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The role of knowledge management in digital transformation in the light of emerging technologies

Dissertation – Thesis Book

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1 Research purpose and objectives

The purpose of this study is to provide a thorough, meaningful, and practical evaluation of organisational knowledge management (KM) in the context of digital transformation and emerging technologies in Hungary. It intends to fill a significant gap in the literature and suggests findings that may be valuable to other scholars pursuing this particular subject.

The primary objective of this research is to provide a holistic overview of the interplay between industrial characteristics, strategic knowledge management approaches, external factors, and the adoption of emerging technologies. To achieve this, the study employs empirical analysis methodologies, ensuring that the findings are both robust and grounded in real-world data. The central research question guiding this endeavour is: 'How do industrial characteristics, strategic knowledge management approaches, external factors (including global events and sectoral differences), and the adoption and impact of emerging technologies collectively shape the implementation, challenges, and outcomes of knowledge management in organisations?'

In addressing this question, the study explores several sub-themes. These include understanding how different industries in Hungary approach knowledge management, the strategies they employ, and the challenges they face. The research also delves into the role of external factors, such as global events and sectoral differences, in influencing knowledge management practices. A significant portion of the study is dedicated to understanding the impact of emerging technologies. As digital tools and platforms become increasingly integral to organisational operations, it is imperative to understand how they intersect with knowledge management practices and what implications they hold for organisations.

2 Research questions

In this chapter, research questions related to the empirical study are articulated and concepts considered having fundamental importance for understanding the research questions are introduced. Beyond formulating hypotheses for the research, a brief overview of the qualitative and quantitative methods used during the study is provided.

Research questions serve the purpose of showcasing the key questions that arise in the researcher's mind. Answering them can help understanding the mechanisms in organisational knowledge management in firms operating in Hungary in the light of digitalisation.

The research aims to find answer for the research questions summarised in the following table.

RQ1:	How industry influences implementation of KM?
RQ1a:	Are there any industrial differences with regards to technological intensity of products and processes?
RQ1b:	Are there any industrial differences with regards to KM strategy?
RQ1c:	Are there any industrial differences with regards to KM project?
RQ1d:	Are there any industrial differences with regards to impediments due to missing KM?
RQ2:	**How sectoral and ownership-related differences affect implementation of permitted KM technologies?**
RQ3:	**Does the COVID-19 pandemic increased usage of emerging technologies?**
RQ4:	**How strategic KM influences information gathering by employees?**
RQ4a:	How strategic KM affects what information source employees turn to the most?
RQ4b:	How strategic KM affects implementation of emerging technologies?
RQ5:	**How do emerging technologies in use affect KM?**
RQ5a:	How do emerging technologies in use affect integration of KM strategy and projects?
RQ5b:	How do emerging technologies in use affect level of technological intensity?
RQ5c:	How do emerging technologies in use affect different dimensions of information sources?
RQ6:	**Which factors affect the volume of emerging technologies in use?**

Table 1. Research questions
Source: own edition

3 Conceptual definition and operationalisation

To apply the right measures, a precise definition of the research variables is necessary. However, a number of theories were used and thoroughly discussed in the literature review section in order to construct the variables needed to validate the study hypotheses.

A variable refers to a characteristic or attribute of an individual or an organisation that can be measured or observed and that varies among the people or organisation being studied. A variable typically will vary in two or more categories or on a continuum of scores, and it can be measured or assessed on a scale (Creswell, 2009).

This section outlines the key variables that were employed in the study to support the research goals and answer the research questions. The task of conceptualisation is to provide a framework for the questions appearing in the research.

Sectors

The classification of economic activities into primary, secondary, and tertiary sectors is a conventional approach to categorising the different segments of an economy based on the nature of their activities. Classification is defined by the European Commission in branches from NACE rev.2 (Eurostat, 2023).

The primary sector is the segment of the economy that extracts or harvests products from the earth. This sector includes activities like agriculture, fishing, forestry, and mining. It is the foundation of all other sectors as it provides the raw materials needed for manufacturing and production. Primary sector includes 'agriculture, forestry and fishing' (Eurostat, 2023).

The secondary sector comprises activities that transform, process, or manufacture goods from raw materials into finished or semi-finished products. This includes

industries like manufacturing, construction, and utilities. The goods produced in this sector serve as a base for the provision of services in the tertiary sector. Secondary sector includes industry and construction, namely 'mining and quarrying' (B), 'manufacturing' (C), 'electricity, gas, steam and air conditioning supply' (D), 'Water supply; sewerage, waste management and remediation activities' (E), and 'construction' (F) (Eurostat, 2023).

