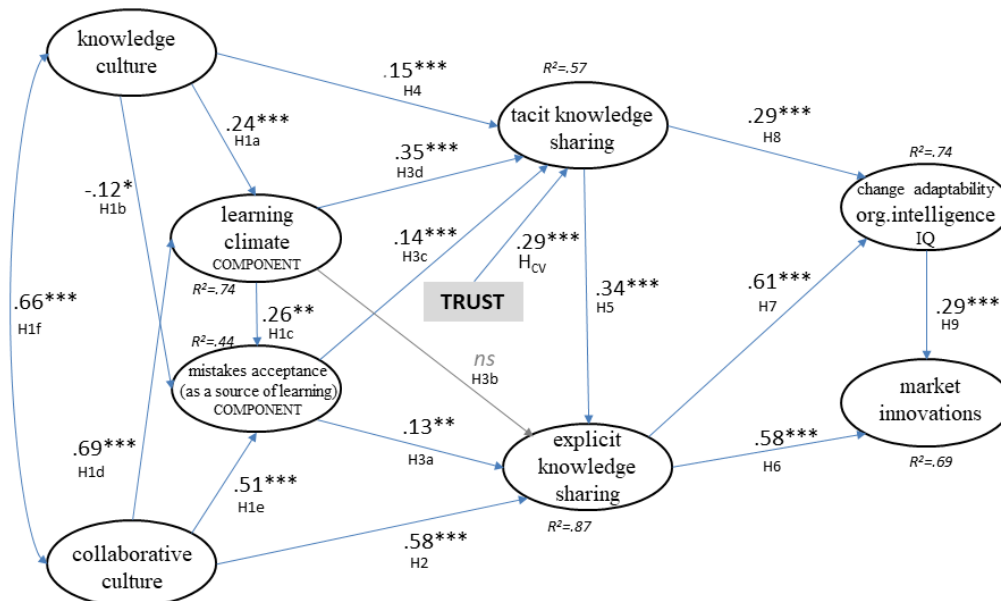
Nevertheless, it exposes why knowledge culture itself is insufficient for knowledge-driven company development. Knowledge, learning, and collaborative culture (KLC cultures) support one another and together deliver to the organization the expected benefit of smooth knowledge sharing (H2 $\beta=.58^{***}$; H3a/c/d $\beta=.13^{**}/.14^{***}/.35^{***}$; H4 $\beta=.15^{***}$; H5 $\beta=.34^{***}$). Finally, knowledge sharing fosters organizational intelligence (H7 $\beta=.61^{***}$; H8 $\beta=.29^{***}$), which matters in creating innovations (H6 $\beta=.58^{***}$), which is a potent source of the expected competitive advantage. Summing up, change adaptability skills reflecting organizational intelligence gained thanks to knowledge sharing leads to innovations (H9 $\beta=.29^{***}$). Table 2a below presents hypotheses verification details supporting this view. Table 2a compares the obtained results for two models: Model A, run with TRUST as CV, and Model B, run without it (Aguinis and Vandenberg, 2014; Becker et al., 2016). The model with TRUST fits the data better. So, it supports the theoretical justification given to input TRUST as a CV to the

study. Therefore, all the subsequent analyses and visualizations (Figure 2, Figure 3) are presented for the model with the TRUST variable as CV.

Table 2a: Hypotheses verification

Model A with TRUST CV			Model B without CV		
Hypothesis	significance	verification	Hypothesis	significance	verification
H1a	.24***	sustained	H1a	.27***	sustained
H1b	-.12*	sustained	H1b	-.17***	sustained
H1c	.26***	sustained	H1c	.30***	sustained
H1d	.69***	sustained	H1d	.68***	sustained
H1e	.51***	sustained	H1e	.44***	sustained
H1f	.66***	sustained	H1f	.67***	sustained
H2	.58***	sustained	H2	.50***	sustained
H3a	.13**	sustained	H3a	.13***	sustained
H3b	.01(.899)	rejected	H3b	.12(.15)	rejected
H3c	.14***	sustained	H3c	.11*	sustained
H3d	.35***	sustained	H3d	.61***	sustained
H4	.15***	sustained	H4	.11(.68)	rejected
H5	.34***	sustained	H5	.30***	sustained
H6	.58***	sustained	H6	.56***	sustained
H7	.61***	sustained	H7	.61***	sustained
H8	.29***	sustained	H8	.28***	sustained
H9	.29***	sustained	H9	.30***	sustained
H _{CV}	.29***	sustained			

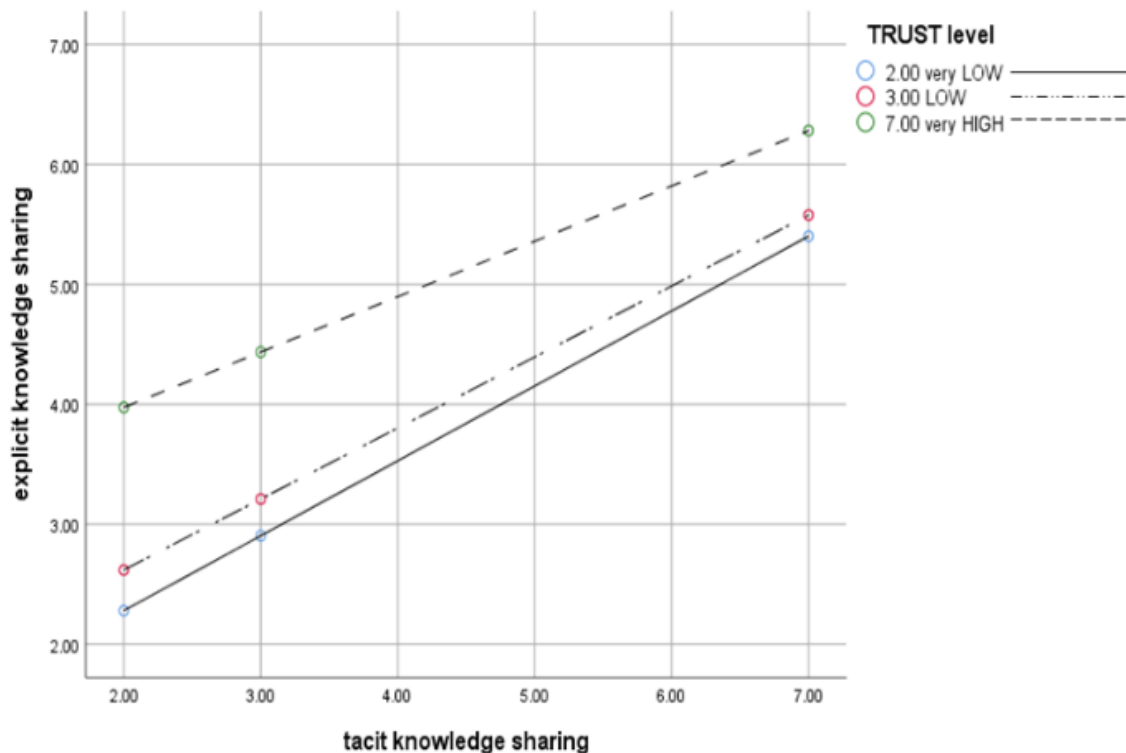
Note: MODEL A n=640, ML; $\chi^2=1043.45(331)$ CFI=.941 TLI=.933 RMSEA=.059 Cmin/df=3,15; *p<.05 **p<.01 ***p<.001. MODEL B n=640, ML; $\chi^2=1016,34(307)$ CFI=.939 TLI=.931 RMSEA=.060 Cmin/df=3,31; *p<.05 **p<.01 ***p<.001 ns-not significant result



Note: n=640, ML; $\chi^2=1043.45(331)$ CFI=.941 TLI=.933 RMSEA=.059 Cmin/df=3,15; p<.05 **p<.01 ***p<.001 ns-not significant result

Figure 2: Results

Figure 2 and Table 2a show that TRUST significantly moderates the relation between TKS and EKS. However, they do not precisely expose how. Therefore, Figure 3 visualizes TRUST's identified, moderated effect on tacit knowledge's impact on the formulation and sharing of its explicit form. Figure 3 shows that the higher the level of TRUST in the organization, the more beneficial the transformation from tacit to explicit knowledge sharing is. Appendix 3 gives details of the visualized effects.



Note: Level of confidence: 95.0000; T variable values are given for the 16th, 50th, and 84th data percentiles (details in Appendix 3)

Figure 3: Visualization of how TRUST impacts tacit knowledge transformation into explicit form

Furthermore, the entire empirical Model A, with TRUST as CV, sustained all hypotheses except H3b (Table 2). What is very interesting is that H4 ($\beta=.15^{***}$) about the positive influence of knowledge culture on tacit knowledge sharing was sustained in Model A, whereas, in Model B (without TRUST as CV), H4 has been rejected ($\beta=.11(.68)$). It suggests that in organizations without developed TRUST, the relation between knowledge culture and tacit knowledge sharing must be probably fully mediated by the learning climate component of a learning culture. In the model with TRUST, this mediation is expected to be partial. Based on these assumptions, hypothesis H1 post-hoc has been formulated below. Table 2b presents its verification details.

H1_{post-hoc}: The learning climate component of learning culture serves as a mediator between knowledge culture and tacit knowledge sharing.

Furthermore, in both Model A and Model B, the H3b about the positive influence of the learning climate component of learning culture on explicit knowledge sharing was rejected. This suggests that the relationship between learning climate and explicit knowledge sharing is probably fully mediated by the mistakes acceptance component of learning culture. Based on these assumptions, the hypothesis H2 post-hoc has been formulated below. Table 2b presents its verification details.

H2_{post-hoc}: The mistakes acceptance component of learning culture serves as a mediator between the learning climate component and explicit knowledge sharing.

Table 2b: Hypothesis post-hoc verification

Hypothesis	Model	Direct effect	Indirect effect	Total effect	Mediation type observed
<i>H1_{post-hoc}</i> <i>KC→LCC→TKS</i>	Model A with TRUST CV	.15***	.10(.003)	.22(.001)	<i>partial mediation</i>
	Model B without CV	.11(.68)	.15(.001)	.29(.001)	<i>full mediation</i>
<i>H2_{post-hoc}</i> <i>LCC→LCM→EKS</i>	Model A with TRUST CV	.01(.899)	.17(.001)	.27(.018)	<i>full mediation</i>
	Model B without CV	.12(.15)	.24(.001)	.40(.005)	<i>full mediation</i>

Note: n=640, ML; p<.05 **p<.01 ***p<.001; ns-not significant result. This bootstrap approximation was obtained by constructing two-sided percentile-based confidence intervals.

The verification of post-hoc hypotheses showed that TRUST empowers the KLC culture synergy impact on knowledge sharing and, consequently, also for organizational intelligence (change adaptability) and innovativeness. Precisely as was expected, the learning climate component of learning culture serves as a mediator between knowledge culture and tacit knowledge sharing. For the model with imputed TRUST CV, it serves as a partial mediator, and without it—as full. So TRUST matters for organizational intelligence building through its strong impact on knowledge-sharing processes. It was also expected that the acceptance of mistakes (as a source of potential learning) in learning culture serves as a mediator between the learning climate component and explicit knowledge-sharing. This hypothesis is sustained for both models—with and without TRUST CV. The full mediation effect is observed for both cases. So, it means that the motivational atmosphere (learning climate component) itself is insufficient and that the mistakes acceptance component supporting the trial-error learning is tremendous for knowledge-sharing processes and consequently for organizational intelligence (change adaptability) and innovativeness.

5. Discussion

The presented results expanded the former studies by Kucharska and Bedford (2020; 2023a-b) and Kucharska (2021a-b) and exposed that KLC cultures and TRUST are needed to develop tacit knowledge sharing, which clearly is an essential ingredient for organizational intelligence development. Moreover, the mistakes acceptance component of learning culture supporting trial-error-learning is tremendous for knowledge-sharing processes, organizational intelligence (change adaptability), and innovativeness. Altogether, knowledge sharing, organizational intelligence, and innovativeness are vital benefits of the synergy that offers the KLC cultures' simultaneous implementation and management. TRUST strengthens this effect.

The interesting issue coming from this study that should be discussed more in-depth is the mistake acceptance component of learning culture identified in this study as a full mediator between the climate component and explicit knowledge sharing. This finding is in line with the former research, which stressed that the organizational ability to learn from mistakes must be supported by company culture to increase the ability to adapt to changes seen as organizational intelligence (Hosseini, Kucharska and Treur, 2024; Kucharska and Bedford, 2020; Rass et al., 2023) and that can be troubled in organizations by the double bias of mistakes phenomena that essence is a clash between positive attitudes and beliefs regarding learning processes and the negative attitudes and beliefs towards accompanying them mistakes (Kucharska and Kopytko, 2024). For organizations to learn from mistakes, communal reflexivity is needed (Ellis et al., 2014). Parker, Racz and Palmer (2020) noted that organizational reflexivity is not exclusively the individual's action—it is a co-created practice of the whole team within a specific organizational context. It is commonly known that there is no learning without mistakes. However, in most organizations, mistakes are perceived as an indicator of negligence and poor performance instead of as part of trial-error learning (Hull, 1930). So, this study shows clearly that implementing the KLC approach in organizations supports organizational trial-error learning and collective intelligence that matter for growth and competitiveness.

Another issue worth discussing in more depth is the identified high correlation between collaborative culture and the learning climate component of learning culture and collaborative culture and explicit knowledge sharing. On the one hand, this interdependency may cause slight bias; on the other hand, it clearly exposes how focal the collaborative culture is for knowledge spreading in Poland. Similar observations were noted by Kucharska (2021a,c) based on different samples collected among knowledge workers in Poland. It might be that is an effect of the fact that employees in Poland are suffering from TRUST in institutions, organizations, and management but, at the same time, strongly rely on relations among coworkers (Kolodziej and Kolodziej-Durnas, 2015;

Sztompka, 1996). Therefore, implementing a collaborative culture is critical in Poland to achieve organizational agency.

6. Limitations and Implications

The key limitation of this research is that it is based on data collected in only one country. Since national culture always impacts organizations. Hence, the business sample explored in this study may reflect Poland's national culture, which suffers from trust. Since Polish people experienced a couple of traumatic collective experiences (e.g., the Second World War and ZSRR occupation after being a Second World War winner because of betrayal of the allies), this trust lack is understandable. Similarly to Kucharska (2017), Kucharska et al. (2017), Kucharska and Bedford (2019; 2020; 2023a-b), and Kucharska (2022, 2021a-b), Kucharska and Rebelo (2022) this study targeted Polish knowledge workers. It gives us a comprehensive view of Poland's company culture, trust, and knowledge-sharing relations. Still, at the same time, it is a limitation inspiring further studies. Benchmarking these findings with knowledge-driven companies across industries and national cultures would be interesting. The second significant limitation is the identified strong interdependency between collaborative culture, learning climate, and knowledge sharing in Poland. This interdependency may cause a slight bias, but at the same time, it might expose how focal collaborative culture is for knowledge spreading in Poland – to be sure how to interpret it, further studies are needed. So, further studies can explore these relations more in-depth.

7. Practical Implications

Practical implications are direct; the KLC approach facilitated by TRUST drives organizational intelligence. Therefore, KLC cultures are worth to be implemented simultaneously. Moreover, there is a risk that organizations with a learning culture developed without collaboration are stuck at the individual level of learning only. Similarly, it is clear that a knowledge culture developed without a multilevel learning culture jeopardizes the organization's growth. In such a case, only old, proven knowledge exploitation is accepted. That extreme situation leads to the rejection of new knowledge that is usually rationalized by the need for business safety security - that is nothing more than a ruse for intellectual laziness or personal barriers of fixed-minded managers. Similarly, knowledge culture rejects the mistakes acceptance component of learning culture that makes learning problematic. Can we learn without mistakes? Obviously, we cannot. So, a knowledge culture without learning and collaboration also jeopardizes organizational development. There is no development without learning. Moreover, the learning climate component of learning culture is insufficient for explicit knowledge sharing, and collaboration is needed to make learning and sharing happen. So, knowledge sharing, organizational intelligence, and innovativeness are vital benefits of the synergy that offers the KLC culture simultaneous implementation and cultivation. TRUST strengthens this effect.

Many organizations assume that if they espouse and even live a knowledge culture, by definition, they have a learning culture and a collaboration culture. It is more apparent than expected. Each of the KLC- sub-cultures requires attention and some effort to be implemented. All of these functional company cultures can exist independently. The effect will be subliminal - but such existence is possible and happens. Collaboration alone creates organizations where everybody feels good, but the company needs to perform. Knowledge culture alone can create organizations that focus too much on perfectionism and control the "status quo" that blocks development. Learning culture alone can focus too much on constantly seeking new, better solutions. Such a constant state can be problematic for organizational learning and development if we omit transforming new knowledge into new organizational rules, procedures, and daily routines. So, the KLC cultures approach can be implemented by having a complete organizational understanding of how all its components affect one another.

Company culture is an asset that requires design, implementation, and management to leverage the company by supporting its strategy. If company culture and strategy misalign, there is no chance for success in the long run. So, knowledge-driven organizations that develop their intellectual capital should implement KLC cultures and take full advantage of the synergy needed for organizational innovativeness. There is no chance for innovativeness without collective intelligence.

Summing up the practical perspective of the obtained results, those managers who care about developing knowledge-driven organizations in the hyperdynamic conditions as observed today need to build collective intelligence. To do so, they must implement KLC cultures and build TRUST. Moreover, if managers working in knowledge-driven organizations do not reflect knowledge, learning, and collaboration cultures—the components of the KLC culture approach—then they should not be managers at all. Reflecting the KLC approach by managers is critical for building organizational intelligence and innovation.

Based on the above, the KLC-approach implementation best practices are:

1. Appreciate new knowledge and new understanding. Never reject new knowledge only because the old ways of acting are solid. Old solutions might not work best in new times. Intellectual laziness can cost you the market. Therefore, always keep your mind open to a deep contextual understanding of "what is going on" and what any new reality means for your internal and external clients and your business." Remember that what fitted yesterday or today might not be relevant tomorrow. Stay open-minded.
2. Learn constantly. Constant learning focus helps you keep the balance between knowledge exploitation and exploration. To do it perfectly, you must recognize context changes and their meaning for your people, clients, and business. So, constantly critically analyze the context, your actions, and their impact. So, think critically, learn, and align your actions with the context change.
3. Learn from your good and bad experiences. Remember, mistakes are harsh, sometimes costly lessons, so you cannot waste the knowledge they bring you. Therefore, be the first to admit mistakes and share the knowledge gained thanks to this harsh event; immediately implement improvements to avoid similar mistakes in the future. Be the best example of learning behaviors you want to see among your organization members.
4. Learn collectively. An organization is a group of people who want to achieve together an aim that each member cannot complete alone. So, for your organization's success, it does not matter what you or one of your employees can achieve alone. The essence of organizational success is what you can achieve together. So, collective instead of individual growth matters more. Therefore, if you want your organization to grow, then enhance the multilevel, collective growth. Organizational learning is not the sum of individual learning but a collective learning issue.
5. Trust the people you work with. If you cannot trust them, find others worth your trust. We rarely accept support from someone we do not trust and vice versa. We do not support people we cannot trust. That is why trust matters so much for learning organizations. Trust is difficult to earn and easy to lose. It is precious because it determines collective acting, especially knowledge sharing. Trust comes from positive mutual experiences. Do not be surprised if your people do not trust you and do not engage at work when you expose overcontrol and treat them like cheaters. Knowledge workers' brilliant minds to engage at work need challenges and trust. Give it to them if you want your organization to grow.
6. The collective intelligence of knowledge-driven organizations results from the smooth cooperation of brilliant minds. To achieve this, you need to implement the KLC approach. We learn about company culture from our experiences, not from formal statements. Employees mirror leaders' behaviors (Badrinarayanan et al., 2019; Hosseini et al., 2023). That is why, as a manager, you must expose it first. You need to create the KLC cultures' synergy experiences among your employees. Without the positive experience of the KLC, your employees will not absorb the KLC. The only way to successfully implement any behavior is to be the perfect example of behavior you want to see among your organization's members.

8. Conclusion

Knowledge sharing, organizational intelligence, and innovativeness are key benefits of the synergy that offers the KLC cultures' simultaneous implementation and management. TRUST strengthens this effect. So, those managers who care about developing knowledge-driven organizations in the hyperdynamic conditions observed today need to build collective intelligence; to do this efficiently, they should implement KLC cultures and build TRUST. The presented results expose that KLC cultures and TRUST are needed to develop tacit knowledge sharing, which clearly is an essential ingredient for organizational intelligence development.

Moreover, this study is another one that breaks with conventions of "exaggerated excellence" and promotes acceptance of mistakes in organizations to develop organizational intelligence. This study showed that implementing the KLC approach in organizations supports organizational trial-error learning and collective intelligence, which matter for growth and competitiveness. Collective intelligence understood as a network of knowledge workers and brilliant minds that collaborate smoothly, is a severe organizational potency that needs to be activated. KLC cultures' synergy facilitates it significantly.

Acknowledgements

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Appendix 1: Scales and Their Sources

Knowledge culture (Kucharska and Bedford, 2020)	All employees perceive knowledge as valuable resource. We have a common language to support knowledge exchange. We are encouraged to share knowledge, ideas, and thoughts. We care about the quality of knowledge that we share.
Learning culture (Kucharska and Bedford, 2020)	<u>Learning climate component</u> All staff demonstrates a high learning disposition. We are encouraged to engage in personal development. We are encouraged to implement new ideas every day. We are encouraged to engage in seeking new solutions. <u>Mistakes acceptance component</u> People know that mistakes are a learning consequence and tolerate it up to a certain limit. Most people freely declare mistakes. We discuss problems openly without blaming others. Mistakes are tolerated and treated as learning opportunities.
Collaborative culture (Kucharska and Bedford, 2020)	My company supports cooperation between workers. Cooperation among the different duties, teams, and departments was encouraged. Co-workers volunteer their support even without being asked. People support each other.
Tacit knowledge sharing (Kucharska and Erickson, 2023)	I share knowledge learned from my own experience. I have the opportunity to learn from the experiences of others. Colleagues share new ideas with me. Colleagues include me in discussions about the best practices.
Explicit knowledge sharing (adapted from Kucharska 2021a)	There is a formal policy encouraging knowledge sharing at my place of work. Knowledge is shared among people in my team and division. Other teams and divisions share knowledge with us. We share our knowledge with other teams and divisions.
TRUST (adapted from Park and Lee, 2014 and Kucharska and Kowalczyk, 2016)	I TRUST people at work. People in my team TRUST one another. People in my division TRUST one another. People in my entire organization TRUST one another.
Change adaptability (org. intelligence - IQ) (Kucharska and Bedford, 2020)	We are flexible to changes. We can adjust ourselves to changes. We adapt to changes easily. We used changes.
External, market innovations (Kucharska and Erickson, 2023a)	We provide competitively superior innovations to our clients. Our innovations are perceived positively by our clients. We are better than our competitors at introducing innovations. I am proud of our innovations.

Note: Adapted scales are those in which statements were reformulated based on the preliminary study to improve their understanding and, thus, measurement quality.

Appendix 2: Cross-Loadings Matrix

	1	2	3	4	5	6	7	8	9
KC1			.917						
KC2			.925						.103
KC3			.705				.152		
LCc4			.135		.245		.403		-.143
LCc3					-.150	.277	.548		.119
LCc2							.820		
LCc1					.174		.694		
LCm3	.831								
LCm4	.895								
LCm2	.947								
LCm1	.903								
C2				.128	.292	.537	-.127	-.113	-.140
C3					-.244	.897			.124
C1						.686			
C4						.487		.115	
EKS1				.172	.143	.121		.451	-.152
EKS2						.180		.435	
EKS3								.898	
TKS3				.667	.315				
TKS2				.864					.111
TKS1				.931	-.124				
TKS3			-.111	.639		-.122		.135	
IQ1					.899	-.241		-.132	.213
IQ2					.597	.115			.495
IQ3				.106	.632				.303
IQ4					.673				.235
InnE1	.118			-.156	.172	.566			
InnE2					.213	.418	.104		.184
InnE3					.173	.444	.121	.122	
T1		.899							
T2		.556	.123		.155				-.102
T3		.878			-.148				
T4		.785				.116			

Loadings extraction method - Maximum Reliability. Rotation method - Promax with Kaiser normalization.

Appendix 3: SPSS PROCESS Output

***** PROCESS Procedure for SPSS Version 3.4 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com

Documentation available in Hayes (2018). www.guilford.com/p/hayes3

Model : 1 Y : eks X : tks W : T Sample Size: 640

OUTCOME VARIABLE: eks

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6595	.4349	2.8256	163.1537	3.0000	636.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	.2237	.2802	.7985	.4249	-.3265	.7739
tk	.6893	.0712	9.6767	.0000	.5494	.8292
T	.4040	.0789	5.1231	.0000	.2491	.5588
Int_1	-.0326	.0157	-2.0758	.0383	-.0634	-.0018

Product terms key:

Int_1 : tk x T

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0038	4.3090	1.0000	636.0000	.0383

Focal predict: tk (X) Mod var: T (W)

Conditional effects of the focal predictor at values of the moderator(s):

Z4	Effect	se	t	p	LLCI	ULCI
2.0000	.6242	.0471	13.2434	.0000	.5317	.7168
3.0000	.5917	.0392	15.1112	.0000	.5148	.6686
7.0000	.4615	.0608	7.5887	.0000	.3420	.5809

***** ANALYSIS NOTES AND ERRORS *****

Level of confidence for all confidence intervals in output: 95.0000 W values in conditional tables are the 16th, 50th, and 84th percentiles. NOTE: Standardized coefficients not available for models with moderators.

----- END MATRIX -----

Reshaping Knowledge Flow: The Impact of Ecollaboration Platforms in It-Project Knowledge Transfer

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Abstract: This research embarks on an in-depth exploration of the transformative dynamics initiated by eCollaboration platforms in the field of IT project management, with a particular focus on knowledge transfer processes. The study delves into the intricacies of knowledge transfer, encompassing both its intra-project dynamics and its transfer from projects to project-based organisations (PBOs). The overall aim is to unravel the impact of eCollaboration platforms on this complex process and to provide insights into the evolving landscape of knowledge management in the context of IT projects. Methodologically, the study adopts a qualitative content analysis approach. Recognising the paradigmatic aspects that might limit insights for proponents of the quantitative paradigm, the chosen approach facilitates an in-depth exploration of the multifaceted nature of knowledge transfer within IT project management. The study involves a cohort of eleven project managers in Austria, with meticulous interviews conducted and recorded to ensure a comprehensive data collection process. The subsequent data analysis involves a systematic evaluation of the accumulated information derived from these expert interviews. This comprehensive analysis integrates both quantitative and qualitative components, providing a nuanced understanding of how eCollaboration platforms influence knowledge transfer within the complex landscape of IT projects. The research findings provide valuable insights into the evolving dynamics of knowledge transfer in the context of IT project management. By examining the impact of eCollaboration platforms on this process, the study contributes to a deeper understanding of the challenges and opportunities that arise in the area of knowledge management in IT projects. These findings have practical implications for project managers and organisations seeking to optimise knowledge transfer processes within their projects and project-based organisations. Ultimately, this research serves as a timely exploration of the transformative potential of eCollaboration platforms to reshape the flow of knowledge within IT project management. It paves the way for improved collaboration and knowledge sharing in the digital age and offers a critical perspective on the evolving landscape of IT project management practices.

Keywords: eCollaboration, Knowledge flow, Knowledge transfer, IT-project management

1. Introduction

This research evaluates changes in knowledge transfer through the use of eCollaboration platforms in IT project management. Knowledge transfer within projects and from projects to project-based organisations (PBOs) is a multi-faceted evolutionary process influenced by various factors and dynamic circumstances. Zhou *et al.* (2022) examined knowledge transfer from projects to PBOs using simplified variables in their study. However, the development of complex dynamic models requires further research. Furthermore, their research primarily addresses knowledge transfer from projects to PBOs, neglecting to examine how project managers use eCollaboration platforms to manage this knowledge transfer. Zhou *et al.* (2022) suggest that future research should broaden its focus to include other aspects of knowledge generation or the entire knowledge management process within PBOs. While Hetemi, Pushkina and Zerjav (2022) focus their analysis on collaborative knowledge work practices specifically within IT projects in their organisational context, there is a need for future research to explore the intricacies of knowledge work in settings that span multiple projects and organisations. Given the preliminary nature of the findings in their study, there is an opportunity for future research to enhance understanding through the use of qualitative research designs. The study highlights the importance of developing a robust understanding of project-based knowledge work and its practices, and emphasises its central role as a key capability for both public and private sector organisations striving for success within their organisational ecosystems. This implies a call for the current study to expand beyond the parameters set by Zhou *et al.* (2022) by considering additional elements in the knowledge management process. Furthermore, it suggests that Hetemi, Pushkina and Zerjav (2022) need to conduct further research that explores the intricacies of knowledge work in contexts that transcend individual projects and organisations, thereby addressing the existing research gap regarding forms of knowledge transfer in project management. Against this

background, the epistemic focus of this study is on the transformation of knowledge transfer practices within eCollaborative projects. In addition, it includes the corresponding willingness to transfer knowledge from the project to the project-based organisation (PBO).

2. Theoretical Background

The terms tacit and explicit knowledge go back to Polanyi (1966) who states that people often know more than they can express. According to Pawlowsky (2019), tacit knowledge is interwoven with action and tied to the person who has the experience. It cannot be put into words, or only incompletely. Nonaka and Takeuchi (2012) add that tacit knowledge is based on individual experience and includes elusive factors such as beliefs and perspectives. In contrast, explicit knowledge is defined as easily transferable in language and processable in formal form (Pawlowsky, 2019). Nonaka and Takeuchi (2012) describe explicit knowledge as knowledge that can be expressed in clear sentences, technical data and manuals, and can be easily shared. Reinmann (2009) summarises that knowledge is considered implicit when it cannot be articulated directly and depends heavily on experience. In contrast, we speak of explicit knowledge when it can be articulated linguistically and decoupled from the primary knowledge carrier. Polanyi emphasised that the two forms of knowledge are inextricably linked. This duality is also evident in project knowledge, where both formalised project documentation and implicit knowledge arise in the minds of those involved in the project (Christian, 1994; Schindler, 2001). The interplay between tacit and explicit knowledge is crucial to understanding knowledge transfer in projects. While tacit knowledge is deeply personal and difficult to articulate, explicit knowledge is easily documented and shared. This duality poses challenges, especially in project management.

eCollaboration technologies address these challenges by providing platforms that facilitate the codification and sharing of tacit knowledge. These systems enable better coordination and communication by integrating both tacit and explicit knowledge into project workflows. Kock et al. (2001) define eCollaboration in the broadest sense as collaboration between people working on a common task using electronic technologies. As examples of eCollaboration technologies, they cite web-based chat tools, web-based asynchronous conferencing tools, email, collaborative writing tools, group decision support systems and teleconferencing. Schauer and Zeiller (2011) state that eCollaboration systems support the communication, coordination and collaboration of employees to work together towards a common goal and create economic value. This definition is consistent with Riemer's (2007) definition, which defines eCollaboration systems as software that supports communication, coordination and collaboration between human processes in groups. Bettoni *et al.* (2016) provide a knowledge-based definition of eCollaboration. They describe knowledge-based eCollaboration as a coordinated activity between different individuals who use electronic technologies to work on a single, common task, and who simultaneously make a conscious and continuous effort to build and maintain an underlying shared knowledge structure as a basis for accomplishing their task.

What these definitions have in common is that eCollaboration technologies support human knowledge carriers in working on a common task and thus also in working on a common project. When these definitions of eCollaboration are combined with Thiel's (2002) transfer model, the result is that the transfer channels listed in the transfer model can be equated with the term eCollaboration technologies. This suggests that different systems are used in the context of project management. Riemer (2007) defined four main system classes to characterise eCollaboration technologies. This classification is still valid today and is used in current studies.

Everyday systems are used continuously by teams as primary systems to support daily activities. They provide basic functionality to support all three types of social interaction - communication, coordination and collaboration. Everyday systems focus on asynchronous, text-based and thus codified communication. The systems provide email functionality as the primary mode of communication. Other typical features include shared calendars, address books, task lists, document areas and discussion forums. The main form of perception provided by these systems is that of a workspace in relation to documents held in shared areas (Riemer, 2007).

Integrated systems have many features in common with everyday systems, such as email, calendars, address books and to-do lists, but their key feature is support for synchronised communication. These systems also offer instant messaging and text conferencing. A key feature is presence information to create informal attention (Riemer, 2007).

Systems in the Coordination Systems class focus on specific aspects of team coordination. These systems are typically used by team members on an ongoing basis, albeit as a secondary system to the Everyday systems. Typical features include document areas, group calendars, task lists, project and resource plans, project controlling, document distribution lists and workflows (Riemer, 2007).

Meeting systems include systems that support online meetings and video conferencing. These can be used for specific situations and as secondary systems. The systems are based on rich synchronous communication capabilities such as text chat, audio and video communication. Other typical features include sharing of applications and whiteboards. Polls can be conducted to support ad hoc decisions and online presentations can be held to conduct online seminars (Riemer, 2007).

Based on Riemer's (2007) classification, the systems can be assigned to Thiel's (2002) transfer model. Figure 1 shows Thiel's (2002) transfer model extended to include these systems. This figure shows that the systems cover all transfer channels. It also shows that two systems can be used for asynchronous and formal knowledge transfer. From this it can be concluded that when both systems are actually used in projects, the codified material knowledge carriers are either distributed or stored redundantly. It can therefore be concluded that systematic transfer should be given high priority at this stage in order to minimise the risk of knowledge loss.

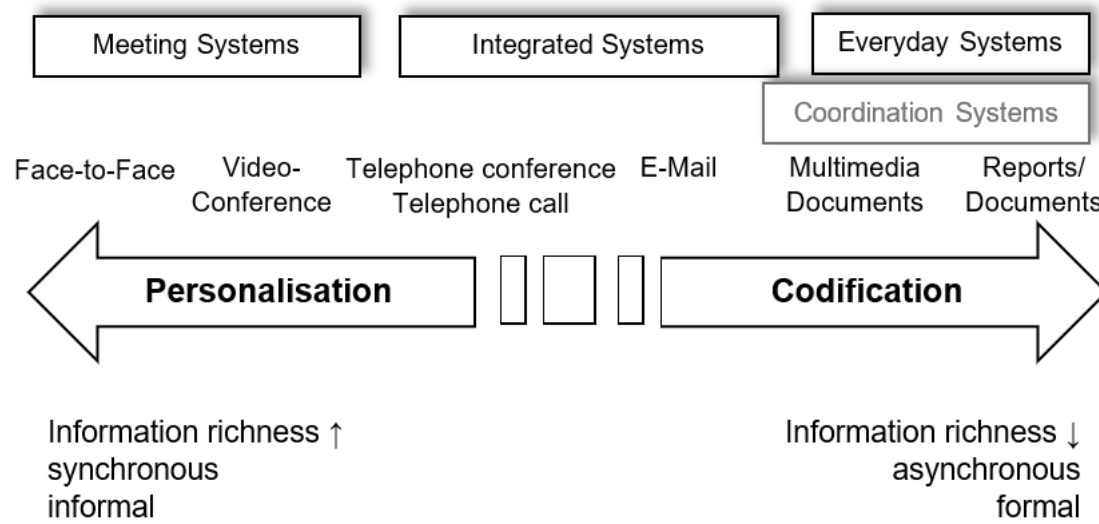


Figure 1: Transfer methods according to Thiel (2002) extended by classification according to Riemer (2007)

According to Riemer (2007), systems for integrating project features are quite similar to coordination systems. The processes of collaboration and coordination are supported by coordination systems, while integrated systems add the communication aspect. In addition to project management functions, integrated systems are systems that provide a range of functions from basic to knowledge management functions in relation to a company's organisation. In summary, eCollaboration systems form the technological basis for knowledge transfer in the project. It can be argued that it is necessary to define a system for their use and to control the transfer of knowledge across the boundaries of the systems.

3. Literature Review

The results of Hetemi, Pushkina and Zerjav (2022) study on collaborative knowledge work practices in IT projects describe and explain how cross-domain project teams collaborate and apply knowledge work practices within and across projects and in the IT industry. This study confirms that collaborative practices involving project members are essential. It is also necessary to understand the importance of the collaborative design of information technology as a means of knowledge work for project members. Recent research highlights the evolving landscape of knowledge transfer in different contexts. In IT projects, e-collaboration platforms have facilitated community engagement and social innovation, leading to improved outcomes and new collaborations (Rashid *et al.*, 2024). The digital transformation of micro, small and medium enterprises has been accelerated by Industry 4.0 and the COVID-19 pandemic, highlighting the need for knowledge transfer activities from universities to address readiness challenges (Anatan and Nur, 2023). Intergenerational differences, particularly in computer literacy and ICT use, affect knowledge transfer among engineers, requiring effective employee engagement strategies (Lužar *et al.*, 2023). In multinational companies, internal knowledge transfer is influenced by various factors, with vertical transfers dominating over horizontal ones, and power dynamics playing a significant role in conventional and reverse knowledge transfer (Castro and Moreira, 2023). Collectively, these studies highlight the importance of adapting knowledge transfer strategies to different organisational contexts and using technology for effective collaboration. eCollaboration platforms play a crucial role in knowledge

transfer and codification within IT projects. Knowledge management systems (KMS) support both explicit and tacit knowledge, helping to codify and make accessible previously implicit knowledge (Natek and Lesjak, 2021). The presence of industry norms, system integrators and administrative control influences the use of codification for knowledge transfer across projects (Cacciatori, Tamoschus and Grabher, 2012). Different project types require different approaches to knowledge management, with delivery and investment projects often relying on explicit knowledge and codification, while research and development projects emphasise tacit knowledge and personalisation (Koskinen, 2004). This distinction between tacit and explicit knowledge is crucial when considering how eCollaboration platforms facilitate the transition from implicit knowledge, which is difficult to articulate, to codified knowledge that can be easily shared across projects. Narrative-based systems can facilitate the transfer of explicit knowledge in technological innovation processes, allowing actors to reflect on different perspectives and roles within the innovation process (Burnett, 2012).

Knowledge transfer (KT) requires technology in the form of technical infrastructure, communication networks and a range of information services. Information technologies - multimedia, e-mail, intranet and databases - enable an organisation's employees to share information from different sources (Karlsen and Gottschalk, 2004). According to Kock *et al.* (2020), the correct use of the technological platform is an important success factor for knowledge transfer in projects, but it is also important that this is defined in advance by establishing common procedures, taking into account standards and rules. Recent studies highlight the importance of KT in project management, particularly in IT and sport contexts. Personalised, spontaneous KT, facilitated by informal interactions, has emerged as the dominant form in IT projects (Stampfl, Fischer and Palkovits-Rauter, 2023). Key determinants of KT include personal factors such as motivation and trust, organisational factors and technological factors (Bello, Ahmad and Mohd Nadzir, 2023). The quality of relationships between team members directly affects the effectiveness of KT, with organisational structure playing a mediating role (Ren *et al.*, 2023). In sport management, both formal and informal learning contribute to KT, with digital platforms and athlete agents serving as important tools in the process (Russo *et al.*, 2023). Challenges to effective KT include issues of quantity, distribution, team dynamics and time constraints (Stampfl, Fischer and Palkovits-Rauter, 2023). Successful KT is associated with increased efficiency, improved quality and faster project completion (Stampfl, Fischer and Palkovits-Rauter, 2023), highlighting the need for organisations to develop strategies to improve KT practices.