The tertiary sector is the sector of the economy that concerns services. It is distinct from the secondary sector (manufacturing) and the primary sector (which concerns extraction such as mining, agriculture and fishing). Tertiary sector covers 'wholesale and retail' (G), 'transportation and storage' (H), 'accommodation and food service activities' (I), 'information and communication' (J), 'financial and insurance activities' (K), 'real estate activities' (L), 'professional, scientific and technical activities' (M), 'administrative and support service activities' (N), 'public administration and defence; compulsory social security' (O), 'education' (P), 'human health and social work activities' (Q), 'arts, sports and recreation' (R), 'other service activities' (S), 'activities of households as employers and undifferentiated goods - and service-producing activities of households for own use' (T), and 'activities of extraterritorial organisations and bodies' (U) (Eurostat, 2023).

Ownership of companies (foreign vs domestic)

A domestic corporation refers to a company that is incorporated in and conducts business affairs in its own country. A domestic corporation is often compared to a foreign corporation, which conducts business in a country other than the one where it originated or was incorporated. Foreign companies are enterprises that are ultimately majority controlled by a non-resident entity, either a natural or legal person (European Commission, 2001).

Company size

Micro enterprises are having fewer than 10 persons employed; small enterprises are having 10 to 49 persons employed; medium-sized enterprises are employing 50 to 249 persons; and large enterprises are having 250 or more persons employed (Eurostat, 2023).

Net income

Net income is the value for the fiscal year of sold (finished and semi-finished) products, materials, goods, and performed services, increased with surcharges and mark-ups, containing registration, excise, and energy taxes, reduced by discounts, and excluding value-added tax (VAT). This category also includes the invoiced, VAT-excluded value of product sales and services provided to a foreign-based company or another Hungarian branch of a foreign-based company (KSH, 2023). Net income of Hungarian companies is a public data available at https://www.nemzeticegtar.hu.

Knowledge

Knowledge is information processed by individuals including ideas, facts, expertise, and judgments relevant for individual, team, and organisational performance (Alavi & Leidner, 2001; Bartol & Srivastava, 2002).

Explicit knowledge is defined as knowledge that can be expressed formally using system of symbols or for-mal systematic language (Nonaka, 2002).

Tacit knowledge is personal and embodied (Polanyi, 1962, 1966; Nonaka, 2002), which makes its codification and dissemination very difficult (Nonaka, 2002).

Knowledge management

'Knowledge management describes the process of acquiring, developing, sharing, exploiting and protecting organisational knowledge in order to improve the competitiveness of organisations' (Gaál et al., 2009).

Knowledge management strategy

The term 'knowledge management strategy' represents the set of objectives related to knowledge management within a company and the methods aimed at achieving them (Zack, 1999).

Knowledge management project

Knowledge management projects initiated within organisations have a key objective of capturing, recording, and sharing the knowledge residing in people's minds, transforming individual knowledge into organisational knowledge (KPMG, 2006, Obermayer-Kovacs, 2007).

Knowledge management practices

Knowledge management practices ensure that knowledge flows seamlessly across the organisation, fostering innovation, and driving competitive advantage.

Lloyd (1996) considers the knowledge value chain model, starting with ideas, know-how, and other intangible intellectual capital assets transformed into measurable, tangible intellectual assets as knowledge management practices.

Problem solving - Information source

During knowledge management, it is interesting to see whether the source of knowledge is originated from a person or from a technology-based solution, mainly a tool in case a problem needs to be solved. Therefore, as information source the following major knowledge management practices are considered during the research: turning to a colleague, turning to external sources (e.g. internet), and checking the organisational database (training, document management system, groupware, intranet, etc.) (KPMG, 2014).

Emerging technologies

An emerging technology is 'a relatively fast growing and radically novel technology characterised by a certain degree of coherence persisting over time and with the potential to exert a considerable impact on the socio-economic domain(s) which is observed in terms of the composition of actors, institutions and the patterns of interactions among those, along with the associated knowledge production processes. Its most prominent impact, however, lies in the future and so the emergence phase is still somewhat uncertain and ambiguous' (Rotolo et al., 2015).

Technological intensity

Technological intensity refers to the extent to which machines and technology in general support autonomous human action during work processes.

Technological intensity is defined as the level of knowledge incorporated in companies' products in every industrial sector, and this indicator is typically measured by dividing the average R&D spending by the firm's revenue. The Organisation for Economic Cooperation and Development (OECD) is responsible for the classification of industrial sectors according to their level of technological intensity (OECD, 2003, 2007).

Digital transformation

Digital transformation is 'a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies' (Vial, 2019).

Industry 4.0

'Industry 4.0 covers the digitalisation and automation of the manufacturing environment, and also the creation of digital value chains for the purposes

production, environment and communication between business partners' (Lasi et al., 2014).