The study by Hanisch *et al.* (2009) confirms the support of IT tools as a necessary factor for the quality of knowledge management in projects. Meyer and Weßels (2020) note that the project team of the future must be responsible for defining and managing the collaboration platform, while at the same time creating a balance between control and freedom for the members of that platform. Recent research explores the impact of collaboration dynamics on project performance and knowledge management. Trust and relationship quality among team members positively influence knowledge transfer and project success (Ren *et al.*, 2023; Shang, Cao and Wu, 2023). Contractual control improves basic project performance, but doesn't significantly affect value-added performance (Shang, Cao and Wu, 2023). Organisational structure matters, with centralisation negatively affecting relationship quality and formalisation moderating the effectiveness of knowledge transfer (Ren *et al.*, 2023). Stakeholder engagement and knowledge management positively influence sustainability practices in project management (Blak Bernat, Qualharini and Castro, 2023). Interestingly, the virtual nature of teams does not diminish the impact of stakeholder engagement, knowledge sharing or sustainability practices on project success (Blak Bernat, Qualharini and Castro, 2023). These findings highlight the importance of balancing control and freedom in collaboration platforms to optimise knowledge management and project outcomes in both traditional and virtual environments.

Gruber and Gessler (2022) also state that structural frameworks must be created within the technical infrastructure for knowledge transfer to be successful. Bettoni *et al.* (2016) derive a necessary architecture for eCollaboration systems from their definition of knowledge-based eCollaboration and conclude that the organisational structure (people) and the processes of collaboration (task, knowledge and social processes) play an important role in the success of eCollaboration and must be designed accordingly. It is therefore not enough to focus on eCollaboration technologies, but to take the importance of people and processes seriously and ensure that the design balances all three elements. In terms of technology, it is important that the design of eCollaboration systems takes into account the needs arising from the design of the previous two elements - people and processes. The technology should therefore support these needs (Bettoni *et al.*, 2016). The design of eCollaboration systems should balance people, processes and technology to support knowledge transfer and improve outcomes. For people, strategies include building platforms for participation, developing staff skills, and fostering positive attitudes among decision makers (David *et al.*, 2023). Process approaches include setting clear

objectives, establishing appropriate regulations and incorporating user feedback (David *et al.*, 2023). Technological considerations include understanding the impact of technology, ensuring preparedness and prioritising convenience (David *et al.*, 2023). Sustainable environment training can positively influence knowledge transfer, mediated by motivation to learn (Mohamad *et al.*, 2023). Design thinking profiles in technology-enhanced learning environments significantly impact interpersonal and evaluative skills, which influence knowledge transfer (Avsec, 2023). Organisations can assess and improve their technology implementation maturity using models that address people, process and technology dimensions, increasing the likelihood of successful implementation (Tripathi *et al.*, 2024). This balanced approach is critical for effective e-collaboration and knowledge transfer.

Research by Gilson *et al.* (2021) shows that teams that use technology to communicate find it more difficult to develop and maintain trust. According to North (2021), knowledge exchange is successful when mutual trust has been established between participants and everyone has been able to benefit from the transfer. This suggests that when using technological platforms, project managers need to consider not only the technical capabilities, but also the human and process needs. When a project needs experience in solving difficult problems, especially those that other projects have already dealt with, it can easily access and acquire the knowledge from the information systems. Technology thus makes knowledge available and enables efficient knowledge transfer (Karlsen & Gottschalk, 2004). Project managers can effectively integrate technical, human and process-oriented strategies in technology platforms by focusing on key determinants of knowledge transfer, including personal factors such as trust and motivation, organisational factors and technological factors (Bello, Ahmad and Mohd Nadzir, 2023). Trust between partners has a significant impact on project success and innovation, emphasising the importance of similarity and complementarity of knowledge bases (Vaez-Alaei *et al.*, 2024). A socio-technical framework for implementing lean project management highlights the importance of soft skills and human factors in the context of digital transformation (Lima *et al.*, 2023). To foster trust in projects, managers should address factors such as knowledge, skills, awareness and behaviour, while overcoming challenges related to policy, cost and collaboration (Farouk *et al.*, 2023). By integrating these strategies, project managers can increase trust, facilitate efficient knowledge transfer, and improve project outcomes in complex technological environments.

4. Current Study – aim and Research Question

While previous studies such as Zhou *et al.* (2022) mainly focused on knowledge transfer from projects to project-based organisations, this study specifically examines how project managers use eCollaboration platforms to manage this knowledge transfer. This broadens the focus to the entire knowledge management process within project-based organisations. The primary objective of this study was to gather and examine the practical experiences of project managers, with a particular focus on their practical insights gained from active involvement in operational IT projects. There was a lack of practical recommendations for organisations to improve knowledge transfer in IT projects through the effective use of eCollaboration platforms. This study provides empirically grounded findings that can serve as a basis for such recommendations.

Qualitative research designs investigating knowledge work practices in IT projects were lacking. This study uses a qualitative approach to gain a deeper understanding of the complex social dynamics and authentic contexts of knowledge sharing in IT projects. Given the nature of the research objectives, qualitative research methods were used to explore unknown experiences with eCollaboration by project managers in IT projects. The intention was to uncover insights that could serve as a basis for developing new theories or hypotheses, and to provide a basis for potential future quantitative research efforts aimed at validating or challenging the identified findings.

The aim of this work is not to test existing theories or hypotheses. The aim is that the results of this work will be of use to both the academic and business communities. Hetemi, Pushkina and Zerjav (2022) emphasised the need to explore the complexity of knowledge work in cross-project and cross-organisational contexts. This study takes up this suggestion by investigating the impact of eCollaboration platforms on knowledge transfer in different IT project contexts. One aim of this work is to identify the change in knowledge transfer caused by eCollaboration platforms. Therefore, the study was guided by the research question to what extent has knowledge transfer changed as a result of the increased use of eCollaboration in IT projects. Previous research has not sufficiently investigated the specific effects of eCollaboration platforms on the efficiency, quality and speed of knowledge transfer in IT projects. This study fills this gap by analysing the experiences of IT project managers in detail. This study shows the impact of eCollaboration technologies on the efficiency, quality and speed of knowledge transfer in IT projects and enables future project managers to derive practical

recommendations for organisations to improve knowledge transfer in IT projects through the effective use of eCollaboration platforms.

By addressing these research gaps, the study contributes to a more comprehensive understanding of the changing dynamics of knowledge transfer in the context of IT project management and provides valuable insights for both academics and practitioners in the field.

5. Methodology

To address the central question, a qualitative research framework was used to gain insights into the experiences of project managers in IT projects and their use of eCollaboration platforms. This research adopted an exploratory approach suitable for investigating phenomena that are only partially understood, as suggested by Eisenhardt and Graebner (2007). The deliberate choice of a qualitative method, as opposed to a quantitative one, was motivated by its ability to provide a deeper understanding of the complex social dynamics that are particularly evident in the personal experiences of project managers. In addition, it was considered essential to delve into the complex and authentic context in which knowledge exchange takes place. The choice of techniques within the qualitative research framework was based on factors such as research efficiency, research focus and nuances within the field of IT project management. From the available options, interviews were chosen for their efficiency and alignment with the objectives of the empirical investigation. The construction of the questions in the interview guide allowed for the inclusion of gaps identified in the theoretical segment and interesting facets of knowledge transfer, ensuring that the interviews remained focused on the research question. The expert interviews followed the principles of exploratory expert interviews outlined by Bogner, Littig and Menz (2014). The online interview approach was chosen for research efficiency, and the interviewer, who was familiar with the subject area, assumed the role of co-expert, fostering an interactive dynamic similar to constellation theory. This configuration ensured a balanced interaction during the interviews, where technical knowledge and project management expertise were on an equal footing between interviewer and interviewee. While this approach resulted in a high level of professionalism and factual information, it also maintained a strong professional influence within the boundaries of professional discourse. This interactional approach fits seamlessly with the exploratory nature of this research, as described by Misoch (2019). The interpretation of the results of the data analysis will depend on the underlying philosophical perspective of the researcher. Therefore, transparency regarding the researcher's philosophical stance is necessary to understand the research findings, as emphasised by Biedenbach and Müller (2011). In this study, the foundational philosophical stance adhered to phenomenalist principles and guided the analysis to cultivate insights into the personal experiences of project managers.

5.1 Participants

The researcher shapes the role of an expert throughout the concrete research process, allowing for self-definition based on their positions and associated knowledge, as elaborated by Kaiser (2021). In this study, it is assumed that these experts are tasked with overseeing IT projects and have insights into both the project team and the inherent decision-making mechanisms. Building on the findings of Misoch (2015), these experts are bearers of specialised knowledge acquired through training, often validated by certificates, or through practical involvement in specific organisational tasks. In order to verify the expert status of the respondents in this study, specific criteria were applied, requiring the possession of a valid certification from a reputable project management institute and a minimum of five years' experience in the field of IT project management. The term 'IT projects' encompasses various undertakings, including software development projects, enterprise software integration and implementation initiatives, information systems endeavours, IT infrastructure projects and strategic IT initiatives, in line with the scope outlined in Tiemeyer and Bauer (2010) research. The size of the sample was set at eleven individuals and detailed information on their experience and qualifications is given in Table 1.

Table 1: Information on the interviewed experts

Person, gender	Experience with IT projects	Experience (in years)	Certification(s)
Person 1, male	Digitalisation projects, cloud projects, software development projects, business software implementation projects	19	Project Manager, cPM (pma/IPMA® Level C) Scrum Master

Person, gender	Experience with IT projects	Experience (in years)	Certification(s)
Person 2, male	Implementation projects, digitalisation projects, strategic IT projects	26	Senior Project Manager, cSPM (pma/IPMA® Level B)
Person 3, female	Business software implementation projects	8	Project Manager, cPM (pma/IPMA® Level C) Scrum Master
Person 4, female	Business software implementation projects	8	Project Management Associate, cPMA (pma/IPMA® Level D)
Person 5, male	Software development projects	10	Project Management Associate, cPMA (pma/IPMA® Level D)
Person 6, male	Business software implementation projects	10	PMP® - Project Management Professional
Person 7, female	Business software implementation projects, Software development projects	13	Scrum Master
Person 8, female	Organisational strategy projects, IT projects, process optimisation projects	20	Project Manager, cPM (pma/IPMA® Level C) Scrum Master Product Owner Agile Coach
Person 9, female	Business software implementation projects, data management projects	8	Scrum Master
Person 10, male	Implementation projects, software development projects	19	Project Manager, cPM (pma/IPMA® Level C)
Person 11, male	Implementation projects, infrastructure projects	24	Project Manager, cPM (pma/IPMA® Level C) Scrum Master Product Owner

Based on the above considerations, this research has carefully explored the first-hand perspectives of experienced project managers who have played a crucial role in overseeing IT projects within organisational settings. The selection of these individuals was carefully tailored to closely align with the subject matter of the study, ensuring a comprehensive and adaptable approach deeply rooted in the specific contexts of both the projects and the organisations with which they were associated. The primary focus was on these experts themselves and their experiential journeys, a focus underscored by Misoch's (2015) perspective. Their expertise, particularly the wealth of experiential and active knowledge they brought to the table, formed the focus of the applied research, a methodology that resonates with the perspectives outlined by Diekmann (2021).

Regarding the selection of suitable participants, this research framework opted for a homogeneous sampling strategy in the context of the current study, following the findings of Misoch (2015). This decision was practical, as the intended target group could be efficiently reached through a single channel, allowing for face-to-face interactions during the expert interviews.

5.2 Instrument and Data Collection

The structured expert interview format facilitates the generation of subjective impressions and interpretative knowledge within a specific context, providing a way to fill gaps identified in theory by drawing on professional and expert insights (Döring and Bortz, 2016). The design of the study required a comprehensive and nuanced guide, which balanced the need for detailed inquiries with the flexibility required for open interview situations in order to respond appropriately to respondents. The interview guide also served as a guarantee to ensure comparability of content in the subsequent content analysis. Its design and specifics were tailored to the research interests and the personal research and interview style of the interviewer, following the approach

outlined by Bogner, Littig and Menz (2014). The sequence of questions was strategically organised, beginning with a request for basic biographical information (education, occupation, etc.) to allow the interviewer to form an initial impression of the respondent and tailor the interaction accordingly. Subsequent questions delved into the general research topic and allowed for the possibility of supplementing them with more detailed inquiries as the conversation unfolded, as outlined in Table 2 (Döring and Bortz, 2016).

Table 2: Interview guide

1. information phase
Brief introduction to the study, purpose of the interview
2. demographic data
Education (in project management)
Project management experience
3. Warm-up
- What role do you think knowledge transfer plays in project management? (question derived from Bettoni <i>et al.</i> (2016); Castro and Moreira (2023))
4. main part
- Do you use eCollaboration systems to manage your projects and to what extent do these systems support you in knowledge transfer? (question derived from Hetemi, Pushkina and Zerjav (2022))
- How long have you been working with eCollaboration systems and what exactly do you use them for? (question derived from Bettoni <i>et al.</i> (2016); David <i>et al.</i> (2023))
- To what extent has knowledge transfer changed as a result of the increased use of eCollaboration in your projects? (question derived from research question)
5. fade out
Anything else you want to add or remove?

Interviews were conducted with a pre-determined cohort of eleven participants in March 2023, with an average duration of 43 minutes per session. The interviews were carefully conducted and recorded during individual sessions on the Microsoft Teams platform. In order to maintain ethical standards, explicit consent was obtained from each interviewee, documented by signed consent forms confirming their agreement to the recording process during the scheduled appointments. The subsequent transcription of the video recordings was carried out using the Amberscript web platform, augmented by artificial intelligence (AI) technology.

5.3 Data Analysis

In order to systematically evaluate the accumulated data derived from the guided expert interviews, a thorough content analysis proved essential. As Kuckartz and Rädiker (2022) explain, qualitative content analysis is a "methodically controlled scientific analysis of texts, images, films and other forms of communication" (p. 39). The methodology of qualitative content analysis encompasses three basic approaches: content structuring, evaluative and typifying qualitative content analysis. Given the research design of this study, which precluded category evaluation and typology development, the content structuring method was adopted. In content structuring qualitative content analysis, information is methodically organised into different categories and subcategories (Kuckartz and Rädiker, 2022). This structured framework serves as the basis for the systematic and organised presentation of the research findings. The content analysis category system was initially developed by deductive means and then enriched by inductive insights from the transcripts. The overarching categories were derived directly from the interview guide, resulting in thematic categories that seamlessly reflected the inherent structure of the interview guide (Kuckartz and Rädiker, 2022).

Listing of the main thematic segments:

- eCollaboration
- Change in knowledge transfer

These overarching themes are closely linked to the central research question and effectively encapsulate the focus of this research. In line with the research objective, the key themes identified revolve around

eCollaboration and its changes in knowledge transfer. In addition, these fundamental categories serve as a robust basis for shaping and organising the findings within the final report. The process of delineating types through content analysis is greatly facilitated by the use of quality data analysis (QDA) software, a concept advocated by Kuckartz and Rädiker (2022). Consequently, MAXQDA Standard 2022 was carefully employed to streamline the content analysis in this particular study.

In the initial coding stage, the data collected was thoroughly examined in relation to the main thematic categories and systematic coding was applied accordingly. Sub-categories nested within these main themes emerged through inductive analysis driven by the available data. This process involved examining all coded text segments within a given primary category and merging relevant dimensions to create relevant subcategories. The subsequent coding phase then followed these emergent subcategories, guided by the principles outlined by Kuckartz and Rädiker (2022). Upon completion of the coding process, a series of both basic and complex analyses were conducted. These analyses were structured around the pre-defined categories and revealed correlations between the sub-categories within each primary theme. The content analysis of the expert interview transcripts included both quantitative and qualitative components, incorporating aspects such as frequency counts and verbatim quotes (Kuckartz & Rädiker, 2022).

6. Results

In the main categories, two subcategories emerged inductively. Two subcategories were formed for the systems used. In the two subcategories on systems, the four main system classes for characterising eCollaboration systems from Riemer (2007) were combined. The everyday systems and the coordination systems were combined because both systems cover the task areas of coordination, task lists and document storage and these are usually handled within a tool as part of project management. Integrated systems and meeting systems were also grouped together, as the tasks of these systems, such as group calendars, task lists, project and resource plans, project controlling, as well as document distribution lists, workflows, chats and video conferencing, can now also be handled within one platform. This summary of the main system classes during the data analysis shows that the characterisation created by Riemer (2007) and still used today is no longer up to date, as current technologies already have more functionalities and therefore cover more task areas.

6.1 Everyday and Coordination Systems

When it comes to using eCollaboration systems for operational project management, 10 of the 11 experts named Jira and Confluence by Atlassian. Jira is used for the operational distribution and completion of tasks and Confluence for the collaborative creation of documents, i.e. for the sustainable codification of knowledge. This finding is confirmed by the statements of persons 1 and 4: "Jira is strongly oriented towards task tracking. Whether it's on the project management level (-), but I also see that [...] many people work with it in terms of content, so I currently see Jira as a project management tool" (Transcript_P1, pos. 30) and "accordingly Confluence, which is our documentation tool, so it's very wiki-heavy, so to speak, where the real project knowledge is usually written down, at least as far as possible in terms of content" (Transcript_P4, pos. 37).

This consistent result for the use of eCollaboration systems to perform daily operational activities within projects shows that Atlassian's tools support all three types of social interaction - communication, coordination and collaboration (Riemer, 2007) - and that their use is consistent in practice.

6.2 Integrated Systems and Meeting Systems

In the area of extending everyday systems - the use of integrated systems - and for meeting systems, all experts use Microsoft applications - primarily Microsoft Teams. Microsoft Teams covers the typical functions of these eCollaboration systems, such as document areas, group calendars, task lists, project and resource plans and project controlling, but also offers extensive synchronous and asynchronous communication options, such as text chat, audio and video communication. The tool also allows for the sharing of applications, polling for decision making and whiteboarding. This finding was confirmed in all the interviews and is illustrated by the following statements made by persons 4 and 10:

"And of course MS Teams. That is used more for direct communication, so there are usually channels or Teams channels, so you can maybe send direct chat messages. [But] MS Teams is more for direct chat and of course also very, very important for video calls" (Transcript_P4, pos. 37).

"Using Microsoft Teams [...] where the communication takes place, where you chat and where [...] project-specific documents are sent back and forth and where extras are edited etc." (Transcript_P10, pos. 31).

In the area of integrated systems and meeting systems, a consistent picture emerged across all expert interviews, suggesting that the project managers have independently chosen the same approach and that the Microsoft Teams tool also covers all the project managers' requirements in this area.

6.3 Change in Knowledge Transfer

The experts cited increased transparency as a change in knowledge transfer due to the increased use of eCollaboration systems. Project managers stated that the use of eCollaboration platforms meant that more people had access to project knowledge and that this was therefore better distributed and more visible throughout the organisation. The experts stated that "this knowledge transfer also works much faster and is also transparent because we all have access to it" (Transcript_P6, pos. 36) and "that the knowledge is accessible to everyone" (Transcript_P7, pos. 39). In addition, the experts stated that the increased transparency had improved the overall transfer of knowledge in project management. According to Person 11, "it has improved a lot simply because this knowledge is centralised and freely available about this project" (Pos. 69). This is confirmed by person 2, who states that knowledge transfer "has improved [...] in the sense that it is accessible from anywhere at any time, which is a key factor, that everyone can access it" (Pos. 51). Person 4 also stated that "it is then also more visible to other people what is happening in the project and that is of course a very, very clear plus for transparency and traceability" (Pos. 39). It can be concluded from this that the results of projects are distributed to more people within the project-based organisations and that the associated knowledge transfer of these results can take place more quickly and more comprehensively.