Industry 5.0

Industry 5:0 is a human-centric design solution where the ideal human companion and cobots collaborate with human resources to enable personalisable autonomous manufacturing through enterprise social networks. This, in turn, enables human and machine to work hand in hand. Cobots are not programmable machines, but they can sense and understand the human presence. In this context, the cobots will be used for repetitive tasks and labour intensive work, whereas human will take care of customisation and critical thinking (thinking out of the box) (Maddikunta et al., 2021).

Following the conceptualisation, measurements of research concepts are described in depth since operationalisation is the process of turning concepts into measurable variables. The next table summarises the conceptualisation and operationalisation of company-characteristic-related variables.

Research variable	Content	Definition	Source	Measurement
Sector	Primary	The sector of the economy that extracts or harvests products from the earth. This sector includes activities like agriculture, fishing, forestry, and mining. It is the foundation of all other sectors as it provides the raw materials needed for manufacturing and production.	Eurostat, 2023	Nominal
	Secondary	Comprises activities that transform, process, or manufacture goods from raw materials into finished or semi-finished products. This includes industries like manufacturing, construction, and utilities. The goods produced in this sector serve as a base for the provision of services in the tertiary sector.		
	Tertiary	The sector of the economy that concerns services. It is distinct from the secondary sector (manufacturing) and the primary sector (which concerns extraction such as mining, agriculture and fishing).		
Ownership	Foreign	Enterprises that are ultimately majority controlled by a non-resident entity, either a natural or legal person.	European Commission, 2001	Nominal
	Domestic	Enterprises that are incorporated in and conduct business affairs in its own country.		
Company size	Micro	Micro enterprises are having fewer than 10 persons employed.	Eurostat, 2023	Ordinal
	Small	Small enterprises are having 10 to 49 persons employed.		
	Medium	Medium-sized enterprises are employing 50 to 249 persons.		
	Large	Large enterprises are having 250 or more persons employed.		
Net income	Net income of companies (public data)	The value for the fiscal year of sold (finished and semi-finished) products, materials, goods, and performed services, increased with surcharges and mark-ups, containing registration, excise, and energy taxes, reduced by discounts, and excluding value-added tax (VAT). This category also includes the invoiced, VAT-excluded value of product sales and services provided to a foreign-based company or another Hungarian branch of a foreign-based company.	KSH, 2023; nemzeticegtar.hu	Interval
Technological intensity	Technological intensity of products and services	The extent to which machines and technology in general support autonomous human action during work processes. Technological intensity is defined as the level of knowledge incorporated in companies' products in every industrial sector, and this indicator is typically measured by dividing the average R&D spending by the firm's revenue.	OECD, 2003, 2007	Ordinal, Likert-scale (1-4)
	Technological intensity of company operational processes			

Table 2. Conceptualisation and operationalisation summary - company characteristics
Source: own edition

It lists the variables, their content, a definition considered during the course of the study, the related source(s) and the measurement. In addition to the table, it is important to note that all the following primary data has been collected by quantitative method.

The next table, based on the same structure like the previous table presents the conceptualisation and operationalisation of characteristics related to technological intensity, knowledge management and emerging technologies related variables that has been collected during the empirical research, primarily by quantitative then by post-qualitative methods.

Research variable	Content	Definition	Source	Measurement
Knowledge management	KM strategy	Represents the set of objectives related to knowledge management within a company and the methods aimed at achieving them. Including: KM strategy is part of the corporate strategy; sub-strategy of an independent area; or not existent.	Zack, 1999	Nominal
	KM project	KM projects initiated within organisations have a key objective of capturing, recording, and sharing the knowledge residing in people's minds, transforming individual knowledge into organisational knowledge. Including: there is no information about KM projects; the assessment is in progress currently whether there is a need for such a project; have a KM project; do not have a KM project and do not plan to introduce one; KM project is being developed; thought about introducing a project but rejected it.	KPMG, 2006, Obermayer-Kovacs, 2007	Nominal

KM practice	KM practices ensure that knowledge flows seamlessly across the organisation, fostering innovation, and driving competitive advantage. The knowledge value chain model, starting with ideas, know-how, and other intangible intellectual capital assets transformed into measurable, tangible intellectual assets. Including: Document management and knowledge base system; Communities of Practice; Knowledge map; Intra-organisational social technologies; Internal blogs; Information sharing; Enterprise social network; Corporate instant messaging; Participation in professional communities; Trainings.	KPMG, 2014; Lloyd, 1996	Nominal
Emerging technologies	Business intelligence software		
	Ticket management system		
	Chatbot		
	E-HR		
	Biometric authentication		
	VR technologies		
	3D printing	A relatively fast growing and radically novel technology characterised by a certain degree of coherence persisting over time and with the potential to exert a considerable impact on the socio-economic domain(s) which is observed in terms of the composition of actors, institutions and the patterns of interactions among those, along with the associated knowledge production processes. Its most prominent impact, however, lies in the future and so the emergence phase is still somewhat uncertain and ambiguous.	Rotolo et al., 2015	Nominal
	Management Information System (MIS)		
	Collaborative technologies		
	Artificial intelligence		
	Fraud detection software		
	Content-based recommendation system		
	Virtual assistant		
	Robotic process automation		
	Customer relationship management		
	Drones		
	Internet of Things (IoT)		
	Big data, data mining		

Table 3. Conceptualisation and operationalisation summary – KM, emerging technologies
Source: own edition

4 Hypotheses

The hypotheses are formulated based on the research questions, previous research and the literature review, which are presented in the following table.

Hypotheses
H1: Industry has an overall influence on KM.
H1a: Technological intensity of products and processes is the highest within the secondary (manufacturing) sector.
H1b: KM strategy is implemented within the tertiary (services) sector to a greater extent than within the other sectors.
H1c: KM projects are initiated within the tertiary (services) sector to a greater extent than within the other sectors.
H1d: Impediments due to the lack of knowledge management strategy or project are different depending on industry
H2: Sectoral and ownership-related differences have significant effect on permitted and used KM practices.
H2a: KM practices are permitted and used to a greater extent within the tertiary sector.
H2b: KM practices are permitted and used to a greater extent by subsidiaries of foreign companies.
H3: Usage of emerging technologies increased due to COVID-19.
H3a: Usage of collaborative technologies increased the most due to COVID-19.
H4: Strategic KM implementation has influence on information gathering by employees.
H4a: The higher the KM strategy implementation, the lower the possibility that employees turn to external sources in case of information need.
H4b: The higher the KM strategy implementation, the higher the possibility that employees use more emerging technologies.
H5: Emerging technologies in use positively influence KM.
H5a: Volume of emerging technologies in use has influence KM strategy and projects.
H5b: Volume of emerging technologies in use has influence technological intensity of products and services and corporate operational processes.
H5c: Volume of emerging technologies in use has influence the different dimensions of information sources.
H6: Organisational characteristics (company size, income, knowledge management project & strategy, technological intensity) has influence the volume of emerging technologies in use.

Table 4. Research hypotheses

Source: own edition

5   Research method

The implementation of empirical research is influenced by several factors, among which the role of research questions and the empirical substantiation of hypotheses are prominent, as these determine the applicable research approaches.

This research applies a mixed method (also called as hybrid or integrating method) including quantitative and qualitative research in order to provide in-depth understanding and validation of the studied phenomenon. First, the quantitative study was conducted based on prior analysis of literature and related research. As a second step, the qualitative study was realised building on the previous information that served as a baseline for the quantitative part and based on the results of the quantitative research. Thus, the qualitative part of the study could be also called as a post-qualitative investigation.

5.1   The quantitative method of research

In the quantitative part of the research, a large-scale quantitative survey was developed and carried out online via LimeSurvey web application between September – December 2021.

In preparation and validation of the survey structure, in 2019, a research has been conducted by an international Hungarian-Finnish researchers' group (Saukkonen et al., 2019) to explore levels of adoption of emerging technologies in the human resource management field that serves as preparation for the current research by piloting a set of questions via an online survey conducted in Finland between April-May 2019.

More than 200.000 contacts from various companies from the Orbis (Bureau van Dijk Editions) global database were addressed and invited via e-mail to participate and fill-in the questionnaire. Participation in the study was voluntary,

responses are anonymous. The questionnaire fill-in was advised as approx. 10 minutes.

The survey questionnaire composed of three main parts has been applied: information about the organisation, knowledge management and emerging technologies within the organisation and general information on the respondent.

In the course of the survey, 2703 (n=2703) full responses were included in the database. It was completed mainly by managers and white-collar workers (99% of total) representing organisations operating in Hungary.

The result of the questionnaire was analysed using econometric methods using IBM SPSS 22.0 (all analysis excluding PLS-SEM) and Smart-PLS 4 statistical analysis softwares. The econometric methods (descriptive statistics; Crosstab and its checks: Cramer's V, Pearson's Chi-Square; T-test: Levene statistics, Tamhane; One-way ANOVA; Pearson correlation; Partial Least Squares – PLS).

5.2 The qualitative method of research

During the empirical research, to establish a more in-depth understanding on findings of the quantitative research, qualitative methodology is used. This primary data collection is chosen to explore the most important information and trends in the focus area by interviewing subject matter experts, since no such previous research has been published yet in the aimed research area.