Another factor that has changed, according to the experts, is the perspective of those involved. They increasingly recognise the advantage of shared and available project knowledge and its impact on project success. This is clearly shown in the statement of person 2, who says "that [...] with these tools you can see the advantage that [...] it really is an advantage for everybody when you share information. Because at the end of the day the result is better" (Pos. 51). This allows the interpretation that the amount of codified knowledge has also increased. This interpretation is supported by the statement of Person 1, who says: "By using an intelligently set up Sharepoint, for example, or Confluence, i.e. an intranet system, I think you can gain a lot by getting people to document, because now it is a bit playful, it is comprehensible, it is not somehow rigidly prescribed in which structure the whole thing has to happen. In other words, I think the shyness has just gone a bit (--) to document things because it has become easy" (Pos. 34).

This is also confirmed by the statement of person 4, who stated that "it is more encouraged to write down topics" (Pos. 39). These statements show that the codified transfer of project knowledge has improved through the use of eCollaboration systems and is increasingly used by project managers.

Another aspect that can be mentioned is the geographical component. The codified knowledge is not only available to people in one location, but can be accessed regardless of time and place. This is clearly illustrated by the advantage of eCollaboration systems mentioned by person 6:

"And what you also have to add, of course, is [...] the extension through the possibilities of this online transfer of knowledge [...] to several locations. So we are no longer dependent on being at the same location, but in our case with locations in Germany this can be just as effective as the location in Vienna [...] as if I was sitting in the same office" (Pos. 36).

This finding is confirmed by Person 4, who stated

"Teams has greatly increased the direct exchange, of course, mainly because of the distance, on the other hand, you have to say that MS Teams is also responsible for the fact that the project teams are no longer on site, which is perhaps not always positive, because then of course you can also say, well, the project staff no longer have a direct exchange, but and where this door-to-door communication is perhaps sometimes very important in the project, or where I simply run over quickly, that has of course also had a very strong influence on Teams, because that is simply no longer possible" (Pos. 39).

From this statement it can be concluded that the increased use of eCollaboration systems not only brings benefits but is also viewed critically by project managers. This allows the assertion that the increased use of eCollaboration systems has led to an increase in codified knowledge transfer, but that personalised spontaneous transfer has decreased. This result of the analysis is supported by the additional doubts expressed by person 4: "And I don't know if this is perhaps good now, as I said, on the one hand it means that everyone can work from anywhere, but on the other hand of course this direct exchange of knowledge, this spontaneous exchange is perhaps not quite as strong anymore" (Pos. 39).

7. Discussion

The importance of collaboration in IT projects is emphasised both in the study by Hetemi, Pushkina and Zerjav (2022) and in an empirical study carried out. The results underline the central role of e-collaboration platforms for knowledge transfer in IT projects. This is in line with the findings of Castro and Moreira (2023) who analysed the importance of internal knowledge transfer in multinational companies. They found that vertical transfers dominate over horizontal transfers and that power dynamics play a significant role in conventional and reverse knowledge transfer. These findings suggest that organisational hierarchies and power structures should also be taken into account when implementing e-collaboration platforms in IT projects in order to ensure effective knowledge transfer. The findings highlight the importance of distinguishing between tacit and explicit knowledge in the context of knowledge transfer within IT projects. While tacit knowledge remains difficult to formalise due to its deeply personal and experiential nature (Nonaka & Takeuchi, 2012; Pawlowsky, 2019), eCollaboration platforms provide mechanisms for gradually codifying this knowledge and transforming it into explicit forms that are more accessible and transferable across teams (Lesjak & Natek, 2021). The effective use of these platforms therefore not only facilitates the sharing of explicit knowledge, but also helps to capture and disseminate tacit knowledge that might otherwise be lost (Bettoni et al., 2016). Hetemi, Pushkina and Zerjav (2022) focus on the crucial role of technological infrastructure such as multimedia, e-mail, intranet and databases for successful knowledge transfer. They emphasise that the correct use of this platform should be predefined by common procedures and standards. On the other hand, experts emphasise specific eCollaboration tools, such as Jira and Confluence, as efficient means of distributing tasks and collaboratively creating documents. This illustrates that different technologies are used in practice and highlights the need for specific tools. Both Hetemi, Pushkina and Zerjav (2022) and the surveyed experts agree that the increased use of eCollaboration systems leads to increased transparency of project knowledge. In this context, David et al. (2023) provide valuable insights into the design of e-collaboration systems. They emphasise the importance of a balanced approach that considers people, processes and technology. For the human aspect, they suggest strategies such as building platforms for participation, developing employee skills and fostering positive attitudes among decision makers. These findings could help to further improve the acceptance and effectiveness of e-collaboration tools in IT projects. The study by Hetemi, Pushkina and Zerjav (2022) emphasises that the use of technologies such as multimedia and email allows project results to be distributed on a wider scale. The expert interviews particularly emphasise that the use of eCollaboration platforms leads to improved accessibility and distribution of project knowledge. This observation is supported by the findings of David et al. (2023), who emphasise the importance of clear objectives, appropriate rules and the inclusion of user feedback in the design of e-collaboration processes. Integrating these aspects could help to further improve the transparency and effectiveness of knowledge transfer in IT projects. These tools are described as generally accepted and cover different needs of project managers. The emphasis on the correct use of the technological platform as a crucial success factor for knowledge transfer in projects, as presented by Kock et al. (2020), finds parallels in the expert interviews. It is stressed that the increased use of eCollaboration systems has led to changes in knowledge transfer. It is emphasised that technological platforms should not only be used efficiently, but also take into account the balance between transparency and the loss of spontaneous knowledge transfer. The study by Hanisch et al. (2009) confirms the support of IT tools as a decisive factor for the quality of knowledge management in projects. This is supported by the results of the expert interviews, which emphasise positive changes in knowledge transfer through the increased use of eCollaboration systems, in particular Confluence and Microsoft Teams. Castro and Moreira (2023) add that the effectiveness of knowledge transfer also depends on organisational factors. Their finding that power dynamics play a significant role underlines the need to consider organisational aspects when implementing e-collaboration systems. Meyer and Weßels (2020) emphasise that the project team of the future should be responsible for defining and managing the collaboration platform. This idea of team-oriented responsibility is reflected in the expert interviews, which talk about the standardised use and acceptance of eCollaboration tools. It is pointed out that the tools cover the different needs of project managers. David et al. (2023) complement this perspective by emphasising the importance of developing staff skills and fostering positive attitudes among decision makers. These aspects could be further explored in future research to develop strategies for more effective implementation and use of e-collaboration tools in IT projects. Gruber and Gessler (2022) emphasise the need for structural conditions within the technological infrastructure for successful knowledge transfer. This idea is supported by the experts' statements when they speak of increased transparency and better distribution of project knowledge through eCollaboration platforms. Bettoni et al. (2016) state that the architecture of eCollaboration systems should take into account the needs arising from the design of people and processes. This is in line with the results of the expert interviews, which emphasise that the increased use of eCollaboration systems has led to changes in knowledge transfer. It

is emphasised that in addition to the technological aspects, the balance between transparency and spontaneous knowledge transfer needs to be considered. David et al (2023) provide a valuable addition here by suggesting concrete strategies for designing eCollaboration systems that take into account people, processes and technology. Integrating these findings could help to develop eCollaboration systems that are better tailored to the needs of IT project teams. Research by Gilson et al. (2021) shows that teams using technology to communicate have difficulties in developing and maintaining trust. This contrasts with the results of the expert interviews, which emphasise that the increased use of eCollaboration systems leads to increased transparency and better distributed project knowledge.

8. Conclusion

The experts recommend the use of eCollaboration systems such as Jira and Confluence from Atlassian to make operational project management more efficient. Jira helps to distribute and complete tasks, while Confluence is a platform for collaboratively creating and storing documents and knowledge. All experts use Microsoft programmes, in particular Microsoft Teams, to extend their Everyday systems and meeting systems. Microsoft Teams offers all the features typical of eCollaboration systems, such as document areas, group calendars, task lists, project and resource plans and project controlling. In addition, the tool offers extensive synchronous and asynchronous communication options, such as text chat, audio and video communication, as well as programme sharing, polls for decision-making and whiteboards. All the expert interviews revealed a consistent picture in the area of eCollaboration systems. This suggests that project managers have independently chosen the same approach and that the tools in this area also cover all the needs of project managers. The experts found that the increased use of eCollaboration systems has led to changes in knowledge transfer. One of these changes is increased transparency, as more people have access to project knowledge through the use of eCollaboration platforms, and this knowledge is better distributed and more visible. This means that project results are distributed to more people and knowledge transfer is faster and more traceable. Stakeholders are increasingly recognising the benefits of shared knowledge and its impact on project success. This has probably led to an increase in codified knowledge. However, there are also some critical voices from project managers who believe that the use of eCollaboration systems has reduced the spontaneous transfer of knowledge. Another positive change is that project knowledge can be accessed regardless of time and place, rather than being available only in one place.

The research question about the changes in knowledge transfer due to the increased use of eCollaboration in IT projects can be summarised as an increase in transparency, an increase in codified knowledge and a decrease in personalised knowledge transfer. The use of eCollaboration platforms makes project knowledge more transparent and better distributed. More people have access to knowledge, which makes knowledge transfer faster and more traceable, and the benefits of shared knowledge are better understood. The availability of project knowledge independent of time and place is another advantage. However, there are also critics who fear that the use of these systems has reduced the spontaneous transfer of knowledge. Overall, the use of eCollaboration platforms seems to lead to more project knowledge being available in codified form. In conclusion, the integration of eCollaboration platforms in IT projects not only enhances the transfer of explicit knowledge, but also plays a crucial role in bridging the gap between tacit and explicit knowledge. By enabling the codification of previously unstructured, experience-based knowledge, these platforms help organisations achieve more comprehensive knowledge management practices, leading to more effective and sustainable project outcomes.

9. Limitations and Future Directions

The study has a number of limitations that should be addressed to ensure a more comprehensive and impartial approach. One limitation stems from the expert interviews, where the interviewer assumed the role of co-expert, introducing a strong technical bias. Choosing an alternative interaction configuration, such as having a neutral party conduct the interviews, could have fostered greater trust and facilitated the collection of confidential process knowledge, potentially providing a more comprehensive understanding of the subject matter. Another limitation lies in the active involvement of the researcher in the field, which influenced both the research design and its practical implementation. This involvement may have led to certain assumptions being implicitly accepted and not thoroughly tested in the research. To counteract this, future research could involve people with no prior knowledge of the field to conduct interviews, thus promoting a more objective and open exploration of the phenomena. From an economic perspective, time constraints hindered the implementation of theoretical sampling, resulting in incomplete theoretical saturation and limited insights from the interviews. To address this limitation, conducting additional interviews could increase the representativeness of the sample.

and deepen the findings. Methodologically, the chosen qualitative content analysis approach has paradigmatic aspects that may limit insights, particularly for proponents of the quantitative paradigm. The exploration of complementary research methods could be beneficial in order to gain a more holistic understanding of the issue. In addition, the study focuses predominantly on the IT project management perspective, which may limit the generalisability of the findings. To broaden the scope and applicability of the findings, future research could incorporate project management perspectives from different domains or consider input from different project roles.

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Using Personas in Human Capital Management: A Novel Concept Affected by Legal, Ethical and Technological Considerations

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Abstract: Nowadays, Human Capital Management (HCM) is seen as a service whose consumers are current and potential future employees. Some trends pushing the HCM operations to new approaches are the rise of individualization and flexible work as well as the changing expectations and values that new generations X and Y bring to the way people management is evolving. Companies need new tools and approaches along the lifecycle of their employee relations – from applicant pool construction and maintenance to recruitment and training. In SME companies the management is likely to address HCM needs on a very individual level. However, larger companies need to categorize their human capital into certain entities to mass-customize their HCM services. This paper explores the proponents and challenges in the usability of the Persona concept for HCM. Persona is a service design approach widely applied in marketing, and a few research papers have argued that personas may have a role in improved people-oriented HCM. Personas – as commonly used in the sphere of marketing – aim to create a limited set of archetypes that differ from each other. Whereas the traditional customer and employee clustering methods leaned heavily on demographics (age, experience, job title, etc.), the persona concept adds psychographic elements like values, and social engagement to form the basis of service development and delivery. The contents of personas are often a mix of real-life data-backed facts of people existing and some imaginary attributes. Different personas will likely request different services to feel fully motivated and supported. This paper studies the awareness of personas among HCM experts across industries and countries as well as the ideas for personas in HCM by marketing professional more used with the use of personas in their profession. The qualitative study based on twelve semi-structured individual interviews was conducted in November-December 2022. The results indicate that the HCM community knows about the persona concept and early adoptions or plans for implementation are ongoing. However, the current usage of personas is mainly focused on employer branding and recruitment (the most marketing-type of HCM actions), and only in a few cases does the usage cover the spectrum of internal HCM processes. The study also revealed some limitations for HCM that are not present in the marketing field. Demands for transparency, equality, data privacy, and personal integrity set challenges in clustering the workforce. The novel technical solutions such as Artificial Intelligence (AI) in persona creation offer efficiency and a deeper analytical foundation in persona development but also bring in new questions of transparency and ethicality of their use. The results indicate the further need for research on best practices of creating and using Personas in a way that ethically and legally serves the interests of both the company and the employee.

Keywords: Human capital, Persona, People clustering, Employer branding, HRM/HCM services, AI

1. Introduction

The umbrella term of HCM within an organization covers the human side of the organization, like skills, intelligence, and expertise (Hossain and Roy, 2016) that are needed for current and future business success. HCM is a key process in Knowledge Management (KM) since a company can be seen as a collection of legal and administrative contracts (Butler, 1988) that can only cover a part of what the company knows and is capable of. Well-planned and well-implemented HCM processes can significantly improve an organization's results, extend its goals, and increase its competitiveness (Karahoca, 2008). In recent times, HCM processes have had to adapt to megatrends such as globalization, which has increased the need for flexibility, the shift towards online environments, and the entrance of a new generation into the workforce. These factors contribute to the need to re-examine and re-evaluate traditional practices and approaches in Human Resource Management (HRM) and HCM (Rodriguez and Fernandez, 2017). Organizations are thus in need of new tools for developing and improving their HCM services to respond and adapt to the abovementioned transformations. HCM is pressured to be more individual and personalized in its approach to employees (Averbook, 2022). One proposed way is that companies can individualize their policies and services through employee clustering to serve employees better (Sitaram, 2021). Available employee clustering methods are numerous, but this research focuses on the concept of employee persona. The persona concept represents a clustering and visualization method originating from the sphere of user-centered service design. Alan Cooper created the persona concept in the 1990s as a goal-directed design tool (Cooper, 1998). According to Blomkvist (2002), the persona is a model initially used in

product design. This tool is used to represent archetypical users instead of average users. The persona captures users' features such as behaviors, needs, and motives, and combines them into a single individual representative.

Lately, the concept of persona has attracted a growing interest among HCM practitioners who aim to enhance their recruitment, employee well-being, and training processes. However, the implementation of personas has had minimal research-based backing. Via Google Scholar (in September 2024) the authors were able to identify within the last five years a mere 8 articles and book chapters that discussed the phenomena of employee personas. At the same timespan number of papers on personas in the marketing sphere was close to 150. Simultaneously, HRM practitioners and non-academic sources/websites of HRM service firms are numerous. For example, there is guidance on how to create impactful personas (Aihv, 2024) as well as instructions on how to use personas in the recruitment function of HRM (Personatalent, n.d.) The underlying reasons for usage vs. non-usage of personas in HCM and the role and impact of technology on persona creation and use form a research gap that this study set to fill. The papers that link the persona concept to KM are rare (4 papers in the last 15 years) and would need an update due to changing regulations affecting HRM and the new technologies used in persona creation and usage.

To fill the identified research gap research questions set for this study are:

RQ1: What is the current level of awareness and actual usage of the persona concept among HCM professionals?

RQ2: Which issues support and which ones challenge (set limitations to) the usage of personas in HCM?

RQ3: In what HRM/HCM processes personas can be used and what is the reasoning for their usage?

RQ4: What is the role (supporting or restricting) of technology in the creation and usage of personas?

By answering the research questions the authors aimed to test the perceived viability of the persona concept amongst a heterogeneous sample of HRM/Marketing professionals. Later on, a study with the same research questions could then be replicated with homogeneous samples to get more industry-specificity.

This research paper consists of five components. Firstly, the authors provide an overview and examination of the existing research on the key concepts mentioned in the literature review. Secondly, the authors delve into employee clustering, its rationale, and the persona concept. In section three, the authors explain the research methodology they used, and in section four, they present the empirical findings. The fifth section highlights the main conclusions and discussion.

2. Literature Review

2.1 Employee Clustering

Multiple trends affecting HCM in organizations challenge companies to reconfigure their operations in HCM. Such drivers of change include changing demographics, generational differences, digitalization, flexibility, individualism, and a skills shortage (Farndale *et al.*, 2022).

Flexible Work Arrangements (FWA) have been a popular topic both in professional and academic discussions related to human capital management for most of the 2000s (Allen *et al.*, 2013). They help employees balance their work with non-work responsibilities, by allowing flexibility in terms of when and where the work is done (Rau and Hyland, 2002). Since Generation Z entered the job market and the COVID-19 pandemic led to a shift to remote working, FWA has become a critical element in finding, attracting, motivating, and retaining current and future talent (Hill *et al.*, 2008).

There has been a recent trend towards FWA, which has coincided with a rise in individualism in both the workplace and society. Linthorst and DeWaal (2020) note that in response to this trend, organizations need to focus on providing individual attention to employees and clients, as this has become a key performance indicator that requires close monitoring. To meet these demands, corporate training and mentoring approaches have become more personalized to match employees' career ambitions (Linthorst and DeWaal, 2020). This individualistic view has also impacted reward systems, performance evaluations, and talent management practices. However, instead of implementing fully individual solutions, companies are modularizing and standardizing some components to gain efficiency in their processes (Skjevdal and Idsoe, 2005).

The difference between Generation Z (Gen Z) and Y has been a topic of active research in recent years due to the entry of Gen Z into the workforce. This has brought change and challenges to the labor market. Although different sources define generation timeframes differently, it is often considered that people born in 1980–1994

belong to Generation Y and people born after 1995 belong to Generation Z. According to Pinto *et al.* (2015), the increasing number of elderly people and the entry of a new generation into the workforce are significantly affecting human resource and HCM practices. As each generation has distinct needs, characteristics, motivations, and expectations, a tailored approach is required for effectively managing them. The research conducted by Urlick, Hollensbe, and Fairhurst in 2017 states that Generation Z tends to use technology more, which can create difficulties within multi-generational teams. Novotna (2019) further explains that Generation Z is the first generation to be fully interconnected, as they have been utilizing the internet and digital tools their entire lives.

Generation Z exhibits a strong inclination towards continuous learning, training on-site, remote work, adaptability, and a well-defined work-life balance. They are seeking transformations in their job responsibilities, tasks, and educational pursuits. In contrast to the previous generation, Gen Z's career trajectory is not straightforward, as they tend to switch employers frequently and may even alter their career paths entirely (Klein, 2020). Employers nowadays need to adjust their operations to meet the demands of a new generation, while also creating processes that suit both Gen Z and Gen Y. This requires more personalized approaches. According to Sitaram's research (2021), clustering techniques can help organizations develop such tailored strategies.

Clustering is a statistical method of placing units under study (in this case: people) into categories based on a set of shared variables (Cornish, 2007). For example, customer clustering (more often referred to as segmentation) has long been widely deployed in the marketing field to improve customer experiences, customer satisfaction, and customer closeness and increase customer loyalty over time. The clustering approach started with demographic variables of age, level of income, geographical location, etc. The marketing discipline has lately proceeded to cover sociographic and psychographic attributes such as the values, needs, and wants of the individuals belonging to clusters, thus making it possible to approach the different clusters with mass-tailored differentiated offerings. The clustering approach can be and has been applied also in HRM development since employees are nowadays seen as active customers of services offered by the HCM function in organizations (Sitaram, 2021). Organizations can use clustering algorithms to group employees based on shared characteristics. This enables them to make informed decisions regarding recruitment and retention, training, employee engagement, workforce diversity, and performance management. Several clustering algorithms can be used, such as K-means, Fuzzy c-means, or self-organizing maps (SOMs). These algorithms consume large amounts of data to divide individuals into smaller groups based on shared characteristics. According to Fan (2021), the K-means clustering algorithm can be used, for example, to improve the employee performance evaluation process. Fernandes *et al.* (2017) found through a case study that employees can be grouped into clusters using multivariate clustering analysis.

However, some forces and trends are counteractive to the individualizations and clustering of human capital. These forces can be divided into ethical, (data) privacy, and legal matters. Generally, the concept of ethics can be understood by, for instance, how Cornock and Johns (1995) define its contents: acting with fairness, decisions on what is right and wrong, practices, and rules that stress responsible conduct between individuals and stakeholder groups. Ekuma and Akobo (2015) claim that "the ethics of HRM while sharing many features with general organizational ethics, must at least be relatively unique in several respects". In the sphere of HCM, various ethical dilemmas are present. HCM endeavors of clustering can cause misrepresentation and collusion, data misuse, manipulation and coercion, value and goal conflict, and technical ineptness. (Ekuma and Smith, 2012; Wooten, 2001). On the legal front, the frameworks and risks that set limits to the usability of some principles and techniques of modern employee clustering approaches, such as employee personas, are an inadvertent violation of Title VII of the U.S. Civil Rights Act, the Equal Employment Opportunities Act, the Americans for Disabilities Act (ADA), European Union regulations such as the Employment Equality Framework Directive (Hamilton and Sodeman, 2020). The European Union's General Data Protection Rights directive (EU GDPR) and the national legislation following the spirit and content of the directive also impact how deeply and widely organizations can use novel data-based approaches and techniques. In addition, there are non-legal guidelines and standards of sound and fair HCM operations, such as ISO Standard 30408:2016 on Human Governance (International Standardization Organization, 2016), as well as the more commercial approaches of Investors in People-analysis and Great Place to Work At-framework. These frameworks stress the engagement of all members of the working community, fairness, and trust (between the employees as well as between employees and management) that the novel approaches may hurt, especially in case if not managed and communicated correctly. In summary, ethical, legal, and privacy concerns require companies to treat all members of their workforce with fairness and equity. This also applies to HCM actions, where employees have

the right to know what data is being collected about their behavior and performance, who has access to this data, how it is being used, and for what purpose. Additionally, employees have the right to request that any personal data not necessary to their employer be permanently deleted. These demands address a value liminal to modern HCM fairness: transparency. It is important to understand that HCM equity and equality are not the same things. According to Rodriguez and Morrison (2019), equity refers to implementing policies and practices that enable opportunities for success for everyone. For equality, treating every individual the same way despite the individual or group-based specific needs would suffice. To be equitable, organizations need to treat individuals according to their specific needs, and to offer multiple opportunities for successful work and career (Rodriguez and Morrison, 2019).

2.2 The Persona Concept

Personas are a concept deriving from marketing discipline but have been increasingly used in generic design thinking processes, resulting in new ways of operating from educational systems (Siricharoen, 2021) to cybersecurity systems (Almahri, Bell, and Arzoky, 2019) and sustainable development (Carey *et al.*, 2019).

According to Haak (2017), the concept of a user persona, traditionally used in marketing, has also been actively spreading to HCM. Employee personas are designed to capture the essential characteristics of groups of employees with common characteristics. Personas are then depicted as fictional figures, which contain characteristics from demographics to psychographics as well as skills and competencies. For some companies, the goal of inclusion of personas in their HCM design may be developing a new talent acquisition initiative and, for some – strengthening the employer brand (McLeod, 2022).

Employee persona creation methodology depends on the end goals and available resources. Some methods of persona creation include clear research-type activities conducting surveys, interviews, or holding focus group interviews. Triangulation in persona-creation by combining data collection methods, for example holding focus groups/interviews supplemented by a survey, is likely to lead to better applicability of the employee personas (Brennan, 2017). According to Ditton, Swinbourne, and Myers (2022), there is an opportunity and tendency towards data- and system-driven persona development. Manual persona development can be time and resource-demanding and it can be biased by the personal views and expectations of the people responsible for persona creation (*ibid.*). Typically, in a human-machine interaction, the semi-automated persona approach is based on manual prompts, guidance, and data filters entered by a human. With the intrusion of increased data analytics in HCM, the persona concept can be fully automated using algorithms and big data analytics, if the suitable data set is technically and ethically available. Jansen, Jung, and Salminen (2021) claim that Automated Persona Generation (APG) allows combining big data and persona concepts, creating a multi-layered cast of personas that can enrich the result compared to traditional data collection such as surveys or interviews. APG systems have the potential to identify underlying behavioral patterns of employees and associate them with respective demo- and psychographic groups. Such solutions open new opportunities for the usage of personas in HCM decision-making.

According to McLeod (2022), the persona method is a useful tool for talent acquisition and employer branding. With persona-based thinking, organizations can better attract suitable candidates to apply for open vacancies. The selection process of new employees is improved by identifying attractive talents' key drivers, motivations, needs, and expectations of the workplace. Zhao *et al.* (2018) state that employee personas can be used in various HCM sub-processes such as recruitment, training, performance appraisal, and employee engagement. According to Brennan (2017), organizations can gain multiple benefits from the deployment of the persona approach. These potential benefits include a wider and deeper understanding of the current human resource capital; an understanding of employee experiences and expectations in various HRM processes like onboarding, and performance reviews leading to effective and impactful employee management; enhanced communication with stakeholders; identification of and current and upcoming HCM challenges across the organizational layers; more attractive employer image for potential future candidates to open vacancies and building an enhanced employer brand across HRM functions and to; reduce personal biases in recruitment (*ibid.*).

2.3 Summary of the Knowledge Base

Based on the existing literature, it is evident that employee clustering is establishing its role in HCM due to the changing work environments, evolving FWA, generational shifts, digitalization, and globalization. FWA and individualized approach in HR play a bigger role than ever, especially in attracting and retaining young talents. With the new generation entering the workforce, the need for a more personalized approach and flexibility is evident and supported by scientific literature. The persona concept that originated in marketing is getting

actively adopted in HCM and shows potential to answer to the emerging needs. Using the persona concept in HCM can positively affect and develop several HCM practices such as talent management, employer branding, and talent retention.

The literature outlines that the persona approach has several ethical and legal limitations. For example, the General Data Protection Regulation (GDPR) can severely restrict the persona method usage and lead to the model being too generic and inconclusive. When using the persona concept, professionals have to carefully consider the end goals and desired outcomes to collect the right data. Transparency and privacy have to be taken into account.

3. Methodology

This study is exploratory by nature, indicating that its primary purpose is to explore the research questions and identify the current situation of the topic, which is an understudied and thus only partially known phenomenon. Exploratory research does not imply any final solutions to the problem (Saunders *et al.*, 2012). The primary data was collected in the form of twelve semi-structured individual interviews among marketing professionals (seasoned users of the persona concept) and HCM professionals (the early or future users of the persona concept in the HR sphere). Semi-structured interviews are often used in qualitative research and allow discussion to evolve during the interview while following the structure (Magaldi and Berler, 2020).

Candidates for interviews were chosen from the authors' professional network via LinkedIn invitations. Thus, the sampling method was a combination of purposeful and convenience sampling. The invitations were sent to the network and individuals who accepted the invitation were scheduled for the interview. Each potential interviewee contacted accepted to join, but 2 out of 12 were not able to find time for the interview in the time window specified for the data collection, so they provided their answers to interview questions in writing via e-mail. To increase validity, the authors selected candidates from different fields of industry, different-sized companies, and different positions. Interviewing experts from the marketing field was important as the Persona concept was created in the marketing industry for marketing purposes, and interviewing HRM experts was important to see if and how it is applied there (description) and how the marketing people see that the concept could be used in HCM (ideation). Interviewing individuals from both startups and big corporations was important for authors to gain valuable insights into how the persona concept is approached in different business environments, let alone cultures. In addition, the work experience and the age of candidates varied a lot. Table 1 below gives an overview of the informants based on their field of expertise, the size of their company in terms of personnel number, and their current country of residence. However, in numerous cases, the companies had international scope of action, so no further analysis was conducted using the country of residence as a variable. The interview outline was designed and sent to all interviewees in advance. The interviews were conducted as face-to-face or online interviews lasting from 25 to 45 minutes. The authors recorded interviews with the interviewees' consent and transcribed them verbatim. The data was then subjected to thematic content analysis looking for patterns arising from the dataset as well as areas with a lot of discrepancies of the views that are typical when new approaches are discussed. The interview structure was created based on the findings of the literature review, and revised after the first two interviews as the researchers gained new insights into issues that matter on the practitioner level.

Analysis of the data gathered happened via theme-based pattern recognition. Under the concept of the Themes, the researchers created a vocabulary. For example, under the theme of "DEI= Diversity, Equality, and Inclusion", keywords like "heterogeneity", "minorities", "equity", and "discrimination" were used to identify the themes. The themes of relevance were then recognized from the transcriptions of the interviews based on the vocabulary used.

Table 1: Background of informants

Field of expertise	The size of the company in terms of the personnel number	Country
HRM	500+	Canada
HRM	500+	Finland
HRM	20-49	Finland
Marketing	100-250	Netherlands
Marketing	11-50	Finland

Field of expertise	The size of the company in terms of the personnel number	Country
HRM	500+	Finland
HRM	251-500	Germany
Marketing	500+	Finland
HRM	500+	Finland
Marketing	500+	Finland
HRM	500+	Finland
HRM	500+	Finland

4. Results

The results of the interviews confirmed that all participants are aware of the persona concept and the majority are applying it to their day-to-day or strategic operations. The results confirm the existence of the increasing need for a more individualized approach in organizations and their HCM. More flexibility is expected from employers as the workforce is looking for more personalized solutions that would fit their values and goals more precisely. Many informants outlined the importance of sensitivity to cultural differences even in one country reflecting the differences in business cultures and job role differences impacting the prevalence of the effect of this trend. Results indicate a need for relevant actions aiming at retainment, organizational culture development, and flexible work arrangements. Most informants in the HCM field confirmed that flexibility and individual arrangements are what matters to their employees. More and more employees choose jobs that can offer flexibility, the possibility of remote work, work-life balance, and other benefits. Employees more often appreciate the culture of individual arrangements and expect to be given the freedom to impact their locations and working schedules.

Some informants noted that younger employees (Gen Z) have different career and work expectations than their older colleagues. While the research did not focus on the exploration of the generational differences in expectations, numerous informants touched upon this topic pointing out that Gen Z's way of work and occupational expectations differ drastically from the previous generations. Informants highlight that when creating personas in multigenerational companies, it is important to account for Gen Z differences and expectations.

As was presented in the literature review, the user persona concept can be perceived as a marketing tool reflecting its origin in the marketing and user experience fields. Based on the data from the marketing professionals in the sample of the study, they have been actively using the user persona method to segment and identify their potential customers and their needs when designing new products and/or services. One informant noted that the user persona concept allows them to customize the communication approach and thus expand their customer base and better retain the existing accounts. Results indicate that before informants embark on the journey of using the persona concept it is necessary to understand the goal and objectives of the endeavour. Some HCM experts pointed out that their current roles are interconnected with the marketing function of the company, for example, when recruiting talent. Below, Table 2 presents some of the quotes from informants and themes that emerged from the data.

As depicted in Table 2 below the themes that emerged were: clustering as a wider concept = usage of persona-type clustering without calling the outcome personas (using both demographic and psychographic factors when bundling the target audiences); the power shift in people management (emphasized need for a more personal and value-containing approach to employee relations, especially for Generation Z); current usage of personas is service design (in recruitment and marketing/sales efforts).

Table 2: Interview excerpts on awareness and use of Personas

The Excerpts	Theme	Profile of interviewee (HCM/Marketing)
"We have in HRM some "people baskets" based on roles and context (which operations/business processes person resides). Personas were brought in for succession planning and talent reviews."	Clustering as a wider concept	HCM

The Excerpts	Theme	Profile of interviewee (HCM/Marketing)
"I have not used the Persona as such, but Role/Type (or identity)/Potential clustering => impacted in career path design + used when planning recruitment"	Clustering as a wider concept	HCM
"Even before personas, we categorized our teams to get a better understanding. We used mapping and used categories."	Clustering as a wider concept	HCM
"We use the expression of "ideal candidate" in recruitment, the essence is the same but no trendy name"	Clustering as a wider concept	HCM
"Our product managers have used personas in designing new products and features that better fulfil customer needs"	Clustering as a wider concept	HCM
"Generation Z is completely different from others, so the persona thinking can be beneficial."	Power shift in people management	Marketing
"There's a big employee power now, and they need more autonomy, they want more flexibility, but at the same time, we see the rising need for support, for counselling, and we want to do things in an equal and ethical way."	Power shift in people management	HCM
"Companies are still (in recruitment) operating with the old mindset where they think they make a choice and look for skills. Recruiters today make the choice and are looking for a company culture they empathize with. I was headhunted to my present job and was told I would "make a fit".	Power shift in people management	Marketing
"Individualization is rising, but equity should be the goal. Equality means offering everyone the same. Equity means treating every similar case the same way. And cases do differ."	Power shift in people management	HCM
"When working in industry, we created personas also for our competition. Now in education, we have used student personas when designing educational offerings. Personas can be product and/or customer and/or company personas", for example, what is the persona of a company where a "student persona" is aiming to join => career crafting."	Personas for service design	Marketing
In my previous job the managers placed their people into baskets based on Cultural Fit/Skill Fit/Growth fit", used in salary management and growth planning"	Clustering as a wider concept	Marketing
"We use this concept although we call it employee types. It helps to identify employees' needs and expectations"	Clustering as a wider concept	HCM
"We use in B-to-B LinkedIn marketing – personas are manager/decision-makers whose interests you can use as a filter in your targeting, for example, we do a selection of 100 companies, segmented first by industry but then by personas"	Personas for service design	Marketing

Results propose that the persona concept has multiple advantages and areas of applicability within HCM. It allows HRM professionals to relate to and communicate with groups of employees in a more personal and emotional/value-based way, creating personalized approaches and supporting more individual career paths. The concept is relatively simple to grasp, easy to use, and scalable. Personas are also applicable in the analysis of potential recruits and can assist in recruitment decision-making. However, the results also underline several disadvantages of the concept. The concept might be misleading if oversimplified or too generic, meaning, not able to draw interest towards differences in personas created. Over time, the use of just a few and constant personas can lead to more homogenous and one-minded personnel, thus ignoring the opportunities to change and renew. Persona creation and maintenance may require data analytics and AI skills, as well as it can be expensive and time-consuming. Another disadvantage is that it creates an unwanted possibility of comparing employees with each other, which can lead to missing out on their unique strengths and abilities. Also, it might be too restrictive and limited due to GDPR. When Personas are created systematically, especially in a large organization, they should be rule-based/algorithm-based and work based on data of existing successful employees (to train others to reach the same potential or to recruit new ones who would be likely to succeed). However, based on EU GDPR organizations have limitations on how to store and use such information about their employees. According to the regulation, sensitive data is a set of special categories that should be handled

with extra security. These special categories are ethnic or racial origin; political opinions; cultural or social identity; philosophical or religious beliefs. (GDPR, 2023). On the other hand, leaving these debatable “soft issues” out of the personas would reduce the personas back to skill/competence listings, and thus offer no added value to earlier HCM practices.

To sum up, employee personas can be used as a supportive tool in decision-making but cannot be the only source of information. As depicted in Table 3, themes that emerged when discussing the factors that support and, on the contrary, hinder the usage of personas were: the need for trust and transparency (+ legal compliance) in HCM operations (if people working in an organization do not know why and how the personas are created, there may occur resistance); the policies on DEI (diversity, equality, and inclusion) have made companies very sensitive to processes and frameworks that reinforce biases and create sensations of exclusion; Employer branding that is not touching the current workforce (in another way that that the personas may be created for the archetypes of the existing employee cadre) but is used to communicate company’s values and *modus operandi* to customers and future employees is a process that seems to welcome persona approach, and; is welcomed if it adds clarity and simplicity in seeing the target audience clustered under personas. If it adds a new layer to the existing clustering systems, the persona approach is not welcomed.

Table 3: Interview excerpts on the themes of Persona applicability/non-applicability to HCM

Excerpt	Theme	Profile of interviewee (HCM/Marketing)
“There are tight frames in HRM that cannot be individualized (data and privacy principles, code of conduct) but also flexible frames (training, mentoring) where customizing is possible”	Trust and Transparency	HCM
“If I were to propose this at my SME company, I feel like it would get rejected because people don’t want to be put in a box in a small company”	Trust and Transparency	Marketing
“The job matrix that we use must be backed up by data, and qualitative analysis is crucial for the explanation and to avoid employee frustration.”	Trust and Transparency	HCM
“Persona benefits would be the availability of a tool for HR to be able to relate to groups of employees on a more personal/emotional level and create more personalized development paths and career opportunities. But there are potential disadvantages of a more homogenous and one-minded workforce if hiring practices start to follow only the developed personas and try to make employees fit into certain “boxes”	DEI = Diversity, Equality, Inclusion	Marketing
“We are strong on DEI policies (race, gender, LGBT, disabilities), so we need to think about what it means to present ourselves, personas can make people feel excluded if they do not match the persona. Also, psychographic issues like interests can be more typical, for example, to a certain age or gender, so the persona may be restrictive”	DEI = Diversity, Equality, Inclusion	Marketing
“If personas were used by the HRM, as a worker I would ask why they are created and how they are going to be used. It may affect the psychological safety within the personnel.”	DEI= Diversity, Equality, Inclusion	Marketing
“When we made 4 different personas in our project, we decided to make them gender-free”	DEI= Diversity, Equality, Inclusion	Marketing
“Trying to make employees fit into certain “boxes” is a big disadvantage for the persona concept”	DEI= Diversity, Equality, Inclusion	Marketing
We have a new person in HRM responsible for employee experience and employment marketing for I am doing applicant pool creation and recruitment activities using personas.	Employer Branding	HCM
“Personas would work in recruitment: Marketing is about finding new accounts, and HRM is about keeping people and giving them equal access to HRM services. So, recruitment is more marketing-type action as it is about getting new people in.”	Employer Branding	Marketing
“Personas are good if they add clarity and give practical support to our leaders and supervisors vs. sounding like a new HR theory and/or adding yet another layer = complexity”	Complexity vs. Simplicity of HCM approaches	HCM

Excerpt	Theme	Profile of interviewee (HCM/Marketing)
“Personas are a limited approach, not very accurate and there is the danger in relying too much on potentially inaccurate models. We use already segmentation based on behavioural characteristics, the benefits customers are seeking from product consumption as well as psycho- and demographics”	Complexity vs. Simplicity of HCM approaches	Marketing

The talent acquisition activity can be perceived as a marketing process within the field of HCM since it requires effective and suitable marketing efforts when working on targeting, message creation, and choice of media when advertising the position. Results also show that certain methods of current employee segmentation are actively used. The variables used in segmentation are employee types, roles, needs, skills, etc. Informants pointed out that employee personas allow the company to identify what matters (values, preferences) to their employees. For personas to work and add value to the business, they must be concrete and simple enough to be understood and emphasized by employees and management. Simultaneously, they should not be oversimplified or too generic, so that they add value.