During the qualitative research, semi-structured interviews were conducted. An interview questionnaire guide was designed to support the research.

Confidentiality and anonymity concerns were verified. All participants signed a confirmation letter outlining the purpose of the study, verifying the interviewee's voluntary participation, and outlining how the data will be used. Every personal detail was deleted. Open-ended questions from a pre-written interview framework were given to responders in advance to their interview appointments

to ensure ample time to prepare to any particular subjects they thought would be pertinent.

Semi-structured interviews contained specific questions as well as allowed the participants to share their views freely, while still providing data pertinent to the study objectives. All data were audio-recorded,- and subsequently transcribed verbatim for use in the analysis that also included the researcher's notes. This semi-structured research consisted of four major parts; general understanding and impression about-, organisational practice and individual experience in emerging technologies in the business, and organisational strategy of knowledge management and emerging technologies.

The duration of each interview took between 1-1,5 hours via an online communication platform (Zoom). To conduct interviews, snowball-sampling method was followed.

Interview results then were summarised in case studies, including the analysis of responses.

6 Research results

This section presents the findings of the quantitative and qualitative empirical research, including hypotheses testing and answers to the research questions

6.1 Hypotheses testing

In the following section hypotheses testing are presented resulting in either acceptance, partial acceptance or rejection of hypotheses. These are all based on the results of the quantitative analysis, while qualitative findings were used mainly for validation of answers to the research questions.

Testing H1

Hypothesis 1. Industry has an overall influence on knowledge management.

In the process of testing H1, Crosstab, Pearson's Chi-Square, and Cramer's V have been used during the quantitative analysis to examine the relationship between sectors (based on industries, including technological intensity factors) and knowledge management.

First, companies' technological intensity of products and services and of operational processes in sectoral approach has been investigated.

Testing technological intensity of products and services, and corporate operational processes *(H1a)*, results of the analysis showed that in terms of proportions according to the sectoral approach, the services sector had the highest technological intensity of products and services, followed by the secondary then the primary sectors.

Second, knowledge management characteristics (knowledge management strategy, projects, and impediments) were in focus.

Testing knowledge management strategy in the sectoral approach *(H1b),* the findings indicated that there is no variation in the degree of knowledge

management strategy integration by sectors and that the vast majority of firms (around 65-68%) did not have a knowledge management strategy.

Regarding knowledge management project-related potential differences by sectors *(H1c)*, the degree of knowledge management projects are implemented in the tertiary sector to a greater extent than to the other sectors. However, only 35% of firms had knowledge management projects in place.

Analysing different impediments of knowledge management implementations *(H1d)*, there was no significant sectoral difference found.

Therefore, overall there is a proven finding out of testing H1, which is the following: **knowledge management projects are initiated within the tertiary (services) sector to a greater extent than within the other sectors.**

Testing H2

Hypothesis 2. Sectoral and ownership-related differences have significant effect on permitted and used knowledge management technologies.

During the quantitative study to investigate the relationship between sectoral and ownership-related approach and knowledge management technologies, the following statistical tests were used: Crosstab, Pearson's Chi-Square, and Cramer's V.

Testing knowledge management technologies in the sectoral approach *(H2a)*, conclusion was drawn that most of the significant relationships found between knowledge management practices and sectors are confirming that these knowledge management practices are used in a greater extent within the tertiary sector.

Checking knowledge management technologies in the ownership approach *(H2b)*, it was found that there is a significant relationship between only a few of the knowledge management practices applied and ownership type of the

companies. External professional communities are used to a significantly greater extent by foreign companies' subsidiaries, external messaging network technologies are used significantly greater extent by purely domestic companies.

To conclude finding out of testing H2, it has been proven that k**nowledge management practices are permitted and used to a greater extent within the tertiary sector.**

Testing H3

Hypothesis 3. Usage of emerging technologies increased due to COVID-19.

In the process of testing H3, Crosstab, Pearson's Chi-Square, and Cramer's V have been used during the quantitative analysis to examine the potential change in the volume of emerging technologies' usage due to COVID-19 pandemic.

Relationship between change in the usage of emerging technologies' due to COVID-19 and sectors were tested. Findings resulted in significant relationship with some of the pre-listed technologies, and there was an overall increase in the usage in majority of the emerging technologies *(H3)*.

Furthermore, the top technologies (collaborative technologies, business intelligence application, MIS, big data, data mining, IoT and chatbots) showed growth due to the pandemic regardless of sectors *(H3a)*.