In the era of digitalization, it is natural that also HCM function in companies is also laden with information systems, HRIS (Human Resource Information Systems), These systems, when implemented fully, require all new elements of HRM to be includable (or linkable) to the existing HRIS solutions. Additionally, novel technologies such as Artificial Intelligence (AI) may raise issues of ethics and accountability. From the interviews, certain key themes on the relationships between Persona creation and usage with/without technology arose, as Table 4 highlights.

The key themes were: using technologies together with human judgment/finishing in persona creation, the need to integrate personas to existing HCIS (Human Capital Information Systems), and, increasingly, the potential to use AI in persona creation.

Table 4: Interview excerpts and themes on the role of technology in Persona usage

Excerpt	Theme	Profile of interviewee (HCM/Marketing)
“In this case, technology is better (at making personas) than a person because we are all biased. Perhaps 80 % based on tech and the last 20 % based on human consideration”.	Human-technology interaction	Marketing
“Tech could do it; we try always use tech from CRM (HubSpot) => clustering based on the whole CRM dataset”	Personas integrated into other systems	Marketing
“The job matrix that we use must be backed up by data, and qualitative analysis is crucial for the explanation and to avoid employee frustration.”	Human-technology interaction	HCM
“HRM Personas in the company is a new issue, used for redesigning HR processes, simultaneously HRIS Success Factor system taken in use, personas embedded there”	Personas integrated into other systems	HCM
The job matrix (based on qualifications and skills) is used in the company and shared within the company. Transparent and visible to all. HR can guide how to move in the matrix and how to go to the next level etc. The matrix must be backed up by data, and qualitative analysis is crucial for the explanation and to avoid employee frustration.”	Human-Technology interaction	HCM
“Data used to build employee personas can be sourced, for example, from the company’s helpdesk inquiries (in quantity and quality). If no data is used in the creation of personas, they are harder to defend. But there is a limitation: Data is about history, whereas human capital development should be future-oriented.	Personas integrated into other systems	Marketing
“We used AI in the creation of personas and then reviewed them by 10+ expert interviews => data matched with real-life experience	AI as a tool for persona creation + Human-technology interaction	Marketing

Excerpt	Theme	Profile of interviewee (HCM/Marketing)
“Should be data-supported, for example, usage of product patterns together with sales and CRM people’s gut feelings. When you have identified the pattern of behaviour with the customer, you can foresee what is coming up looking at the same personas with whom you have a longer connection”	Human-technology interaction	Marketing
“The persona concept can be used more in the volume approach, and with the use of AI can be used to select the applicable applicants but then the individualized approach is better to reach the final decisions.”	AI as a tool for persona creation + Human-technology interaction	HCM
“HR systems contain data on role descriptions and evaluations but often supervisors containing soft knowledge are used to place people into categories”	Human-technology interaction + Personas integrated into other systems	HCM

5. Conclusions and Discussion

This exploratory research on novel and understudied phenomena served largely as an introduction to the inclusion of the persona concept in the HCM field of research. It focused on the exploration of the awareness of the personas among HRM/HCM experts as well as their usability (or non-usability) in different HRM/HCM processes to reach research objectives, a secondary data-based knowledge database was created based on the existing research. Previous research has identified the need for a more personalized approach and recognized the use of the persona concept for employee clustering but research papers on the topic were just a few. The empirical part of the research that yielded primary data and the conclusion based on it are presented in the following sections.

5.1 Persona Concept Awareness Among HCM Professionals

The research indicated that among HRM/ HCM professionals there is more knowledge than actual usage of the persona concept. The sub-processes of HCM where the persona concept is deployed include employer branding, recruitment, HR initiatives, and training. While the use of personas is mainly perceived as human-driven, the actual clustering cannot be done without the help of technology, including artificial intelligence. Some organizations use software to cluster the data on their people and the potential future recruits. Based on the results, the persona concept has been used for a while in marketing, and now HR is catching up with the concept. Also, results demonstrate a need for a more individualized approach and flexibility as an overarching factor affecting HCM process design and implementation.

5.2 HCM Areas Potentially Impacted by Persona Concept

The sub-processes of HCM where the persona concept is currently used and where the usage potential was identified were processes that target people outside the company, such as recruitment, talent pool creation, and employer branding, and “soft” HCM processes such as development and training (vs. salary management) where bundling of people is needed for HCM efficiency and mutual benefit between the workers.

5.3 Ethical and Legal Issues in Individualized/Clustered HCM

The promised better targeting of HCM efforts via clustering and individualization can also have some downsides. As the authors discussed in the earlier sections, clustering means limiting the number of HCM service options offered and obtained. This means that different individuals sharing the same job descriptions and organizational positions can be positioned in different clusters. This may spark questions on equality. In organizations, a sense of justice acts as the glue that holds the organization together and maintains teamwork (Cropanzano and Kacmar, 1995). If employees or employee groups feel they are underrepresented in the clusters, the social glue of the organization may suffer. In our empirical sample, in one case, the high status of DEI (Diversity, Equality, and Inclusion) policies of a large national banking corporation caused reservations for the use of personas – either the personas are so vague and short of detail that they do not carry much meaning or then they are detail-laden and thus exclusive for some. The personas can transmit unwanted feelings of gender, age, or race preferences of the management.

Especially in Europe, the GDPR sets high demands for data usage transparency. Especially the use of sensitive personal data is heavily regulated. An individual has a right to know what data of him/her as an employee are stored and where and by whom that data is or will be used. The individual has also the right to deny the usage of that data if not necessary for the other party to perform “normal” transactions. As an example, the employer

needs to know the social security number and bank account details for text and salary purposes. Does the same apply to the psychographics of the employee(s) used to create personas?

5.4 Considerations on Technical Advances for Persona Creation

Increasingly, persona creation is seen as an activity where AI can play a role. In theory, analytical AI can use rich (in mass and format) data to do the clustering. Based on the analysis, generative AI can create personas in text and images. Furthermore, in recruiting AI-powered systems can then search for people matching the persona(s) within the organization or outside of it to create a talent pool and to do headhunting. The challenge may be that the owner of the HCM process does not know the logic or the algorithm of the clustering and persona creation and is thus dependent on the proposal by a “black box”. Still, HCM is responsible for the outcome of the AI-powered analysis and creation, without being in full control. Also, the generic LLMs (Large Language Models) like ChatGPT or Google Gemini lack the specificity of HCM as a function with its unique characters. The foundation models targeted to support HCM specifically are still to be seen and tested for validity. Also, the overarching issue in all LLM or foundation model development is very crucial: What has been the training data of the model, is the data unbiased and fairly collected?

5.5 Theoretical Contributions

In managing their human capital, companies are struggling to find and keep employees, whose knowledge possessions accumulate to create the knowledge pool of the organization. Increasingly, tendencies such as company culture, employee well-being, and employee commitment have led companies to utilize “soft” variables to depict the types of employees they want to find and develop. These psychographic factors include issues like motivational sources, learning styles, knowledge dissemination skills, etc. By using personas companies can better manage the diverse workforce they employ and/or are searching for. Some examples of persona usage in KM are from a stream called user-centric knowledge management, for example, Project management case in which personas were developed to align project offerings with the needs of manufacturing SMEs, facilitating better communication and knowledge sharing among stakeholders (Chmielarz, 2022), Educational planning case (Huynh *et al.*, 2021) where personas were created to assist in the user-centric design of educational offering, and, Knowledge mapping case where the usage of personas aimed to tap into tacit knowledge within the organization (Mahamuni *et al.*, 2018). The new angles that this paper offers are linked to the constraints for persona making and usage: the legal and ethical considerations posed to persona creation and usage as well as the increasing role of AI and other emerging technologies in persona creation and maintenance.

5.6 Research Limitations and Ideas for Further Research

The research has certain limitations. Most interviews were conducted among companies with more than five hundred employees, and thus there was a separate job function for talent acquisition and/or talent management. In small firms, the resources may not be enough to take a novel approach. Also, in an SME company, the management may know and be able to act on a truly individual basis as they know each employee “by name and nature”, so there is no need to segment the existing personnel. However, even for them the employee branding and recruitment might be supported by the persona concept.

The validity of the results was affected by a small number of interviews, which was a purposeful choice due to the choice of exploratory approach and qualitative, interview-based method of primary data collection. Despite the limitations, the study provides the foundation for further research on this topic.

Further research is necessary to fully comprehend the real consequences of the concept and its efficient application in organizations. A larger dataset can enhance the accuracy of the outcomes and help authors delve deeper into the practical aspects of the persona concept. This can facilitate the identification of the process of persona development in HCM functions. Further work on the issue area could focus on the process development of personas and assessment of the pragmatic outcomes of such a process. Also, the impacts of personas on needs in ethics, trust, and transparency would make an important approach to study.

NOTE: This research paper is an extended version of a conference paper in ECKM (European Conference on Knowledge Management) 2023. The link to the original paper (Mikhlin and Saukkonen, 2023) is presented in the references.

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Factors Influencing Knowledge-Sharing Intention in Virtual Waste Management Community: A Systematic Review and AHP Analysis

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Abstract: Most people are unaware of the dangers of waste, so they do not reduce waste. Knowledge and awareness of a system are essential perspectives for realizing socio-economic desires. Virtual communities are a means to share knowledge about proper waste management. Based on previous literature searches, research has yet to identify the factors influencing knowledge-sharing intentions (KSI) in virtual communities focusing on waste management issues. This literature review examines previous research regarding the factors influencing KSI using the Kitchenham method in virtual communities focusing on waste management. This literature review also examines previous research in the context of the higher education community and professional organizations. This literature review resulted in the extraction of data from previous research, including the type of knowledge disseminated, methods of sharing knowledge, technology used to share knowledge, and factors that influence KSI. Thirty-nine factors influence KSI, mapped into five domains: organizational culture, information technology (IT) infrastructure, individuals, perceived risks, and perceived benefits. These factors were then weighted using the Analytical Hierarchy Process (AHP) method to obtain 15 factors based on the characteristics of the community that shared knowledge about waste management. Based on the AHP weighting, it is known that the IT domain infrastructure is the domain that has the highest weight. This research contributes to the academic field, namely the availability of a framework regarding the factors influencing the intention to share knowledge in virtual communities focusing on waste management in Indonesia. This research also provides a practical contribution, namely a framework that can be used by environmental practitioners to develop policies to support environmental sustainability initiatives.

Keywords: Knowledge sharing, Knowledge sharing intention, Virtual community, Virtual waste management, Waste management knowledge

1. Introduction

The waste problem is increasing as the number of human activities increases. The World Bank Organization released data showing that every year, 2.01 billion tons of solid municipal waste are produced, and only 67% of the total waste can be managed safely for the environment (World Bank Organization, 2018). Meanwhile, the issue of waste management that is developing in all countries is related to the sustainable development goals (SDGs) initiated by the United Nations, including clean water and sanitation (goal 6), sustainable cities and communities (goal 11), responsible consumption and production (goal 12), climate action (goal 13), and life below water (goal 14) (United Nations, 2023; 2024). Research conducted by (Mir, Cheema and Singh, 2021) states that most people are unaware of the dangers of waste, so they do not reduce waste. Awareness is an individual's consciousness of new trends through new systems or technologies. At the same time, knowledge is a thorough understanding of something, and the relationship between the two cannot be separated (Alordiah et al., 2023). Knowledge and awareness of a system are essential perspectives for realizing sustainability in socio-economic aspects (Islam et al., 2021).

Previous research has identified a relationship between knowledge management and sustainability. Knowledge management plays a crucial role in sustainability practices that support the Sustainable Development Goals (SDGs) by identifying organizational knowledge needs, developing strategies to enhance learning, and institutionalizing sustainability knowledge within organizations (Klingenberg and Rothberg, 2020). Additionally,

knowledge management has been shown to influence environmental sustainability through the mediation of green innovative culture, green technological use, and environmental awareness (Weina and Yanling, 2022). To effectively manage sustainability knowledge, there are three key approaches: identifying the sustainability knowledge required based on organizational goals, developing strategies and securing resources to acquire sustainability skills, and disseminating this knowledge throughout the organization (Klingenberg and Rothberg, 2020). Knowledge-sharing, as part of knowledge management, involves the distribution of knowledge between individuals within an organization. Knowledge-sharing requires adequate support to maximize its benefits for the organization through system.

Knowledge-sharing systems are designed to support individuals' sharing of knowledge among virtual communities of practice (CoP) through mechanisms and frameworks that enable members to communicate and collaborate (Corbett-Etchevers et al., 2024). These systems aim to help users explore new or foreign perspectives and increase tacit knowledge (Wu, 2022). This study seeks to determine the factors that influence the knowledge-sharing intentions of virtual community members regarding waste management, facilitated by social media. Knowledge-sharing is an essential factor for the sustainability of a community and must be supported by active participation from its members (Liu and Zhang, 2020). Social media serves as one of the electronic technologies that supports knowledge-sharing (Tajpour, Hosseini and Mohiuddin, 2023). Virtual communities can utilize developing social media technology to facilitate sharing experiences regarding sustainable waste management. Social media can increase virtual community engagement by promoting environmentally friendly practices, raising awareness, and fostering a sense of the need for sustainable living among users (Redyantanu, Yatmo and Atmodiwirjo, 2022). Besides social media, various technologies support virtual communities to support sustainable lifestyles through waste management. A framework for intelligent household waste management in Indonesia states that information technology such as machine learning, artificial intelligence, social media, and digital applications is one of the determining dimensions for communities to carry out sustainable waste management practices (Wirani, Eitiveni and Sucahyo, 2024). Furthermore, sustainable waste management practices carried out by virtual communities can encourage a creative economy through community-based initiative programs with recycling and upcycling projects, as well as waste collection services that provide incentive-based exchange (Redyantanu, Yatmo and Atmodiwirjo, 2022). Understanding the factors that affect knowledge-sharing intentions in virtual waste management communities is crucial for guiding knowledge management practices to promote environmental sustainability by disseminating waste management knowledge. These factors help develop a framework for knowledge-sharing intentions within the virtual waste management community. When knowledge is well-managed and widely disseminated within the community, environmental awareness will grow, supporting sustainability initiatives (Weina and Yanling, 2022). This illustrates how knowledge-sharing practices can foster effective waste management practices.

Several studies have explored the factors that support knowledge-sharing intention (KSI) in areas such as social media for higher education students (Hosen et al., 2021), online platform (Bi and Cao, 2022), or virtual communities (Luo et al., 2021). However, no research has explicitly addressed KSI within virtual communities focused on waste management. Virtual communities play a crucial role in disseminating knowledge about waste management, as they foster community-driven efforts to protect the environment at even the smallest scale. Factors influencing KSI in waste management communities were identified through a Systematic Literature Review (SLR) of previous research related to KSI in virtual communities, academic institutions, and professional organizations. These studies utilized knowledge-sharing methods based on knowledge management theory (Becerra-Fernandez, Irma; Sabherwal, 2015). This research has yet to find a similar domain, virtual communities, focusing on waste problems. Still, this research has strong arguments for using previous research that discusses higher education students, online platforms, academic institutions, and professional organizations.

The selection of prior research that discusses higher education students is considered appropriate in this research because students are active in sharing knowledge and using digital platforms to collaborate (Abdullah et al., 2024). This condition is in line with the character of virtual communities, which focus on sharing information and collaborating to achieve sustainability goals. The context of sharing knowledge with the help of online platforms is also similar to research conducted because online platforms are an essential medium to support the provision of helpful communication for online communities that focus on health sustainability (Bi and Cao, 2022). Apart from the similarities between communities that use online platforms, the harmony between the health community and the waste management community is that they have common goals, the desire to carry out the best practices in disseminating knowledge, and the involvement of various groups. Meanwhile, academic institutions have the characteristics of being the primary source of scientific knowledge and innovation that encourages a culture of knowledge sharing. This condition is relevant to virtual communities

that focus on waste problems because of the encouragement for the emergence of a knowledge-sharing culture that involves innovation. Meanwhile, the choice of the previous research domain, which focused on professional organizations, was considered consistent because professional organizations are a forum for practitioners to share knowledge that is in line with their field and can increase information capabilities for their members (Lin and Hwang, 2021).

This study uses one of the virtual communities in Indonesia, which focuses on waste management issues, to get arguments for the similarity of characteristics from previous research selections. One of the online waste management communities in Indonesia that is used as a characteristic comparison with previous research is the LyfeWithLess (LWL) Online Community. LWL Online Community was chosen because it is one of the online communities that focuses on waste management using a minimalist lifestyle approach. The context of students as individuals who act as knowledge producers by using social media assistance is in line with the characteristics of community members who are members of a waste management community called Lyfe With Less (LWL). The community carries out a knowledge-sharing process about efforts to manage waste by building a minimalist lifestyle through social media such as Instagram (@lyfewithless), Facebook (Lyfe With Less), Spotify Podcast (LyfeWithLess), and website (lyfewithless.com). The LWL virtual community uses various electronic technologies, such as websites aligned with research (Chedid et al., 2020) of professors and researchers at universities in Portugal. This research uses electronic technology support such as websites, email, and academic portals and is influenced by aspects of organizational culture to support KSI.

Research conducted by (Abdel Fattah et al., 2020) on students in Oman using the meeting method is also considered in line with the LWL virtual community, which routinely conducts knowledge-sharing using virtual seminars with topics around waste management efforts. In addition, research conducted by (Endres and Chowdhury, 2022) on students in business classes and (Matsuo and Aihara, 2022) on health organizations is also considered to be in line with the characteristics of the LWL virtual community because it uses best practices. The LWL virtual community provides simple best practices that are linked to the telegrams used by the community. This literature review aims to identify the factors influencing KSI in virtual community that focused on waste management in Indonesia. The identified factors will be used to design a framework to support knowledge-sharing intention regarding waste management in the virtual communities. This research uses analytical hierarchy process (AHP) method to weigh factors influencing KSI in the LWL virtual Community that was obtained from SLR.

2. Theoretical Foundation

2.1 Knowledge-sharing

Knowledge-sharing is one factor that drives the success of knowledge management practices (Jennex, 2006). Knowledge-sharing is the process of sharing or transferring explicit or tacit knowledge that is addressed individually to increase the knowledge of the individual recipient (Doronin, Lei and Shah, 2020). Knowledge-sharing is a complex process of social interaction, but the individuals involved benefit from social network connections and social interaction to gain access to new information and expertise (Han, Grace Oh and "Pil" Kang, 2022). Knowledge users carry out knowledge-sharing by utilizing their social networks to share knowledge that is considered significant (Wang et al., 2022a). In mobile social networks, knowledge-sharing has increased creativity, learning, and the creation of valuable cyberspaces (Hoseini, Saghafi and Aghayi, 2019).