Thus, proven findings out of testing H3 are the following: **the usage of emerging technologies increased due to COVID-19, and the usage of collaborative technologies increased the most due to COVID-19.**

Testing H4

Hypothesis 4. Strategic knowledge management implementation influences information gathering by employees.

The following statistical analyses were employed in the quantitative study to investigate the relationship between strategic knowledge management implementation and information gathering by employees, therefore to test H4: One-way ANOVA, Levene statistic, Tamhane and Scheffe post-hoc tests.

The organisational database is used more when the knowledge management strategy is more integrated *(H4a)*, according to the results of the one-way ANOVA.

Furthermore, out of the results of Chi-square analysis it can be stated that the higher the overall knowledge management strategy implementation level, the higher the possibility that employees use more emerging technologies *(H4b)*.

In conclusion, main findings of this part of the analyses are that **the higher the knowledge management strategy implementation the lower the possibility that employees turn to external sources in case of information need**, and that **the higher the knowledge management strategy implementation the higher the possibility that employees use more emerging technologies**.

Testing H5

Hypothesis 5. Emerging technologies in use positively influence knowledge management.

In the process of testing H5, Crosstab, Pearson's Chi-Square, and Cramer's V have been used during the quantitative analysis to examine the relationship between emerging technologies and knowledge management.

Finding of the analyses showed that the number of technologies in use positively influenced the implementation level of knowledge management strategy and knowledge management projects.

Also, the number of technologies in use positively affected the level of technological intensity of products and services and technological intensity of operational processes.

The number of technologies in use was positively influencing the degree of turning to a colleague and using the organisational database in case of info need. However, the number of technologies in use did not affect the extent of turning to external sources, there has been no correlation found.

The key findings proven by testing H5 is that the **volume of emerging technologies in use has influence on knowledge management strategy and projects,** and that **the volume of emerging technologies in use has influence on technological intensity of products and services and corporate operational processes**.

Testing H6

Hypothesis 6. Organisational characteristics (company size, income, knowledge management project & strategy, technological intensity) has influence on the volume of emerging technologies in use.

During of testing H6, PLS, Durbin-Watson test, and VIF have been used to investigate the potential influence of organisational characteristics to the volume of emerging technologies in use.

According to the analyses, it was concluded that the volume of the used emerging technologies is mostly influenced by the implementation level of the knowledge management project, followed by the net income (after all, this has to be financed from something) and the technological intensity of the product and services.

Proven finding out of testing H6 is that **the organisational characteristics (company size, income, knowledge management project and strategy,**

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technological intensity) has influence on the volume of emerging technologies in use.

Overall, out of the six main hypotheses two were accepted and four were partially accepted due to some rejected sub-hypotheses.

The following table demonstrates the summary of hypotheses testing and their results.

Hypotheses		Result
H1: Industry has an overall influence on knowledge management.		PARTIALLY ACCEPTED
H1a:	Technological intensity of products and processes is the highest within the secondary (manufacturing) sector.	REJECTED
H1b:	Knowledge management strategy is implemented within the tertiary (services) sector to a greater extent than within the other sectors.	REJECTED
H1c:	Knowledge management projects are initiated within the tertiary (services) sector to a greater extent than within the other sectors.	ACCEPTED
H1d:	Impediments due to the lack of knowledge management strategy or project are different depending on industry	REJECTED
H2: Sectoral and ownership-related differences have significant effect on permitted and used knowledge management practices.		PARTIALLY ACCEPTED
H2a:	Knowledge management practices are permitted and used to a greater extent within the tertiary sector.	ACCEPTED
H2b:	Knowledge management practices are permitted and used to a greater extent by subsidiaries of foreign companies.	REJECTED
H3:	**Usage of emerging technologies increased due to COVID-19.**	ACCEPTED
H3a:	Usage of collaborative technologies increased the most due to COVID-19.	ACCEPTED
H4: Strategic knowledge management implementation has influence on information gathering by employees.		ACCEPTED
H4a:	The higher the knowledge management strategy implementation the lower the possibility that employees turn to external sources in case of information need.	ACCEPTED
H4b:	The higher the knowledge management strategy implementation the higher the possibility that employees use more emerging technologies.	ACCEPTED
H5: Emerging technologies in use positively influence knowledge management.		PARTIALLY ACCEPTED
H5a:	Volume of emerging technologies in use has influence on knowledge management strategy and projects.	ACCEPTED
H5b:	Volume of emerging technologies in use has influence on technological intensity of products and services and corporate operational processes.	ACCEPTED
H5c:	Volume of emerging technologies in use has influence on the different dimensions of information sources.	PARTIALLY ACCEPTED
H6: Organisational characteristics (company size, income, knowledge management project & strategy, technological intensity) has influence on the volume of emerging technologies in use.		PARTIALLY ACCEPTED

Table 5. Summary of hypotheses tests with results

Source: own edition

6.2 Answers to research questions

The research aimed to provide understanding on the multifaceted dimensions of knowledge management and its interplay with various factors, including the influence of external and internal characteristics of organisations and emerging technologies.

Starting with **RQ1**, the study sought to discern how industry influences the implementation of knowledge management. The overarching hypothesis suggested that the industry has a significant influence on knowledge management, which was partially accepted. Delving deeper, the research found that the technological intensity of products and processes was not the highest within the manufacturing sector, contrary to the initial hypothesis. Interestingly, while it was hypothesised that the tertiary (services) sector would implement knowledge management strategies and initiate projects to a greater extent than other sectors, only the latter was accepted.

RQ2 aimed to understand the effects of sectoral and ownership-related differences on the implementation of permitted knowledge management technologies. The results were mixed. Knowledge management practices were found to be more prevalent in the tertiary sector. However, contrary to expectations, subsidiaries of foreign companies did not use these practices more than domestic entities.

The **RQ3** focused on the impact of the COVID-19 pandemic on the usage of emerging technologies. The results were clear: the pandemic led to an increased adoption of emerging technologies, especially collaborative technologies.

RQ4 explored the influence of strategic knowledge management on information gathering by employees. The findings were affirmative. Higher implementation of knowledge management strategy resulted in employees relying less on external sources for information. Furthermore, a strong correlation was found between the

level of strategic knowledge management implementation and the likelihood of employees using more emerging technologies.

RQ5 delved into the effects of emerging technologies on knowledge management. The research found that emerging technologies, especially the volume of such technologies in use, positively influenced knowledge management. These technologies played a pivotal role in the integration of knowledge management strategies and projects and also influenced the technological intensity of products and services.

Lastly, **RQ6** sought to identify the factors affecting the volume of emerging technologies in use. Organisational characteristics, including company size, income, and the presence of a knowledge management project, were found to have a partial influence on the adoption of emerging technologies.

In conclusion, the research provided invaluable insights into the intricate dynamics of knowledge management and its interrelation with various sectors, emerging technologies, and global events like the COVID-19 pandemic. The findings underscore the importance of adapting to technological advancements and understanding sectoral differences to harness the full potential of knowledge management.

7 Collection of Theses

Thesis 1 posits that the technological intensity of products and processes is highest within the tertiary (services) sector. Contrary to the initial hypothesis that the manufacturing sector would dominate in this regard, the research findings underscore the pivotal role of the services sector in driving technological intensity. This shift can be attributed to the rapid digital transformation and the increasing reliance on technology-driven solutions in service delivery.

Thesis 1. *Technological intensity of products and processes is the highest within the tertiary (services) sector.*

Thesis 2 emphasises that knowledge management projects are predominantly initiated within the tertiary sector. This aligns with the growing recognition of the importance of knowledge as a critical asset in service-oriented industries. The emphasis on knowledge management projects in this sector underscores the need for continuous learning, innovation, and adaptation to changing market dynamics.

Thesis 2. *Knowledge management projects are initiated within the tertiary (services) sector to a greater extent than within the other sectors.*

Thesis 3 and Thesis 4 examine into the different aspects of knowledge management practices. While the research confirms that these practices are more prevalent in the tertiary sector, it challenges the notion that subsidiaries of foreign companies are more inclined towards these practices than domestic entities. This finding suggests that local companies are equally, if not more, proactive in harnessing knowledge management practices to drive organisational success.

Thesis 3. *Knowledge management practices are permitted and used to a greater extent within the tertiary sector.*

Thesis 4. *Ownership type influences participation in external professional communities (are used to a significantly greater extent by foreign companies'*

subsidiaries) and usage of external messaging network technologies (are used significantly greater extent by purely domestic companies).

The impact of the COVID-19 pandemic is explored in Thesis 5, which asserts that the usage of emerging technologies, especially collaborative tools, has surged due to the pandemic. This demonstrates the ability of organisations to adapt to formerly unprecedented difficulties. The accelerated adoption of collaborative technologies underscores their role in ensuring business continuity, fostering communication, and facilitating remote work.

Thesis 5. *Usage of emerging technologies, especially collaborative technologies increased due to COVID-19.*

Thesis 6 highlights the influence of strategic knowledge management on employees' information-seeking behaviours. A higher implementation of knowledge management strategy correlates with a reduced reliance on external information sources. Furthermore, a robust knowledge management strategy encourages employees to embrace emerging technologies, emphasising the mutual benefits between strategic planning and technological adoption.