Several studies have identified ways to share knowledge in communities, higher education academics, and professional associations. Some ways to share knowledge include communities of practices (CoP), electronic technology, after-action reviews, seminars, or meetings (Awad and Ghaziri, 2004). CoP develops a learning environment that supports knowledge-sharing to achieve innovation, flexibility, and competitiveness (Mládková, 2023). In research (Matsuo and Aihara, 2022), learning goals are proven to mediate the effect of CoP on knowledge-sharing. Social media is one of the electronic technologies that is currently developing. The use of social media in virtual communities has also been researched by (Hoseini, Saghafi and Aghayi, 2019), using the Telegram platform to search, learn, entertain, communicate, and get advice. Research conducted by (Endres and Chowdhury, 2022) used the after-action review method on students who were given complex tasks, then students were asked to reflect to find ways to make fewer mistakes. Research conducted by (Abdel Fattah et al., 2020) encourages students to share knowledge on the results of seminars or meetings.

2.2 Knowledge-Sharing Intention (KSI)

KSI is the desire to give the best effort when sharing knowledge with other community members (Kim, Lee and Oh, 2020). KSI is a motivational factor that individuals should have (Hoseini, Saghafi and Aghayi, 2019). According

to (Bi and Cao, 2022), KSI is related to behavioral factors that are influenced by personal and environmental factors, which consist of the supporting platform environment and the platform user environment. KSI can be reflected by the willingness of community members to share their knowledge if other community members ask questions (Zhou, 2019). Research conducted by (Hsu and Lin, 2020) states that KSI in the context of social media is defined as the level of user trust in sharing their knowledge through social media. Students who are encouraged to do KSI on social media will generate confidence among students and support the development of KS culture (Hashmi, Soroya and Mahmood, 2021).

2.3 Goal and Research Questions

This literature review aims to identify factors that influence KSI in communities, healthcare organizations, and HEIs that have similarities with communities that focus on waste management. There are four research questions (RQ) developed in this study, namely:

RQ1: What types of knowledge are shared?

RQ2: What are the ways to share knowledge?

RQ3: What technologies are used to support knowledge-sharing in the community?

RQ4: What factors influence knowledge-sharing intention in the community?

RQ5: What is the framework to guide knowledge-sharing intention in a virtual waste management community?

In RQ1 and RQ2, this literature review contains references, scope, types of knowledge shared, and ways to share knowledge. In RQ3, this literature review contains technologies used to support knowledge-sharing in the community. In RQ4, this literature review contains factors influencing knowledge-sharing intentions that impact knowledge-sharing behavior. RQ5 is answered using the framework to identify knowledge-sharing intentions in virtual waste management communities. The framework embodies the language and processes needed to guide knowledge management practices, especially knowledge sharing, to support environmental sustainability.

3. Research Method

The literature review was carried out by adapting the guidelines from Kitchenham (Kitchenham, 2004). Based on these guidelines, this literature review aims to identify research positions regarding the factors that influence knowledge-sharing intention regarding waste management practices from relevant articles since 2019. This literature review also provides a framework to support the development of new research positions related to knowledge-sharing intention. This literature review conducted an article search using criteria including Population, Intervention, Comparison, Outcome, and Context (PICOC). Table 1 will present the structure of the research question based on the PICOC criteria. This literature review identifies the factors influencing knowledge-sharing intention in the waste management community.

Table 1: Research question structure

Population	knowledge sharing intention, factor, driver
Intervention	community, communities, household, individual, higher education student
Comparison	knowledge-sharing intention in household community, knowledge-sharing intention in health community, knowledge-sharing intention in higher education civitas, knowledge-sharing intention in individual
Outcome	factor affect knowledge-sharing intention in waste management community
Context	waste management community

3.1 Article Searching Process

This literature review uses five journal databases for article searches: Scopus, Science Direct, IEEE Xplore, Emerald Insight, and Sage Journal. The process of searching for articles using Boolean Search with search queries is presented in Table 2.

Table 2: Boolean search for article search

Database Journal	Boolean Search
Scopus	TITLE-ABS-KEY (("knowledge-sharing intention") AND (factor OR driver) AND (community OR household OR communities))
Science Direct	("knowledge-sharing intention") AND (factor OR driver) AND (community OR household OR communities)
IEEE	("knowledge-sharing intention") AND (factor OR driver) AND (community OR household OR communities)
Emerald Insight	("knowledge-sharing intention") AND (factor OR driver) AND (community OR household OR communities)
Sage Journals	("knowledge-sharing intention") AND (factor OR driver) AND (community OR household OR communities)

This literature review applies these search queries to the title, keywords, and abstract of all articles. At the initiation stage, this literature review found 730 articles consisting of 45 articles on Scopus, 79 articles from Science Direct, five from ACM Digital Library, 572 from Emerald Insight, and 28 from Sage Journals. The flow of the systematic literature review process is presented in Figure 1.

3.2 Article Selection Process

Articles obtained from the stages of the article search process will then be evaluated for suitability based on the title and abstract. The evaluation results were 363 articles consisting of 12 from Scopus, 33 from Science Direct, one from ACM Digital Library, 303 from Emerald Insight, and 14 from Sage Journal. The next stage was to make a selection based on full text and produce 25 (21 without duplicate) articles consisting of five articles from Scopus, five articles from Science Direct, 1 article from ACM Digital Library, nine articles from Emerald Insight, and four articles from Sage Journal. In the final stage, this literature review applies several criteria to evaluate the quality of articles. In the final stage, there are 20 articles to be extracted. There are seven rules to evaluate the quality of articles:

1. The article describes the research objectives related to knowledge-sharing intention.
2. The article writes an appropriate literature review, background, and research context.
3. The article displays related work from previous research, which help supports the primary research contribution.
4. The article clearly describes the factors, drivers, and framework for knowledge-sharing intention in the community.
5. The article includes statement indicators.
6. The article has research results related to knowledge-sharing intention.
7. Articles display conclusions that are relevant to the objectives or research problems.

4. Results

This section presents the results of data extraction according to the research question. A comparison of the scope, types of knowledge shared, methods of knowledge-sharing, technologies used to support knowledge-sharing, supporting theories, and factors influencing KSI are presented in Appendix 1.

4.1 Type of Knowledge Shared

This literature review has identified the types of knowledge used by the community. These types of knowledge include specific knowledge, general knowledge, simple knowledge, complex knowledge, procedural knowledge, and tacit-explicit knowledge. This literature review uses knowledge categorization derived from theories regarding knowledge management (Becerra-Fernandez, Irma; Sabherwal, 2015). Specific knowledge in the context of online health communities (OHC) identified by research (Zhou, 2019; Liu and Zhang, 2020; Bi and Cao, 2022; Zhang and Liu, 2022) is individual treatment experiences and health information which are specific and rarely known by the general public (Asghar et al., 2023). With academics at HEI, specific knowledge shared is about the areas of expertise of academics (Akosile and Olatokun, 2020) (Hashmi, Soroya and Mahmood, 2021) (Chedid et al., 2020). In the context of professional accountants, the specific knowledge shared is related to topics regarding accounting (Lin and Hwang, 2021). In research conducted by (Hsu and Lin, 2020), in the context of members of the Facebook community, specific knowledge is shared according to the expertise of each member. Other people commonly known general knowledge, so it is easy to share with others (Becerra-

Fernandez, Irma; Sabherwal, 2015). In research (Hoseini, Saghafi and Aghayi, 2019; Luo et al., 2021; Liao, 2022), general knowledge in virtual communities relates to general knowledge that members know according to their interests, such as music, movies, or other topics.

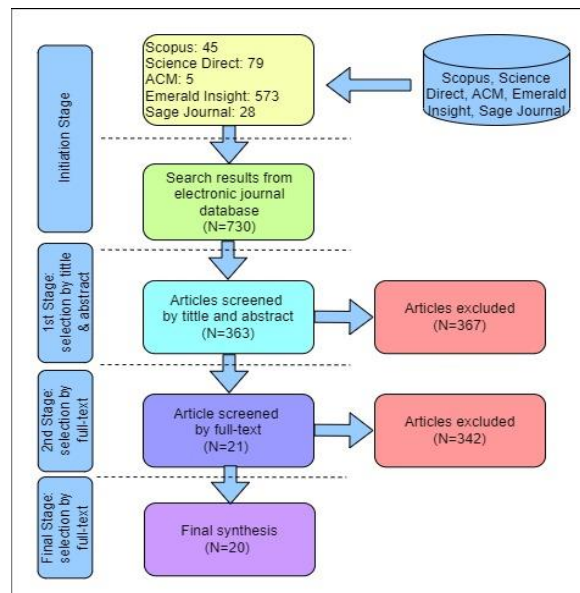


Figure 1: The flow of the systematic literature review process

Simple knowledge focuses on one particular primary area (Becerra-Fernandez, Irma; Sabherwal, 2015). In online travel communities (OTC) (Selim et al., 2022), simple knowledge is shared according to tourist experiences at specific locations. In the context of a higher education institution (HEI), the knowledge shared relates to the subject chosen by students as in research (Abdel Fattah et al., 2020; Hosen et al., 2021). In research (Kim, Lee and Oh, 2020), simple knowledge shared by learning community members is related to Macintosh usage, game development, education, architecture, software, and math. Complex knowledge involves various areas of expertise (Becerra-Fernandez, Irma; Sabherwal, 2015) and is in line with research (Endres and Chowdhury, 2022) on management students at HEI who research knowledge on tasks that are complex and require expertise in several fields.

Procedural knowledge relates to steps to produce specific outcomes (Becerra-Fernandez, Irma; Sabherwal, 2015). Procedural knowledge in nurses relates to hospital patient care procedures (Matsuo and Aihara, 2022). Tacit knowledge can be considered as intuition and know-how individual knowledge that is difficult to articulate and transfer, in contrast, explicit knowledge relates to data and information that is easy to communicate and codify (Shahzad, Chilba and Arslan, 2024). Research conducted by (Wang et al., 2022b) examines the influence of tacit and explicit knowledge on virtual communities according to their respective topics and interests. The mapping of knowledge types is presented in Figure 2.

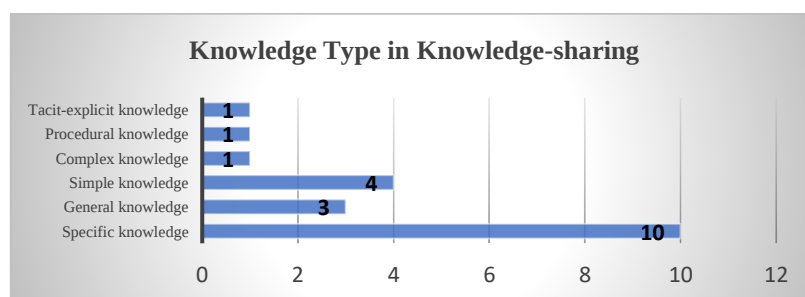


Figure 2: Knowledge type in knowledge-sharing

4.2 Ways to Share Knowledge

This literature review has identified several types of way to share knowledge, such as communities of practices (CoP), electronic technology, seminars or meetings, and after-action reviews. Several studies have identified ways to share knowledge through CoP and electronic technology (Zhou, 2019; Liu and Zhang, 2020; Bi and Cao, 2022; Zhang and Liu, 2022) on OHC, (Kim, Lee and Oh, 2020) on learning communities (Hoseini, Saghafi and

Aghayi, 2019) in social networking services (SNSs) communities, (Lin & Hwang, 2021) in professional accountant communities that also involve the water cooler method, (Hsu and Lin, 2020) in Facebook communities in Taiwan, (Selim et al., 2022) on OTC, (Wang et al., 2022b) on virtual communities. Research using the CoP to share knowledge was carried out on nurses at the hospital (Matsuo and Aihara, 2022).

Research that using after action to share knowledge was conducted (Endres and Chowdhury, 2022) on management students at HEI. Previous research also using electronic technology with social media among HEI students is research conducted by (Akosile and Olatokun, 2020; Hosen et al., 2021; Asghar et al., 2023), (Chedid et al., 2020) on academic portals, websites, and e-mails, (Hashmi, Soroya and Mahmood, 2021) on SNSs. Research conducted by (Abdel Fattah et al., 2020) used the seminar and meeting method for HEI students in Oman. The mapping of the knowledge-sharing method is presented in Figure 3.

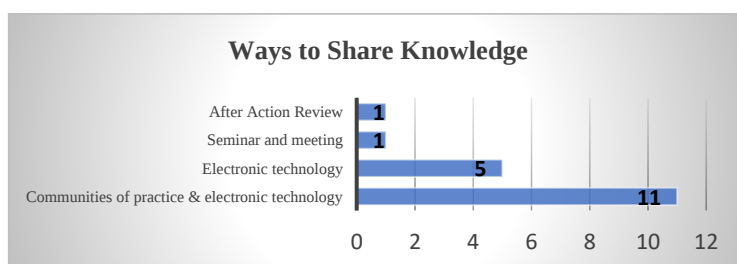


Figure 3: Ways to share knowledge

4.3 Technology Used to Support Knowledge-sharing

This literature review has identified 17 studies that use electronic technology to support knowledge-sharing, namely online health platforms (Zhou, 2019; Liu and Zhang, 2020; Zhang and Liu, 2022), SNSs (Hsu and Lin, 2020; Kim, Lee and Oh, 2020; Hashmi, Soroya and Mahmood, 2021; Hosen et al., 2021; Asghar et al., 2023), mobile social network (Hoseini, Saghafi and Aghayi, 2019), web-based platform (Akosile and Olatokun, 2020; Bi and Cao, 2022), online search engines (Lin and Hwang, 2021), collaborative web (Luo et al., 2021), online travel platform (Selim et al., 2022), virtual communities platform (Liao, 2022; Wang et al., 2022b). The mapping of the technology used to support knowledge-sharing is presented in Figure 4.

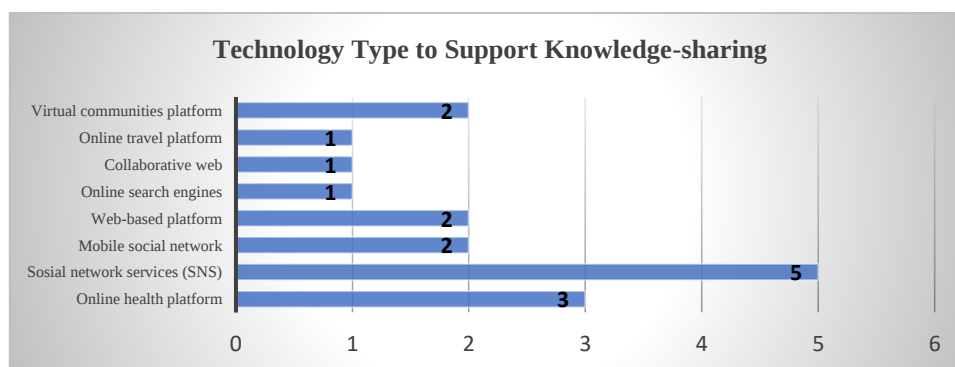


Figure 4: Technology type to support knowledge-sharing

4.4 Factors Influencing Knowledge-Sharing Intention

This literature review identified 39 factors influencing knowledge-sharing intention (KSI) from previous research. These factors will be mapped into several domains, namely organizational culture, information technology (IT) infrastructure, perceived risk, perceived benefit, and individuals. Domain organization culture and IT infrastructure are components of knowledge management infrastructure (Becerra-Fernandez, Irma; Sabherwal, 2015). The mapping between domains and factors is presented in Table 3. Domain mapping is carried out based on the definition of each factor. The organizational culture domain relates to factors that show the similarity of vision, mission, understanding, feelings, beliefs, and values that develop within an organization (Assoratgoon and Kantabutra, 2023). A good organizational culture can be built based on trust between members and organizational culture can strengthen trust between members (Mousa Alriyami et al., 2024). The IT Infrastructure domain relates to the characteristics of the digital platforms used to share knowledge. Domain Perceived Risk relates to uncertain and unwanted factors (Matsuo and Aihara, 2022). The Perceived Benefit domain relates to the benefits felt by users when using a system (Huang, 2023). The individual domain is

associated with the personal and psychological characteristics of a person who is the motivation (Kim, Lee and Oh, 2020; Hosen et al., 2021) . An explanation of each factor used as an argument for grouping factors is available in Table 3.

Table 3: Mapping between domains and factors

No.	Factor	Research	Frequency
Domain: Organization Culture			
1	Sense of belonging: The emotional attachment to being part of a community that focuses on waste management	(Liu and Zhang, 2020)	1
2	Shared Cognition: Similarity of thinking between members in a community to share knowledge about waste management	(Hoseini, Saghafi and Aghayi, 2019)	1
3	Trust: The hope held by individuals towards something that can be relied on to share knowledge regarding waste management.	(Hoseini, Saghafi and Aghayi, 2019; Akosile and Olatokun, 2020; Chedid et al., 2020)	5
	Trust in other member: Trust to share knowledge about waste management with community members	(Zhou, 2019)	
	Trust in community: Trust to share knowledge about waste management in the community	(Bi and Cao, 2022)	
4	Commitment		4
	Community commitment: Strong commitment to share knowledge within the community focused on waste management	(Bi and Cao, 2022)	
	Virtual community commitment Strong commitment to a virtual community focused on waste management	(Liao, 2022)	
	Normative commitment, affective commitment, continuance commitment: The commitment of community members related to moral, emotional and dependency drives to share knowledge about waste management in the community	(Luo et al., 2021)	
5	Relationship commitment: Commitment to maintaining long-term relationships in the community	(Zhang and Liu, 2022)	1
	Expected relationship: A person's expectations of relationships in a community that focuses on waste management	(Hsu and Lin, 2020)	
6	Subjective norm: Subjective norms that apply to a community that focuses on waste management	(Abdel Fattah et al., 2020; Chedid et al., 2020; Hashmi, Soroya and Mahmood, 2021; Selim et al., 2022)	4
7	Organisational culture: An organizational culture rooted in a community that focuses on waste management	(Akosile and Olatokun, 2020)	1
8	Reward system: The community has a reward system for members who share knowledge about waste management	(Akosile and Olatokun, 2020)	2
	Virtual community rewards:	(Wang et al., 2022b)	

No.	Factor	Research	Frequency
	The virtual community gives awards to members who implement a culture of sharing knowledge regarding waste management		
9	Management support: Support provided by community management to sustain a culture of sharing knowledge regarding waste management	(Akosile and Olatokun, 2020)	1
10	University policy: Policies regarding knowledge sharing in the university context	(Akosile and Olatokun, 2020)	1
11	Social influence: Social influence that encourages someone to share knowledge about waste management	(Asghar et al., 2023)	1
Domain: IT Infrastructure			
12	Performance expectancy: The level of effectiveness of technology to support knowledge sharing regarding waste management in the community	(Asghar et al., 2023)	1
13	Effort expectancy: The level of ease of use of a technology that supports sharing knowledge about waste management in the community	(Asghar et al., 2023)	1
14	Document exchange: Technological functionality that supports document exchange as a basis for knowledge-sharing activities in the community	(Hosen et al., 2021)	1
15	Virtual communication: Technology that supports the communication process as part of sharing knowledge in the community	(Hosen et al., 2021)	1
16	Knowledge formation: Technology that can support the formation, creation and sharing of knowledge in communities	(Hosen et al., 2021)	1
17	Availability of infrastructure: Availability of technological infrastructure, which is the basis for carrying out knowledge-sharing activities in the community	(Akosile and Olatokun, 2020)	1
18	Usage of social media: Availability of social media to share knowledge between community members	(Akosile and Olatokun, 2020)	1
Domain: Perceived Risk			
19	Privacy risk: The level of concern of individuals in a community that their data will be misused	(Zhou, 2019)	1
20	Loss of knowledge power: The level of fear of individuals in a community who feel that sharing knowledge can reduce their superiority	(Lin and Hwang, 2021)	1
Domain: Perceived Benefit			
21	Perceived worth: Community members feel that sharing knowledge about waste management is a valuable action	(Liu and Zhang, 2020)	
22	Expected reciprocal benefit:	(Hsu and Lin, 2020)	