Thesis 6. *Strategic knowledge management implementation influences information gathering by employees.*

The higher the knowledge management strategy implementation the lower the possibility that employees turn to external sources in case of information need.

The higher the knowledge management strategy implementation the higher the possibility that employees use more emerging technologies.

Thesis 7 encapsulates the positive influence of emerging technologies on knowledge management. The volume of these technologies in use directly impacts the integration of knowledge management strategies and projects.

Moreover, it influences the technological intensity of products, services, and corporate operational processes.

Thesis 7. *Emerging technologies in use positively influence knowledge management.*

Volume of emerging technologies in use has influence on knowledge management strategy and projects.

Volume of emerging technologies in use has influence on technological intensity of products and services and corporate operational processes.

8 Novelty, practical implications

8.1 Research novelty

The field of academic research is continually evolving, with scholars striving to address gaps, introduce new methodologies, and provide fresh perspectives on existing knowledge. This section is to highlight novelty and innovation encompassed within this dissertation centred on knowledge management, digitalisation and emerging technologies in Hungary.

One of the primary novelties of this research is the extensive sample-based quantitative analysis pertaining to knowledge management in Hungary. Such a comprehensive approach ensures a robust and representative understanding of the subject.

The research introduces the application of a new analysis technique, namely Partial Least Squares Structural Equation Modelling (PLS-SEM), in the context of knowledge management. This advanced statistical method offers a nuanced understanding of complex relationships.

The research delves into the intricate relationship between organisational knowledge management and emerging technologies, providing insights into how the two domains intersect and influence each other.

The study newly establishes a detailed exploration of various relationships, such as the relationship between sectors and the technological intensity of products, services, operational processes, knowledge management projects, and the application of knowledge management practices. It also examines the influence of ownership type on participation in external professional communities and the usage of external messaging network technologies. Furthermore, it assesses the impact of the COVID pandemic on the increased usage of emerging technologies and the association between strategic knowledge management implementation

and the information sources utilised by employees, with a particular focus on external information sources and emerging technologies.

Innovative Aspects of the Research

Building upon previous studies, this research offers a renewed examination of knowledge management practices in Hungary including an extensive and representative sample, ensuring that the findings are up-to-date and relevant.

The study provides an unprecedented overview of the current status of knowledge management in Hungary. It investigates various facets, including technological intensity, knowledge management strategies, projects, initiators, and the primary challenges that hinder the implementation of knowledge management within Hungarian companies.

The research offers a holistic understanding of digitalisation, especially from a sectoral perspective. It also ensures a comparative analysis with findings of public reports by the European Union (e.g., DESI, EIBIS).

In conclusion, this PhD research introduces novel methodologies, exploring uncharted relationships, and building upon previous studies. This research not only addresses current gaps but also lays a solid foundation for subsequent studies. It paves the way for exploring the potential benefits of applying knowledge management from a practical standpoint, such as e.g. the development of an emerging technologies based knowledge management maturity model.

8.2 Practical implications

As technology advances, businesses are becoming more flexible and adaptable to change, even at the strategic level. In the evolving landscape of business, the relationship between knowledge management and technological adoption has emerged as a critical determinant of organisational efficacy. The research offers significant implications for enterprises.

The finding that technological intensity is most pronounced within the services sector within the examined organisations from Hungary underscores the sector's pivotal role in driving innovation and adaptation. Organisations operating within this domain are thus forced to continually invest in technological advancements, ensuring they remain at the forefront of service delivery and operational efficiency. The emphasis on knowledge management initiatives within the tertiary sector highlights the sector's recognition of knowledge as a key asset. This suggests a pressing need for organisations to foster a culture that values continuous learning, promotes knowledge sharing, and implements systems for knowledge management.

Interestingly, the research challenges the notion that subsidiaries of foreign companies are more inclined towards knowledge management practices than domestic entities. This finding underscores the universality of knowledge management practices, suggesting that their adoption is not strictly contingent upon organisational origin.

The marked influence of the COVID-19 pandemic on the adoption of emerging technologies provides a clear directive for organisations. In an era marked by remote work and digital collaboration, the integration of collaborative tools has transitioned from being a luxury to a necessity. Organisations must, therefore be proactive in taking the initiative to apply these technologies to ensure business continuity and effective stakeholder communication.

The alignment of strategic knowledge management with employee information-seeking behaviours emerges. Organisations are responsible for making sure that their knowledge management strategies resonate with the informational needs of their employees. This alignment not only optimises information flow but also enhances overall organisational efficiency.

Lastly, the relationship between emerging technologies and knowledge management is evident. The integration of cutting-edge technologies can significantly amplify knowledge management processes, enabling organisations to derive actionable insights and foster innovation.

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