No.	Factor	Research	Frequency
	Community members hope that by sharing knowledge about waste management, they will gain reciprocal benefits		
23	Reputation: Opinions obtained from other community members due to knowledge-sharing activities	(Hoseini, Saghafi and Aghayi, 2019; Hosen et al., 2021)	2
24	Reciprocity: Expectation to get something similar in the future because you have carried out knowledge-sharing activities	(Hoseini, Saghafi and Aghayi, 2019; Lin and Hwang, 2021)	2
25	Performance: Increasing the results of a knowledge-sharing process within the community	(Endres and Chowdhury, 2022)	1
Domain: Individual			
26	Personal identity: A strong identity attached to community members and encouraging sharing of knowledge regarding waste management	(Kim, Lee and Oh, 2020)	1
27	Self-efficacy: The level of confidence of community members to share knowledge about waste management	(Wang et al., 2022b)	4
	Web-specific self-efficacy: The ability of community members to use the web to encourage sharing knowledge regarding waste management.	(Kim, Lee and Oh, 2020)	
	Knowledge Creation Self-efficacy: Community members' confidence in being able to create knowledge that is then shared	(Kim, Lee and Oh, 2020)	
	Knowledge self-efficacy: Community members' confidence in being able to generate, manage and share knowledge regarding waste management	(Akosile and Olatokun, 2020)	
28	Altruism: The desire of community members to help in sharing knowledge without expecting rewards or rewards	(Hoseini, Saghafi and Aghayi, 2019; Hsu and Lin, 2020; Hosen et al., 2021)	3
29	Enjoyment: The enjoyment felt by community members when sharing knowledge about waste management	(Selim et al., 2022; Wang et al., 2022b)	2
30	Learning goal: Goals that community members want to achieve and relate to learning from shared knowledge sources	(Matsuo and Aihara, 2022)	1
31	Personal information management capabilities: The ability of community members to be able to manage information related to waste management	(Lin and Hwang, 2021)	1
32	Satisfaction: It feels good when community members can share knowledge about waste management	(Selim et al., 2022)	1
33	Perceived behavioural control: Perceived control over sharing knowledge with community members	(Hashmi, Soroya and Mahmood, 2021; Selim et al., 2022)	2
34	Attitude:	(Selim et al., 2022)	5

No.	Factor	Research	Frequency
	Positive or negative attitudes of community members towards sharing knowledge about waste management		
	Student's attitude: Positive or negative attitudes of students towards sharing knowledge	(Abdel Fattah et al., 2020)	
	Attitude toward knowledge-sharing: A community member's view on sharing knowledge about waste management	(Chedid et al., 2020; Hashmi, Soroya and Mahmood, 2021; Bi and Cao, 2022)	
35	Personal expectations: Community members' expectations regarding the benefits they will get if they share knowledge about waste management	(Akosile and Olatokun, 2020)	1
36	Willingness to share: Willingness of community members to share knowledge about waste management	(Akosile and Olatokun, 2020)	1
37	Personal interaction: Individual relations from community members and other members in sharing knowledge	(Akosile and Olatokun, 2020)	1
38	Ambiguity tolerance: Tolerance for conditions of opaqueness when sharing knowledge in the community	(Endres and Chowdhury, 2022)	1
39	Reflective thinking: The ability of community members to assess existing knowledge and ensure compliance with community needs	(Endres and Chowdhury, 2022)	1

4.5 Factor Weighting with Analytical Hierarchy Process (AHP) Method

This literature review uses the analytical hierarchy process (AHP) to determine factors influencing KSI in the LWL Virtual Community. AHP is used to obtain an assessment of the criteria owned by the management of the LWL virtual community, which is then used in the assessment of prioritized factors. AHP can simplify decision-making by dividing complex problems into structured stages (Benmoussa et al., 2019). The AHP method will produce a priority scale, namely the factors with the main priority that influence KSI in the LWL virtual community.

There are three main elements of AHP, namely problems, criteria, and alternatives. The problem, according to this literature review, is the factors that influence KSI in the LWL virtual community. The criteria in the literature review include compliance with the vision and mission of the LWL virtual community (C1), conformity with the objectives of the LWL virtual community (C2), and characteristics of members of the LWL virtual community (C3). Alternatives in this literature review include 39 factors identified from previous research. Based on interviews with LWL management, information was obtained that C1 and C2 had the same interests, while C1 and C2 were considered more critical than C3.

Determination of the values of each alternative is obtained from interviews to determine alternative values based on the level of importance of the Likert scale. The value of the scale explains that a scale of 5 means very important, and a scale of 1 means very unimportant. AHP weighting produces factors with certain weights which are presented in Table 3. Based on Table 4, it can be seen that the domain that has the highest average weight value is the IT Infrastructure domain. Based on the results of the interviews, 15 factors with the highest weight were selected to be developed into a framework of the factors that influence KSI in the LWL virtual community. Table III shows the top 15 factors according to AHP weighting. Table 5 presents a comparison of the 15 factors obtained based on the highest frequency of occurrence in previous studies and based on AHP weighting. Figure 5 presents a framework developed based on the results of AHP weighting according to Table 5.

Table 4: AHP weighting results

Domain	Factor	AHP Weight	Average AHP Weight
Organizational Culture	Sense of belonging	0,030268239	0,023612
	Trust in community	0,030268239	
	Virtual community commitment	0,030268239	
	Management support	0,029952581	
	Shared Cognition	0,024214591	
	Trust in other member	0,024214591	
	Expected relationship	0,023357559	
	Subjective norm	0,018160943	
	Organisational culture	0,018160943	
	Virtual community rewards	0,018160943	
	Community policy	0,018160943	
	Social influence	0,018160943	
IT Infrastructure	Performance expectancy	0,029329524	0,026139
	Virtual communication	0,029329524	
	Usage of social media	0,029329524	
	Effort expectancy	0,023745234	
	Document exchange	0,023745234	
	Knowledge formation	0,023745234	
	Availability of infrastructure	0,023745234	
Individual	Altruism	0,029329524	0,021534
	Personal interaction	0,029329524	
	Personal information management capabilities	0,024534835	
	Willingness to share	0,023929524	
	Knowledge self-efficacy	0,023745234	
	Enjoyment in helping other	0,023745234	
	Learning goal	0,023745234	
	Perceived behavioural control	0,023745234	
	Attitude	0,018950545	
	Personal expectations	0,018950545	
	Personal identity	0,018160943	
	Satisfaction	0,018160943	
	Ambiguity tolerance	0,012576653	
	Reflective thinking	0,012576653	
Perceived Benefit	Reciprocity	0,018160943	0,015927
	Performance	0,018160943	
	Perceived worth	0,018160943	
	Reputation	0,012576653	
	Expected reciprocal benefit	0,012576653	
Perceived Risk	Privacy Risk	0,006992362	0,006992
	Loss of knowledge power	0,006992362	

Table 5: List of the top 15 factors and AHP weighting

Previous Research			AHP Weighting	
No.	Factor	Frequency	Factor	Weight
1	Commitment	6	Sense of belonging	0,030698
2	Trust	5	Trust in community	0,030638
3	Attitude	5	Virtual community commitment	0,030638
4	Subjective norm	4	Management support	0,030317
5	Self-efficacy	4	Performance expectancy	0,029686
6	Altruism	3	Virtual communication	0,029686
7	Reward system	2	Usage of social media	0,029686
8	Reputation	2	Altruism	0,027194
9	Reciprocity	2	Personal information management capabilities	0,024824
10	Perceived behavioural control	2	Shared Cognition	0,02451
11	Sense of belonging	1	Trust in other member	0,02451
12	Shared Cognition	1	Attitude toward knowledge-sharing	0,024156
13	Management support	1	Personal expectations	0,024156
14	Performance expectancy	1	Effort expectancy	0,024034
15	Effort expectancy	1	Document exchange	0,024034

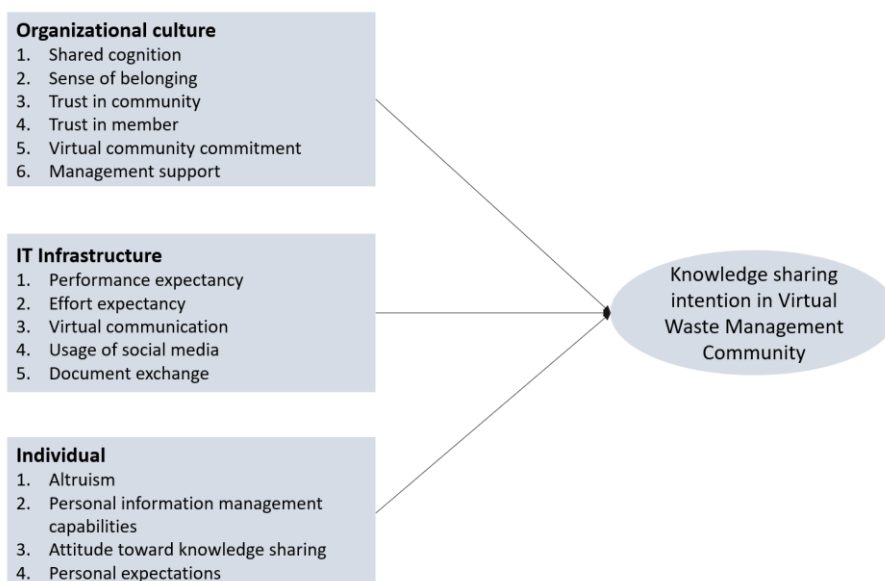


Figure 5: KSI framework in LWL virtual community

5. Discussion

This literature review identified 25 previous studies, which were then extracted to obtain information on knowledge types, ways to share knowledge, and technologies to support knowledge-sharing. The type of knowledge that is often shared based on previous research is specific knowledge. The ways to share knowledge that is often used based on previous research is CoP and electronic technology. Technology to support knowledge-sharing, which is often used based on previous research, is social network services. This literature review also extracts and synthesizes the factors that influence knowledge-sharing intention from previous research. There are 39 factors found in this literature review and mapped into six domains: organizational culture, IT infrastructure, perceived risk, perceived benefit, and individual. The number of occurrence

frequencies from previous studies calculated the factors found. This literature review carries out AHP weighting to assess the factors LWL virtual community management prioritized. Based on the results of the AHP, 15 factors support KSI in the LWL virtual community.

The research results can enrich the literature regarding factors influencing KSI in virtual communities focusing on waste management. The framework proposed in this study can serve as a theoretical basis for future research on using KSI in virtual contexts. The framework developed in this research helps guide knowledge management practices through knowledge-sharing to increase environmental sustainability among virtual community members. Environmental practitioners can use this framework to develop policies to encourage and facilitate effective knowledge sharing in virtual communities that can support environmental sustainability initiatives through waste management. In addition, future research can use this framework to assist knowledge management practices in virtual communities in other contexts such as the health, education, and tourism sectors.

6. Conclusion

This literature review has reviewed four aspects to answer the research question: the type of knowledge shared, the way to share knowledge, the technology used to support knowledge-sharing in the community, and the factors that influence knowledge-sharing intention in the community. Knowledge types distributed based on previous research are specific knowledge, simple knowledge, general knowledge, complex knowledge, procedural knowledge, and tacit-explicit knowledge. Based on previous research, the way to share knowledge are CoP and electronic technology, electronic technology, after-action reviews, seminars, and meetings. Based on previous research, the technologies to support knowledge-sharing are social network services, online health platforms, mobile social networks, web-based platforms, online search engines, collaborative web, online travel platforms, and virtual communities' platforms. The systematic literature review adopted in this literature review uses the Kitchenham method. This literature review also summarizes the factors influencing KSI in virtual communities, higher education civitas, and professional organizations.

This literature review also proposes mapping the factors that influence KSI in the community based on five domains: organizational culture, IT infrastructure, perceived risk, perceived benefit, and individual. Domain organization culture and IT infrastructure are the main aspects of knowledge management infrastructure. Based on the mapping results, there are 15 factors with the highest frequency of occurrence in previous research, namely commitment, trust, attitude toward knowledge-sharing, subjective norm, self-efficacy, altruism, reward system, reputation, reciprocity, perceived behavioral control, sense of belonging, shared cognition, management support, performance expectancy, and effort expectancy. In addition, using the AHP method, 15 factors have the highest weight to influence KSI in the LWL virtual community, namely: a sense of belonging, trust in the community, virtual community commitment, management support, performance expectancy, virtual communication, usage of social media, altruism, personal information management capabilities, shared cognition, trust in other members, attitude toward knowledge-sharing, personal expectations, effort expectancy, and document exchange. Based on the AHP weighting, it was found that the IT infrastructure domain is the domain that has the highest weight. The fifteen factors resulting from AHP weighting will become a framework of the factors influencing KSI in the LWL virtual community.

This literature review has several weaknesses that can be developed in future research. This review makes limited generalizations, namely using a research context different from virtual communities focusing on waste management. The results of this literature review are then validated so that LWL virtual community managers can decide on factors considered necessary for the community. This research focuses more on mapping KSI factors without considering how the research results can be applied to virtual communities and provide appropriate solutions for community managers. This literature review needs to identify the latest technological developments, such as artificial intelligence-based technology, intelligent knowledge management systems, or knowledge recommendation systems implemented in virtual communities. Similar research starting with a systematic literature review can identify aspects of technological development related to adopting digital platforms based on artificial intelligence or intelligent systems that can increase knowledge-sharing activities in virtual communities. This literature review can be developed further by validating several LWL virtual community management to reduce the subjectivity of the results. Several types of knowledge identified in previous studies include specific, general, simple, complex, procedural, and tacit-explicit knowledge. Recommendations for future research to convey the types of knowledge and details of the knowledge shared. Future research can identify other knowledge appropriate for the community, such as experienced-based, domain-specific, individual, and external knowledge. The majority of previous research applied electronic technology with CoP.

In the context of massive social media, future research can apply a combination of other knowledge-sharing methods such as electronic technology using social media, social collaboration 4.0 platforms, online open forums, and CoP. Future research can identify the characteristics of the CoP and the suitability of the knowledge-sharing process with the vision and mission of the community.

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Appendix 1: The Results of Data Extraction

No.	Research	Scope	Knowledge Type (RQ1)	Knowledge e-sharing Method (RQ2)	Technology Support Knowledge-sharing (RQ3)	Theory	Factors Influencing KSI (RQ4)
1	(Liu and Zhang, 2020)	Online health communities	Specific knowledge	CoP and electronic technology	Online health platform	Social Exchange Theory: Benefits & Costs	Sense of belonging Perceived worth
2	(Kim, Lee and Oh, 2020)	Social networking services (SNS) learning communities	Simple knowledge	CoP and electronic technology	Facebook communities	Theory of Planned Behavior (TPB), personal online identity, self-efficacy terhadap intention to share knowledge	Personal identity Web-specific self-efficacy (WSSE) Knowledge Creation Self-efficacy (KCSSES)
3	(Hoseini, Saghaei and Aghayi, 2019)	Mobile Social networks (MSN): Telegram, WhatsApp, Line and Viber	General knowledge	CoP and electronic technology	MSN	Social context, psychological context, cultural context, technological context	Trust Reciprocity Shared Cognition Reputation Altruism
4	(Bi and Cao, 2022)	Online health communities	Specific knowledge	CoP and electronic technology	web-based platform	Commitment-trust theory, theory of reasoned action (TRA), technology acceptance model (TAM), dan Social cognitive theory (SCT)	Attitude toward knowledge-sharing
5	(Matsuo and Aihara, 2022)	Health care organizations	Procedural knowledge	CoP	-	SCT	Learning goals
6	(Lin and Hwang, 2021)	Accounting professional	Specific knowledge	CoP and electronic technology	Online search engines	1. Social exchange theory 2. knowledge management	Personal information management capabilities Social-Psychological benefit and cost factors: a. Image b. Reciprocity c. Loss of knowledge power
7	(Luo et al., 2021)	Online communities di platform digital (Baidu)	General knowledge: Douban: movie, book, music;	CoP and electronic technology	collaborative web	1. Social exchange theory 2. commitment model	Affective commitment Continuance commitment

No.	Research	Scope	Knowledge Type (RQ1)	Knowledge e-sharing Method (RQ2)	Technology Support Knowledge-sharing (RQ3)	Theory	Factors Influencing KSI (RQ4)
		Experience, Baidu Zhidao, Douban, and Zhihu)	Zhihu: various topics				Normative commitment
8	(Hosen et al., 2021)	Social media among college students in West Malaysia	Simple knowledge	Electronic technology	SNS	1. SCT 2. connectivism theory	Document exchange Virtual communication Knowledge formation Reputation Altruism
9	(Hsu and Lin, 2020)	Facebook community members in Taiwan	Specific knowledge	CoP and electronic technology	SNS	Social exchange theory	1. Altruism 2. Expected reciprocal benefit 3. Expected relationship
10	(Selim et al., 2022)	Online travel communities	Simple knowledge	CoP and electronic technology	Platform: Tripadvisor.com, lonelyplanet.com, and virtualtourist.Com	1. Expectation Confirmation Model (ECM) 2. TPB	1. Subjective norm 2. Satisfaction 3. Perceived behavioural control 4. Attitude
11	(Akosile and Olatokun, 2020)	Academics at Bowen University (Nigeria)	Specific knowledge	Electronic technology	SNS	1. TRA 2. TPB	Organisational factors: 1. Organisational culture 2. Reward system 3. Management support 4. University policy Individual factors: 1. Knowledge self-efficacy 2. Trust 3. Personal interactions 4. Personal expectations 5. Willingness to share Technological Factors: 1. Availability of infrastructure 2. Usage of social media
12	(Chedid et al., 2020)	Professor and researcher at HEI	Specific knowledge	Electronic technology	academic portal, website, e-mail	TRA	1. Attitude towards knowledge-sharing 2. Subjective norm 3. Trust
13	(Hashmi, Soroya and Mahmood, 2021)	SNS between the library and information management researcher (postgraduate student)	Specific knowledge	Electronic technology	SNS	TPB	1. Attitude 2. Subjective norm 3. Perceived behavioural control

No.	Research	Scope	Knowledge Type (RQ1)	Knowledge-sharing Method (RQ2)	Technology Support Knowledge-sharing (RQ3)	Theory	Factors Influencing KSI (RQ4)
14	(Zhou, 2019)	Online health communities	Specific knowledge	CoP and electronic technology	Online health platform	Teori Stimulus-Organism-Response (SOR)	1. Trust in community 2. Trust in other member 3. Privacy risk
15	(Wang et al., 2022b)	Virtual communities	Tacit & Explicit	CoP and electronic technology	Virtual communities platform	-	1. Virtual community rewards 2. Enjoyment 3. Self-efficacy 4. Explicit knowledge-sharing
16	(Abdel Fattah et al., 2020)	HEI students in Oman	Simple knowledge	Seminars and meeting	-	TPB	1. Student's attitude 2. Subjective norms
17	(Endres and Chowdhury, 2022)	Students in a management class are given complicated assignments	Complex knowledge	After action review	-	Motivation-Opportunity-Ability (MOA)	1. Ambiguity tolerance (AT) 2. Reflective thinking (RT) 3. Performance
18	(Asghar et al., 2023)	HEI students in Pakistan	Specific knowledge	Electronic technology	SNS	UTAUT and leadership theory	1. Performance expectancy 2. Effort expectancy 3. Social influence 4. Social media-based KSI
19	(Liao, 2022)	Virtual communities	General knowledge	CoP and electronic technology	Virtual communities platform	TPB	Virtual community commitment
20	(Zhang and Liu, 2022)	OHC	Specific knowledge	CoP and electronic technology	Online health platform	social exchange theory and commitment-trust	Relationship commitment